Quantifier Scope Ambiguities in English, German, and Asante Twi (Akan): Structural and Pragmatic Factors

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Contents

List of Abbreviations

0-emb	zero embedding
1-emb	single embedding
2-emb	double embedding
ACD	antecedent contained deletion
AgrP	agreement phrase
CCG	Combinatorial Categorial Grammar
CI	confidence interval
CNP	complex noun phrase
Comp	complement
DP	determiner phrase
EA	external head analysis
Exp	experiment
FCI	free choice item
fin	finite
FU	follow-up
inf	infinite
IP	inflection phrase
IR	inverse reading
LF	Logical Form
MA	matching analysis
N	noun
Neg	Negation
NP	noun phrase
NPI	negative polarity item
NumP	number phrase
obj	object
PF	Phonological Form
PL	plural
PP	prepositional phrase
PPI	positive polarity item
QP	quantificational phrase
QL	Quantifier Lowering
QR	Quantifier Raising
RA	raising analysis
sbj	subject
ScoT	Scope Transparency
SG	singular
Spec	specifier
SR	surface reading
SVC	serial verb construction
TP	tense phrase
vP	voice phrase
VP	verbal phrase

List of Glosses

1	first person
2	second person
3	third person
ACC	accusative
CD	clausal determiner
COMP	complementizer
CONS	consecutive marker
COP	copular
DEF	definite
EMPH	emphatic marker
FOC	focus marker
FUT	future tense
IND	indefinite article
NEG	negation
NOM	nominative
OBJ	object
PAST	past tense
PL	plural
POSS	possessive
PRF	perfect aspect
PRT	particle
QM	question marker
REL	relative clause marker
SBJ	subject
SG	singular
TOP	topic marker

1 Introduction

This thesis is concerned with the phenomenon of quantifier scope ambiguities. This phenomenon has been researched extensively, both from a theoretical and from an empirical point of view. Nevertheless, there are still a number of under-researched topics in the field of quantifier scope, which will be the main focus of this thesis. I will take a closer look at three languages, English, German, and the Asante Twi dialect of Akan (Kwa, Niger-Kongo). The goal is a better understanding of the phenomenon of quantifier scope both within each language, as well as from a cross-linguistic perspective. First, this thesis will provide a series of experiments that allow a direct cross-linguistic comparison between English and German – two languages about which specific claims have been made in the literature. I will also provide exploratory research in the case of Asante Twi, where so far, no work has been dedicated specifically to the study of quantifier scope. The work on Asante Twi will go beyond quantifier scope and also target the quantifier and determiner system in general. The question is not only if particular scope readings are possible or not, but also which factors contribute to an increase or decrease of scope availability, and if there are factors that block certain scope readings altogether. While some of the results confirm and thereby strengthen previous claims, other results contradict general assumptions in the literature. After a short introduction to the phenomenon of quantifier scope in section 1.1, I will provide a summary of the topics of this thesis in section 1.2. In section 1.3, I summarize the main results of this thesis.

1.1   The phenomenon of quantifier scope

The study of quantifier scope ambiguities is concerned with sentences as in (1.1). This sentence contains two quantifying expressions, the existential *some* and the universal *every*. Whenever more than one quantifying expression occurs in a sentence, a scope ambiguity may arise. The ambiguity arises because the two quantifying expressions interact with one another. Thus, a sentence like (1.1) with two such elements has two different interpretations. Under the surface reading, the first quantifier scopes over the second quantifier. Under the inverse reading, the second quantifier scopes over the first quantifier. The resulting readings are represented and paraphrased in (1.1a) and (1.1b).

(1.1)   [**Some** student] read [**every** book].
     a. $\exists > \forall$: $\exists x[\text{student}(x) \wedge \forall y[\text{book}(y) \rightarrow \text{read}(y,x)]]$
     $\approx$ There is a single student who read all the books.
     b. $\forall > \exists$: $\forall y[\text{book}(y) \rightarrow \exists x[\text{student}(x) \wedge \text{read}(y,x)]]$
     $\approx$ For every book there is a (potentially) different student who read it.

Scope ambiguities can arise between various types of quantificational expressions, but in this thesis, I will focus on existential and universal determiners as in (1.1). Scope ambiguities are interesting for linguistic research for several reasons:

First, it is unclear how the ambiguity arises in the first place. Are we dealing with a lexical or a syntactic ambiguity? Or can we think of yet another type of ambiguity? This question has been answered in different ways by different researchers, albeit some suggestions have gained more popularity than others. One particularly prominent account, which is also the main focus of this thesis, is the covert movement account, which renders it into a syntactic ambiguity (May 1977, 1985). Throughout this thesis, I will present data that clashes with such an approach.

Second, the ambiguity does not consistently arise – sometimes only one of the readings is available. For example, particular quantifiers do not seem to interact scopally (e.g. Beghelli & Stowell 1997). There are also cases of so-called frozen scope, where the inverse reading is absent in a particular structure (e.g. Larson 1990). Inverse readings have also been said to be absent when an island boundary or a clause-boundary in general intervenes between the two quantifiers (e.g. May 1977, 1985). This thesis will provide evidence that this ban is not as strict as often assumed.

Third, even when both readings are available, usually one of them is more salient than the other. Most of the time, this is the surface readings. However, the more research is done on this topic, the more factors seem to arise that can impact scope preference. Some of those factors are of syntactic nature, such as the syntactic role, the linear/hierarchical order of the quantifiers or the particular syntactic construction those quantifiers occur in (e.g. Ioup 1975, Reinhart 1983, Gillen 1991). Some factors are of lexical-semantic nature, such as the choice of quantifiers, properties of the noun quantified over, or the type of predicate (e.g. Ioup 1975, Micham et al. 1980, Kurtzman & MacDonald 1993). Some factors are related to pragmatics, such as information structure and the corresponding prosodic pattern, context or world knowledge effects (e.g. Kempson & Cormack 1981, Krifka 1998, Anderson 2004). This thesis will put special focus on two of those factors: the type of syntactic construction and world knowledge effects. Lexical factors are only considered in the case of Asante Twi.

Fourth, there are also language-specific factors. Certain languages allow for inverse readings more readily than others. This is commonly explained by differences between the grammars of these languages. Some authors assume that the mechanism giving rise to inverse readings is completely absent in some languages (e.g. Frey 1993 for German), while others assume that the mechanism is universally available and only interaction with additional grammar-specific aspects cause cross-linguistic differences (e.g. Bobaljik & Wurmbrand 2012). While Bobaljik & Wurmbrand (2012) assume that these grammar-specific aspects block inverse readings completely (local scope rigidity), it is also conceivable that these aspects only cause a reduction in scope availability. In this thesis, I will argue for the latter by investigating how the possibility of scrambling and the possibility of scope inversion interact. This is the main motivation for the cross-linguistic aspect of this thesis, particularly the direct comparison between German and English.

Further fields of interest regarding scope ambiguities concern language processing in scope ambiguity resolution or L1 and L2 acquisition of scope options. However, these topics go beyond the scope of the thesis and will be largely ignored here.

This apparently fuzzy nature of quantifier scope has inspired much work, but it also makes it difficult to understand the phenomenon in depth and provide a unified account. The goal of this thesis is to provide some relevant data to contribute to a broader understanding of the phenomenon.

1.2 The scope of this thesis

This thesis presents a series of experiments on quantifier scope in English and German as well as fieldwork data on quantifiers and quantifier scope in Asante Twi. This thesis is structured as follows: I will first provide some general background on quantification and quantifier scope ambiguities in chapter 2 and then discuss each language on its own, starting with English in chapter 3, followed by German in chapter 4, and Asante Twi in chapter 5. In chapter 6, I provide a broader, cross-linguistic picture and discuss theoretical implications and methodological issues. The research in this thesis covers topics pertaining to language-specific, cross-linguistic, theory-related, and methodological aspects. The reader can expect the following questions to be discussed throughout this thesis:

Language-specific questions:
- German: To what extent are inverse readings available in canonical transitive sentences?
- Asante Twi: To what extent are inverse readings available depending on the type of constructions and the choice of quantifier?

Cross-linguistic questions:
- Is there a categorical difference between English and German due to differences in scrambling options?
- Does Asante Twi pattern with English due to its strict word order?

Theory-related questions:
- Are inverse readings completely blocked by island clause boundaries, as commonly assumed?
- Can the phenomenon of scope adequately be captured by assuming covert movement?

Methodological questions:
- Can task and plausibility effects explain the large variability in results of scope studies?
- Is introspection based on expert intuition a reliable source for semantic phenomena such as quantifier scope ambiguities?

The scope of each chapter 3-6 is the following. In chapter 3 and 4, I provide an experiment series that allows for a direct comparison of English and German. The experiment series consists of eight experiments in total: two main and one follow-up experiment on English and two main and three follow-up experiments on German. The two main experiments are identical between the two languages to allow for a close comparison of the results. The first experiment tests the degree to which inverse readings are accepted in English and German in canonical transitive sentences and the impact plausibility considerations have on this acceptability. This experiment further tests to what extent inverse readings are blocked by a relative clause boundary in each language. The second experiment is a replication of the first experiment with a change in task, thereby providing methodological insights into task effects and allowing for replication of the first experiment under slightly different circumstances. The follow-up experiments in English and German control for a number of potentially confounding factors. However, we will see that the overall pattern does not change across experiments.

The fieldwork data on Asante Twi is of more exploratory nature and covers a broader range of data. This is because compared to English and German, quantifier scope is a much more under-researched

topic in Asante Twi. Further, in order to identify which determiner quantifiers can be used to investigate quantifier scope, there is extensive preliminary work in sections 5.3-5.5 on (i) the indefinite article *bí*, (i) the bare noun, (iii) the universal quantifier *biara*. I investigate the behaviour of these expressions and provide an analysis for each of them. I then turn to quantifier scope ambiguities in section 5.6, where I investigate to what extent inverse readings are available to speakers of Asante Twi in (i) simple transitive sentences, (ii) ditransitive sentences, (iii) embedded sentences. I further test to what extent this availability is influenced by the choice of quantifiers as well as contextual factors. Due to COVID-19 related travelling restrictions, it was not possible to run a controlled experiment similar to English and German. I will, however, present a proposal of how an experiment could be implemented in the future.

In the last chapter, I provide a cross-linguistic perspective of the language-specific findings in chapter 3-5 and compare the languages to one another. In particular, I discuss the extent to which inverse readings are available in each language and how this availability is influenced by (i) the pragmatic factor of world knowledge, (ii) the grammar-specific factor of free vs. strict word order, (iii) the structural factor of clausal embedding, (iv) the speaker-specific factor of individual variability. I then proceed to discuss what the results of this thesis together with previous work in the field can tell us about theoretical accounts to quantifier scope in a more general sense. In particular, I discuss whether the common analysis of scope inversion as resulting from a form of covert movement is well-founded and supported by empirical evidence. I end this chapter with a discussion on methodological aspect, particularly pertaining to the question of how useful introspective versus experimental data is when investigating quantifier scope.

1.3 Main findings and implications

In the following, I provide a summary of the main empirical results of this thesis and the implications this has on the theory of quantifier scope. Before discussing the scope-related findings, I provide a short summary of the study of quantifiers in Asante Twi.

1.3.1 Quantifiers in Asante Twi

In sections 5.3-5.5, I take a closer look at three elements in Asante Twi, the indefinite article *bí*, the bare noun, and the universal quantifier *biara*.

(i)　*Indefinite bí*

The indefinite article *bí* is commonly said to be inherently specific and to represent a choice function (Arkoh 2011, Bombi 2019, Owusu 2019, 2020). I provide data showing that *bí* can be interpreted as non-specific in a much broader set of contexts than previously assumed. I argue that this data can more readily be captured by assuming that *bí* is a regular existential quantifier. Its common interpretation as specific as well as other meaning inferences associated with it can be covered satisfyingly by assuming that it has an obligatory domain restriction as a part of its lexical meaning.

(ii)   Bare noun

As for the bare noun, I show that in contrast to bare nouns in many other languages, a (pseudo-) noun incorporation analysis cannot work for Asante Twi. Instead, I argue that the bare noun projects a full DP, which can also capture its variable interpretation as both definite and indefinite without the need of stipulating ambiguity. I further show that this variable interpretation can be captured by assuming that the bare noun is a weak existential quantifier, which is in competition with the overt and semantically stronger definite and indefinite articles *no* and *bí*. Further variation can be explained by taking into account interaction with information structure.

(iii)   Universal biara

Finally, I show that the expression *biara* is lexically highly underspecified. It is used as a distributive universal quantifier, as a free-choice item, and as a negative polarity item. In that, it is similar to certain other West African languages, such as Hausa (Zimmermann 2009). However, I show that in the case of Asante Twi, these are true meaning components that cannot be derived through other means such as scopal interaction with other operators. Instead, I provide another attempt of capturing those meaning components without having to assume true polysemy. This will be based on the treatment of free-choice and negative polarity items by Chierchia (2013) and Dayal (2013).

1.3.2   Quantifier scope in English, German, and Asante Twi

I now turn to the results of the experiments on quantifier scope in English and German as well as the fieldwork studies on quantifier scope in Asante Twi.

(i)   Word order freedom

In chapter 4, I show that in German, contrary to claims in the theoretical literature (Frey 1993, Lechner 1996, Pafel 2005, Bobaljik & Wurmbrand 2012), inverse readings are available in canonical transitive sentences. These readings are dispreferred and less available than in English, but not blocked. This finding is in line with a previous experiment on German from Bott & Radó (2018). This result is taken as evidence against an account of local scope rigidity (Bobaljik & Wurmbrand 2012), where the option of overt scrambling blocks inverse readings completely. Further evidence comes from Asante Twi, which, despite being a language with strict word order, does not allow for inverse readings as readily. These findings complement previous results from a number of other languages, which also provide evidence against a local scope rigidity account based on word order freedom.

(ii)   World knowledge

I further show that world knowledge is a major factor in scope resolution, in line with previous claims (e.g. Saba & Corriveau 2001, Villalta 2003). If the situation described by the surface reading is perceived as implausible, its acceptance is reduced, while the acceptance of the inverse reading increases, up to the point of turning around the general surface scope bias. At the same time, plausibility considerations do not completely override other factors such as structural constraints. The experimental

data provided in here is novel in that the world knowledge factor is particularly controlled for. I argue that plausibility considerations may be one reason why experimental results on quantifier scope sometimes vary to a great degree. Another reason may be task-related effects, which will also be shown to play an important role. Further, I show that speakers are affected to varying degrees by pragmatic and structural factors.

(iii)   Embedding

The experiments further show that inverse readings are not fully blocked by a relative clause boundary. This contradicts the common assumption that scope inversion is clause-bounded (e.g. Chomsky 1975, May 1977, 1985). It is, however, in line with a number of introspective judgments and corpus examples from the literature (e.g. Szabolcsi 2010, Barker 2021) as well as a previous experiment from Tsai et al. (2014). While in German, inverse readings are still significantly reduced in relative clauses compared to unembedded sentences, in English, no such difference can be found. In the case of English and Asante Twi, I further show some additional data that indicates that inverse readings are also not fully blocked by other types of clause boundaries.

(iv)   Individual variability

A recurring theme throughout this thesis will be the fact that the ability to obtain inverse readings varies greatly between speakers. Even in a language like English, where inverse readings are said to be readily available, there are speakers who reject them across the board. In conditions in which different factors support different readings, participants follow varying strategies, which results in a bimodal distribution. This phenomenon of individual variability has been observed in previous studies on quantifier scope (Gil 1982, Anderson 2004, Brasoveanu & Dotlačil 2015). I will discuss some potential reasons for this variability.

1.4   Consequences for the theory of quantifier scope

The finding that inverse readings are not blocked in embedded clauses and particularly in island environments poses major problems for an account that is based on covert movement such as Quantifier Raising (May 1977, 1985). Under such an approach, inverse readings are derived through covert movement of the lower quantifier to a position above the higher quantifier. Consequently, covert movement and thus scope inversion should be blocked whenever overt movement is blocked, i.e. in syntactic islands. In chapter 6, I argue that none of the solutions proposed in the literature to account for apparently "exceptional" wide scope phenomena in embedding environments can get around this problem and cover the whole range of data. I further argue that even if this was possible, it would lead to a theory of exceptionalism, where each new data point has to be accommodated for by additional theoretical assumptions, thereby inflating the system. I will further discuss similar exceptional behaviour in the case of overt extraction and approaches which take islands to be a phenomenon related to semantic, pragmatic, and processing factors rather than a syntactic constraint. Under such an assumption, exceptional scope behaviour in island environments would not constitute an argument against a covert movement approach anymore. However, as a consequence, we would also lose our own evidence in favour of a covert movement approach, as no parallelism can be shown. I argue that the

scope data in embedding environments may be accommodated for more easily with semantic approaches to quantifier scope. I propose that there is no abstract syntactic constraint that prevents inverse readings across clause- or island-boundaries. Instead, the general dispreference can be explained by an accumulation of other factors related to semantics, pragmatics, and language processing. Such a perspective on quantifier scope predicts a reduction of inverse readings in embedded environments, but not a strict ban. If too many factors come together, inverse readings may indeed be excluded, but most of the time, gradual rather than categorical differences would be expected, in line with the findings in this thesis. Such an approach is an extension from previous multi-factorial approaches (e.g. Ioup 1975, Pafel 2005).

2 Background on Quantification and Quantifier Scope

The following chapter will provide a general background on quantificational expressions and then proceed to the more specific features of determiner quantifiers. A basic introduction to quantifier scope ambiguities will follow, highlighting the most prominent aspects of it. I will then proceed to walk through various syntactic and semantic approaches to quantifier scope ambiguities, showing which aspects they can best capture and what they fail to account for.

2.1 Background on quantifiers

In this chapter I will provide some background on characteristics of quantifiers in natural language, the way they are analysed in formal semantics as well as common ways of categorizing them depending on their properties. This is of special relevance to the question of quantifier scope for multiple reasons. First, we have to clarify what falls into the category of a "quantifier" in the first place and how it should be defined. Only then can we know when we are dealing with the phenomenon of quantifier scope ambiguity. As we will see, this question is not easily answered. Second, from a compositional point of view, we need to know how a quantifier is analysed semantically. Only then can we understand how we get from the meaning of the quantifiers and the other elements of the sentence to the meaning of the sentence as a whole. Third, it has been shown that the interpretation of doubly quantified sentences significantly hinges on the specific choice of quantifiers and their respective properties (e.g. Ioup 1975, Liu 1990, Beghelli & Stowell 1997). However, since quantifiers on their own are not the main focus of this thesis, I will restrain myself to a brief introduction of this vast field and describe only those aspects that are relevant for the discussion on quantifier scope in the subsequent chapter. This chapter is structured as follows: In the first section, I will give a very general notion of quantificational elements. In the second section, I will present a common semantic analysis of quantifiers. Finally, in the third section, I will describe a number of different features that apply to quantifiers.

2.1.1 Quantificational expressions

Natural languages have a large set of elements that can be described as quantificational in a broad sense. The first group of such elements that typically comes to mind – and that is also most extensively researched – is exemplified in (2.1a). These are elements that occupy a determiner position and thus take a noun phrase as argument. They are sometimes given the term *D-quantifiers* for that reason (Partee et al. 1987). Numerals as in (2.1b) fall into the same group[1]. It is possible to modify those elements in various ways, as shown in (2.1c). Adverbials on the other hand, such as the temporal adverbials given in (2.1d), are grouped into the complementary category of *A-quantifiers*. They do not take a noun but instead a whole clause as their argument. Many more elements may fall under this term, which makes it a category that is not very well-defined. For example modals such as *may* or *must* in (2.1e) are said

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[1] Syntactically, numerals are sometimes given their own projection NumP. I will ignore such syntactic details here, since they are irrelevant for the topic of this thesis.

to existentially/universally quantify over possible worlds. Even though these categories (especially the latter one) are somewhat vague, they can be useful as an initial categorization. This thesis will solely deal with elements of the D-quantifier category.

(2.1)   a. All/every/many/some/few burglar(s) escaped.
        b. One/five burglar(s) escaped.
        c. Exactly two/more than three/almost every burglar(s) escaped.
        d. Burglars always/sometimes//never try to escape.
        e. Burglars may/must get a prison sentence.

The shared property of all these quantificational elements is conveniently captured in the so-called *tripartite structure*, see (2.2). It was introduced in Heim (1982) and received further treatment in e.g. Partee et al. (1987) and Partee (1991). In a very general sense, the position of the operator can be taken by any quantificational element, the position of the restrictor is taken by the set the quantificational element quantifies over, and the position of the nuclear scope is taken by what is expressed about this restricted set.

(2.2)

S

Operator	**Restrictor**	**Nuclear Scope**
all	"cases"	main clause
must	if-clause	assertion
not	subordinate clauses	focus
almost every	common noun phrase	consequent
always	topic	main predication
mostly	presuppositions	comment
generic	focus-frame	…
if	domain restrictions	
some	reset default values	
…	antecedent	
	context	
	…	
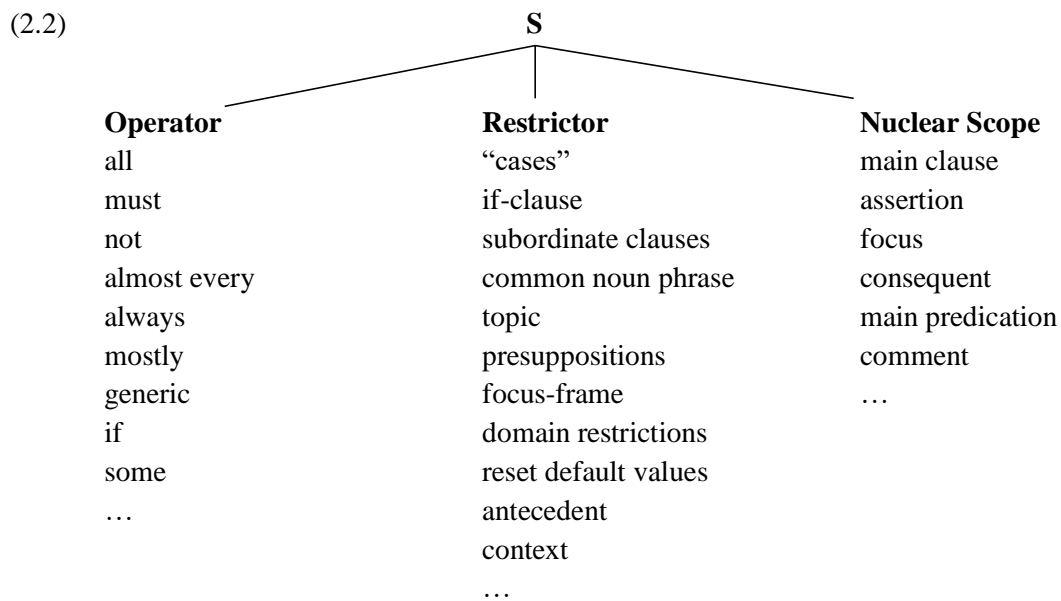
(adapted from Partee 1991, p. 163)

An example of a sentence with D-quantification, which is divided into the tripartite structure, is shown in (2.3). The same is shown for a sentence with A-quantification in (2.4).

(2.3)   Every dog barks.
        [every]   [dog]   [barks]
        operator   *restrictor*   *nuclear scope*

(2.4)   Mary usually knows who is dating whom.
        [usually$_{x,y}$]   [x is dating y] [Mary knows that x is dating y]
        operator   *restrictor*   *nuclear scope*

(adapted from Partee 1991, p. 168)

I will not discuss A-quantification in any more depth, as this thesis is focussed on quantifier scope between D-quantifiers only. Partee (1991) points out that the tripartite structure does not need to have any syntactic reality nor do all the elements listed in (2.2) need to share the same syntactic structure. The tripartite structure is solely aimed at representing some basic correlation in the structure or semantics between very different kinds of quantificational elements[2]. The tripartite structure is recursive, as shown in (2.5).

(2.5)

```
                              S
         ┌────────────────────┼────────────────────┐
     Operator             Restrictor          Nuclear Scope
                                      ┌──────────────┼──────────────┐
                                  Operator       Restrictor    Nuclear Scope
                                                                     │
                                                                   […]
```
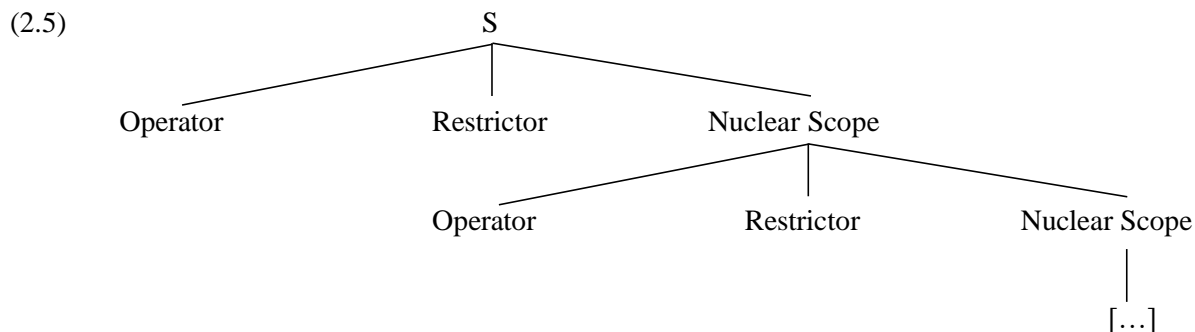
Montague (1973) and Barwise & Cooper (1981) shaped the theory of generalized quantifiers, which manifests more technically the intuitive tripartite division for the special case of noun phrases. The motivation behind their work was to give a general syntactic treatment of natural language quantifiers, which cannot fully be captured by the two quantifiers $\forall$ and $\exists$ of first-order logic. In this framework, elements like *every* or *some* are *quantifier determiners*, while the full NPs *every dog* or *some dog* are *quantifiers*. In fact, all noun phrases are seen as quantifiers, even proper names, and denote relations between two sets, see (2.6).

(2.6)

$$
\begin{array}{c}
\text{every dog barks} \\
\forall x[\text{dog}(x) \rightarrow \text{bark}(x)]
\end{array}
$$

```
              every dog barks
            ∀x[dog(x) → bark(x)]
           ┌──────────────┴──────────────┐
       every dog                       barks
  λB.∀x[dog(x) → B(x)]              λx.bark(x)
      ┌──────┴──────┐
   every           dog
λA.λB.∀x[A(x) → B(x)]   λx.dog(x)
```
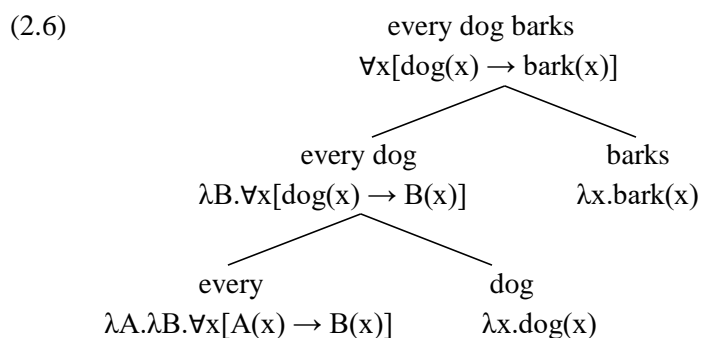
The definition of what counts as a quantifier in Barwise & Cooper (1981) is extremely broad. It effectively captures an infinitely large set of elements, since virtually all NPs fall under this definition. However, other authors have proposed other definitions of what counts as a quantifier, ranging from extremely narrow to extremely broad definitions. For example, as will be discussed in more depth later in section 2.2.4, much literature has been devoted to excluding existentials from the set of quantificational elements. The reason is that they show behaviour that is non-typical for truly quantificational elements. They have thus been analysed as choice functions or generalized Skolem terms (e.g. Reinhart 1997, Winter 1997, Kratzer 1998, Steedman 2012). Steedman proposes a

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[2] However, see Diesing (1992) and Diesing & Jelinek (1995) for an approach to quantifier scope ambiguities that incorporates that basic notion of tripartite structures by mapping the nuclear scope to VP and the restrictor to IP.

particularly strict definition of quantifiers, which only contains *every* and *each* in the case of English. Other authors assume that existentials are ambiguous and thus still have a quantificational interpretation (e.g. Diesing 1992, Winter 1997, Kratzer 1998). Frey (1993) only considers modified QPs like *almost every* unambiguously quantificational, since with simplex quantifiers, a specific or collective reading is also possible[3]. Some discussion has also circled around the question whether definite determiners are quantificational (e.g. Strawson 1950, Montague 1973, Barwise & Cooper 1981, Hornstein 1984, Krifka 1992, Isac 2006, Glanzberg 2007). I will not devote myself to a specific definition of what exactly should be regarded as a quantifier for the purpose of this thesis. The studies on quantifier scope presented in chapters 3-5 all investigate the narrow vs. wide scope of elements that are considered true quantifiers under almost all definitions and are therefore fairly uncontroversial, such as *jede(r/s)* in German, *every* in English, and *biara* in Twi.

2.1.2   Properties of (D-)quantifiers

Quantifiers are often categorized depending on their logical-semantic features. This chapter will present some of the most important features: conservativity, monotonicity, symmetry/intersectivity, and distributivity. Additionally, quantifiers are categorized as to whether they are existential, universal, or proportional. The following categorizations and definitions are mainly borrowed from Barwise & Cooper (1981) and Keenan & Stavi (1986) and the reader is referred to these two pieces of work for an extensive treatment of quantifiers. Figure 2.1 serves as a visual help for those definitions.
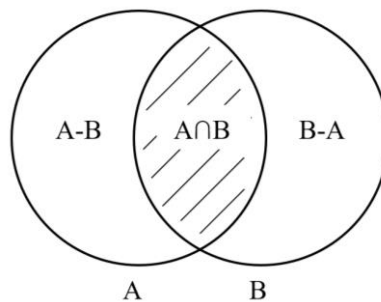
Figure 2.1: Visualization aid for properties of D-quantifiers.

(i)   Conservativity

Not all logically conceivable quantifiers are conservative, but as far as is known, all natural language D-quantifiers are conservative[4]. Conservativity is defined as follows: $Q(A)(B) \leftrightarrow Q(A)(A \cap B)$. Less formally, this means that the subset B-A is irrelevant for the truth of a sentence $Q(A)(B)$. The examples in (2.7) show that conservativity indeed applies to all the quantifiers exemplified there. The set of individuals who are working but are not students can be ignored when determining the truth value of the sentence.

---

[3] See section 4.1.1 for a discussion if this point of view is justified.
[4] Barwise & Cooper point out that one natural language example of an element that is not conservative is *only*. However, this is not a determiner and thus no exception to the generalization.

(2.7)   a. Every student is working ↔ Every student is a student that is working   ✓
        b. Some students are working ↔ Some students are students that are working   ✓
        c. Most students are working ↔ Most students are students that are working   ✓

(ii)   *Monotonicity*

Monotonicity describes the possibility of drawing inferences to the sub- or superset of a quantifier's argument. When an inference to the subset is possible, the quantifier is called *monotone decreasing* or *downward entailing*. When an inference to the superset is possible, the quantifier is called *monotone increasing* or *upward entailing*. Because quantifiers have two arguments, there are two types of monotonicity, depending on whether the inference is drawn to the sub-/superset of the leftward argument (restrictor) or the rightward argument (nuclear scope). Leftward monotonicity relates to the inferences that can be drawn to the sub- or superset of the leftward argument (the restrictor) of a quantifier, see (2.8).

Monotone increasing/upward entailing ↑: $Q(A')(B) \rightarrow Q(A)(B); A' \subset A$
Monotone decreasing/downward entailing ↓: $Q(A)(B) \rightarrow Q(A')(B); A' \subset A$

(2.8)   a. Every [student]$_A$ is working → Every [1st semester student]$_{A'}$ is working   ↓
        b. Some [1st semester student]$_{A'}$ is working → Some [student]$_A$ is working   ↑

Rightward monotonicity relates to the inferences that can be drawn to the sub- or superset of the rightward argument (the nuclear scope) of a quantifier, see (2.9).

Monotone increasing/upward entailing ↑: $Q(A)(B') \rightarrow Q(A)(B); B' \subset B$
Monotone decreasing/downward entailing ↓: $Q(A)(B) \rightarrow Q(A)(B'); B' \subset B$

(2.9)   a. Every student [is working hard]$_{B'}$ → Every student [is working]$_B$ ↑
        b. Some students [are working hard]$_{B'}$ → Some students [are working]$_B$ ↑
        c. No students [are working]$_B$ → No students [are working hard]$_{B'}$ ↓

There are also *non-monotonous* quantifiers. Some of these quantifiers are only non-monotonous with respect to one argument. For example *few* is leftward non-monotonous, but rightward decreasing, as exemplified in (2.10). Other quantifiers are non-monotonous in both directions, like *exactly three* in (2.11). However, at least in English, all simple quantifiers are monotonous, only complex quantifiers can be fully non-monotonous.

(2.10)   a. Few [students]$_A$ are working ↮ Few [1st semester students]$_{A'}$ are working
        b. Few students [are working]$_B$ → Few students [are working hard]$_{B'}$ ↓

(2.11)   a. Exactly three [students]$_{A'}$ are working ↮ Exactly three [1st semester students]$_A$ are working
        b. Exactly three students [are working]$_B$ ↮ Exactly three students [are working hard]$_{B'}$

Monotonicity is reflected in a number of linguistic phenomena. One example are negative or positive polarity items (NPIs/PPIs), also discussed in section 5.5, which can only be used in monotone decreasing or increasing environments respectively:

(2.12)   a. Few students [ever]$_{NPI}$ work.
         b. *Some student [ever]$_{NPI}$ works.

(2.13)   a. *No students [possibly]$_{PPI}$ work.
         b. Every student [possibly]$_{PPI}$ works.

Monotonicity also plays a role in NP conjunction. As Barwise & Cooper (1981) show, using the conjunction *but* as in (2.14), the two elements combined must not be of the same monotonicity. A monotone decreasing quantifier like *few* cannot be combined with another monotone decreasing quantifier, but only with a monotone increasing quantifier.

(2.14)   Few$_↓$ mathematicians but [✓many$_↑$/*no$_↓$] linguists have worked on natural language conjunction.

(adapted from Barwise & Cooper 1981, p.107)

As we will see in section 2.2.5, monotonicity of quantifiers also plays a role in scope inversion.

   (iii)   Symmetry/Intersectivity

A quantifier has the property of being symmetric/intersective if the truth of Q(A)(B) solely depends on the intersection of A and B: Q(A)(B) ↔ Q(B)(A). Examples of such quantifiers are *a, some, a few, exactly three, at least three*. Examples of non-symmetric quantifiers are *all, every, each, most, many*. (2.15) shows the natural language test for three of these quantifiers.

(2.15)   a. Some students are working ↔ Some individuals who work are students   ✓
         b. Every student is working ↔ Everyone who works is a student   ✗
         c. Most students are working ↔ Most individuals who work are students   ✗

A quantifier is defined as weak if its existence can be asserted. Otherwise it is strong. This is tested by combining the quantifier with an existential construction such as "There is/are …" or "There exists …" (Milsark 1974). Strong quantifiers cannot be uttered in such contexts because they inherently presuppose existence and asserting something that is presupposed causes a clash. Intersective/symmetric quantifiers can typically be used in existential sentences, i.e. they are weak.

(2.16)   a. *There is every new student at my school.   → *Strong*
         b. There is a/some new student at my school.   → *Weak*

Some authors have suggested that weak quantifiers are generally ambiguous between a weak and a strong interpretation (e.g. Milsark 1977, Diesing 1992). Furthermore, partitive constructions always render a weak quantifier strong. Certain scope ambiguities have sometimes been explained in terms of strength. For example, an indefinite under its strong interpretation gives rise to a wide scope reading,

while under its weak interpretation it gives rise to a narrow scope reading. Weak/intersective quantifiers do not actually need to be analysed as generalized quantifiers but can be viewed as adnominal modifiers.

(iv)   Distributivity

Distributivity describes to what extent a quantifier allows access to the single members of the set it quantifies over. This becomes visible in the ability to combine with an inherently collective or distributive predicate, as in (2.17). However, distributivity is not just a binary distinction. Rather, quantifiers can be ordered on a scale depending on their degree of distributivity. *Each*, for example, is known to exhibit a stronger degree of distributivity than *every*. The stronger the distributivity property of a quantifier is, the more prone it is to take wide scope. Even though the most commonly known distributive quantifiers are universal quantifiers, existential quantifiers can have that property too (de Hoop 1995, Bach et al. 1995).

(2.17)   a. *Every student gathered.
        b. All students gathered.

(v)   Universal, existential and proportional quantifiers

A quantifier Q(A)(B) is *existential* if: $A \cap B \neq \emptyset$. An existential quantifier *asserts* the existence of the elements in A. Examples of existential quantifiers are *a* or *some*. The example sentence (2.18a) is true if the intersection of the set of students and the set of individuals who are working contains at least one individual. A quantifier Q(A)(B) is *universal* if: $A \subseteq B$. A universal quantifier *presupposes* the existence of the elements in A. Examples of universal quantifiers are *all, every* or *each*. The example sentence (2.18b) is true if the set of students is a subset of the set of individuals who are working. A quantifier Q(A)(B) is *proportional* if its truth depends on $\frac{|A \cap B|}{|A|}$. Examples of proportional quantifiers are *many, most* or *few*. The example sentence (2.18c) is true if the number of students that are working is a sufficiently high number of all the students (typically the lower bound for *most* is set at 50%).

(2.18)   a. [Some]$_Q$ [student]$_A$ [is working]$_B$
        b. [Every]$_Q$ [student]$_A$ [is working]$_B$
        c. [Most]$_Q$ [students]$_A$ [are working]$_B$

In the remainder of this thesis I will ignore proportional quantifiers like *most* and only investigate the scopal interaction of non-proportional universals and existentials. See also section 2.2.4 on the special case of existentials and whether or not they should be treated as quantifiers at all.

2.1.3   Semantic types

From a type-theoretical perspective, we can assign a quantificational determiner the type ‹‹e,t›,‹‹e,t›,t››, i.e. it is a function from properties to a function from properties to truth values. A quantificational determiner takes an argument of type ‹e,t› to give out a quantifier of type ‹‹e,t›,t›, see (2.19).[5]

---

[5] See Heim & Kratzer (1998) on type-driven compositional semantics.

(2.19)

```
                        every dog barks
                             ‹t›
                    _____/  _____
                   /                    \
              every dog                barks
              ‹‹e,t›,t›                 ‹e,t›
          ____/      \____
         /               \
      every             dog
  ‹‹e,t›,‹‹e,t›,t››     ‹e,t›
```
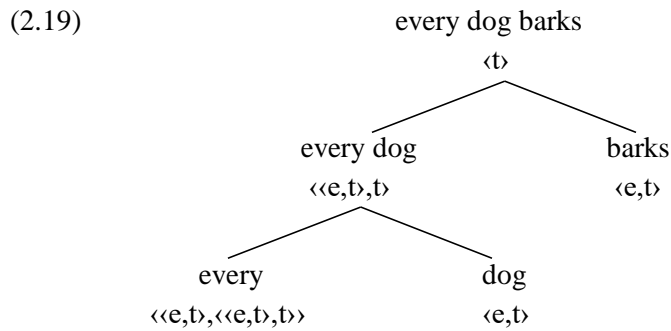
However, in this system, a quantifier in object position will cause a type clash, which can be seen in (2.20). Here, the object QP *every dog* requires an argument of type ‹e,t›, which cannot be satisfied by the ‹e,‹e,t››-type predicate *feed*. The latter, on the other hand, requires an argument of type ‹e›, which cannot be satisfied by the ‹‹e,t›,t›-type QP *every dog*.

(2.20) Peter feeds every dog

```
                    ‹t›
              ____/     \____
             /               \
          Peter          feeds every dog
           ‹e›                 ✗
                        ____/      \____
                       /                \
                    feeds            every dog
                  ‹e,‹e,t››          ‹‹e,t›,t›
                                 ____/      \____
                                /               \
                             every             dog
                         ‹‹e,t›,‹‹e,t›,t››     ‹e,t›
```
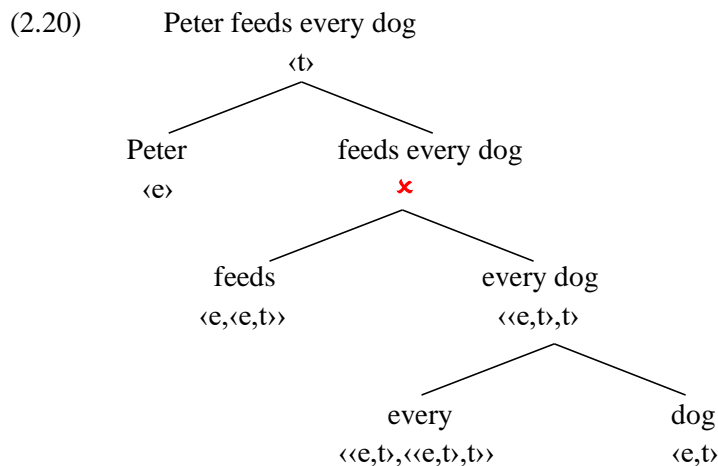
Several strategies have been discussed in the literature to solve this problem. One solution was given by Heim & Kratzer (1998), based on May's (1977) covert movement operation of Quantifier Raising (QR), see (2.21). Quantifiers will be raised at the abstract level of Logical Form (LF) to a position, where they can be interpreted (see section 2.3.1 for more details on QR).

The second solution was presented in Partee & Rooth (1983), Partee (1986), Hendriks (1988) and Jacobson (1996). Rather than solving the issue in a syntactic way, as May did with his idea of QR, their suggestion of flexible types moved the burden onto the semantics. Flexible type theory allows different categories to map onto a whole family of types rather than just one specific type. The predicate *feed*, for instance, could type-shift to a higher-order type ‹‹‹e,t›,t›,‹e,t››, which can then take a quantifier instead of an individual as an argument without causing a type clash. However, a common criticism about this approach is that it tends to overgeneralize: what instances of type-shift are allowed and under what circumstances? It is difficult to limit type-shifting to cases like (2.20) above, excluding it in cases where it would produce an ungrammatical sentence. We will see in section 2.3.2 how the type-shift method has been applied to account for quantifier scope ambiguities.

Finally, a more recent approach by Steedman (2000) within the framework of Combinatorial Categorial Grammar avoids both covert movement and flexible types. This approach allows several ways of combining constituents, by shifting type-raising to the lexicon. Instead of shifting the semantic type, this happens at the level of syntactic categories. All three approaches will be discussed in more detail in section 2.3, which deals with the analyses of quantifier scope.

(2.21)   Peter feeds every dog
                     ⟨t⟩

        [every dog]₁   λx. Peter feeds x
        ⟨⟨e,t⟩,t⟩   ⟨e,t⟩

    every   dog   1   Peter feeds x
 ⟨⟨e,t⟩,⟨⟨e,t⟩,t⟩⟩   ⟨e,t⟩   ⟨t⟩

                               Peter   feeds x
                               ⟨e⟩   ⟨e,t⟩

                                          feeds   t₁
                                        ⟨e,⟨e,t⟩⟩   ⟨e⟩
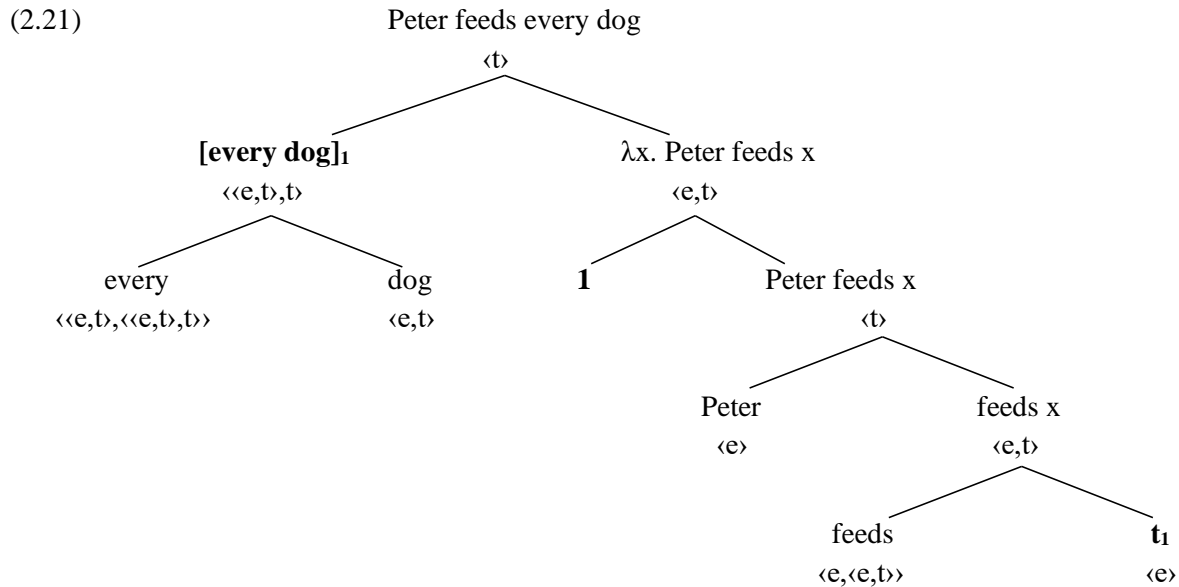
2.2   The phenomenon of quantifier scope

2.2.1   Introduction

Quantifier scope ambiguities have been studied extensively from both a theoretical and an empirical perspective. Such ambiguities can arise when a sentence contains more than one quantificational expression. An example is given in (2.22), where an existential quantifier *a surveillance camera* is in subject position and a universal quantifier *every burglar* is in object position. This sentence has two interpretations, depending on which of the two quantifiers takes wide scope. Under the surface reading (2.22a), the structurally higher existential quantifier takes scope over the structurally lower universal quantifier, expressing that there is only a single surveillance camera that recorded all the burglars ($\exists >$ $\forall$). Under the inverse reading (2.22b), the structurally lower universal quantifier takes scope over the structurally higher existential quantifier, expressing that for each burglar there is a (potentially different) surveillance camera that recorded them ($\forall > \exists$).

(2.22)   [**A** surveillance camera] recorded [**every** burglar].
　　　　a. $\exists > \forall$: $\exists x[\text{surveillance-camera}(x) \land \forall y[\text{burglar}(y) \rightarrow \text{record}(y,x)]]$
　　　　≈ There is this one surveillance camera that recorded every burglar.
　　　　b. $\forall > \exists$: $\forall y[\text{burglar}(y) \rightarrow \exists x[\text{surveillance-camera}(x) \land \text{record}(y,x)]]$
　　　　≈ For every burglar there is a (potentially) different surveillance camera that recorded him.

Scope ambiguities can arise between many different kinds of quantificational expressions or operators, such as various determiner quantifiers (2.22), negation (2.23a), wh-words (2.23b), modals (2.23c), adverbs (2.23d), or numerals (2.23e).

(2.23) a. **Every** surveillance camera did**n't** record the burglars.

$\forall$>Neg ≈ None of the surveillance cameras recorded the burglars.

Neg>$\forall$ ≈ Not every surveillance camera recorded the burglars.

b. **What** did **every** surveillance camera record?

Wh>$\forall$ ≈ Which one thing was recorded by all of the surveillance cameras?

$\forall$>Wh ≈ For each surveillance camera, which thing did it record?

c. The police officer **may** install **every** surveillance camera.

May>$\forall$ ≈ It is possible for the police officer to install all the cameras.

$\forall$>May ≈ For each camera, it is possible for the police officer to install it.

d. **Some** burglar **always** escapes.

$\exists$>Always ≈ There is this one burglar who escapes every single time.

Always>$\exists$ ≈ Each time there is some burglar or other who manages to escape.

e. **Two** surveillance cameras recorded **every** burglar.

Two>$\forall$ ≈ There are two surveillance cameras and each of them recorded all the burglars.[6]

$\forall$>Two ≈ Each burglar was recorded by two (potentially different) cameras.

However, not all readings are equally easy to obtain. In some sentences, there is a stronger preference for one reading than for the other. For instance, in (2.23a-e) above, the reader might have a harder time with some readings than with others. Moreover, not all combinations of quantificational expressions do in fact give rise to both readings in the first place, see (2.24). In (2.24a-d) we see some examples that are considered to be unambiguous despite the presence of two operators (see Liu 1990, Beghelli 1993, 1995, Beghelli & Stowell 1997 for a discussion of missing readings in English). Example (2.24a) and (2.24b) cannot have the inverse reading even though the same type of sentence construction would allow inverse readings with another choice of quantifiers. In (2.24c), we have an example of a complement clause and in (2.24d) we have an example of the double object construction (see Larson 1990). In both these cases the inverse reading is banned, even though in a different type of construction, the very same choice of quantifiers would give rise to ambiguity. This effect becomes even more apparent once we have more than two quantificational expressions in the same sentence. If we take a naïve, purely combinatorial approach, the number of readings should increase dramatically with the number of quantifiers: while sentences with only two such elements can have two readings, a sentence with three elements would already result in six readings, a sentence with four elements in twenty-four readings, etc. While it is unlikely to find a sentence with a very large number of operators, finding three or four is not too uncommon. However, we do not usually struggle to understand the meaning of such

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[6] Numerals in fact allow for even more readings. For example, under a cumulative interpretation, neither camera A nor camera B necessarily recorded all the burglars – it just says that every burglar was recorded by at least one of the cameras A or B. This cumulative reading, first discovered by Scha (1981), is one that cannot be reduced to any linear ordering of the two expressions (see also van Benthem 1989, Keenan 1992, Landman 2000; see Sternefeld 1998 and Beck & Sauerland 2000 on how this cumulative reading relates to collective readings). However, as the rest of this thesis is mainly focused on inverse scope readings of universal quantifiers, I will not discuss these various readings of numerals in any more detail.

a sentence. While to a certain extent, the sentence might just be left underspecified, some readings are clearly non-existent or extremely difficult to obtain.

(2.24) a. **No** surveillance camera recorded **a** burglar.

✓No>∃

✗∃>No ≈ There is this one burglar that was recorded by none of the surveillance cameras (but other burglars were recorded).

b. **One** surveillance camera recorded **two** burglars.

✓One>Two

✗Two>One ≈ There are two burglars and each of them was recorded by a different surveillance camera.

c. **A** police officer said that the surveillance camera recorded **every** burglar.

✓∃>∀

✗∀>∃ ≈ For every burglar there is a different police officer who says that the surveillance camera did not record him.

d. The burglar gave **one** police officer **every** stolen item.

✓∃>∀

✗∀>∃ ≈ For each stolen item there is a different police officer to whom it is given.

The most fundamental generalization about scope ambiguities is that in almost all cases, the reading that is dispreferred or missing is the inverse reading, which is also known to generally require more processing resources than the surface reading (e.g. Catlin & Micham 1975, Micham et al. 1980, Gillen 1991, Kurtzman & MacDonald 1993, Tunstall 1998, Anderson 2004, Pylkkänen & McElree 2006, Hackl et al. 2012, and many more). A famous case of a rare exception of this rule are so called inverse linking constructions (May 1977), where the inverse reading is typically preferred or sometimes even the only available reading (see e.g. Kurtzman & MacDonald 1993, Bott & Radó 2009 for experimental evidence). Inverse linking constructions are cases where one QP is contained inside of another QP. They are linked by prepositions of location (Gabbay & Moravcsik 1974) or possession and relation (May & Bayle 2006). An example is given in (2.25).[7]

(2.25) At the conference yesterday, I managed to talk to [a guy [from every raw rubber producer from Brazil]].

✗∃>∀; ✓∀>∃

(example from VanLehn 1978, p. 31)

Inverse linking cases have been taken as evidence for Quantifier Raising (May 1985, Huang 1995, Hornstein 1995), even though there is debate as to where exactly the raised quantifier attaches to. See Zimmermann (2020) for an overview of inverse linking and possible ways of analysis. As for the proclaimed preference for inverse readings, inverse linking constructions are tricky in that in most of the examples provided in the literature the surface reading is pragmatically highly implausible. For

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[7] This effect is especially unexpected, because DPs have sometimes been claimed to be islands for scope (May 1985, Büring 2004, Charlow 2010), which would mean that the lower quantifier should be banned from taking scope over the higher one altogether (see section 2.2.3 on scope islands). However, for this and other reasons, other authors claim that DPs are not scope islands (e.g. Sauerland 2005).

instance, in (2.25), it is hard to imagine how a single person could be part of all raw rubber producers in Brazil. It is therefore difficult to see if the inverse reading is only preferred due to pragmatic reasons[8] or if there is something about the syntactic structure of inverse linking constructions that causes this effect. This influence of pragmatics was already pointed out in Huang (1982), who therefore claimed that inverse linking constructions are ambiguous just like other types of doubly-quantified sentences. It does in fact seem to be the case that the surface reading becomes available, once it is made pragmatically more plausible, see (2.26). In fact, the surface reading even seems to be the preferred reading here. It is therefore unclear, whether inverse linking constructions are such an unusual outlier after all.

(2.26)   Anna read [a book [about every noble prize winner]].
$\checkmark \exists > \forall$; $\checkmark \forall > \exists$

2.2.2   Entailment problem

With some examples of doubly-quantified sentences, it might actually be debatable if we are dealing with two truly distinct interpretations after all. Take sentence (2.27) for example:

(2.27)   Every surveillance camera recorded a burglar.

The surface reading says that for every camera, there exists a burglar that was recorded by this camera. This reading is highly underspecified as to how many burglars have been recorded. Figure 2.2. exemplifies this. Even though the most prominent reading is (a), where for each camera there is a distinct burglar (i.e. a one-to-one mapping), any other number of burglars being recorded by the cameras is conceivable too, such as (b) and (c), as long as no camera is left without a corresponding burglar. Thus, this also includes the reading represented in (b), which would be the only conceivable scenario for the inverse or existential-wide-scope reading of sentence (2.27). That means, if a speaker of English says that sentence (2.27) has the interpretation (b), this does not tell us anything about whether or not the inverse reading is in fact available. It could simply be one of the many interpretations of the underspecified surface reading.
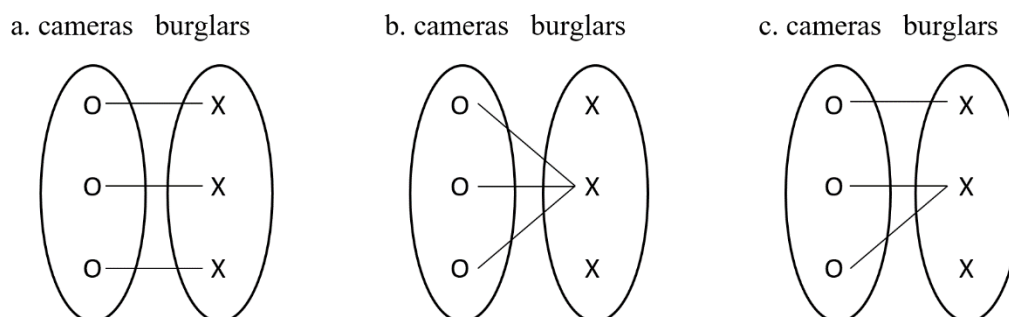
Figure 2.2: Possible interpretations of underspecified $\forall > \exists$ quantifier order in (2.27).

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[8] See chapters 3-5, which show how great the impact of pragmatics is in other doubly-quantified constructions.

This so-called entailment problem has been widely acknowledged and discussed in the scope literature for a long time (e.g. Reinhart 1976, 1997, Cooper 1978, Kempson & Cormack 1981, Ruys 1992, Tunstall 1998, Altman et al. 2005). So, is there scope ambiguity after all? Certain choices of quantifiers/operators do indeed give rise to two truly distinct readings, e.g. non-monotone quantifiers like *exactly two* (Fodor & Sag 1982, Ruys 1992).

(2.28)   Exactly two surveillance cameras recorded a burglar.

Under the surface reading, sentence (2.28) would be true in (a) and (b) out of the three scenarios exemplified in Figure 2.3, but not in (c). Under the inverse reading, it would be true in (b) and (c), but not in (a).
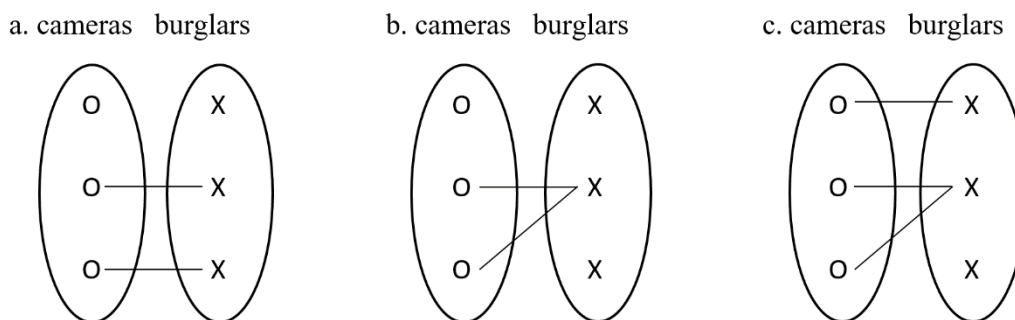
Figure 2.3: Possible (a,b) and impossible (c) interpretations with non-monotone quantifier in (2.28).

Some researchers claim that sentences like (2.27) are only vague, not ambiguous (e.g. Reinhart 1976, 2006), and only sentences like (2.28) can be considered truly ambiguous. Others maintain that *all* doubly-quantified sentences are ambiguous (e.g. Tunstall 1998) – the ambiguity is simply impossible to detect in certain configurations and only becomes visible with, for example, non-monotone quantifiers, where no one reading is entailed by the other. To avoid this entailment issue altogether, for the remainder of this thesis I will only use examples where the inverse reading is not entailed in the surface reading. That is, in the case of universals and existentials, the order will always be $\exists>\forall$ and never $\forall>\exists$. The reason for this choice is that the studies presented in chapters 3-5 will surround the question to what extent (or if at all) the *inverse* reading is available. As described above, the surface reading should always be a possible in the sentence types under investigation anyway. The order $\exists>\forall$ ensures that the presumed inverse reading can clearly be distinguished from the surface reading in that the former is not entailed in the latter, even though the reverse entailment relation is still in place.

2.2.3   Syntactic islands and clause-boundedness

A well-known and widely discussed restriction on quantifier scope ambiguities is that inverse readings are unavailable when the lower quantifier is located in a syntactic island (e.g. May 1985, Huang 1995). A syntactic island is a clause out of which no overt movement, such as wh-movement, can occur (see Ross 1967 on syntactic islands). This is shown in (2.29a-d) with a number of different types of islands. This parallel behaviour to overt movement was taken as evidence that inverse readings must arise due

to some type of movement too – a form of covert movement[9]. This is discussed in more detail in section 2.3.1 on the Quantifier Raising approach of May (1977, 1985).

(2.29) a. *Relative clause island:*
   The officials installed [**a** surveillance camera] that recorded [**every** burglar].
   ✓∃>∀; ✗∀>∃

b. *Temporal adjunct island:*
   The officials installed [**a** surveillance camera] after [**every** burglar] escaped.
   ✓∃>∀; ✗∀>∃

c. *Complex noun phrase island:*
   The official heard [**a** claim] that [**every** burglar] escaped.
   ✓∃>∀; ✗∀>∃

d. *Wh-island:*
   [**An** official] asked why [**every** burglar] escaped.
   ✓∃>∀; ✗∀>∃

However, there is a problem with this generalization: Firstly, the unavailability of inverse readings is in fact not restricted to island environments, but to any type of embedded clause, even in cases where overt movement is grammatical, see (2.30a) vs. (2.30b). This is the well-known effect of *clause-boundedness* (Chomsky 1975, Farkas 1981, Fodor & Sag 1982, Abusch 1994, Beghelli 1993, Fox 1995, a.o.).

(2.30) a. An official said that every surveillance camera recorded the burglars.
   ✓∃>∀; ✗∀>∃

b. ✓What$_i$ did an official say [~~every surveillance camera~~]$_i$ recorded the burglars?

The reason why inverse readings are unavailable in island environments might thus be completely unrelated to the reason why overt wh-movement cannot apply. It could be due to a more general problem with embedding that has nothing to do with islands. On the other hand, some authors have pointed out that there are in fact examples of sentences, where inverse readings out of an embedded complement clause do seem to be available[10] (e.g. VanLehn 1978, Farkas & Giannakidou 1996, Reinhart 1997, Fox 2000). Example (2.31) allows for a reading where it is not always the same doctor that makes sure that a tranquilizer is given, but instead the doctor may vary from patient to patient ('For every patient, there is a doctor who makes sure that a tranquilizer is given to them.').

(2.31) A doctor will make sure that we give every new patient a tranquilizer.[11]
   ✓∃>∀; ✓∀>∃

(Reinhart 1997, p. 350)

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[9] However, see section 6.2.1 for a broader discussion on this presumed connection and the status of islands.

[10] It has been argued that such examples of inverse scope are only apparent and in fact due to the interaction of the quantifier with the genericity operator (Fox & Sauerland 1996). However, Farkas & Giannakidou (1996) provide evidence that inverse readings also occur in sentences that are clearly not generic.

[11] Due to the presence of three QPs in this sentence ('a doctor', 'every patient', 'a tranquilizer'), this sentence is in fact very complex and may have more readings than the two stated above. However, I will ignore the role of the last QP, since it is not relevant here.

This is also shown in more recent, experimental work (Syrett 2015). In fact, when the complement clause is non-finite, it seems to be even easier to obtain an inverse reading, as shown in example (2.32) from Hornstein (1995). This is why sometimes, the phenomenon has been referred to as *finite-clause constraint*.

(2.32)   Someone expected [$_S$ every Republican to win].
　　　　✓∃>∀; ✓∀>∃

However, similar claims have been made for certain island environments too: there are several examples of introspective judgments in the literature, where inverse readings out of such islands seem possible (e.g. May 1977, Hulsey & Sauerland 2006, Szabolcsi 1997/2012), see the example in (2.33).

(2.33)   A book which every prisoner left surprised the warden.

<div align="right">(May 1977, p. 223)</div>

This is again supported by more recent experimental work (Tsai et al. 2014/Scontras et al. 2017, Tanaka 2015). In face of these counterexamples, the above stated correlation of inverse scope readings and overt movement seems much less obvious – unless we can find that the ban on overt movement out of islands is also less strict as thought. Indeed, Tanaka (2015) shows that not only are inverse readings out of different types of adjunct islands marginally available in English, also overt movement seems to be merely reduced in acceptability rather than completely excluded. This is in line with the long known notion of *weak* and *strong islands*. More importantly, Tanaka shows that the availability of inverse readings and the acceptability of overt movement show a surprisingly parallel behaviour in relative acceptability ratings across different types of adjunct islands. While this can be taken as evidence to save the original claim that overt and covert movement behave in parallel, the stark contrast between complement clauses like (2.30a) and (2.30b) remains: while the inverse reading is either impossible or very hard to get, the wh-sentence is typically rated to be perfectly acceptable.

The data around the clause-boundedness of QR is thus more blurry than it seems on first sight. VanLehn (1978) already suggested that the phenomenon of clause-boundedness might in fact not be due to grammatical reasons. The source for this assumption are sentences where inverse readings are available out of relative clauses under specific conditions. This is the case when the quantifier *each* is chosen (which according to Ioup's 1975 hierarchy has a particularly strong desire to take wide scope, see section 2.2.6), and when the relative pronoun is absent, see (2.34). Szabolcsi (1997/2012), too, points out that in contrast to *every*, *each* can often give rise to an inverse scope reading even when the embedded clause is tensed. In subsequent work, the clause-boundedness effect has been attributed to processing reasons rather than a grammatical rule (e.g. Fox 1999, Tanaka 2015, Wurmbrand 2018), see also section 2.2.4 below.

(2.34)   At the conference yesterday, I managed to talk to a guy representing each raw rubber producer from Brazil.
　　　　✓∃>∀; ✓∀>∃

<div align="right">(VanLehn 1978, p. 31)</div>

2.2.4 Exceptional wide scope

The debate around island effects and other cases where inverse scope is not detected is further complicated by the phenomenon of exceptional wide scope. In their famous example (2.35), Fodor & Sag (1982) show that the indefinite within the conditional can take wide scope. This is unexpected because conditionals are considered islands for movement. The sentence allows the reading that the speaker will only inherit a fortune under the condition that a specific friend of his dies. This is a common feature of indefinites, which can easily take wide scope in an almost unrestricted way, see also Endriss (2009) for an extensive overview of this phenomenon.

(2.35) If **a friend of mine from Texas** had died in the fire, I would have inherited a fortune.

<div align="right">(Fodor & Sag 1982, p. 369)</div>

This phenomenon is commonly dealt with by treating indefinites such as *a* or *some* as choice functions or generalized Skolem terms (Reinhart 1997, Winter 1997, 2004, Kratzer 1998, Steedman 2012). A choice function has the semantic type ‹‹e,t›,e›, i.e. it is a function from sets to individuals. In other words, it is a function "[…] that picks a unique individual from any non-empty set in its domain" (Kratzer 1998, p. 6). The choice-functional approach for sentence (2.35) is shown in (2.36). It can be read as follows: there exists a choice of a friend of mine from Texas, such that if that friend dies in the fire, I will inherit a fortune.

(2.36) ∃f [die in the fire (f (friend of mine from Texas)) → inherit fortune (I)][12]

This approach solves the island problem described above in that the indefinite never actually leaves the island. That is, we can arrive at the indefinite-wide-scope interpretation without having to assume movement across the island boundary. There is in fact empirical evidence for this seemingly theoretical trick provided by Winter (1997): in a sentence like (2.37), where the indefinite *a* is replaced by a plural numeral, the indefinite can take apparent wide scope, but it cannot distribute over the conditional, supporting the idea that it is still 'trapped' within the island. The sentence in (2.37) can only have the wide-scope meaning that for three specific friends of mine, if *all three* of them had died in the fire, I would have inherited a fortune. It cannot mean that for three specific friends of mine, if *any one* of them had died in the fire, I would have inherited a fortune.

(2.37) If **three friends of mine from Texas** had died in the fire, I would have inherited a fortune.

While some authors have argued that indefinites are lexically ambiguous between a choice/Skolem function and a quantifier (Winter 1997, Kratzer 1998), others claim that a purely choice/Skolem functional approach can cover all empirical facts and a quantificational analysis is unnecessary (e.g. Steedman 2012). However, there are also arguments against choice functional approaches. For example, as Endriss (2009) points out, the category of elements that are analysed as choice functions cannot be distinguished from the category of elements that are analysed as quantifiers on any semantic or morphosyntactic basis, i.e. this category must be stipulated. Endriss (2009) further mentions that elements categorized as choice functions, in contrast to proper names, can occur in existential

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[12] See Kratzer (1998) for a discussion on whether the choice function is existentially or contextually bound.

constructions, even though both are considered to be of type ‹e›. For an overview of other arguments, see Endriss (2009). Alternative approaches to this phenomenon have often described wide-scope indefinites as simply scopeless. For example, Schwarzschild (2002) takes wide scope to be an illusion arising from maximal domain restriction to a singleton set. See also Charlow (2020) for a recent approach to this issue, employing yet another route.

Since the experiments in this paper solely investigate inverse scope effects of distributive universals, I will not dive deeper into the analysis of indefinites here. However, the issue will be picked up again in section 5.3 when discussing the Asante Twi indefinite *bi*.

2.2.5   Exceptional narrow scope

Apart from unexpected wide scope interpretations, there is also the opposite phenomenon – cases where inverse readings are not detected, contrary to expectation. These cases seem to be more lexically determined. Bare plurals constitute such a case (see e.g. Carlson 1977b, Ruys & Winter 2011). Example (2.38) cannot have the reading that there are Midwestern cities such that John met every inhabitant of them, even though this reading is the more plausible one.

(2.38)   John met every inhabitant of midwestern cities.
$\checkmark$/#$\forall$>$\exists_{pl}$; ✗$\exists_{pl}$>$\forall$

(Ruys & Winter 2011, p. 175)

Another case consists of (modified) numerals which cannot take wide scope over a preceding existential (Liu 1990, Beghelli 1993, 1995), see (2.39). However, this could also be the inability of existentials to interact scopally with each other rather than a general inability of numerals to take wide scope. This varying behaviour of numerals is also sometimes called *mixed scope* (see Ioup 1975, Beghelli 1993).

(2.39)   **A** surveillance camera recorded **(exactly) two** burglars.
$\checkmark$$\exists$>2; ✗2>$\exists$

Inverse readings are also unavailable with monotone decreasing quantifiers (Ruys & Winter 2011), as shown in (2.40).

(2.40)   a. **A** surveillance camera recorded **few** burglars.
$\checkmark$$\exists$>few; ✗few>$\exists$
b. **Every** surveillance camera recorded **few** burglars.
$\checkmark$$\forall$>few; ✗few>$\forall$

While this thesis is not primarily concerned with exceptional wide scope or missing readings, the examples above show that quantifier scope ambiguities are a complex problem with no simple solution. In the following final section, I am going to present a collection of various factors that have been shown to impact the degree to which the inverse reading is available in doubly-quantified sentences.

2.2.6   More factors in scope interpretation

(i)   Linear order/c-command/grammatical function/semantic role/animacy

The general preference of surface over inverse readings has been tackled in various different ways. The most obvious and also earliest assumption was that *linear order* decides on scope interpretation (Johnson-Laird 1969, VanLehn 1978, Fodor 1982, Gillen 1991, Tunstall 1998, AnderBois et al. 2012). That is, the quantifier that linearly precedes the other quantifier preferably takes wide scope. However, it was quickly noted that linear order is strongly correlated with a number of other factors. The linearly preceding element in most cases also c-commands[13] the subsequent element, which lead Reinhart (1983) to the conclusion that *c-command* is the decisive factor. Another suggestion was that *grammatical function* plays an important role (Ioup 1975, Micham et al. 1980, Gillen 1991, Kurtzman & MacDonald 1993, Tunstall 1998, Baltzani 2002, Anderson 2004, AnderBois et al. 2012), or alternatively *semantic role* (Jackendoff 1972, Grimshaw 1990, Kurtzman & MacDonald 1993) or *animacy* (Catlin & Micham 1975, Micham et al. 1980). The hierarchies in (2.41) below illustrate how the preference to take wide scope is ordered from left (strongest) to right (weakest) with those different factors that allegedly influence scope interpretation. Some authors have also suggested that several of these factors are at play and interact with each other (e.g. Ioup 1975, Kurtzman & MacDonald 1993).

(2.41)   a. *Grammatical function hierarchy (Ioup 1975):*
              topic > deep and surface subject > deep or surface subject > indirect object >
              prepositional object > direct object
         b. *Thematic hierarchy (Kurtzman & MacDonald 1993):*
              agent > experiencer > theme
         c. *Animacy hierarchy (Micham et al. 1980):*
              animate > inanimate

As mentioned above, these factors typically correlate strongly, which makes it difficult to differentiate between them. The problem is illustrated with example (2.42). The quantifier *some girl* (i) linearly precedes *every book*, (ii) c-commands *every book*, (iii) is the subject of the sentence, (iv) acts as an agent, (v) and is animate. That is, all five proposed factors would support *some girl* to preferably take wide scope over *every book*.

(2.42)   [Some girl] read [every book].

(ii)   Type of quantifier

Ioup (1975) was the first to propose a hierarchy for quantifiers and also to test it experimentally. She claims that the relative preference to take wide scope is part of the lexical semantics of quantifiers. In (2.43), the quantifiers of English are ordered from the highest preference on the left to the lowest preference on the right.

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[13] A node A c-commands a node B iff the first branching node above A also dominates B and B and A do not dominate each other.

(2.43) *Quantifier hierarchy:*
      each > every > all > most > many > several > some$_{pl}$ > a few

Ioup claims that this hierarchy is universal and provides data from various languages that she investigated in her surveys. Note that monotone decreasing quantifiers are completely excluded from this hierarchy (see section 2.1.2). Ioup points out that the wide scope preference seems to correlate with the number of elements contained in the set. An exception seems to be the singular indefinite *a*, not included in her hierarchy. She says that this element might be located between *every* and *all*. This exceptional status of *a* is supported through experimental work (e.g. Feiman & Snedeker 2016). See also section 2.2.4 on the analysis of *a* as choice/Skolem function. Ioup's hierarchy has been confirmed in much subsequent work and for various languages and is one of the least controversial factors, even though not all authors assign it the same weight as Ioup (see e.g. Tunstall 1998, Bott & Radó 2007, 2009, Radó & Bott 2012, 2018, AnderBois et al. 2012).

    (iii)   *World knowledge & context*

Even though many authors have speculated that world knowledge or contextual information must have a strong impact on quantifier scope interpretation, it is a factor that is much more vague and difficult to control for. In particular world knowledge – or more generally, what is considered to be plausible – may vary between speakers of the same language, but also between different cultures. In the case of inverse linking in section 2.2.1, we saw that plausibility considerations can cause the inverse reading to appear more prominent than it actually is. At the same time it can also happen that the inverse reading seems to be absent just because the scenario it describes is too implausible. Ruys & Winter (2011) therefore advocate that "[…] a reading is absent only if we have found it absent despite its being plausible – or better, despite its being the only plausible reading of the sentence." (Ruys & Winter 2011, p. 165). This train of thought will become important later in the discussion of the experiments presented in this thesis.

Even though contextual aspects of scope interpretation has never really been the centre of attention, a number of authors have investigated its effect (Saba & Corriveau 1997, Villalta 2003, Anderson 2004, Srinivasan & Yates 2009, AnderBois et al. 2012, Syrett 2015). Anderson (2004) asked participants to choose between the surface and inverse reading of sentences after reading a short context that was biased towards one of the readings based on the number of participants mentioned in there. This is exemplified in (2.44) (see also section 3.1 for a more detailed description of Anderson's experiments). In the former case, participants opted for the inverse reading in 19% of the cases, while in the latter case, they chose it in 53% of the cases.

(2.44) a. *context SR-biased:* […] One weekend, the climbing equipment shop sponsored **a show to demonstrate the sport.**
      b. *context IR-biased:* […] One weekend, the climbing equipment shop sponsored **a race between climbing enthusiasts**.
      c. *target sentence:* While an official timed the event, [an experienced climber] scaled [every cliff].

                                       (adapted from Anderson 2004, p. 58)

Similarly, Syrett (2015) shows that in the case of Antecedent Contained Deletion sentences with a finite clause in English, Quantifier Raising is promoted by a context that supports this reading. Villalta (2003) shows for how-many-questions that context plays a crucial role in processing and interpretation of scope. In a self-paced-reading study, ambiguity resolution was delayed in dependence of the context. Generally, these works show that the dispreferred reading can be boosted if it is initially biased. This is a relevant test case for languages or constructions which are suspected to block inverse readings. Further, the pragmatic impact may also explain some of the differences that occur between different studies of the same phenomenon.

A number of authors have attempted to build predictive models that take information provided by general world knowledge into account. For example, in Saba & Corriveau (2001), world knowledge was based on the number typicality of the first argument with respect to the second argument. For instance, in a sentence like "A doctor lives in every city.", the typicality of a single doctor being involved in different instances of living in a city is very low. Therefore, the inverse reading is strongly preferred (see the discussion on inverse linking constructions in section 2.2.1). Similarly, Srinivasan & Yates (2009) ran two experiments, showing that a model that takes pragmatic knowledge into account – in their case in terms of number typicality – improves scope judgments. They claim that scope preferences can be reduced or even turned around through pragmatic knowledge.

(iv) Information structure & prosody

Various authors have discussed how scope interpretation is dependent on aspects of information structure such as *topic/comment* or *focus/background* (e.g. Kempson & Cormack 1981, May 1985, Krifka 1998, Ionin 2001, a.o.). For instance, Kempson & Cormack (1981) claim that whatever is marked as topic preferably takes wide scope. Bobaljik & Wurmbrand (2012) suggest that even though German does not generally allow for inverse readings, specific demands of information structure may give rise to such interpretations. In Russian, the inverse reading is considered to be available under contrastive focus (Ionin 2003, Neeleman & Titov 2009, Ionin & Luchkina 2018). In Greek, Oikonomou et al. (2020) show that information structure plays a major role in scope assignment.

Information structure is often marked through special prosodic patterns. Even though there are only few experimental studies testing this on a larger scale and in a controlled way, many authors have claimed that prosody has an influence on scope interpretation based on introspective judgments. Depending on the language, certain prosodic patterns are said to make the inverse reading more prominent (or available in the first place). For English, a fall-rise pattern has been suggested to increase inverse scope interpretations (Jackendoff 1972, Liberman & Sag 1974, Ladd 1980, Ward & Hirschberg 1985). Sugawara et al. (2018) provide experimental evidence that indeed, both English-speaking children and adults associate this prosodic pattern with the inverse reading. Similarly, for German, the rise-fall contour (or hat-contour) is said to make inverse readings (more) available (Löbner 1990, Höhle 1991, 1992, Frey 1993, Büring 1994, 1997, Jacobs 1997, Krifka 1998, Sauerland & Bott 2002). In Japanese, too, a rise-fall pattern can make inverse readings available in canonical SOV sentences, even though Japanese is otherwise often described as scope-rigid (Kitagawa 1994, Sato & Maeda 2018). For Russian, Ionin & Luchkina (2015, 2018) claim that contrastive prosody makes inverse readings easier to obtain. However, the effect is said to only hold with OVS, but not with SVO, word order. A natural question that arises is whether information structure and prosody can interact with scope interpretation

independently. Surányi & Turi (2018) provide a production experiment in Hungarian, suggesting that prosody cannot be used independently of information structure to express a certain scope reading. To what extent this is also the case for other languages is yet to be tested.

2.2.7   Cross-linguistic perspective on quantifier scope

The example sentences in this chapter have so far mostly been in English (even though many of the generalizations extend to other languages). However, the picture is further complicated when taking language-specific peculiarities into account. What holds for English does not necessarily hold for other languages. Languages differ greatly in the extent to which quantifier-scope ambiguities arise, the degree to which certain readings are more or less preferred and the environments in which this is the case.

English is generally considered to readily allow for inverse readings across different types of syntactic constructions, even though the surface reading is still preferred (e.g. Fodor 1982, Kurtzman & MacDonald 1993, Anderson 2004). Other languages are much more restricted as to which constructions allow for inverse readings. German, for example, has been said to only allow for inverse readings under specific conditions (Frey 1993, Pafel 2005, Bobaljik & Wurmbrand 2012, see also section 4.1). However, subsequent studies showed that inverse readings, despite being clearly dispreferred, do not seem to be as restricted as previously thought (Bott & Radó 2007, 2009, Radó & Bott 2012, 2018, Bott & Schlotterbeck 2015). Similarly, early work on Russian made it seem like Russian only allows for surface readings (Ionin 2003). However, later experiments showed that this strong claim needs to be relaxed, as inverse readings can in fact arise (Stoops & Ionin 2013, Ionin et al. 2014, Ionin & Luchkina 2015, Antonyuk 2015). There are also languages that seem to completely resist inverse scope interpretations. Mandarin is generally considered to be extremely scope-rigid (Huang 1982, Aoun & Li 1989, 1993, Liu 1990), an assumption that is supported by various experiments on both doubly-quantified sentences (Tsai et al. 2014/Scontras et al. 2017) and sentences with a quantifier and negation (Zhou & Crain 2009).

On the other hand, the phenomenon of quantifier scope is also not completely random. Certain features and patterns seem to be cross-linguistically stable and some differences between languages arise in a regular and predictable way. Ioup (1975), as noted further above, provides a hierarchy of quantifiers (2.43) and grammatical functions (2.41), ordered by how likely they are to take wide scope, which she claims to hold cross-linguistically. The inverse linking constructions presented in section 2.2.1 have the unusual effect of exhibiting a preference for inverse readings cross-linguistically. As demonstrated in section 2.2.6, information structure and prosody have been shown to have important and largely comparable effects on scope interpretation across languages (Jackendoff 1972, Liberman & Sag 1974, Ladd 1980, Ward & Hirschberg 1985, Sugawara et al. 2018 for English; Löbner 1990, Höhle 1991, 1992, Büring 1994, 1997, Krifka 1998, Sauerland & Bott 2002, Bobaljik & Wurmbrand 2012 for German; Ionin, Neeleman & Titov 2009, Ionin & Luchkina 2018 for Russian; Kitagawa 1994, Watanabe 2000, Sato & Maeda 2018 for Japanese; Surányi & Turi 2018 for Hungarian; Oikonomou et al. 2020 for Greek). Bobaljik & Wurmbrand (2012) claim that languages with less word order freedom allow for inverse readings more than languages with more word order freedom, with the argument that in the latter case, speakers can just express the intended scope constellation via overt movement (see also section 2.3.1). This indeed seems to be the case by comparing English (little freedom, IR easily

available) with German, Turkish, Hungarian, Russian, Japanese, or Korean (more freedom, IR rather difficult to obtain). However, there are also counterexamples to this alleged correlation. Mandarin, like English, has strict word order, but does not give rise to inverse readings. Greek, on the other hand, has fairly relaxed word order, but seems to allow for inverse readings quite readily (Varkanitsa et al. 2016, Oikonomou et al. 2020). The reasons for this are not fully clear, even though some suggestions have been made (e.g. Huang 1982, Aoun & Li 1989).

2.3 Approaches to quantifier scope

In the course of the last two sections on quantifier scope ambiguities, we have seen that we are dealing with a multi-dimensional phenomenon with highly variable behaviour. This variable behaviour needs to be explained. Many researchers have done their best to adequately describe and analyse scope ambiguities, employing a multitude of different approaches. In the following, I will discuss some of the most important approaches that have come about in the past few decades and their respective benefits and limitations. As we have seen, quantifier scope is a complex phenomenon and the approaches vary as to the aspects on which they focus and are thus able to explain. As is common practice, I will divide the different approaches into broad classes: those approaches that treat quantifier scope ambiguities more as a syntactic phenomenon (2.3.1) and those that treat them more as a semantic phenomenon (2.3.2).

2.3.1 Syntactic approaches

This section presents accounts that tie scope interpretation tightly to syntactic structure. This can mainly be done in two different ways, which are not mutually exclusive. One way is to assign dedicated positions in the tree where the respective QPs move to and can take scope (Hornstein 1995, Beghelli & Stowell 1997). This approach tends to have the problem in being too strict in the scopal options that are predicted. The other way is to stipulate a general covert movement operation at LF with the purpose of rearranging quantifiers to align with the right scope interpretation. An operation like this has the opposite problem in tending to overgenerate, i.e. predicting more interpretation options than are actually available in the grammar of the language. This can, however, be regulated in accounts that make reference to economy principles, which can then readily explain not only the (un-)availability but also the gradual difference between scope preferences and associated processing costs.

One of the earliest and also most prominent accounts on quantifier scope was developed by May (1977, 1985). According to this account, scope relations are determined by the hierarchical relations of quantifiers at the abstract representational level of Logical Form (LF). May proposes a covert syntactic operation named Quantifier Raising (QR) that applies at LF. QR is a covert A'-movement operation that can raise a quantifier at LF to a position where it can receive wide scope[14]. If we apply this to (2.45a), the inverse reading (IR) arises when the universal quantifier phrase is raised to a position from which it can c-command the existential quantifier phrase. This is illustrated in (2.45b).

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[14] Another important reason for the introduction of this operation was to avoid a type clash in sentences with object QPs, see section 2.1.3.

(2.45)   a. A surveillance camera recorded every burglar.

b. $\forall > \exists$: [[$_{NP}$ every burglar]$_2$ [[$_{NP}$ a surveillance camera]$_1$ [t$_1$ [$_{VP}$ recorded t$_2$]]]]

May's idea of Quantifier Raising was implemented in numerous subsequent accounts, some of which will also be discussed further below, though the details may vary. May's approach is appealing for multiple reasons. First, it can explain the well-known differences in preference and processing difficulty between surface and inverse readings by stipulating that inverse readings require an additional operation step. Various approaches based on QR have taken advantage of this (e.g. Wurmbrand 2018, Blok 2019). Secondly, QR can resolve two issues at once, i.e. the type clash of object QPs described in section 2.1.3 and scope ambiguities[15]. Finally, the idea of covert movement aligns well with the parallel behaviour seen in overt movement such as wh-movement. It is generally accepted that QR as a covert syntactic operation should be subject to the same constraints as an equivalent overt syntactic operation, such as wh-movement. This idea was originally supported by the observation that inverse scope is unavailable in exactly those syntactic configurations where overt movement is banned, namely syntactic islands. The idea is that the inverse reading in (2.46a) is unavailable because QR cannot apply for the same reason why overt wh-movement cannot apply in (2.46b). However, see section 2.2.3 on why this correlation with syntactic islands is not as straightforward as it appears on first sight.

(2.46)   a. The officials installed [a surveillance camera] that recorded [every burglar].

✓$\exists > \forall$; ✗$\forall > \exists$

b. *Who$_i$ did the officials install a surveillance camera that recorded [every burglar]$_i$?

There is, nevertheless, another strong argument in favour of QR, namely the case of Antecedent Contained Deletion (ACD). An example is given in (2.47a) from May (1985). In such sentences, the ellipsis site is contained in its own antecedent. Under the common assumption that the antecedent is copied into the ellipsis site, the infinite regression problem arises, as exemplified in (2.47b). There, by copying the antecedent into the ellipsis site, the ellipsis site itself is copied too and therefore never resolved. However, if the QP is raised via QR, as in (2.47c), this problem can be circumvented.

(2.47)   a. Dulles [$_{VP1}$ suspected [$_{NP}$ everyone who Angleton did [$_{VP2}$ **e**]]]

b. Dulles [$_{VP1}$ suspected [$_{NP}$ everyone who Angleton did [$_{VP2}$ **[$_{VP1}$ suspected [$_{NP}$ everyone who Angleton did [$_{VP2}$ e]]]**]]] $\rightarrow$
Dulles [$_{VP1}$ suspected [$_{NP}$ everyone who Angleton did [$_{VP2}$ **[$_{VP1}$ suspected [$_{NP}$ everyone who Angleton did [$_{VP2}$ [$_{VP1}$ suspected [$_{NP}$ everyone who Angleton did [$_{VP2}$ e]]]**]]]]]] $\rightarrow$ […]

c. [$_{NP}$ everyone who Angleton did [$_{VP2}$ **e**]]$_i$ Dulles [$_{VP1}$ suspected t$_i$] $\rightarrow$
[$_{NP}$ everyone who Angleton did [$_{VP2}$ **suspected t$_i$**]]$_i$ Dulles [$_{VP1}$ suspected t$_i$]

(adapted from May 1985, p. 11-12)

In addition to the raising operation QR, May also introduced the operation of Quantifier Lowering (QL). The reason for this is demonstrated in examples like (2.48), repeated from (2.23a) above, where the quantifier can take scope *below* a subsequent operator. Because in this system only quantifiers and not

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[15] But see e.g. Blok (2019) why this conflation is not necessarily an advantage.

operators like negation can undergo QR, May's idea is that the quantifier lowers to a position below negation.

(2.48)   [Every surveillance camera] [didn't] record the burglars.
　　　✓∀>Neg; ✓Neg>∀

However, QL has not met the same success as QR. One reason is that movement operations downward are generally avoided in syntax. Also, the observed correlation between QR and overt movement with respect to island sensitivity cannot be seen with QL. Therefore, while QR was adopted in much subsequent work, many authors tried to do without QL. Aoun & Li (1989) instead proposed the Scope Principle, which says that "[a]n operator A may have scope over an operator B iff A c-commands B or an Ā-member in the chain[16] headed by B." (Aoun & Li 1993, p. 204). Later, effects originally explained via QL were instead understood as part of the broader phenomenon of reconstruction (Chomsky 1977). A reconstructed element "[…] seems to behave as if it occupied a position different from its 'surface' position […]" (Sportiche 2006, p. 38). Particularly, it behaves as if it occupied the position in which it occurred before it was moved. After the introduction of the Copy Theory of movement (Chomsky 1993, 1995), it was not necessary anymore to assume QL. Separating reconstruction from an operation like QR is also supported by the fact that inverse readings caused by reconstruction tend to be much easier to obtain cross-linguistically than inverse readings not caused by reconstruction. If both cases were captured by the same covert movement operation QR/QL, it would be unclear how that difference comes about. Reconstruction will become important in section 6.2.1, where I will analyse to what extent it can serve as an explanation for unexpected inverse readings in relative clauses.

It is also possible to treat quantifier scope ambiguities in the syntax without stipulating a covert movement operation like QR. Hornstein (1995), for example, provides an account to quantifier scope ambiguities that is set within the Minimalist Framework. In this approach, DPs obligatorily move to the specifier of AgrP in order to have their case checked. They can take scope from either this position or their base position, once LF is computed, see (2.49). In order to explain why strong/presuppositional QPs generally take wide scope, Hornstein claims that they obligatorily take scope in SpecAgrP. This is also why in his account, an ∀>∃ sentence like (2.50) is not ambiguous but merely vague: no two distinct LFs are generated. The LF in (2.50b) is illicit, because a strong QP like *every camera* must take scope from its SpecAgrP position.

(2.49)   A camera recorded every burglar.
　　　a. ✓[$_{AGRsP}$ [a camera]$_{sbj}$ [$_{AGRoP}$ [every burglar]$_{obj}$ [$_{VP}$ t$_{sbj}$ [recorded t$_{obj}$]]]]
　　　b. ✓[$_{AGRsP}$ [$_{AGRoP}$ [every burglar]$_{obj}$ [$_{VP}$ [a camera]$_{sbj}$ [recorded t$_{obj}$]]]]

(2.50)   Every camera recorded a burglar.
　　　a. ✓[$_{AGRsP}$ [every camera]$_{sbj}$ [$_{AGRoP}$ [a burglar]$_{obj}$ [$_{VP}$ t$_{sbj}$ [recorded t$_{obj}$]]]]
　　　b. ✗[$_{AGRsP}$ [$_{AGRoP}$ [a burglar]$_{obj}$ [$_{VP}$ [**every camera**]$_{sbj}$ [recorded t$_{obj}$]]]]

While Hornstein's account is elegant in not requiring any additional operations such as Quantifier Raising (see also the subsequent section), it fails to explain why inverse readings are generally

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[16] A chain contains the operator B itself, its traces, and potential variables bound by it.

dispreferred. Since both DPs raise for case-checking reasons, there is no additional step associated with inverse readings that would explain their lower acceptability and higher processing costs. Furthermore, because this account makes reference to specific AgrP locations in the tree, it does not easily capture all possible constructions where inverse readings are available. It is also not clear if this approach can extend to other languages in the same way.

Beghelli (1995) and Beghelli & Stowell (1997) provide an account similar to Hornstein (1995) in that they require QPs to move to specific positions in the syntactic tree from which they can take wide scope. However, while in Hornstein (1995), this occurs as a side effect of DPs moving through their usual position for case-checking reasons, Beghelli & Stowell introduce a whole range of new functional categories, where features can be checked and where scope can be taken, see (2.51).

(2.51)

```
RefP
├── Spec
│   └── GQP
└── CP
    ├── Spec
    │   └── WhQP
    └── AgrSP
        ├── Spec
        │   └── CQP
        └── DistP
            ├── Spec
            │   └── DQP
            └── ShareP
                ├── Spec
                │   └── GQP
                └── NegP
                    ├── Spec
                    │   └── NQP
                    └── AgrOP
                        ├── Spec
                        │   └── CQP
                        └── VP
                            └── . . .
```

(Beghelli & Stowell 1997, p. 6)
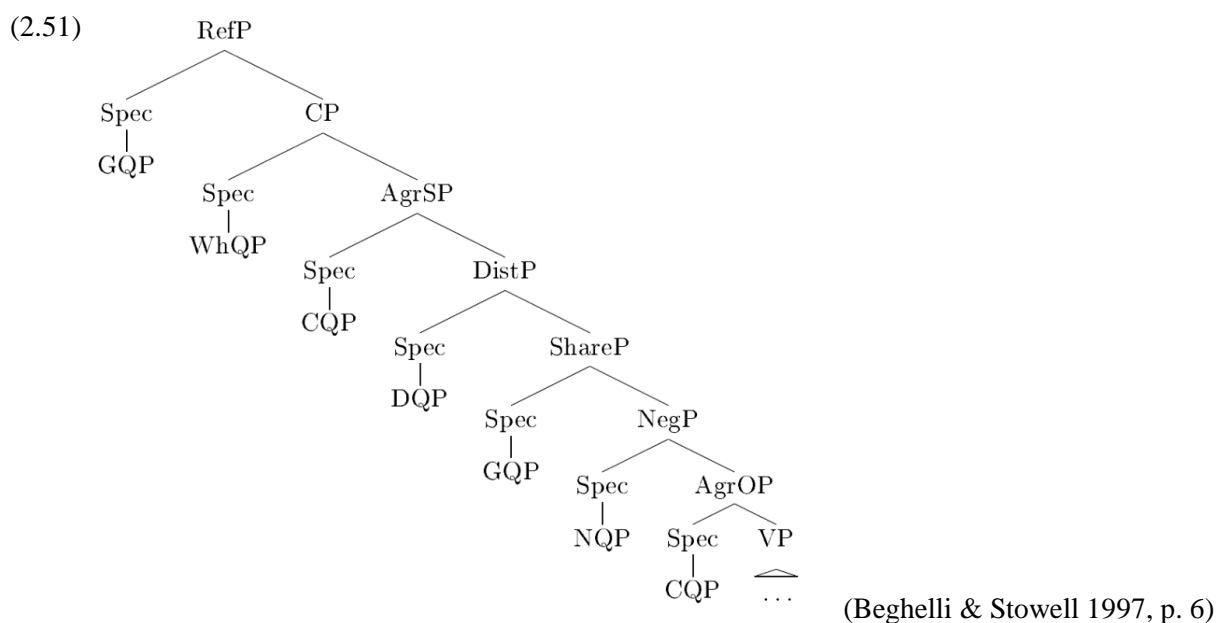
Quantificational expressions are grouped into five classes: interrogative QPs (WhQP) like *what*, negative QPs (NQP) like *nobody*, distributive-universal QPs (DQP) like *every*, counting QPs (CQP) like monotone decreasing quantifiers (*few*) and modified numerals (*more than three*), and group-denoting QPs (GQP) like existentials (*some*), numerals (*one*), and definites (*the*). Different types of quantifiers have to move to different positions via QR, even though some of them can go to more than one target position. The c-command relationship at LF determines scope. Even though they assume that the movement happens via QR, it is severely restricted in this account. While Beghelli & Stowell's account was originally developed for English, they point out that there is also evidence from other languages in support of their account, e.g. KiLega, Palestinian Arabic, Hindi, and various Germanic languages. Szabolcsi (1997/2012) proposes that in Hungarian, quantifiers overtly move to dedicated positions in the tree that strongly correlate with the ones proposed in Beghelli & Stowell, and that quantifiers take scope from these positions. Beghelli & Stowell's account captures syntactically why some quantifiers tend to take wide scope easier than others and can make sense of a lot of the variation in scope ambiguities, both in English and a number of other languages. An further advantage of their account is that it is more restrictive than the classical QR approach and it also predicts gradual differences depending on quantifier choice. In contrast to that, in the accounts of May (1977, 1985) and

Aoun & Li (1989), QR is applied very liberally and is not tied to specific positions in the tree. However, Beghelli & Stowell's account only makes binary predictions (inverse scope available/unavailable) and cannot easily provide an explanation or description of the gradual differences between scope preferences. There are, however, various approaches based on QR that do a better job at this. These approaches make reference to economy considerations and will be presented in the following.

Fox (1995, 2000) provided one of the first accounts on scope that make reference to economy principles. He coined the term *Scope Economy*, claiming that covert movement operations such as Quantifier Raising have to be motivated by a change in interpretation, otherwise such movement is blocked. He provides evidence from ellipsis sentences, which are subject to the Parallelism Constraint, as given in (2.52).

(2.52)   *Parallelism Constraint:*
      The scope-bearing elements in the antecedent sentence must receive scope parallel to that of the corresponding elements in the ellipsis sentence.

<div align="right">(Fox 2000, p. 31)</div>

A sentence like (2.53) is unambiguous according to Fox, since Quantifier Raising in the elided part is blocked by Scope Economy, as raising the universal above the name 'Mary' would not lead to a change in semantics (2.53b). At the same time, raising the universal only above 'some boy' in the first clause, where it does lead to a change in semantics, would be a violation of parallelism (2.53c). Sentence (2.54), on the other hand, should be ambiguous. There, Quantifier Raising can succeed in both the antecedent and the elided clause under economy considerations, thereby also satisfying parallelism.

(2.53)   Some boy admires every teacher and Mary does too.
      a. some boy_1 [every $teacher_2$ [t_1 admires t_2]] and $Mary_1$ [every $teacher_2$ [t_1 admires t_2]]
      b. *every $teacher_2$ [some boy_1 [t_1 admires t_2]] and every $teacher_2$ [$Mary_1$ [t_1 admires t_2]]
      c. *every $teacher_2$ [some boy_1 [t_1 admires t_2]] and [$Mary_1$[every $teacher_2$ [t_1 admires t_2]]

(2.54)   Some boy admires every teacher and some girl does too.
      a. some boy_1 [every $teacher_2$ [t_1 admires t_2]] and some $girl_1$ [every $teacher_2$ [t_1 admires t_2]]
      b. *every $teacher_2$ [some boy_1 [t_1 admires t_2]] and every $teacher_2$ [some $girl_1$ [t_1 admires t_2]]

<div align="right">(adapted from Fox 1995, p. 298-299)</div>

However, Anderson (2004) tested for the availability of inverse readings in elided sentences and found that Fox' introspective judgment about these sentences was not replicated in a quantitative experiment with native speakers of English. Participants did in fact accept the inverse reading of the first conjunct in sentences equivalent to (2.53). See also chapter 3 for a replication and more in-depth discussion of these results.

Nevertheless, Fox' Scope Economy provides an elegant explanation for the clause-boundedness effect of Quantifier Raising. Fox assumes that there is no extra constraint that restricts QR in complement clauses compared to overt A-bar movement. In both cases, successive cyclic movement applies. However, while overt movement applies for reasons of feature-checking, covert movement is restricted by economy considerations. Therefore, in order to arrive at the inverse reading for an embedded clause

like (2.55), repeated from (2.24c) above, the QP would have to undergo two steps of QR and both of them would need to be justified by a semantic change[17]. However, only the second step, where the second QP is raised above the first QP, does in fact change the meaning of the sentence. The first step is blocked, because the second QP is still below the first QP, thereby not leading to any meaning change.

(2.55)   [**A** police officer] said [that the surveillance camera recorded [**every** burglar]].

However, being strict about Fox' Scope Economy would mean that QR cannot be used anymore to explain cases of ACD (discussed further above), since there is no change in the meaning of the sentence. Cecchetto (2004) addresses this issue by widening the definition of what constitutes as a semantic motivation for QR. According to Cecchetto, QR can also apply to resolve a type mismatch (see section 2.1.3) or to resolve the infinite regression problem of ACD. Fox' Scope Economy was later extended by Mayr & Spector (2012) to a Generalized Scope Economy Condition[18].

Reinhart (1995, 1997, 2006) also presents an economy account on quantifier scope, *Interface Economy*, but her account includes the influence of contextual information. It is based on the surface order of the quantifiers, i.e. the default reading is the surface reading, which is determined by the c-command relationship of the two quantifiers. When the surface reading is at odds with contextual information, this can induce Quantifier Raising. As a consequence, a procedure called *Reference Set Computation* applies on an additional layer in the Y-model. See Figure 2.4 below, where LFs and PFs are compared and the LF which is a better fit (surface vs. inverse reading) is chosen[19].

Reference Set Computation

PF   LF

Spell-Out
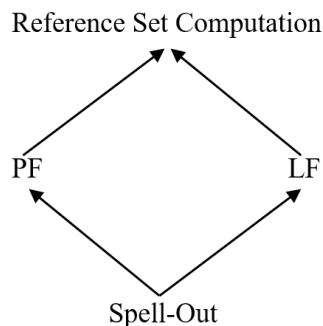
Figure 2.4: Reinhart's (1995, 1997, 2006) economy model.

Reinhart's account has the advantage that it can explain why inverse readings are harder to obtain than surface readings. Reference Set Computation is an additional step in processing and therefore requires more resources. Since the surface reading can do without it, it is easier to obtain. The inverse reading, on the other hand, necessarily requires this step and therefore incurs higher processing costs. Furthermore, Reinhart's account can explain why in inverse linking context, the inverse reading is in fact often the preferred reading: in most inverse linking examples, the surface reading is highly

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[17] I am talking here about the steps that would be necessary excluding a preceding step to vP for type reasons.

[18] But see Nasta (2015) for a criticism on both Fox' Scope Economy and Mayr & Spector's Generalized Scope Economy and a more pragmatic implementation of scope economy.

[19] In her earlier work, Reinhart assumed that scope interpretations are determined only by the surface c-command relationship (Reinhart 1976). A sentence is ambiguous only when the QPs mutually c-command each other. In her later work presented here, the surface c-command relationship only determines which reading is *preferred*.

implausible (see section 2.2.1). It is also in line with Anderson's (2004) findings that the inverse interpretation is *always* associated with additional processing costs, even when it is the preferred or only possible reading. This is because it is *always* associated with an additional step of Reference Set Computation, independent of whether or not the surface reading is even an option. However, Reinhart's account also predicts that given a context under which the surface reading is plausible, the inverse reading should not readily be available. This is not supported by data from various experiments including the ones presented here in chapters 3-5.

Similarly, Tunstall (1998) also builds on Fox' Scope Economy, but presents a more processing-oriented approach to scope ambiguities, based on economy considerations. She formulates the *Principle of Scope Interpretation* as cited in (2.56), which takes as the default/preferred scoping the c-command relationship at LF that arises after all necessary operations have applied. Thus, similarly to Reinhart's (1995, 1997, 2006) Reference Set Computation, it does not categorize different readings into available or unavailable but rather into more or less preferred.

(2.56)   *Principle of Scope Interpretation:*
"The default relative scoping in a multiply quantified sentence is computed from the required LF-structure of that sentence, where the required LF is determined by required grammatical operations acting on the S-structure. The default scoping is the preferred scoping unless there is evidence to go beyond it."

(Tunstall 1998, p. 56)

Bobaljik & Wurmbrand (2012) provide a structural-based cross-linguistic account of quantifier scope, which contrasts sharply with previous accounts, such as Reinhart's Interface Economy, in the direction of LF-PF comparison. They assume that the operation of Quantifier Raising is universally available across languages. The differences between languages come about through the interaction with a soft (= violable) economy constraint *Scope Transparency* (ScoT). This constraint says that if A precedes B at the level of LF, then A also precedes B at the level of PF. In this system, LF is the input to PF, i.e. multiple PFs compete for one LF.

(2.57)   *Scope Transparency (ScoT):*
If the order of two elements at LF is A››B, the order at PF is A››B.

(Bobaljik & Wurmbrand 2012, p.373)

That means, if overt movement of a lower QP above a higher QP is possible, but not applied, the sentence will only have the surface reading. When overt movement is unavailable, ScoT can be violated and the sentence can have both readings. ScoT may also be violated if it is outperformed by another, higher-ranked constraint, which blocks overt movement. This way, Bobaljik & Wurmbrand (2012) arrive at a notion of local rather than global scope rigidity. Cross-linguistically, this predicts that languages with more word order freedom should be more restrictive in scope possibilities than languages with less word order freedom, because in the former, overt movement is an option in most cases, thereby satisfying Scope Transparency in that LF and PF are aligned[20]. Bobaljik & Wurmbrand

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[20] This is in line with suggestions by Sæbø (1997) or Miyagawa (2012), who consider QR as essentially a covert form of scrambling. Consequently, this predicts scope-rigidity in languages with overt scrambling.

discuss several languages, including English and German. German is a language with significant word order freedom, i.e. the availability of inverse scope should be very limited in comparison to a language like English, where overt movement is usually blocked, thereby licensing the violation of Scope Transparency. This is demonstrated in (2.58).

(2.58)   *intended LF:* ∀>∃
  a. English (strict word order):
    ✓PF1: [a camera]SBJ recorded [every burglar]OBJ
    (satisfying hard constraint of English word order, violating soft constraint ScoT)
    ✗PF2: [every burglar]OBJ recorded [a camera]SBJ
    (satisfying soft constraint ScoT, violating hard constraint of English word order)
  b. German (flexible word order):
    ✗PF1: [eine Kamera]SBJ hat [jeden Einbrecher]OBJ aufgenommen
    (violating soft constraint ScoT)
    ✓PF2: [jeden Einbrecher]OBJ hat [eine Kamera]SBJ aufgenommen
    (satisfying soft constraint ScoT)

However, even in free word order languages like German, inverse readings are not completely blocked, as there are certain cases, where overt movement cannot apply. One example given by Bobaljik & Wurmbrand is presented in (2.59).

(2.59)   *Context:* Two friends are talking about last night, when one of them visited Peter, who is crazy about jazz. On that occasion, Peter played a record by Miles Davis, a record by John Coltrane, and a record by Fred Frith.

a.	Peter	hat	[eine	Platte	[jedes	Musikers]]	aufgelegt.
	Peter	*has*	*a*	*record*	*every*	*musician.GEN*	*played*
a'.	*Peter	hat	[jedes	Musikers]i	[eine	Platte ti]	aufgelegt.
	Peter	*has*	*every*	*musician.GEN*	*a*	*record*	*played*
b.	Peter	hat	[eine	Platte [von	jedem	Musiker]]	aufgelegt.
	Peter	*has*	*a*	*record by*	*every*	*musician*	*played*
b'.	Peter	hat	[von	jedem Musiker]i	[eine	Platte ti]	aufgelegt.
	Peter	*has*	*by*	*every musician*	*a*	*record*	*played*

      'Peter has played a record by every musician.'
                                   (adapted from Bobaljik & Wurmbrand 2012, p. 381)

In (2.59a), we have a case of a nested DP, where the lower universal QP *jedes Musikers* (= every musician) is the genitive complement of the higher existential QP *eine Platte* (= a record). Overt movement of the genitive complement leads to ungrammaticality, as shown in (2.59a'). Because overt movement cannot apply, the only way of expressing the scope ∀>∃ is via covert movement, i.e. Quantifier Raising. Therefore, both the surface and the inverse reading are available. In (2.59b) on the other hand, the lower QP is a PP-adjunct instead of a genitive complement, which can move overtly, as

witnessed by the grammaticality of (2.59b'). Thus, in this case, Scope Transparency is not overridden and only the surface reading should be available.[21]

Another example that Bobaljik & Wurmbrand provide has to do with the interaction of Scope Transparency with information structure. More specifically, they discuss inverse scope readings under the rise-fall contour (see e.g. Krifka 1998, also discussed in section 2.2.6). They show that the inverse reading is possible for a sentence like (2.60) with the contrastive topic in subject position, pronounced with a rising pitch. This is because it is impossible to simultaneously satisfy Scope Transparency for the reading $\forall > \exists$ and the information structural constraint of Topic > Focus when the existential is a contrastive topic and the universal is in focus. As a result, the inverse reading is possible for (2.60) in violation of ScoT, but in satisfaction of Topic>Focus.

(2.60)   … weil mindestens   /EIN   Student \JEDen   Roman *…*
         … sinceat-least one   *student*   *each*   *novel*
         gelesen hat.
         read   *has*
         '… since at least ONE student read EVERY novel.'

         ✓$\exists\forall$; ✓$\forall\exists$

(adapted from Bobaljik & Wurmbrand 2012, p. 401)

Bobaljik & Wurmbrand's account captures a fundamental cross-linguistic pattern, namely that the presence or absence of alternative PFs that express the respective LF in their surface order plays a role in the extent to which a language allows inverse scope readings. Even though exceptions can be found, this correlation does seem to hold with respect to the languages that Bobaljik & Wurmbrand cite (English, German, Dutch, Japanese) and what is known about a number of other languages in the scope literature: e.g. Korean, Russian and Hungarian, showing more word-order freedom than English and only allowing for inverse scope to a limited extent, see e.g. Beck & Kim (1997), Marsden (2004) for Korean, Ionin & Luchkina (2015), Antonyuk (2015) for Russian, and Brody & Szabolcsi (2003) for Hungarian. However, this account also faces a number of problems. Similar to other accounts discussed here, Bobaljik & Wurmbrand's approach also only makes predictions about the (non-)availability of inverse readings, but not about the varying degree to which inverse readings may be available across constructions or languages. Further, as Blok (2019) points out, it is not clear which other hard or soft constraints ScoT interacts with and what happens if three or more constraints are at play instead of only the usual two factors that Bobaljik & Wurmbrand present in their examples and which give rise to the so-called ¾-signature. Blok speculates that with the consideration of more constraints, this account could be turned into a graded system. This might then resemble some of the multi-factorial accounts, which will be discussed in section 2.3.2. Further, an essential part of this account, which also distinguishes it from many other approaches, is the order of LF and PF: here, we start out with a single LF and then the various possible PFs compete for this LF. While this may predict which expression a

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[21] The judgment that (2.59b) has only the surface reading seems to be based on introspection and might not be representative of the majority of German speakers. In fact, it is a well-known and documented fact that in German, similar to many other languages, cases of inverse linking or PP constructions, which is what we find in (2.59b), are quite exceptional. They tend to give rise to inverse readings as often as or even more often than surface readings (e.g. Bott & Radó 2009, 2012). For many Germans, the inverse reading might thus be available in (2.59b'). Sentence (2.59b') would then actually constitute an argument *against* Bobaljik & Wurmbrand's account.

speaker will use in order to express the intended meaning, it is unclear how it would be applicable to the listener, who by definition starts out with a specific PF, which then has to be assigned a meaning. The latter – one PF for which the LF with the best fit is chosen – is the approach that Reinhart has taken. Finally, an issue that is also raised by Bobaljik & Wurmbrand themselves, is the question of what counts as an alternative LF. They assume that information structure is also a part of LF, which excludes cases of topicalization. However, as Oikonomou et al. (2020) note, scrambling is also associated with certain effects in information structure.

One of the problems that the majority of the accounts to quantifier scope interpretation have, including most of the more semantic accounts that will be presented in the following section, is that they tend to simplify the phenomenon by turning it into a binary categorization problem: inverse readings are either present or absent. However, while in some cases it may indeed seem like inverse readings are completely banned, most of the time we are actually dealing with a gradual phenomenon. That is, inverse readings are dispreferred most of the time and the difference between languages or different constructions lies in the *degree* to which they are dispreferred. In fact, there is a growing body of literature that shows that structures which were said to completely block inverse readings, do in fact allow them, at least to a certain degree. This is both the case with certain constructions, like embedded clauses or islands, as discussed in section 2.2.3, as well as with certain languages like German or Russian, where inverse readings seem to be more available than originally predicted (e.g. Radó & Bott 2018 for German, Ionin & Luchkina 2015 for Russian). This will also become more apparent in the studies presented in chapter 3-5. In contrast to that, Wurmbrand (2018) offers another perspective on Quantifier Raising, which is strongly processing-driven and makes gradual rather than categorical predictions. It also removes the complete ban on inverse readings in embedded clauses. As pointed out in the examples (2.31)-(2.33) above, there are cases of both complement clauses and islands, where, contrary to the common wisdom, the inverse reading can be assigned. This is also true for cases of Antecedent Contained Deletion, see (2.61), which are commonly analysed as involving QR too, as discussed at the beginning of this section. Studies by Syrett & Lidz (2011) and Syrett (2015) show that such sentences are accepted by some speakers. At the same time, the wide-scope interpretation in (2.61b) was associated with higher processing costs, which is what we expect if an additional QR step is involved. See also Hackl et al. (2012) for additional processing data in favour of QR in ACD.

(2.61)   Someone said he could jump over every frog that Jessie did.
  a. *narrow scope:* Someone said [every frog that Jessie did ~~jump over~~]$_1$ he could jump over t$_1$.
  b. *wide scope:* [every frog that Jessie did ~~say she could jump over~~]$_1$ someone said he could jump over t$_1$.

(Syrett 2015, p. 587, modified)

Wurmbrand proposes that Quantifier Raising is not clause-bounded at all, as traditionally assumed, nor is it banned in island environments. Instead, Quantifier Raising can apply also in embedded sentences via successive cyclic movement through SpecCP. Wurmbrand thus rejects a special clause-boundedness constraint and the Scope Economy put forward in Fox (1995, 2000). While in principle, QR is not restricted by the grammar, each step is associated with a processing cost. Thus, the more steps have to be undertaken, the higher the costs are and the harder it is to parse the sentence up to the point where it becomes impossible. Wurmbrand supports this idea with data from Tanaka (2015), who ran a study that

shows that the availability of inverse readings is not the same across the board, but gradual in embedded environments. For example, the availability of inverse readings in (2.62a) is lower than in (2.62b), which is in turn lower than (2.62c). See section 3.1.7 for a detailed description of the experiment.

(2.62)　a. A girl burst out laughing [listening to each boring audiobook.]
　　　　b. A professor burst out laughing [after meeting each student].
　　　　c. An academic burst out laughing [during each war film].

<div align="right">(examples from Tanaka 2015, p. 111)</div>

The gradual decline of inverse reading availability over different types of clausal adjuncts parallels their structural complexity and therefore the number of QR-steps required. In fact, Tanaka finds a similar gradual pattern for the acceptability of overt movement out of islands. A sentence like (2.63a), which is a case of the Complex Noun Phrase Constraint, receives a lower acceptability rating than (2.63b), which is a case of a temporal gerund adjunct, even though both are islands.

(2.63)　a. Who_1 did you hear the rumour [Connie is getting married to t_1]?
　　　　b. Which $student_1$ did he burst out laughing [after meeting t_1]?

<div align="right">(Tanaka 2015, p. 110)</div>

Table 2.1 shows the distribution of QR-steps and thus IR-availability that Wurmbrand proposes for complement clauses. The assumption is that QR applies successively through phase boundaries. Different types of complements exhibit varying syntactic complexity and thereby give rise to varying numbers of phase boundaries that need to be crossed in order to arrive at the inverse reading.

absolute island	attitude/speech complement (believe, claim)	future complement (decide, expect)	tenseless complement (try, manage)	simple predicates
	indicative	**Subjunctive**		
movement impossible; syntactic locality violation	✓QR in syntax			
	3 domains, 4 steps:	2 domains, 3 steps:	1 domain, 2 steps:	within 1 domain, 1 step:
	ɵɵɵɵ	ɵɵɵ	ɵɵ	ɵ
	least acceptable ←		→ most acceptable	

Table 2.1: QR-steps in different types of complement clauses, taken from Wurmbrand 2018, p. 24.

attitude/speech complements:　　future complements:　　tenseless complements:
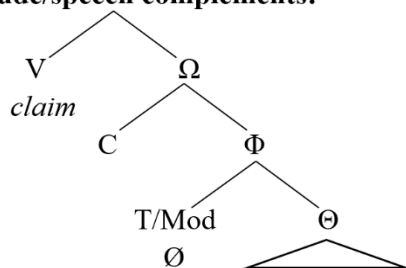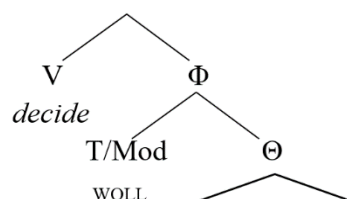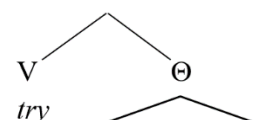
<div align="right">(adapted from Wurmbrand 2018, p. 22)</div>

2.3.2 Semantic approaches

In section 2.3.1 we have seen that many authors have made an attempt to tie the phenomenon of quantifier scope ambiguities closely to the syntax. They have stipulated covert movement like QR and/or assigned specific locations in the syntax tree to quantifiers in order for them to take scope from there. However, other authors have criticized such stipulations and refrained from explaining the phenomenon by turning it into a syntactic ambiguity.

Cooper (1975, 1978, 1983) was the first to offer a non-structural approach to quantifier scope ambiguities, so called *Cooper Storage*. He argues that claiming distinct syntactic structures requires the respective syntactic evidence for their existence. According to him, it is not necessary to stipulate two distinct syntactic structures for the respective scope interpretations. In his account, the same syntactic representation can have two semantic interpretations. An example is given in (2.64). The possible meaning representations of the example sentence are given in $\Phi 1$- $\Phi 5$. These meaning representations are always an ordered pair of the predicate and the so-called *store* (underlined for better visibility). The store may contain any of the two quantifiers Q1 and Q2 together with the variables bound by them. One of those quantifiers can bind the predicate. The variables x and y can be bound by their corresponding quantifier at any step of the process. As can be seen, this does in fact lead to *more* semantic representations than actually exist. Only once the store is emptied, the sentence is interpretable. That is, only $\Phi 4$ and $\Phi 5$ correspond to actual interpretations, namely the surface and the inverse reading.

(2.64)   [A camera]$_{Q1}$ recorded [every burglar]$_{Q2}$.

$Q1 = \lambda B.\exists q[CAMERA(q) \wedge B(q)]$

$Q2 = \lambda A.\forall p[BURGLAR(p) \rightarrow A(p)]$

$\Phi 1 = \langle RECORD(x)(y), \underline{\langle x/Q1, y/Q2 \rangle} \rangle$

$\Phi 2 = \langle Q2(\lambda y.RECORD(x)(y), \underline{\langle x/Q1 \rangle} \rangle$

$\Phi 3 = \langle Q1(\lambda x.RECORD(x)(y), \underline{\langle y/Q2 \rangle} \rangle$

$\Phi 4 = \langle Q1(\lambda x.Q2(\lambda y.RECORD(x)(y), \underline{\langle \rangle} \rangle$

$\Phi 5 = \langle Q2(\lambda y.Q1(\lambda x.RECORD(x)(y), \underline{\langle \rangle} \rangle$

A general problem with semantic approaches to quantifier scope ambiguities and specifically with Cooper's approach is that they tend to overgenerate. Even though Cooper provides an attempt to explain the lack of inverse readings in complex noun phrases, the large number of environments where inverse readings are restricted cannot readily be explained in this system. Furthermore, the general, cross-linguistically observable preference for surface readings and the additional processing costs associated with inverse readings also cannot be explained in this account. The system itself does not provide any preference for one reading – neither semantic derivation is more or less complex than the other. It is often argued that the purpose of such systems is solely to identify how the ambiguity comes about in the first place and all further restrictions must be added later on. This is of course a valid argument and in syntactic accounts like QR, additional assumptions must be made as well. The difference is that in a QR-based account, certain properties of scope essentially come "for free". However, as we will see throughout this thesis and discuss in depth in section 6.2, these properties turn against a QR system, once there is evidence that they do not in fact hold. Finally, Steedman (2012) points out that Cooper Storage, while not stipulating a covert syntactic movement operation, still involves stipulation of an

additional mechanism, i.e. both QR and Cooper Storage are a problem in the Minimalist Framework (Chomsky 1995).

In section 2.1.3, I showed that the type clash of object QPs is typically dealt with in one of two ways: Quantifier Raising or type shift. The same is true for quantifier scope ambiguities. Section 2.3.1 presented a large number of accounts that are based on QR, but other authors have suggested a non-movement approach that employs type-shifting options instead. For instance, Partee & Rooth (1983) suggest that transitive verbs, despite denoting relationships between individuals by default, can also be type-shifted to avoid a clash in the derivation. Hendriks (1988, 1993) follows Partee & Rooth in assuming that predicates can have more than one semantic type. The type typically assigned to a transitive verb is ‹e,‹e,t››. That is, it takes two arguments of type e (individuals). The transitive verb can be type-shifted to ‹‹‹e,t›,t›,‹e,t›› thereby taking a quantifier of type ‹‹e,t›,t› as an object argument, or to type ‹‹‹e,t›,t›,‹‹‹e,t›,t›,t››, in the case of a doubly-quantified sentence. Instead of stipulating a covert movement operation, these accounts have to introduce a type-shifting operator that maps a relation between individuals to a relation between quantifiers. The ambiguity of doubly-quantified sentences arises because type raising the predicate to type ‹‹‹e,t›,t›,‹‹‹e,t›,t›,t›› can proceed in two ways, with one derivation resulting in the surface reading, and the other one resulting in the inverse reading.

Type-shifting has been adopted by other authors with some modifications, e.g. Jacobson (1992) or Shan & Barker (2006). Hendriks (1993) further claims that this approach can capture the commonly assumed island sensitivity of quantifier scope by lexically restricting type-shifting. For example, the type-shifting operator can act on transitive predicates but not on relative clause operators. However, the preference of surface readings over inverse readings and the processing costs associated with the inverse readings are harder to explain with this account. Additional processing costs could be associated with the type shifting operation similar to the way it was proposed for the application of QR. However, that would predict processing costs in many more cases when a quantifier is present, even when there is no scopal interaction with a second quantifier. This is an undesired prediction that also occurs when QR serves the double function of saving type clashes and creating inverse scope readings, as pointed out by Blok (2019). Blok therefore suggests that type shifting operations should be used for type mismatches only, while QR should be applied only to create various scope readings.

Steedman (2012) implements a way of dealing with quantifier scope ambiguities in *Combinatorial Categorial Grammar* (CCG). He attempts to remain as close as possible to the surface form, i.e. surface-compositional. Indeed, LF is not required beyond the level of lexical heads. Steedman has a very narrow definition of what constitutes a quantifier. In his framework, only the universal distributive expressions *each* and *every* count as quantifiers in English. All non-universal NPs on the other hand are treated as Skolem terms, i.e. as individuals of type *e*, and thus do not truly take inverse scope but only give the illusion of doing so (see section 2.2.4 on Skolem/choice functions). An indefinite that is c-commanded by a universal quantifier gives the illusion of wide scope when Skolem specification occurs before the universal enters the derivation. An example for the inverse reading of a scope ambiguous sentence is given in (2.66)[22]. In contrast to type-theoretical approaches, neither the predicate nor the universal quantifier have to be given multiple lexical entries with varying types. Instead, the universal quantifier

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[22] The syntax should be read the following way: X/Y takes a Y to its *right* and returns an X, X\Y takes a Y to its *left* and returns an X. Each line represents a step in the derivation, the dashed line represents the point of Skolem specification.

(the only true quantifier in this system) *always* takes a verb and another NP as arguments, thereby always taking scope over them. The indefinite never truly takes wide scope, it only may give the illusion of doing so if the Skolem term is specified at an earlier point, see (2.65) vs. (2.66) in italics. Steedman shows that a broad range of scope phenomena can be covered in his system, including also inverse linking and reconstruction (see 2.2.1 and 2.3.1 further above).

(2.65) *Surface reading:*

a camera	recorded	every burglar
S/(S\NP)	(S\NP)/NP	(S\NP)\((S\NP)/NP)
: λz.z(skolem' camera')	: λx.λy.record'yx	: λzλy.∀x[burglar'x → zyx]
: λz.z(sk_{camera'})		S\NP : λy.∀x[burglar' x → record' yx]

$$S : \forall x[\text{burglar' } x \rightarrow \text{record' } (sk_{camera'})x]$$

(2.66) *Inverse reading:*

a camera	recorded	every burglar
S/(S\NP)	(S\NP)/NP	(S\NP)\((S\NP)/NP)
: λz.z(skolem' camera')	: λx.λy.record'yx	: λzλy.∀x[burglar'x → zyx]
		S\NP : λy.∀x[burglar' x → record' yx]

$$S : \forall x[\text{burglar' } x \rightarrow \text{record' } x(\text{skolem' camera'})]$$
$$S : \forall x[\text{burglar' } x \rightarrow \text{record' } x\ sk^{(x)}_{camera'}]$$

The appeal of Steedman's account is that it works without additional mechanisms such as Quantifier Raising or Cooper Storage. No additional level of Logical Form is required in Combinatorial Categorial Grammar, everything can be computed directly from the surface structure. On the other hand, the very same simplicity of the system leaves unexplained the fact that inverse readings are both dispreferred and harder to process. While with a mechanism like QR, it is possible to explain this phenomenon through additional covert movement steps and thus increasing deviance from the surface structure, the same cannot be done here. It is not obvious from the derivations in (2.65) vs. (2.66) why the former should be more complex than the latter. By definition, the universal always takes wide scope, independent of its c-commanding position relative to the indefinite. It is not even possible to stipulate that specifying the Skolem term either earlier or later somehow makes the sentence more difficult. Table 2.2 illustrates this. Depending on the word order, late Skolem specification corresponds to the preferred reading in one case but to the dispreferred reading in the other case.

Order	Preferred reading	Skolem specification	Dispreferred reading	Skolem specification
∀ […] ∃	∀ > ∃	late	∃ > ∀	early
∃ […] ∀	∃ > ∀	early	∀ > ∃	late

Table 2.2: Relationship between early vs. late Skolem term specification according to Steedman (2012) and preferred vs. dispreferred reading

Steedman himself targets the question why there is a preference of surface over inverse readings. Following Hajicová et al. (1998) and Kennelly (2004), he assumes that this is simply due to information structural reasons. However, this alone seems like a rather unsatisfying assumption, as this pattern can

be seen across-the-board. Albeit the inverse reading might be more available in some cases than in others depending on information structure, this alone cannot be the reason, because the preference asymmetry never completely flips, unless the surface reading is rendered implausible by context or world knowledge (as will be shown the following chapters). Alternatively, Crain & Steedman (1985) and Altmann & Steedman (1988) suggest that the inverse reading for a sentence with ∃>∀ quantifier order is more difficult to obtain because it would require more novel entities to be introduced than under the surface reading[23]. However, Anderson (2004) shows that participants still prefer the surface reading even when multiple entities have been mentioned before. It is therefore unclear, if this can serve as the only explanation.

Another type of direct-compositionality approach to scope is based on *continuations*, suggested for example by Barker (2002), Shan & Barker (2006), Barker & Shan (2014) and Kiselyov & Shan (2014). Sternefeld (2019) describes continuations as "[…] a placeholder for material that will be supplied only at a later stage in the processing of a sentence." (Sternefeld 2019, p. 9). Any expression comes with a continuation, which relates the expression to the larger context that contains it. The expression is then called a continuation variable and denotes a function from the uncontinuized variable type to a truth value. The toy example from Barker (2002) in (2.67) exemplifies this concept.

(2.67) John saw Mary.
  a. *John*   Continuation: $\lambda x.$ **saw m** x Semantic type: ‹e,t›
  b. *Mary*   Continuation: $\lambda y.$ **saw** y **j**   Semantic type: ‹e,t›
  c. *saw*   Continuation: $\lambda R.$ R **m j**   Semantic type: ‹‹e,t›,t›
  d. *saw Mary* Continuation: $\lambda P.$ P **j**   Semantic type: ‹‹e,‹e,t››,t›

  (adapted from Barker 2002, pp. 214-215 & 217)

In Barker's (2002) system, a quantifier has the same type as a continuized NP. In fact, they only exist in a continuized form. A scope ambiguity arises because composition rules can be continuized in multiple ways, depending on what is taken as the continuation of what. In the example (2.67) above, *saw Mary* can be the continuation of *John* or *John* can be the continuation of *saw Mary*. Obviously, in this example with proper names, the resulting meaning will be the same. In an example like (2.68), if the DP *a camera* is a continuation of the VP *recorded every burglar*, the result is the surface reading. If, on the other hand, the VP is a continuation of the DP, then the result is the inverse reading.

(2.68) [DP A camera] [VP recorded every burglar].

The preference for surface scope follows from general processing considerations, namely that sentences are processed on-line from left to right and therefore, default evaluation in the sense of continuations also applies from left to right (Shan & Barker 2006). However, same as the previous approaches, continuation-based approaches require additional assumptions to limit scope in island environments.

Kiselyov & Shan (2014) follow a different path and push the burden of ambiguity onto lexical semantics, i.e. polysemy. One and the same quantifier expression has several denotations which vary

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[23] cf. Fodor's (1982) *models of the world* approach, and Kurtzman & MacDonald's (1993) *single reference principle*

only in their continuation levels (in their *strength*). In a system of hierarchical levels of continuations, a higher level means that the quantifier can take a higher context as argument, resulting in wider scope. The exceptional wide scope behaviour of indefinites (see section 2.2.4) is here explained by a different level specification compared to universals.

2.3.3 Multi-factorial approaches

I will finish this chapter by calling attention to so-called multi-factorial accounts (e.g. Ioup 1975, VanLehn 1978, Kuno 1991, Kurtzman & MacDonald 1993, Pafel 2005). These accounts are typically less occupied with an in-depth formal analysis of quantifier scope ambiguities and how they can be represented in the syntax or built in a compositional fashion. Instead, they are more interested in the different factors that promote one reading or the other and how these factors interact with each other. Examples for such factors can be the lexical properties of the quantifiers involved, the grammatical or semantic role of the respective QPs or information structural aspects. Which factors exactly are thought to play a role varies somewhat from one author to another, although there are large overlaps (see also the overview in section 2.2.6). Commonly, these factors are thought of as adding up in a cumulative fashion: the more factors favour one QP, the stronger the preference for a wide-scope interpretation of this QP. For instance, Ioup's (1975) grammatical function and quantifier hierarchies would predict a sentence like (2.69) to be ambiguous. The quantifier *every* is higher on the quantifier hierarchy than *a*, but *a camera* as a subject is higher on the grammatical function hierarchy than *every burglar*.

(2.69) A camera recorded every burglar.
      quantifier hierarchy: every > a
      grammatical function: a > every

It is sometimes assumed that when the asymmetry between factors favouring one QP versus the other is too large, the sentence is simply unambiguous (e.g. Pafel 2005). However, all accounts share that scope ambiguity is considered a continuous rather than a categorical phenomenon. These accounts are often supported by robust evidence, since these factors can be checked experimentally with little effort, as done by many researchers (see the literature on experiments in English and German in sections 3.1 and 4.2). It is important to note that these multi-factorial accounts and the accounts presented further above are not mutually exclusive. They may in fact complement each other very well and provide a better fit of the data, given there already exists a certain overlap. For example Beghelli (1995) and Beghelli & Stowell (1997), presented in section 2.3.1, incorporate Ioup's (1975) quantifier hierarchy into a syntactic, QR-driven account to quantifier scope. Bobaljik & Wurmbrand (2012) also provide a QR-based account, where the interaction with other constraints (e.g. the information structural aspects of topic and focus) play a role in determining the scopal possibilities, even though the predictions they make are of a categorical nature.

2.4 Summary

Chapter 1 began with some background on quantificational expressions in general and proceeded to the specifics of determiner quantifiers. We saw that there is a large set of different types of quantificational

expressions, which can be put under the same umbrella using the notion of tripartite structures. We also saw that determiner quantifiers can be described along a number of features like monotonicity, intersectivity, or distributivity, which are linguistically relevant categories that can also have an impact on scope interpretations. Section 2.2 provided a general background of the phenomenon of quantifier scope ambiguities and certain peculiarities in their behaviour, such as clause-boundedness or exceptional wide scope. We also saw that there are a variety of factors that are known to influence scope interpretation, such as the semantics of the quantifiers, grammatical/semantic role, information structure, prosody or contextual information. In section 2.3, I presented a number of different accounts on quantifier scope and their associated merits and limitations. The relative scoping of quantifiers can be determined via dedicated positions in the tree, a syntactic operation like Quantifier Raising, a mechanism like Cooper Storage, type-shifting operations, continuations, or by passing the burden onto the specification process of generalized Skolem terms as in the case of CCG.

3 Quantifier Scope in English

In this chapter, I will present two experiments on quantifier scope in English and one follow-up experiment. In section 3.1, I will start out by providing an overview of previous experimental work on quantifier scope in English. While a lot of extensive research has been done in this area, all showing that inverse readings are available in English, the three experiments presented in the remainder of this chapter will nevertheless provide important novel insights. First, even though a large number of experiments have been conducted, the results obtained were highly variable across these experiments, even when similar sentence types were used, as will be shown in section 3.1. Second, even though the relationship between syntactic islands and scope availability has been discussed extensively in the literature, experimental work on this topic is very limited. Finally, while the influence of contextual or world knowledge considerations have been mentioned by many authors, again, only limited experimental work on the impact of plausibility considerations specifically is available. In section 3.2 and 3.3, I will therefore present two experiments that test to what extent inverse readings are available in simple sentences using transitive predicates with an existential subject and a universal object. The two experiments will provide insight into the effect of task in that experiment E1 tests for the *availability* of inverse readings and experiment E2 tests for the *preference* of one reading over another. Additionally, both experiments test to what extent a single or double embedding into a relative clause reduces the availability of inverse readings and to what extent pragmatics can boost a generally dispreferred reading. The results of these experiments suggest that (i) inverse readings are readily available to speakers of (American) English in the sentences tested, (ii) relative clause embeddings do not exclude inverse readings, contrary to what is usually assumed, (iii) plausibility considerations play a major role in ambiguity resolution, (iv) the specific choice of task can change the results to a great extent, and (v) there is a lot of variation even between participants of the same language. In section 3.4, I will present a tentative follow-up study in order to test for several potential explanation of the results obtained in experiment E1 and E2. This follow-up study tests for the availability of inverse readings in various different island environments. Even though caution is required in interpreting the results of this experiment, they still indicate that neither relative clauses nor other islands strictly exclude inverse readings. Finally, the experiments presented in this chapter will provide a baseline for the two other languages investigated in this thesis: German in chapter 4 and Twi in chapter 5. However, the cross-linguistic comparison itself will be deferred to chapter 6.

3.1   Experimental background on quantifier scope in English

While today, it is uncontroversial that English allows for inverse readings in a multitude of different constellations, this was not always the case. In earlier literature on quantifier scope from the 70s and 80s it is common to find claims that in sentences where a universal follows an existential, inverse readings are non-existent or very strongly dispreferred (Jackendoff 1972, Lakoff 1971, Reinhart 1976, 1983). Later experimental work, however, showed that while the surface reading is generally the preferred option, the inverse reading is readily available too. The fact that the inverse reading is generally dispreferred (apart from the exceptional case of inverse linking, see section 2.2.1), still remained to be explained. Some authors have provided processing reasons to account for this effect

(e.g. Anderson 2004, Wurmbrand 2018), others explain it on the basis of economy in the grammatical system (e.g. Fox 1995, 2000, Reinhart 2006), see chapter 2 for further explanation.

The experimental literature on quantifier scope in English is vast. I will therefore describe only those publications in more detail that are either of special relevance to those aspects of quantifier scope investigated in this thesis or that have had a strong impact in the field of quantifier scope research in general. Moreover, since this thesis is mainly concerned with the interpretational possibilities of scope ambiguities in native adult language, work about processing of quantifiers (e.g. Urbach & Kutas 2010, Urbach et al. 2015, Freunberger & Nieuwland 2016) or scope ambiguities (e.g. Filik et al. 2004, Dwivedi et al. 2010, Clark & Kar 2011, Ionin et al. 2014) and L1-acquisition of scope (e.g. Musolino 1998, Lidz & Musolino 2002, Musolino & Lidz 2006, Goro 2007, Gualmini et al. 2008, Szendrői et al. 2017) or L2-acquisition of scope (e.g. Miyamoto & Yamane 1996, Lee et al. 1999, Dellicarpini 2003, Marsden 2004, 2009, Özçelik 2009, Chung 2012, Wu & Ionin 2019) will be largely ignored here and only referred to when relevant to the topic at hand. The interested reader is referred to the list of publications given above. Further, I will skip certain parts of the works below when summarizing them, only targeting those aspect that are relevant to the subsequent sections. For the complete presentation of experimental results, the reader is referred to the original works. I will put special focus on inverse readings in transitive ∃>∀ constructions, inverse readings out of embedded clauses, and methodological issues. We will see that all of the studies presented below show that inverse readings are available in English transitive constructions. The results between those experiments vary a lot, though, in that the acceptance of inverse readings ranges from only 16% all the way up to 58%. I will hypothesize that this might be due to task and plausibility effects. Some of the experiments employ tasks that test for the general availability of the two readings (Gillen 1991), while other experiments force participants to choose between the two readings (Gillen 1991, Anderson 2004). Also, most of these experiments do not take into account the general plausibility of the two readings across item contexts. I therefore specifically control for task and plausibility in my own experiments in section 3.2 and 3.3. Finally, a few of the experiments test for inverse readings in island environments (Tsai et al. 2014/Scontras et al. 2017, Tanaka 2015). Their results seem to suggest that inverse readings are marginally available in those environments, contrary to what is usually assumed. I therefore explore this effect in more depth in my own studies in 3.2-3.4.

3.1.1 Gillen (1991)

In her thesis, Gillen (1991) presents ten experiments on the interpretation of quantifier scope ambiguities in English, employing a variety of different tasks and sentence constructions. I will only report on the first seven experiments, as the other experiments employ double object/dative constructions, which are not the focus of this chapter. In the first three experiments, Gillen asked participants to draw a diagrammatic representation of a doubly-quantified sentence they were given. Examples of such representations are given in Figure 3.1, where a drawing like (a) is interpreted as existential-wide-scope, or in Gillen's terms *converging*, and a drawing like (b) is interpreted as universal-wide-scope or *diverging*.
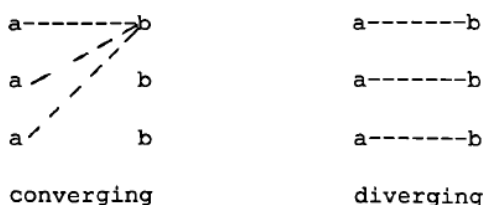
Figure 3.1: Types of diagrams used in experiments 1-7 in Gillen (1991), p. 55.

In experiment 1 and 2, three factors were tested: voice (active/passive), type of universal (all/every), and type of existential (a/some$_{sg}$/some$_{pl}$), see (3.1) for an example. In experiment 3, voice was replaced by quantifier order in active sentences, see (3.2). In experiments 2 and 3, reading and drawing times were measured. There were 12, 24, and 12 participants, respectively.

(3.1)   a. {A pupil / some pupil / some pupils} admire(s) {all teachers / every teacher}.
          b. {All teachers / every teacher} are/is admired by {a pupil / some pupil / some pupils}.
                                                                                  (adapted from Gillen 1991, p.54)

(3.2)   a. {A pupil / some pupil / some pupils} admire(s) {all teachers / every teacher}.
          b. {All pupils / every pupil} admire(s) {a teacher / some teacher / some teachers}.
                                                                                  (adapted from Gillen 1991, p.74)

The original values for the various experiments in Gillen (1991) were variably presented in percentage of diverging diagrams, scores outs of 5, or scores out of 2. For better comparability between experiments, I converted all results into percentage of diverging diagrams. Table 3.1 shows the results for quantifier order and type of universal.

		surface order: ∃-∀		surface order: ∀-∃	
		all	every	all	every
diverging diagrams in %	Exp. 1	28%		50%	
		17%	39%	42%	58%
	Exp. 2	23%		52%	
		22%	24%	43%	60%
	Exp. 3	17%		58%	
		12%	21%	49%	68%

Table 3.1: Results of Exp. 1-3 in Gillen (1991), p. 57, 220, 224 in % of diverging diagrams.

It can be seen that the values were relatively comparable across experiments. Gillen found a significant effect of quantifier order in that the quantifier that came first was more likely to take wide scope. This was the case even in experiment 3, where voice was not a factor anymore. There was also an effect of quantifier type in that *every* took wide scope more often than *all*. In both experiments 1 and 2, the

existential *a* received more converging diagrams across conditions than the existential *some*, while in experiment 3, the values were the same. In both experiment 2 and 3, the response times (reading + drawing times) were longer when participants opted for a diverging than when they opted for a converging diagram.

In experiments 4 and 5, Gillen used a forced-choice task, where participants had to choose the preferred one out of two diagrams presented (converging vs. diverging, see Figure 3.1 above). The items were the same as in experiment 3, but they were split across experiments with experiment 4 testing the existentials *a* and *some$_{SG}$* and experiment 5 *some$_{PL}$*. Experiments 6 and 7 were parallel to 4 and 5, but participants did not have to choose between the two diagrams. Instead, they were only shown one diagram at a time and indicated its acceptability. Also, both voice and quantifier order were included. There were 10 participants in each of the experiments 4-5, 64 participants in experiment 6, and 32 participants in experiment 7. Table 3.2 shows the results in percentage of diverging diagrams for quantifier order, type of universal, and voice in the case of experiment 6 and 7. As can be seen from the values in the table, the difference between quantifiers found in these experiments was less reliable compared to the previous experiments. As in the previous experiments, the existential *a* took wide scope more often than *some*. No effect of grammatical function was found in experiment 6 and 7, where both quantifier order and voice were manipulated. In experiment 4 and 5, reading and evaluation time were measured separately. In both experiments, the reading times were longer when participants subsequently chose the divergent diagram, while the evaluation times were longer when participants chose the converging diagram. The difference in reading times was greater for *all* than for *every*. For *all*, the reading times were longer in ∀-∃ order than in ∃-∀ order, for *every* the pattern was reversed.

| | | ∃-∀ | | ∀-∃ | |
		all	every	all	every
diverging diagrams in %	Exp. 4 (∃$_{sg}$)	42%		38%	
		24%	58%	53%	24%
	Exp. 5 (∃$_{pl}$)	30%		34%	
		12%	50%	58%	12%
	Exp. 6 (∃$_{sg}$)	52% / 48%		57% / 63%	
	active/passive	52% / 47%	51% / 50%	56% / 65%	59% / 61%
	Exp. 7 (∃$_{pl}$)	14% / 20%		58% / 52%	
	active/passive	11% / 17%	17% / 24%	64% / 53%	52% / 52%

Table 3.2: Results of Exp. 4-7 in Gillen (1991), p. 230, 242, 251, 266 in % of diverging diagrams.

From her experiments, Gillen tentatively proposes the following approach to quantifier scope ambiguities in English: "[…] people initially set up a default model for a doubly quantified sentence which does not fully disambiguate scope. Syntax (ie word order) affects the interpretative machinery in

the first instance so that a rough model can be set up […]. The effect of word order is later mediated by semantics (ie the characteristics of individual quantifiers), context and general knowledge effects which combine to elicit the most plausible interpretation. Refining the mental model is an optional second stage which occurs only if made necessary by a subsequent task." (Gillen 1991, p. 205)

Gillen's experiment series provides a great example for the impact small differences in task or design can have: even though the stimuli themselves were very similar in experiments 1-3 and 4-7, the results differed greatly. While experiments 1-3 matched the predictions, experiments 4-7 not only had null results but partly even showed the exact opposite effects, e.g. with *all* receiving about 2x as many diverging choices than *every* in the ∀-∃ word order in experiment 4. It is not fully clear why these differences occur. Gillen speculates that the low numbers of diverging diagrams in ∀-∃ word order could be because "[…] subjects find the converging diagram easier to deconstruct than the diverging diagram." (Gillen 1991, p. 102). However, it is not clear why this would disproportionally affect the quantifier *every*. It is also not necessarily obvious why this diagram should be so much easier to understand. Moreover, in experiment 6, where participants were not forced to choose between conditions, no clear differences were observable at all, with all effects apart from *type of existential* disappearing. Across conditions, the numbers are all around the 50% mark (47-65%). One problem with at least some of the experiments 1-7 may be the low number of participants or data points in general[47]. Gillen also does not report on excluding any participants or having a control criterion for the quality of participants' judgments. With a low total number of participants, a few oddly-behaving participants can greatly impact the results. Another problem is that Gillen did not only test the ∃-∀ order of quantifiers, but also the ∀-∃ order. As discussed in chapter 2, with the latter order we cannot reliably identify inverse readings. Thus, only the conditions with ∃-∀ order actually provide meaningful data on inverse interpretations.

3.1.2   Kurtzman & MacDonald (1993)

Kurtzman & MacDonald (1993) ran four experiments collecting felicity judgments on doubly-quantified sentences. They criticise methodologies of earlier experiments on quantifier scope. About VanLehns's (1978) study, for instance, they say that the items were not well controlled for plausibility or other lexical or syntactic ambiguities. Also, they consider conscious judgments that ask directly for the ambiguity problematic[48]. This together with unrestricted time could cause confounds. Participants' judgments may then not reflect their first interpretation, but the conclusion they arrived at after lengthy reflection. They may also be more prone to develop strategies throughout the course of the experiment, being biased by the way they had responded to previous items. Similar criticism was put against the studies of Johnson-Laird (1969) and Micham et al. (1980), in which they let participants judge the truth of sentences with respect to matrices. Kurtzman & MacDonald therefore employed a different method. They asked participants to judge the felicity of a disambiguating sentence as a continuation to a doubly-quantified sentence. An example is given in (3.3). The idea behind this design is that participants will judge the continuation as felicitous only if they obtained the respective reading. The singular

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[47] Experiment 3, for example had only twelve participants and each participant provided two judgments per condition, which amounts to 24 data points per condition in total.
[48] See also Matthewson 2004 on the same problem in semantic fieldwork.

continuation is meant to only be compatible with the inverse reading of (3.3a) and the surface reading of (3.3b), while the plural continuation is meant to only be compatible with the surface reading of (3.3a) and the inverse reading of (3.3b). In experiment 2, Kurtzman & MacDonald tested the items in (3.3) with passive voice. Additionally, in experiment 3, they tested inverse linking structures, which I will omit here, as they are not relevant to the subsequent experiments. Moreover, half of the predicates used were action and the other half were perception verbs.

(3.3)   a. Every kid climbed a tree. {The tree was / The trees were} full of apples.
        b. A kid climbed every tree. {The kid was / The kids were} full of energy.

<div align="right">(adapted from Kurtzman & MacDonald 1993, p. 252)</div>
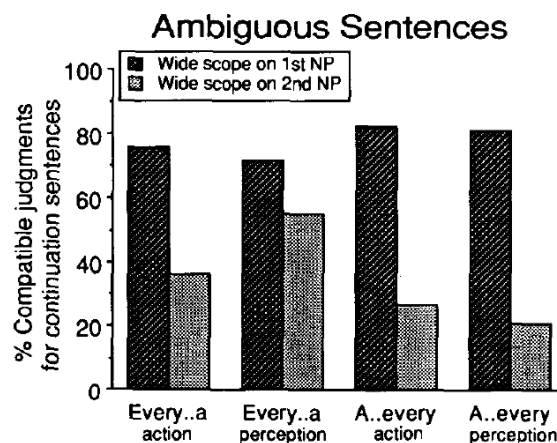
Figure 3.2: Results of experiment 1 from Kurtzman & MacDonald (1993), p. 255.

Kurtzman & MacDonald found that the interpretations were influenced by different factors interacting with one another. Linear order did not seem to have a relevant effect, but grammatical function did. In the active sentences, there was an effect of linear order, in that the first NP received wide scope more often than the second NP. There was also an effect of order of quantifiers, in that the inverse reading was chosen more often when the universal preceded the existential than the other way round, which they attributed to Fodor's (1982) single reference principle rather than to lexical bias. This principle says that when a reader/listener encounters an existential like *a* first, it will be interpreted as referring to a single entity. The motivation for this assumption is that the single referent interpretation is always a possible interpretation, while the multiple reference interpretation is only possible if later on in the sentence there is also a universal quantifier. Moreover, if the referents have not been mentioned before, introducing only a single new mental representation to the set of discourse referents is the simpler choice. Kurtzman & MacDonald thus argue that single reference as a default strategy is both simpler and more efficient for the parser, resulting in lower processing costs. If the reader/listener encounters a universal quantifier later on, they may reanalyse the sentence. However, since this evokes additional costs, this will still remain the dispreferred strategy and only be employed if e.g. contextual pressure is high enough. Finally, there was an effect of type of verb, in that the inverse reading was chosen more often with a perception than an action verb. For the passivized versions of (3.3), however, they did not find any effect. The authors concluded that this was the case because at least two contradicting factors were at play: the first one would favour the first NP (e.g. linear order, surface subject, c-command,

topic) and the second one would favour the second NP (e.g. thematic hierarchy, external argument). As a conclusion of their experiments, Kurtzman & MacDonald argued for a parallel model of scope processing, in which the different readings are considered in parallel, with a subsequent selection of the one interpretation that provides the best fit with respect to the factors at play.

Even though the experiments in Kurtzman & MacDonald had a major impact in experimental research on quantifier scope, there are also a number of problems with the studies, some of which have been pointed out by other researchers, too. Firstly, even though the authors tried a methodology that is less direct, it still involves an explicit task that makes it easy for the participants to detect the ambiguity and understand what the study is about, even in the presence of filler items. To what extent this is a problem for linguistic studies at all can be debated, however it does not avoid the problem Kurtzman & MacDonald pointed out in the first place. Also, as pointed out in e.g. Tunstall (1998) or Anderson (2004), the disambiguated continuations are in fact not completely unambiguous. In (6a) for instance, the singular continuation is in fact compatible with the surface reading, if the reader has a distributive interpretation of the second sentence in mind: "Every kid climbed a tree. For each kid, the tree that he/she climbed, was full of apples." Additionally, with a plural continuation, participants might just accommodate the existence of more kids/trees. This is a general problem with less direct methods: The judgments, too, are less direct and may thus answer a different question than intended. The continuation sentences may be considered felicitous for reasons other than the specific scope reading presumed. At the same time, some participants might have judged the plural continuation sentence as bad after a sentence with $\exists > \forall$ order, simply because of the morphological mismatch, thereby giving the impression of fewer inverse readings than actually obtained. This may also explain the non-ceiling values of 75-78% in the $\forall$-$\exists$ conditions where the continuation sentence aligned with the surface reading. Further, same as in Gillen (1991), the uninformative $\forall$-$\exists$ order of quantifiers was used in half of the items, thereby not actually providing data on the availability of inverse readings.

3.1.3   Tunstall (1998)

Tunstall conducted a series of experiments on scope ambiguity resolution, of which I will only report two, as only these employ transitive sentences comparable to the experiments in this thesis[49]. She tested transitive sentences with the existential *a* in subject and the universals *each* or *every* in object position. Additionally, in the first experiment[50], she manipulated the presence or absence of a secondary predicate like *dirty* in (3.4). In the second experiment[51], as shown in (3.5), the predicates were divided into resultative (*thin*) and depictive (*raw*) predicates[52]. Participants were asked to choose between two paraphrases that were supposed to unambiguously represent the surface and inverse reading.

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[49] Her other experiments test for inverse readings in dative constructions, double object constructions, double PP constructions, and inverse linking constructions.

[50] In Tunstall's thesis called pilot experiment 1.

[51] In Tunstall's thesis called experiment 3.

[52] The addition of the predicates was done in order to test the *Differentiation Condition*, which states that *each*, but not *every*, requires full distributivity over events. The predicates are supposed to make differentiation of events easier, thereby improving the use of *each*.

(3.4) A painter bought {each/every} brush (dirty).
SR-paraphrase: The brushes were all bought by the same painter (and they were all dirty when bought).
IR-paraphrase: Each brush was bought by a possibly different painter. (Plus each one was dirty when it was bought.)

(adapted from Tunstall 1998, p. 138)

(3.5) A boy sliced {each/every} carrot {∅ / thin / raw}.
SR-paraphrase: All the carrots were sliced by the same boy {∅ / into thin pieces / when they were raw}.
IR-paraphrase: Each carrot was sliced by a possibly different boy {∅ / into thin pieces/ when it was raw}.

(adapted from Tunstall 1998, p. 141)

The results of the two experiments are given in Table 3.3. Because Tunstall did not find any difference between resultative and depictive predicates, the results were reported collapsed. It can be seen that the presence of a secondary predicate reduces the choices of inverse readings. However, even in the condition without predicate, the inverse reading is clearly dispreferred. Tunstall also found an effect of quantifier in the first experiment, but not in the second one.

		Exp. 1	Exp. 2
participants (analysed)		19	77
+ predicate	each	16%	9%
	every	11%	9%
- predicate	each	37%	21%
	every	16%	17%

Table 3.3: Results in % of IR-paraphrase in Tunstall (1998), p. 139 & 145.

One problem with the task used by Tunstall is that participants were forced to choose between the two readings. Such a task carries the risk of hiding the actual acceptability of a dispreferred reading, as participants will usually choose the preferred reading over the dispreferred one. This will be discussed in more detail in sections 3.2. and 3.3.

3.1.4 Anderson (2004)

In her thesis, Anderson investigates quantifier scope ambiguities in English, providing data from 13 off-line questionnaires and on-line self-paced-reading experiments. I will only report a subset of the results. Across experiments, Anderson tests the same type of target sentence: a transitive verb, an animate existential subject with the quantifier *a*, and a universal object with the quantifier *every*. In the first experiment, participants read the doubly-quantified sentences in isolation and had to choose the

better fit out of two paraphrases, see (3.6). In experiment 2, the same target sentences were preceded by a context ~6 sentences long, which biased either towards the surface or towards the inverse reading via the number of referents mentioned (singular vs. plural). An example for such a context is given in (3.7). Participants were then asked a forced-choice *how-many*-question, which could be answered with *one* (SR) or *several* (IR).

(3.6)   *Target:*   A member of the club tested every recipe.
          Exp. 1:   SR: One member tested recipes. / IR: Several members tested recipes.
          Exp. 2-13:   How many club members tested recipes?   SR: one / IR: several
                                                    (adapted from Anderson 2004, p. 267 & 272)

(3.7)   *Context:*   The members of the gourmet club decided to put out a cookbook of their favorite recipes. They wanted the recipes to be easy enough for an inexperienced cook. …
          SR-bias: … The president of the club requested that **a volunteer** test the recipes to make sure that the instructions were correct. After a short discussion, …
          IR-bias: … **Members** who nominated recipes were required to test the recipes to make sure that the instructions were correct. …
          Target: … [A helpful member] tested [every recipe].
                                                    (adapted from Anderson 2004, p. 272)

Experiment 4A was a self-paced reading experiment using the same task as Exp. 2, but the target sentence was followed by a disambiguating continuation sentence, similar to Kurtzman & MacDonald (1993), see (3.8). Exp. 5A was similar to Exp. 4A, but the sentences were embedded into the same biasing contexts as in Exp. 2.

(3.8)   *Continuation sentence (Exp. 4-5):*
          SR: The **member** made valuable corrections.
          IR: The **members** made valuable corrections.
                                                    (adapted from Anderson 2004, p. 318)

The off-line results of the experiments are summarized in Table 3.4 in percentage of inverse responses. In experiment 1, Anderson shows that while the surface reading is preferred, participants still prefer the inverse over the surface reading in 19% of the cases when they have to make a choice. Experiment 4A shows that continuation sentences like (3.8), despite changing the results in the expected direction, do a poor job at disambiguating the doubly-quantified sentence. In experiment 2, biasing towards the preferred surface reading did not change the results compared to not biasing at all. Biasing towards the inverse reading, however, did indeed boost the inverse reading. In experiment 5A, on the other hand, where both a biasing context and a continuation sentence were included, the context had very little effect on the final judgment. It is unclear why the inverse reading was chosen more often when there was an SR-biased context compared to no context at all with both a SR-continuation (25% vs. 13%) and an IR-continuation (55% vs. 41%).

		Exp. 1	Exp. 4A	Exp. 2	Exp. 5A
participants (analysed)		38	29	24	30
no bias	no continuation	19%			
	SR-continuation		13%		
	IR-continuation		41%		
SR-biased context	no continuation			19%	
	SR-continuation				25%
	IR-continuation				55%
IR-biased context	no continuation			53%	
	SR-continuation				30%
	IR-continuation				56%

Table 3.4: Results in % of IR-choices from Exp. 1, 2, 4A, 5A in Anderson (2004), p. 53, 62, 75, 92.

Anderson also ran a series of experiments that tested the interpretation of ellipsis sentences of the form in (3.9), which are predicted to be unambiguous according to Fox (2000), see section 2.3.1 for his arguments. All experiments were preceded by a context that biased either for the surface or the inverse reading and employed the forced-choice *how-many* questions described above. Experiment 7, 12, and 13 were almost identical, but in experiment 12, the quantified sentence and the ellipsis sentence were linked through the conjunction *and*, and in experiment 13, the sentence presentation was divided in a different way. Experiment 9 had an additional sentence after the ellipsis sentence, as in (3.10). In experiment 11, individual-level predicates like *love* or *know* were used rather than the stage-level predicated in the other experiments.

(3.9)   An experienced climber scaled every cliff. The owner of the shop did, too.

(adapted from Anderson 2004, p. 338)

(3.10)   The shop's sales increased substantially the next weekend.

(adapted from Anderson 2004, p. 142)

The results for this experiment series are summarized in Table 3.5 in percentage of inverse responses. It can be seen that unexpectedly, the inverse reading was in fact available and was not excluded by any of the manipulations done across the various experiments. In fact, while the values for the IR-biased context are similar to the comparable experiment 2, the values for the SR-biased context were consistently higher with 31-50% compared to only 19% in experiment 2. In face of these results, Anderson rejects Fox' Scope Economy constraint.

	Exp. 7	Exp. 9	Exp. 11	Exp. 12	Exp. 13
participants (analysed)	24	36	24	28	40
SR-biased context	32%	34%	50%	31%	31%
IR-biased context	56%	67%	56%	49%	41%

Table 3.5: Results in % of IR-choices from Exp. 7, 9, 11, 12, 13 in Anderson (2004), p. 151, 166, 201, 210, 224.

By-participant data is limited, but Anderson reports that in experiment 1, 12 of the 38 participants consistently chose the surface reading and that there was no one participant who chose the inverse over the surface reading in more than 54% of the cases. Reading times were recorded in experiment 4, 5, and 7. In experiment 4 and 5 the inverse continuation sentence was read slower than the surface continuation sentence. In experiment 7 but not in experiment 5, the IR-biased context slowed down reading times in the quantified sentence, but in experiment 7, the continuation sentence was read more slowly after the IR-biased context than after the SR-biased context. Experiment 7 showed that reading times were longer when the inverse reading was chosen.

One problem with Anderson's experiments, similar to Tunstall's experiment, is the fact that the forced-choice paradigm does not allow to draw any conclusions about the extent to which the inverse reading is in fact *available*. It only tests which reading is the preferred one, thereby potentially underestimating the general acceptance of inverse readings by speakers of English.

3.1.5   Marsden (2004)

Marsden's (2004) study is not mainly focussed on scope interpretation in English. It is a study of L2-acquisition of Japanese with English, Chinese, and Korean native speakers. However, one of the sub-experiments provides data from 24 native speakers of English on English doubly-quantified sentences, which I will present here. The sentences tested were transitive SVO sentences with an existential in subject and a universal in object position. The subject either had the quantifier *someone* or a NumP and the object quantifier was either *every* or *all,* see (3.11). Marsden employed a picture-matching-task, where one out of two possible pictures (representing the surface and inverse reading respectively) was shown together with a sentence, which was presented both written and auditory. Participants had to indicate on a four-point likert-scale to what extent the sentence matches the picture.

(3.11)   a. *∃-every:* [**Someone**] stroked [**every** cat].
   b. *∃-all:* [**Someone**] carried [**all** the suitcases].
   c. *Num-every:* [**Three** girls] flew [**every** kite].
   d. *Num-all:* [**Two** girls] washed [**all** the windows].

(adapted from Marsden 2004, p. 185)

The results are given in Table 3.6, where a value between 1.5 and 3 indicates acceptance and a value between 0 and 1.5 indicates rejection. As can be seen, the surface reading is accepted to a high degree

across all conditions. The inverse reading is accepted in both conditions with *every* but rejected in conditions with *all*. Acceptance of the inverse reading is higher when the existential *someone* is used compared to a numeral. However, the values are still lower than in the surface condition, indicating that, despite available, the inverse reading is still dispreferred.

	a: (∃-*every*)	b: (∃-*all*)	c: (*Num-every*)	d: (*Num-all*)
picture: SR	**2.68**	**2.98**	**2.91**	**2.95**
picture: IR	**1.96**	0.93	**1.74**	0.85

Table 3.6: Results on a scale from 0-3 of the experiment on English speakers in Marsden 2004, p. 195. Values >1.5 indicate acceptance, values <1.5 indicate rejection.

In a second study with 21 participants, Marsden (2004) shows that English speakers also accept a pair-list reading (inverse reading) with questions like "What did everyone buy?". In fact, this reading is preferred with a rating of 2.98 compared to the individual reading (surface reading) with a rating of 2.01. However, since wh-questions involve overt wh-movement, the inverse reading can arise through reconstruction of the wh-expression into its original position below the universal quantifier.

3.1.6 Tsai et al. (2014)/Scontras et al. (2017)

Tsai et al. (2014)[53] present a cross-linguistic study comparing Mandarin, English, and Mandarin heritage speakers. In the following, I will only present the data from the English sub-experiment. The authors ran a picture-matching task, where participant had to judge on a 7-point likert-scale to what extent the sentence appropriately describes the picture. The pictures were photos of Playmobil-figures enacting the situation (taken from the Bruening Scope Project). The sentences were presented auditory. Examples for the conditions are given in (3.12). The sentences were transitive sentences and quantifier order varied between ∃-∀ and ∀-∃. The existential was either the indefinite article *a* or the numeral *one*. In the ∃-∀ quantifier order, there was another condition where the universal was embedded into an existential relative clause. 130 participants completes the experiment from which 16 participants were excluded. The results are presented in Table 3.7.

(3.12) a. {**A / One**} shark attacked **every** pirate.
    b. **Every** shark attacked {**a / one** pirate}.
    c. There is {**a / one**} shark that attacked **every** pirate.

(adapted from Scontras et al. 2017, p. 17)

The authors found that the existential-wide-scope reading received high ratings across all conditions and was highest in the embedded conditions. The universal-wide-scope reading was the preferred reading in the ∀-∃ quantifier order. The inverse universal-wide-scope reading received an intermediate rating in the a-∀ condition, indicating that this is a dispreferred but available reading. The overall lower

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[53] The same experiment was presented again in Scontras et al. (2017).

ratings of the a-∀ condition is interpreted by the authors as a consequence of indefinites in subject position, which are dispreferred in English. When the indefinite was replaced with a numeral, ratings dropped noticeably. The authors argue that the lower inverse ratings of one-∀ compared to a-∀ in both the unembedded and the embedded condition are not due to a specificity interpretation, as the existential in ∀-one order does not take wide scope more often than in ∀-a order. They argue that what is at play here is the single reference principle of Fodor (1982) and Kurtzman & MacDonald (1993), which is stronger with the numeral than with the indefinite due to its phonological saliency. Even though inverse readings are not expected to occur with relative clauses, the embedded a-∀ condition still received a rating of 3.1, higher than the two conditions with the numeral in subject position. The authors interpret this as evidence that inverse readings out of relative clauses are marginally possible. They explain this effect with a head-raising analysis of relative clauses, where the RC-head noun reconstructs into the relative clause site and RC-internal Quantifier Raising occurs. This approach will be discussed in more detail in section 3.2.4.

	a-∀	one-∀	∀-a	∀-one	there a-∀	there one-∀
∀-wide-scope	4.5	2.1	6.5	6.6	3.1	2.3
∃-wide-scope	5.6	6.2	5.5	5.6	6.2	6.5

Table 3.7: Rating results on a scale from 1-7 from English experiment in Tsai et al. 2014, p. 8.

3.1.7   Tanaka (2015)

Tanaka conducted two studies that specifically test for the parallel behaviour of inverse scope and wh-extraction (see also section 2.2.3). The basis for these experiments is a graded categorization of islands. Tanaka uses the distinction from Cinque (1990) with three types of islands: selective weak (wh-islands, negative islands), non-selective weak (non-finite adjuncts), and strong (finite adjuncts, subject islands). Tanaka's prediction is that if wh-extraction and inverse scope are both movement phenomena, this should show in the same graded island pattern. Further, Tanaka tested the *Single Event Grouping Condition* of Truswell (2007, 2011), which says, simplified, that wh-movement can only occur when the events described in the constituent containing the movement chain are spatiotemporally connected. In the first experiment, Tanaka used three types of adjuncts, bare participle gerunds, after-prepositional gerunds and during-PPs, see (3.13). The sentences were presented within a context in the form of a dialogue, see (3.14) for two of the conditions. Additionally, the contexts in half of the cases were manipulated to make explicit that the event in the matrix clause is caused by the event in the embedded clause. This was done to test for the Single Event Grouping Condition of Truswell (2007, 2011), according to which the ratings in after-gerunds, where this condition is violated, should be improved when the events are linked through causation. The target sentences were either wh-questions or doubly-quantified sentences with the existential *a* and the universal *each*. Participants were asked to judge how acceptable the target sentence is with respect to the context on a scale from 1 to 5. Tanaka used strong islands as ungrammatical controls and non-embedded sentences as grammatical controls. In the case of quantifier scope, complement clauses were also added as a control condition. 80 mono-lingual speakers

of British English participated in the experiment. The results are shown in Figure 3.3 and 3.4 for wh-extraction and scope ambiguities respectively.

(3.13) a. *bare participle gerund/causal:*
   WH: **Which comedy programme** did he burst out laughing [listening to t_{WH}]?
   Q: **A manager** burst out laughing [listening to **each comedy programme**].
   b. *bare participle gerund/non-causal:*
   WH: **Which audiobook** did she burst out laughing [listening to t_{WH}]?
   Q: **A girl** burst out laughing [listening to **each boring audiobook**].
   c. *after-prepositional gerund/causal:*
   WH: **Which student** did he burst out laughing [after meeting t_{WH}]?
   Q: **A professor** burst out laughing [after meeting **each student**].
   d. *after-prepositional gerund/non-causal:*
   WH: **Which professor** did she burst out laughing [after meeting t_{WH}]?
   Q: **A girl** burst out laughing [after meeting **each professor**].
   e. *during-PP/causal:*
   WH: **Which comedy film** did Rob burst out laughing [during t_{WH}]?
   Q: **One of the guys** burst out laughing [during **each comedy film**].
   f. *during-PP/non-causal :*
   WH: **Which war film** did he burst out laughing [during t_{WH}]?
   Q: **An academic** burst out laughing [during **each war film**].

   (adapted from Tanaka 2015, p. 110-111)

(3.14) a. **Q - bare participle gerund/causal:**
   Mary and Tom are talking about Ms White and Mr Black, sales managers who always listen to the radio in their offices at lunchtime.
   Mary: *At lunchtime yesterday, I went to Ms Whites office to return her umbrella. When I knocked on the door, I heard her burst out laughing. She was listening to Just a Minute on the radio.*
   Tom: *What a coincidence! While you were visiting Ms White's office, I went to Mr Black's office to return his dictionary. When I opened the door, I saw him burst out laughing as well. He was also listening to a comedy programme, but it was Cabin Pressure. I know that both Just a Minute and Cabin Pressure are funny enough to make even someone that serious laugh out loud.*
   Mary: *Oh, <u>a manager burst out laughing listening to each comedy programme</u>. I didn't know that our bosses are both fans of comedy shows.*
   b. **Q - bare participle gerund/non-causal:**
   Two college students are talking about their friends Wendy and Iris, who had to study some audio books for their course on business management. When the weather was good, they usually could be found studying at their favourite spots in the park.
   Oliver: *When I met Wendy the other day, she was sitting on her favourite bench listening to Time Management. She told me that audio book was incredibly boring. Afterwards, I hid behind a tree near her bench and sent her a very funny text message. As soon as she had a look at her mobile phone, she burst out laughing.*

Erin: *Ha-ha, well done! That must have cheered her up. What about Iris? Did you meet her as well?*

Oliver: *Yes, I did. After surprising Wendy, I saw Iris sitting on the grass under a tree. She was listening to The Hypnotic Salesman, and seemed very bored. So, again, I hid behind a tree and sent her a funny message. Like Wendy, my message made her burst out laughing.*

Erin: *A girl burst out laughing listening to each boring audiobook. That must have been a very funny message. Can you send it to me as well?*

(Tanaka 2015, p. 113-114)
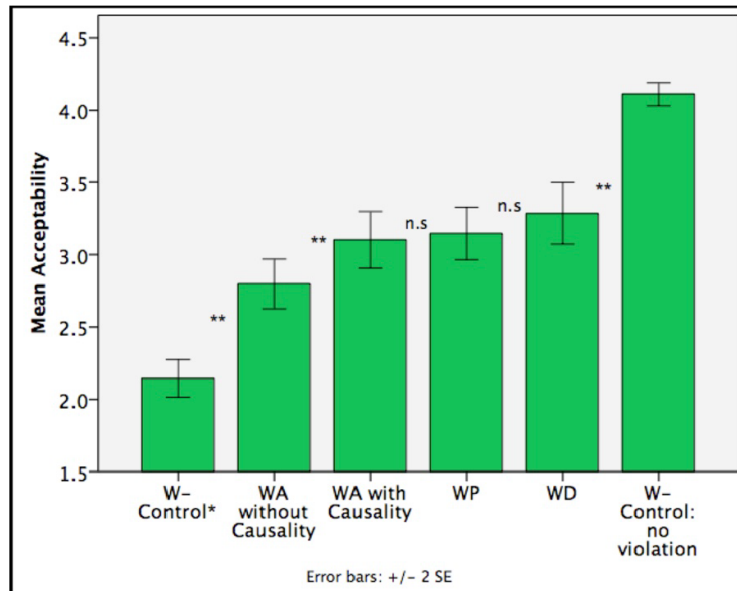
Figure 3.3: Results of wh-extraction of experiment 1 in mean acceptability from Tanaka 2015, p. 122. WA = after-gerund, WP = bare participle, WD = during-PP.
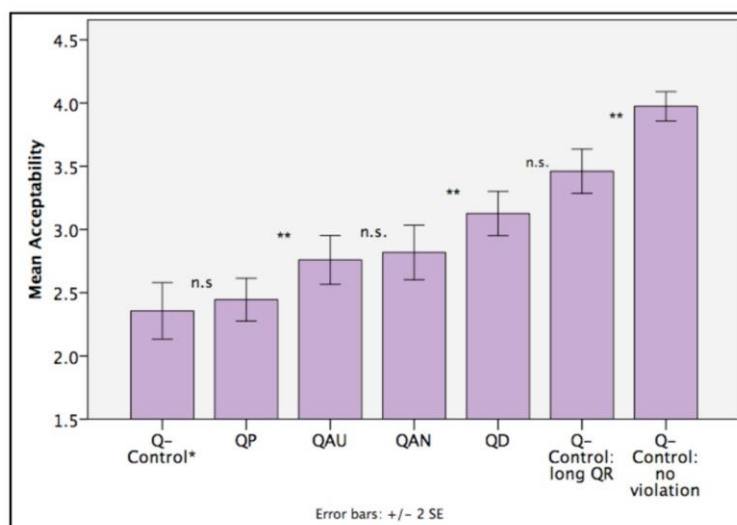
Figure 3.4: Results of quantifier scope of experiment 1 in mean acceptability from Tanaka 2015, p. 127. QP = bare participle, QAU = after-gerund/non-causal, QAN = after-gerund/causal, QD = during-PP, long QR = complement clause.

Tanaka found that both in the Wh- and the Q-condition, after-gerunds and during-PPs were rated better than the ungrammatical controls and worse than the grammatical controls, signalling an intermediate state. However, while the bare participle gerunds were rated similar to the other two conditions in the case of wh-extraction, they were rated no different from ungrammatical controls in the case of quantifier scope. Further, manipulation of causality only had an effect in after-gerunds in the case of wh-extraction, but not in the case of quantifier scope. Finally, doubly-quantified complement clauses were rated lower than grammatical controls, but still higher than the ungrammatical controls and in fact higher than the after-gerunds and bare participles, too.

Tanaka conducted a second study, where only doubly-quantified sentences were tested. The sentences contained either an indicative or a subjunctive complement clause and the embedded universal was either subject or object, see (3.15).

(3.15)   a. *Indicative/subject:*
            Context: Sue is an attractive post-doc. There are five male professors in the department. Rumours fly. At least one PhD student of each of the professors started one at some point.
            Target: Last year, a different student said that each professor dated Sue.
         b. *Indicative/object:*
            Context: Sue is an attractive post-doc. There are five male professors in the department. Rumours fly. At least one PhD student of each of the professors started one at some point.
            Target: Last year, a different student said that Nancy dated each professor.
         c. *Subjunctive/subject:*
            Context: Prof Chomsky visited the department last week. In the department, there are three professors, each supervising one PhD student. Each professor came up with an idea of arranging for their PhD student to meet with Prof Chomsky.
            Target: After the lecture, a different professor suggested that each student talk to Prof Chomsky.
         d. *Subjunctive/object:*
            Context: Prof Dawkins visited the department last week. In the department, there are three professors, each supervising one PhD student. Each of the professors had an idea of asking Prof Dawkins to meet with their PhD student.
            Target: After the lecture, a different professor suggested that Prof Dawkins talk to each student.

                                                    (adapted from Tanaka 2015, p. 150-151 & 153)

Subjunctive complements were predicted to be more acceptable than indicative complements. This time, the sentences were supposed to block the surface reading by the use of the modifier *different*. The task was the same as in the first experiment. 207 out of 294 participants were analysed. The results can be seen in Figure 3.5. Tanaka found no effect of grammatical function, but an effect of clause type in the subject-condition. All four types of complement clauses were significantly worse than unembedded sentences, but significantly better than the strong islands that served as control. From the results of the two experiments, Tanaka concludes that (i) inverse scope arises through the covert movement operation QR and therefore is blocked or reduced in the same environments as wh-extraction, (ii) differences occur because the two phenomena each are mediated by one additional constraints, namely the Single Event Grouping Condition in the case of wh-extraction and Scope Economy in the case of QR. The

former can explain why causality only had an effect in the case of overt movement and the latter can explain why only the acceptability of inverse readings, but not of wh-extraction, is reduced in complement clauses.
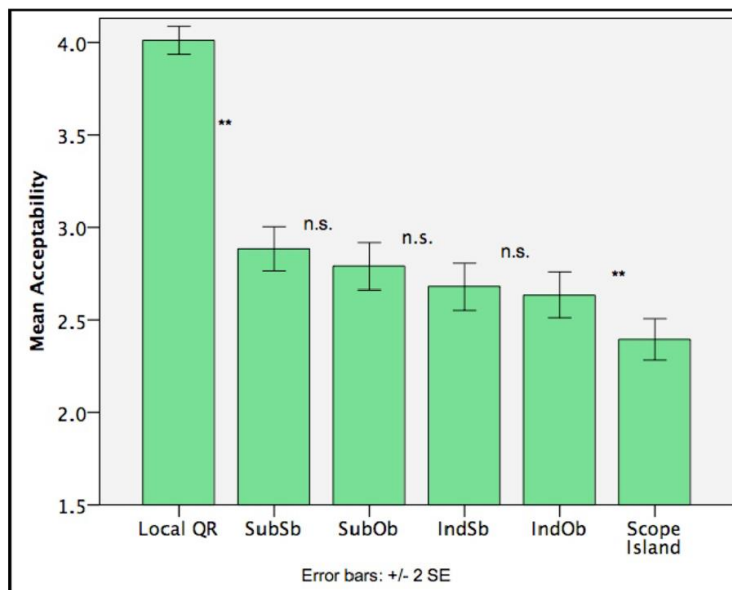
Figure 3.5: Results of experiment 2 in mean acceptability from Tanaka 2015, p. 159. Sub = subjunctive, Ind = indicative, Sb = subject, Ob = object.

Even though Tanaka presents a thoroughly designed study with impressive results on the relationship between overt and covert movement in islands, there is one aspect about the experiment on quantifier scope which seems problematic, namely that the type of task chosen is rather unusual for the detection of scope readings. Asking participants how acceptable they find a sentence in a given context carries the problem that there is little control over what exactly participants are rating. Participants may find that a sentence does not sound well in a certain context for various reasons that are unrelated to the specific scope reading they got. Second, it is not clear that the use of *different* in the sentences in experiment 2 does actually enforce the inverse reading. This is because the word different does not need to be bound and distributed over. Let's take (19b) for instance: the most prominent reading of the target sentence is that just one single student said that Nancy dated each professor, but that this student is different from the other students mentioned before. Participants might have judged the sentence as acceptable without actually obtaining the inverse reading. See also Moltmann (1992) on this use of *different* in English.

3.1.8 Summary

The above experiments all show that inverse readings are available but dispreferred in English transitive sentences. Several factors have an impact on the interpretation, such as the choice of quantifiers, contextual number bias, and the type of task. For example the results in Tsai et al. (2014)/Scontras et al. (2017) and Gillen (1991) indicate that, as for the choice of existentials, the lexical bias to take wide scope can be ordered as *one > a > some*, with *one* having the strongest preference to take wide scope

and thus being most resistant to allow inverse scope when followed by a universal quantifier. As for universal quantifiers, experiments by Gillen (1991) and Tunstall (1998) show that, in line with Ioup's hierarchy, *each* is most likely to take wide scope, followed by *every* and *all*. At the same time, Gillen's experiments showed that such effects can disappear with a different choice of task. In line with many processing-oriented experiments, not discussed above, the studies of Gillen (1991) and Anderson (2004) also support the general claim that inverse readings are associated with higher processing costs, reflected in longer reading and response times.

Even though the experiments all show that inverse readings are available in transitive sentences, the ratings differ greatly from one study to another, despite the items having the same structure $Subj_{a/some}$-V-Obj_{every} and active voice. The values vary between 16% (Tunstall), 19% (Anderson), 39% (Gillen), and 58% (Gillen) in forced-choice experiments and between 23% (Kurtzman & MacDonald) and 51% (Gillen) in non-forced-choice experiments. One explanation for these varying results could be plausibility considerations. In Anderson (2004), a slight number bias in context boosted the choice of IR from 19% to 53%. We have already seen in section 2.2.1 that the implausibility of the surface reading in most examples of inverse linking constructions has the effect that the surface reading is strongly dispreferred or even seems excluded altogether. There, I also made a similar argument in the case of complement clauses. In most of the studies described above, even though the impact of pragmatics was generally acknowledged, the items were not specifically tested and controlled for this. It could therefore simply be that in some studies, more items were used where the scenario of the inverse interpretations was more likely in terms of world knowledge than in others. I will therefore present a design, where the plausibility of the two interpretations is specifically taken into account.

Further, in the study of Tsai et al. (2014)/Scontras et al. (2017) there was the surprising effect that inverse readings were not completely excluded from relative clauses in existential sentences. This is in contrast to the mainstream assumption that inverse scope readings are impossible in island environments. Tanaka (2015) found a similar effect for adjunct islands and complement clauses, where the acceptability rating for IR was reduced but not so low as to indicate complete absence. However, Tanaka also found that this effect paralleled wh-extraction, where acceptability ratings also indicated marginal acceptability. In the following experiments, I will therefore test the availability of inverse readings in single- and double-embedded sentences.

3.2 Experiment E1: effects of embedding and plausibility

Experiment E1 was conducted to test for the general availability of inverse readings in English sentences with an existential subject and a universal object as well as the impact of embedding as a structural factor and world knowledge as a pragmatic factor. There were three main research questions:

Q1: To what extent is the inverse scope of a universal object over an existential subject available in a canonical, unembedded sentence?

Q2: To what extent does plausibility/world knowledge play a role in the availability of inverse readings?

Q3: To what extent are inverse readings available when the second quantifier is embedded inside a relative clause island?

The motivation for Q1, despite the multitude of previous experiments on quantifier scope in English, is the large variability in results obtained in those studies, potentially arising due to task and/or plausibility effects, which will be controlled for here. This is thus also the motivation for including Q2, as plausibility is usually not controlled for. As it is often claimed to play a role in scope resolution, this study systematically tests for this effect. The motivation for Q3 is the fact that despite the common assumption that inverse readings are banned across syntactic islands or clause boundaries in general, there is also data to suggest that these readings may be at least marginally available, see section 2.2.3 and 3.1. This experiment tests whether inverse readings are more available in a single island embedding compared to a double embedding.

3.2.1   Methods

(i)   Materials

The stimuli were originally created in German for the German version of this experiments (see section 4.3) and then translated to English. Deviations between the two languages were kept minimal. Changes were made when the exact wording sounded unnatural to native speakers, since the confound of a slightly different wording on the comparability between the languages was considered smaller than the confound of an unnaturally sounding items on the response behaviour of participants. Additionally, cultural adaptions were made, e.g. by changing locations (Berlin vs. New York City). The overall structure and all the factors that were relevant for this experiment were kept identical. The experiment had a 2x3 factorial design with the factors (i) *plausibility* and (ii) *embedding*. Plausibility was a between-item factor with two levels: neutral and biased. In the neutral condition, surface and inverse reading were both plausible scenarios according to general world knowledge. In the biased condition, on the other hand, only the inverse reading described a plausible scenario, while the surface reading was highly implausible[54]. The factor plausibility was controlled for in a pre-test, which will be described further below. The factor embedding was a within-item factor with three levels: 0-emb, 1-emb, and 2-emb. The 0-emb condition had no embedding. The 1-emb condition contained a single relative clause embedding, where the universal object was embedded inside the relative clause, while the existential object was the head of the relative clause. The 2-emb condition contained the same relative clause embedding as 1-emb, but the universal object was embedded once more into a finite clause. Each item was preceded by a context that was stated as an assumption about the future and introduced the two NPs.

Each item was followed by one of two possible questions, either targeting the availability of the surface reading (Q-ONE) or the inverse reading (Q-MORE). The answer 'yes' to Q-ONE indicates that the

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[54] The reason why no third condition *SR-biased* was used is that the surface reading was not the focus of interest in those experiments. The main question was to what extent the inverse reading would be available and what effect plausibility considerations might have on this availability. In fact, Anderson (2004) found no difference in IR-acceptance between a non-biasing context and an SR-biasing context, see section 3.1.4 above. Further, since the surface reading is assumed to be available anyway, there is no need to additionally boost this reading by a biasing context. However, note that unexpectedly, the results for the surface reading were far from ceiling, see the discussion of this experiment.

surface reading was accessible to the participant for a particular item, while the answer 'yes' to Q-MORE indicates that the inverse reading was accessible to the participant. This kind of task was chosen over the more common forced-choice task to be able to test if the inverse reading is available at all. Many experiments on scope have employed a forced-choice task, where participants are forced to choose between the surface and the inverse reading (e.g. Gillen 1991, Tunstall 1998, Anderson 2004), see section 3.1. The problem with such a task is that it is not actually indicative of *availability* but only of *preference*. If the inverse scope is possible but strongly disfavoured, participants may always or mostly opt for the surface reading, thereby completely hiding the existence of the inverse reading (see also the fieldwork methodology discussion in Matthewson 2004). In sections 3.3 and 4.4, I present an experiment that uses the forced-choice task and show the effect that this has on the results in comparison to the kind of task used in experiments testing for availability. Examples of the target items are given in (3.16) for the neutral condition and in (3.17) for the biased condition.

(3.16) **Neutral:**

   Context: The police officer hoped that the burglars might be recorded by newly installed
     surveillance cameras, and then, in fact …

     0-emb   … a newly installed surveillance camera recorded every burglar.

     1-emb   … there was a newly installed surveillance camera [that recorded
           every burglar].

     2-emb   … there was a newly installed surveillance camera [which hung
           in such a way [that it recorded every burglar]].

   Question: Can this sentence be understood to mean that, overall, …

     Q-ONE   … **only a single** newly installed surveillance camera recorded the
           burglars?   *yes/no*

     Q-MORE   … **more than one** newly installed surveillance camera recorded
           the burglars?   *yes/no*

(3.17) **Biased:**

   Context: Before the storm the police made an announcement that the access roads to
     the city center could be blocked by fallen trees, and then, in fact, …

     0-emb   … a fallen tree blocked every access road.

     1-emb   … there was a fallen tree [that blocked every access road].

     2-emb   … there was a fallen tree [which was positioned in such a way
           [that it blocked every access road]].

   Question: Can this sentence be understood to mean that, overall, …

     Q-ONE   … **only a single** fallen tree blocked the access roads?
                         yes/no

     Q-MORE   … **more than one** fallen tree blocked the access roads?
                         yes/no

The target sentences always had the following structure: the word order was canonical subject-before-object with a transitive, non-agentive predicate, i.e. the subject was always inanimate. The subject was an existential QP with the indefinite article *a*, the object was a universal QP with distributive *every*. This order was chosen to avoid the entailment problem described in section 2.2.2.

The target sentence was preceded by a short context, which served to control for effects of information structure and prosody, since these have been shown to have an impact on scope interpretation, see section 2.2.6. Controlling for information structure was particularly important for the German version of this experiment, see the subsequent chapter 4. The context thus contained the same predicate and NPs as the target sentence to give them the information structure status *given*. This was done by making an assumption or prediction about the future, which was then instantiated in the target sentence. Since these NPs were already introduced in the context, they necessarily had to carry number morphology. The decision was made in favour of plural rather than singular morphology, since the former is considered the more inclusive, or number-neutral form in both English and German (e.g. Corbett 2000, Sauerland et al. 2005). This is also supported by data from downward entailing contexts, e.g. negation or questions (Link 1983, Krifka 1989, Sauerland et al. 2005, Renans et al. 2020). However, it is easy to see how this could introduce a potential confound, biasing the participants towards the plural response due to morphological matching[55]. Such a plural response would then be incorrectly interpreted as a case of inverse reading and thus result in a false positive. One of the filler conditions, filler 2, was therefore designed to control for this potential confound. This issue will also be taken up in the discussion. The six different filler conditions are given in (3.18) to (3.23). Apart from filler 6, these filler conditions were either unambiguous or strongly favoured one of the two possible answers and thus also served as control items.

Filler 1: *No ∀*
This condition only contained an existential QP, but no universal QP.
(3.18)   The employees of the ski patrol announced they would temporarily close a ski slope
due to the danger of avalanches, and then, in fact, they did close a ski slope.
Q: Can this sentence be understood to mean that, overall, …
Q-ONE   … **only a single** ski slope was closed by the employees?
Q-MORE   … **more than one** ski slope was closed by the employees?
➜ Expected response: Q-ONE - **yes**; Q-MORE - **no**

Filler 2: *No ∀, 2-emb*
This condition only contained an existential, but no universal QP, and was doubly embedded in the same way as the 2-emb target items. This filler type was included to ensure that participants' response behaviour is not just driven by the structural complexity, independent of scope relations. In addition, this condition also controlled for the potential confound of morphological matching in the targets. If participants were simply matching morphological number, this should be visible in this filler condition, where the NP is also introduced with a plural in the context, but the plural response is clearly wrong.
(3.19)   The secretary suggested that the missing letter might be hidden under folders, and then,
in fact, there was a folder [that was positioned in such a way [that it covered the letter]].

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[55] In fact, remember that Anderson (2004) manipulated context by previously introducing either a single or multiple referents. However, note that in her stimuli, the referents in the context were real entities in the situation established, see (3.7), while in the stimuli used in here, the contextually mentioned referents are only potential referents about a possible event in the future. Further, even though the referents in Anderson's stimuli are picked up again later in the context, (*a volunteer/members*), she uses the same strategy as is used in here of initially using the plural to introduce a group of referents in the first place (*the members*). Further, it is not clear to what extent this manipulation has an effect, since Anderson obtained mixed results. As can be seen in Table 3.4, there was a notable effect in experiment 2, but no effect in experiment 5A.

Q: Can this sentence be understood to mean that, overall, …

Q-ONE   … **only a single** folder covered the letter?

Q-MORE   … **more than one** folder covered the letter?

➔ Expected response: Q-ONE - **yes**; Q-MORE - **no**

Filler 3: *Referential*

This condition contained an existential subject QP and a universal object QP, just as the target items, but with an additional sentence, in which a singular pronoun anaphorically referred back to the existential subject QP.

(3.20)   The travellers demanded that a trip to the Baltic Sea be offered, and then, in fact, a bus driver drove every traveller to the Baltic Sea. But I forgot <u>her</u> name.

Q: Can this sentence be understood to mean that, overall, …

Q-ONE   … **only a single** bus driver drove the travellers to the Baltic Sea?

Q-MORE   … **more than one** bus driver drove the travellers to the Baltic Sea?

➔ Expected response: Q-ONE - **yes**; Q-MORE - **no**

Filler 4: *Each*

This condition contained the strongly distributive quantifier 'each', which distributed over a plural subject DP.

(3.21)   The tenants on the ground floor threatened to file a complaint about the drums on the 1st floor, and then, in fact, they filed a complaint <u>each</u>.

Q: Can this sentence be understood to mean that, overall, …

Q-ONE   … **only a single** complaint was filed by the tenants?

Q-MORE   … **more than one** complaint was filed by the tenants?

➔ Expected response: Q-ONE - **no**; Q-MORE - **yes**

Filler 5: $\forall$-$\exists$

This condition was similar to the target sentence, but with the order of quantifiers reversed, i.e. with a universal subject QP and an existential object QP.

(3.22)   The doctor ordered that the nurses should be supported by caregivers, and then, in fact, <u>each caregiver supported</u> a nurse.

Q: Can this sentence be understood to mean that, overall, …

Q-ONE   … **only a single** nurse was supported by the caregivers?

Q-MORE   … **more than one** nurse was supported by the caregivers?

➔ Expected response: Q-ONE - **no**; Q-MORE - **yes**

Filler 6: *Ellipsis*

This condition was added to test for the availability of inverse readings under VP-ellipsis. The items are taken from Anderson (2004) in a slightly modified version, ensuring that the two subject denotations come from two disjoint sets.

(3.23)   The Dingaling Circus presented their elephant show to the excited audience. The trainer announced that the elephants could be rewarded by spectators, and then, in fact, <u>a spectator</u> rewarded every elephant, and <u>the trainer</u> [_{VP} did], too.

Q: Can this sentence be understood to mean that, overall, …

Q-ONE   … **only a single** spectator rewarded the elephants?
Q-MORE   … **more than one** spectator rewarded the elephants?
➔ Expected response: Q-ONE - **yes**; Q-MORE - **no**

The purpose of filler 6 was to test if the unexpected result from Anderson (2004) about inverse scope in VP-ellipsis could be repeated. According to the economy account of Fox (2000), sentences like (3.23) should only allow for the surface reading due to the interaction of economy and parallelism constraints, see section 2.3.1. Anderson (2004) tested this prediction and found that English speakers in fact can obtain the inverse reading for sentences like (3.23), see section 3.1.4. However, many of her items contained a potential confound, an example for which is given in (3.24). Here, participants might assume that the president of the club is also a member of the club. In that case, even under the surface reading, the total amount of members that tested recipes is two – the helpful member from the antecedent and the club's president from the elided clause. This could lead to a false positive in that participants give the inverse scope answer without actually having obtained an inverse interpretation. In filler 6, Anderson's items were thus modified in a way that the two subject denotations come from disjoint sets.

(3.24)   <u>A helpful member</u> tested every recipe. <u>The club's president</u> did, too.

<div align="right">(Anderson 2004, p. 335)</div>

There were 24 items in the neutral and 24 items in the biased condition, resulting in 48 target items in total. The total number of filler items was 48. The items were distributed on 6 lists via a Latin Square design, such that each participant saw a certain target item in only one of the three embedding condition and that each item was only shown with one of the two possible question types. Each participant thus saw 96 items in total.

(ii)   Pre-test

The factor plausibility was controlled for in a pre-test. This pre-test was conducted in German as a pre-test for the German version of this experiment, which will be presented in section 4.3. Because the English items were translations of the German items and thus almost identical in content, no separate pre-test was conducted for English. 21 native speakers of German participated in the pre-test, which was conducted online. They read contexts that were in correspondence with the contexts also used in the main experiments. For each context they indicated on a 7-point likert-scale which scenario out of two they perceived as more or less plausible. An example is provided in (3.25), which corresponds to the biased example item (3.17).

A cross in the middle would indicate that both situations are considered equally plausible, while a shift to the left side indicates that the single-item situation is considered more plausible and a shift to the right side indicates that the multiple-item situation is considered more plausible. The extreme ends of the spectrum indicate that that respective situation was considered the only imaginable situation. The average across participants for each item was calculated. Items with values in the middle range (3.0-5.0) were used for the neutral condition and items with values towards the right end of the spectrum (5.0-7.0) were used for the IR-biased condition.

(3.25)   Die Polizei hatte vor dem Sturm davor gewarnt, dass die Zufahrten in die Innenstadt blockiert werden könnten. Tatsächlich wurden die Zufahrten dann alle blockiert, und zwar insgesamt von…

'The police had warned before the storm that the entrances to the city center could get blocked. Indeed, the entrances did all get blocked, namely by overall …'

Welche Situation halten Sie für plausibler?
'Which scenario do you consider more plausible?'

…einem einzigen Baum '… *a single tree*'	1	2	3	4	5	6	7	…mehr als einem Baum '… *more than one tree*'
	einzig mögliche Situation *'only possible situation'*	viel plausibler *'much more plausible'*	etwas plausibler *'somewhat more plausible'*	etwa gleich plausible *'about equally plausible'*	etwas plausibler *'somewhat more plausible'*	viel plausibler *'much more plausible'*	einzig mögliche Situation *'only possible situation'*	

(iii)   Participants

58 native speakers of English participated in the experiment. They were recruited through the online platform Prolific and received a compensation of 8£. To avoid effects of dialect, the participant pool was restricted to US citizens. 15 participants had to be excluded from the analysis because they did not reach the threshold of correctly answering 3/4 of the control filler conditions[56]. Among the remaining 43 participants, 19 were female and 24 were male. They were 21-45 years old, with a mean age of 33.

(iv)   Procedure

The experiment was conducted online via the free software OnExp, version 1.3.1 (GNU General Public License) of the University of Göttingen (http://onexp.textstrukturen.uni-goettingen.de). Participants first read the general instructions and were then trained for the task with three practice items. The target and filler items were presented in randomized order in two blocks of equal length. Participants could take a break after the first block. Participants were instructed to only follow their own intuition as native speakers and to not make additional assumptions beyond the information actually provided in the text.

3.2.2   Predictions

English is generally known to be a language that allows for inverse readings in a variety of different constructions. More specifically, it is generally acknowledged that English allows for inverse readings of a universal object over an existential subject in transitive sentences. This has also been shown in a

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[56] It is not clear why the drop-out rate was so high in this particular experiment. None of the other experiments had a high drop-out rate (ranging between 0-6 participants), even though they were only minimally different from this one. For example, experiment E2 in the next section is only different in the type of question asked and the experiment G1 in the next chapter is an identical German replication of E1. The participants of multiple other experiments presented in here were also conducted via Prolific, i.e. they had a similar participant pool. A particular reason for this high drop-out rate could therefore not be identified. Note, however, that higher drop-out rates in online experiments compared to lab experiments are generally not unusual.

number of experiments, see section 3.1 above. In all of the theoretical frameworks presented in chapter 1, the prediction for the unembedded condition is that inverse readings should be acceptable. This should be the case for both the biased and the neutral condition. However, since previous literature has shown that context and world knowledge play an important role in scope ambiguity resolution (e.g. Kurtzman & MacDonald 1993, Saba & Corriveau 2001, Villalta 2003, Reinhart 2006), one would expect that more participants should be able to obtain the inverse reading in the biased condition than in the neutral condition. However, purely structural approaches would not predict any difference. Generally, approaches that make categorical distinctions can only predict the presence or absence of a certain reading, but not a gradual difference. This is different from e.g. multi-factorial accounts, where the degree of acceptability of inverse readings is part of the system.

As for the embedded conditions, all of the accounts presented in section 2.3 rule out the inverse reading. Those accounts that are based on Quantifier Raising predict that, because QR is a covert movement operation, it should be subject to the same movement constraints as overt movement. Since relative clauses are considered islands for movement, Quantifier Raising of the embedded universal should be blocked by general movement principles. This is the case even in accounts like Tanaka (2015) or Wurmbrand (2018), where the notion of islands is significantly relaxed. There, in infinitive adjuncts and complement clauses QR is marginally acceptable, but relative clauses are still considered strong/absolute islands. Hulsey & Sauerland (2006), however, assume that relative clause boundaries can be crossed by QR – without explaining how this could be reconciled with the general idea of islands and QR as a movement operation. The semantic accounts discussed in section 2.3.2 have in common that they do not predict island-boundedness as a necessary consequence of the system, as would be the case with QR. However, in order to account for the presumed island-effects, they all make additional assumptions to restrict scope. In his CCG account, Steedman (2012) assigns the relative operator a categorical type that prevents inverse readings. In Hendriks' (1988, 1993) type-shifting account, the type-shifting operator is lexically restricted to predicates and cannot act on a relative clause operator. In the continuation-based account of Barker (2002), the composition rules are adjusted accordingly to accommodate clause-boundedness. That is, in all those accounts, in the way they are stated in the cited works, inverse readings are not predicted. At the same time, the empirical results of Tsai et al. (2014)/Scontras et al. (2017), provide some evidence that inverse readings are marginally accepted in English relative clauses. Thus, the 1-emb condition in the present experiment may also be accepted to a certain degree. Figure 3.6 shows the general predictions for the results of experiment E1.
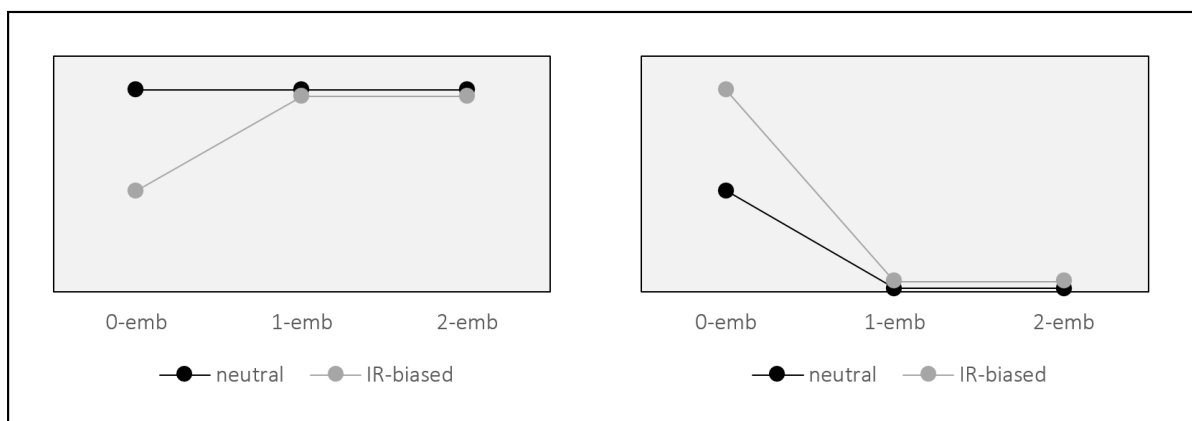
Figure 3.6: Predictions for experiment E1 for Q-ONE (left) and Q-MORE (right).

Inverse readings in 1-emb and 2-emb should be banned across the board. In the 0-emb/neutral condition, they should be acceptable to a certain degree and in 0-emb/IR-biased this value should be boosted. The surface reading, on the other hand, should be available to a high degree across the board. However, in the 0-emb/IR-biased condition it should be reduced strongly, because QR is structurally permitted and participants' response should be mainly driven by plausibility considerations.

3.2.3 Results

The results are visualized in Figure 3.7[57]. In the neutral condition, participants accepted the surface reading in 69% (95% CI[58]: 0.62-0.76) of the cases in the 0-emb condition. The acceptability increased with deeper embedding to 80% (95% CI: 0.74-0.86) in 1-emb and 89% (95% CI: 0.83-0.93) in 2-emb. In the biased condition, participants accepted the surface reading in 34% (95% CI: 0.26-0.41) of the cases in both the 0-emb and the 1-emb condition. The acceptability increased to 68% (95% CI: 0.60-0.75) in the 2-emb condition. As for the inverse reading, participants accepted it in 52% (95% CI: 0.45-0.60) of the cases in both the 0-emb and the 1-emb condition in the neutral condition. The acceptability decreased to 19% (95% CI: 0.14-0.26) in the 2-emb condition. In the biased condition, participants accepted the inverse reading in 84% (95% CI: 0.77-0.89) of the cases in the 0-emb condition. The acceptability decreased with deeper embedding to 74% (95% CI: 0.66-0.80) in the 1-emb and to 44% (95% CI: 0.36-0.51) in the 2-emb condition.
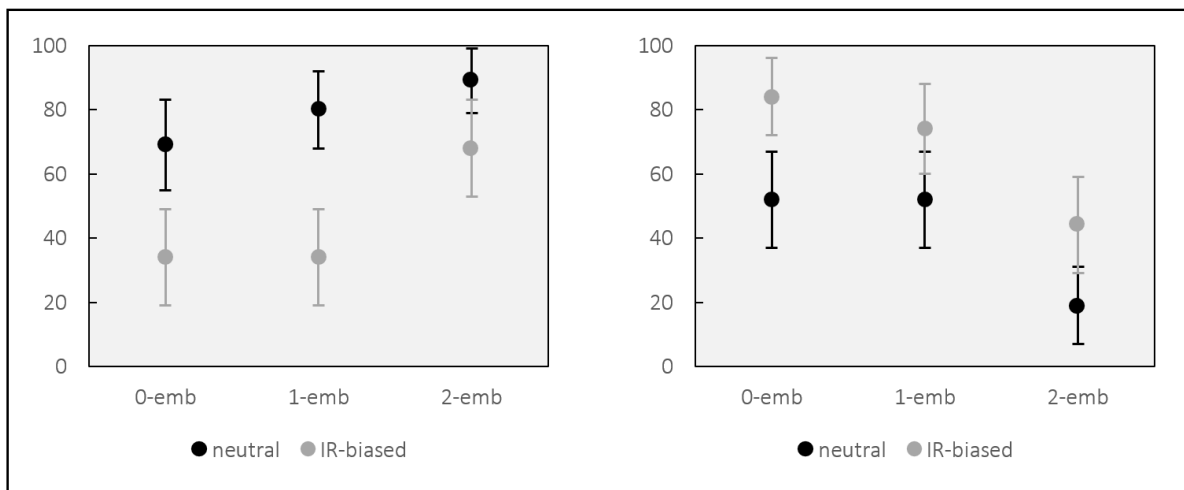
Figure 3.7: Results of experiment E1 in proportion of 'yes'-answers across conditions for Q-ONE (left) and Q-MORE (right). Error bars mark 95% CI.

The results were analysed using the free software R (version 3.6.1; R Core Team 2019) with a generalized linear mixed model fit by maximum likelihood using the package lme4 (Bates et al. 2015). The factor plausibility was analysed with a treatment contrast with neutral as the baseline. The factor embedding was analysed with a sliding contrast, thereby comparing the 1-emb to the 0-emb and the 2-emb to the 1-emb condition. The two question types were merged by collapsing 'yes'-answers to Q-

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[57] Eight items had to be excluded in two of the 12 lists due to a coding error which led to a mistaken visual presentation.
[58] CI = confidence interval

ONE with 'no'-answers to Q-MORE and 'no'-answers to Q-ONE with 'yes'-answers to Q-MORE[59]. The analysis revealed a main effect of plausibility, with a significant difference between neutral and biased ($p < 0.01$, SE = 0.21) as well as a main effect of embedding with a significant difference between 2-emb and 1-emb ($p < 0.01$, SE = 0.18). However, the difference between 1-emb and 0-emb did not reach significance ($p = 0.09$, SE = 0.19). No interaction was significant (neutral/biased vs. 0-/1-emb: $p = 0.93$, SE = 0.26; neutral/biased vs. 1-/2-emb: $p = 0.3$, SE = 0.28).

The results for the filler items are given in Table 3.8 below. The outcome was in line with the expectations with 5-13% acceptance of the incorrect answer and 87-98% acceptance of the correct answer.

	Filler 1: no∀	Filler 2: no∀, 2-emb	Filler 3: referential	Filler 4: each	Filler 5: ∀-∃	Filler 6: ellipsis
Q-ONE	98%	98%	95%	13%	12%	67%
Q-MORE	8%	6%	5%	87%	93%	47%

Table 3.8: Experiment E1 - proportion of 'yes'-answers across all filler/control conditions.

3.2.4 Discussion

(i)   Fillers

The results of the filler items indicate that the overall design worked as expected and that participants both understood the task and parsed the sentences in enough depth to answer to questions accordingly. Specifically, Filler 2 controls for the potentially confounding effects of a plural NP in the context: If participants' behaviour were simply guided by shallow morphological processing, i.e. they only answer 'more than one' because they have encountered a plural NP at some point, this should become visible in an increased percentage of unexpected 'yes'-answers to Q-MORE, both in the target conditions and in Filler 2. Filler 3-5 are also important as the items in these conditions resemble the target items in terms of semantic complexity. They all express relations between two quantified (or plural) DPs. The

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[59] The logic behind collapsing the two question types is the following: Participants are either asked if the sentence can be understood to mean that there is only a single X, or that there is more than one X. Logically, the two types of questions cover all possible interpretations: there can only be either exactly one X, or more than one X. The third logical possibility, zero X, is contradictory to the information given in context and target clause. Given this, the two interpretations elicited are complementary: Whenever a participant says 'no' to Q-ONE (exactly one), they were unable at that moment to interpret the sentence under the surface reading, and thus *must* have obtained the other interpretation (more than one). Conversely, whenever a participant says 'no' to Q-MORE (more than one), they were unable to interpret the sentence under the inverse reading, and thus *must* have had the other interpretation (exactly one). Let us consider condition 0-emb/neutral for illustration: in 100-69=31% of all cases, when being explicitly asked for the surface reading, participants did not obtain it and consequently *only* obtained the inverse reading. The 69% show the number of times when *at least* the surface reading was available, but potentially sometimes the inverse reading too. In 100-52=48% of the cases, when being explicitly asked for the inverse reading, participants did not obtain it and consequently *only* obtained the surface reading. The 52% thus show the number of times when *at least* the inverse reading was available, but potentially sometimes the surface reading too. Collapsing the responses therefore gives us, on the one hand, all cases in which the inverse reading was available, independent of whether or not the surface reading was available too, and, on the other hand, all cases in which the surface reading was available, independent of whether the inverse reading was available too.

participants' task in processing and interpreting such sentences is therefore comparable to that of the target sentences. The level of incorrect responses in the filler conditions thus serves as a baseline for the target items. This baseline is around 10% and represents the 'noise' in participants' answer. This noise may partly be caused by factors that are completely unrelated to the task, e.g. when participants misread the sentence or the question, accidentally click on the wrong button, are distracted, etc. To a certain extent it may also be caused by confounds related to the design or the specific items used, which will be discussed further below. Values in the target items that are clearly above ~10% will be taken as indicative of the respective scope reading. In that sense, I will follow Vogel's (2019) classification on degrees of grammaticality. Vogel takes acceptance levels of <10% as ungrammatical and >90% as grammatical, with another 10% of uncertainty. Acceptance levels ranging from 20% to 80% can neither be considered fully grammatical nor ungrammatical, but represent some degree of markedness. The range of 60-80% is considered slightly marked and 20-50% marked. Even though in my experiments, I do not test grammaticality per se, but availability of different interpretations, Vogel's classification can still be extended to this case. This is because the interpretations which a sentence permits are also guided by underlying grammatical principles. Applying this classification to the filler conditions, we see that they match the 10% and 90% threshold of ungrammaticality, with a few percentages of additional uncertainty. Following Vogel, I will consider a reading to be available in a given language if the acceptance rate is 20% or higher.

The ellipsis filler condition, which used items of Anderson (2004) in a slightly modified way, replicated Anderson's main finding that participants accept inverse readings even in elided sentences – an environment where, according to Fox' (2000) Scope Economy account, inverse readings should be blocked. This was the case despite controlling for the potential confound, thereby strengthening the validity of the original results in Anderson (2004). In fact, the inverse reading was not only marginally but readily available. The values were fairly close to the values in the neutral target condition, with 47% IR and 67% SR in the case of ellipsis and 52% and 69% in the case of neutral/0-emb, thus indicating that the elided conjunct has no effect on interpretation at all.

(ii)   Baseline condition: IR readily available

In the 0-emb/neutral condition, participants accepted the inverse reading in 52% of the cases and the surface reading in 69% of the cases. This is in line with previous experiments in that it shows that the inverse reading is readily available in English, but less preferred compared to the surface reading. In comparison to the two experiments presented in section 3.1 with a comparable design (transitive ∃>∀ sentences with a non-forced-choice task), the values are almost identical to Gillen (1991), where participants accepted the inverse reading in 51% of the cases, and much higher than in the experiment of Kurtzman & MacDonald, where participants judged an IR-disambiguating continuation sentence as felicitous in 23% of the cases. Even though the surface reading received higher values than the inverse reading, indicating the predicted preference for surface readings, the difference is much smaller than expected. In fact, the expectation was that surface readings would always be accepted in the neutral condition. In Reinhart (1995, 1997, 2006) for example, reference set computation only takes place when the surface reading is not compatible with the context. However, the items were specifically designed to render both the surface and the inverse reading plausible. In other studies, where participants were not forced to choose between the two readings, non-ceiling effects can in fact be observed too, even if less pronounced. In Gillen's (1991) experiment 6, 83% of the participants accepted the surface reading

and in Kurtzman & MacDonald (1993), about 80% accepted the surface reading in the relevant condition. In the acceptability rating task of Tsai et al. (2014)/Scontras et al. (2017), participants rated the surface scope reading in the relevant condition with 5.6/7, clearly lower than the rating of 6.5 for the surface reading in the condition with reverse quantifier order ∀-∃. It is true that, from a structural point of view, the surface reading should always be available. However, from a processing-oriented view, it seems plausible that participants opt for the first of two plausible construals that comes to mind. Depending on world knowledge and subjective experience, some participants may thus first come up with a situation verifying the inverse scope reading, and then subsequently stick to this construal in answering Q-ONE with 'no'. See, e.g., Sanford & Garrod (1998) for such processing-driven, subpropositional derivation of meanings.

(iii)   Plausibility: strong impact

The IR-bias lowered the availability of the surface reading by 34 percentage points (neutral: 79%; IR-biased: 45%) and boosted the inverse reading by 26 percentage points (neutral: 41%; IR-biased: 67%) across embedding conditions. The effect was strong enough to turn the inverse reading into the preferred reading for both 0-emb and 1-emb. While the items were specifically designed to make the surface reading highly implausible, this shows that the effect of plausibility is clearly strong enough to explain at least some of the notable variation between the results of different studies discussed above. This is in line with claims and predictions from previous literature (Gillen 1991, Kurtzman & MacDonald 1993, Saba & Corriveau 2001, Villalta 2003, Anderson 2004, Reinhart 2006, Srinivasan & Yates 2009). However, while the effect is often acknowledged, it is not usually controlled for. The results show that it is worthwhile to take this effect into account when designing a study on quantifier scope. On the other hand, despite the high implausibility of the surface reading, the inverse reading was still rejected in 1/3 of the cases. This suggests that structural factors still play a role in the general preference for surface readings, which cannot be fully overridden by plausibility. As we will see below, participants vary with respect to how much importance they assign pragmatic versus structural factors.

(iv)   Embedding: IR available

As discussed earlier, it is generally assumed that inverse scope from relative clauses should not be available, even though certain exceptions have been noticed, see section 2.2.3. This is also predicted by most syntactic and semantic accounts on quantifier scope. Surprisingly, not only are the values for 1-emb not decreased to a level similar to the unambiguous control sentences. The rating did not drop at all in comparison to the condition without embedding. In both cases we find an availability of 52% in the neutral condition. This is partly in line with the findings of Tsai et al. (2014)/Scontras et al. (2017), who did find a decline with relative clauses, but not as strong as expected. It is also in line with several authors who have pointed out the existence of inverse readings in relative clauses based in introspective judgments and corpus data (e.g. Sharvit 1999, Szabolcsi 2010, Barker 2012, Barker 2021). Even more surprisingly, however, is the fact that even in the 2-emb condition, despite the availability dropping, the ratings are still at 19%. At the same time, 19% is just below the boundary of what is considered a real effect in Vogel's (2019) classification. We can therefore not say with certainty, if this is still noise or a real effect. While in the IR-biased conditions, a plausible explanation might be that participants simply ignore grammar for the sake of pragmatics, which causes the unexpectedly high results in the 1-emb condition, the same cannot be said for the neutral condition. Here, the surface reading is just as plausible

as the inverse reading. QR-based accounts assume that the availability of inverse scope should parallel the acceptability of wh-extraction, since both are subject to the same island restrictions. If we apply wh-extraction to the sentence in (3.16), as in (3.26a), it should be clear that overt movement across the island boundary is ungrammatical and to most speakers even unintelligible. This effect is even stronger in the case of a double-embedding in (3.26b).

(3.26)   a. Who$_i$ was there a newly installed surveillance camera [that recorded t$_i$]?
          b. Who$_i$ was there a newly installed surveillance camera [which hung in such a way
             [that it recorded t$_i$]]?

Tsai et al. (2014) assume a head-raising analyses of relative clauses (see e.g. Bhatt 2002, Hulsey & Sauerland 2006) to account for their unexpected findings regarding relative clauses. Under this analysis, the RC-head is base-generated inside the RC-site and raises to its surface position, see Figure 3.8. Tsai et al. suggest that the raised RC-head can reconstruct into its original position and subsequently, RC-internal Quantifier Raising of the object above the subject can apply. In section 6.2.1, I will discuss in depth whether any particular relative clause analysis can serve as a satisfying explanation for inverse scope in relative clause environments. There, I will come to the conclusion that they cannot.
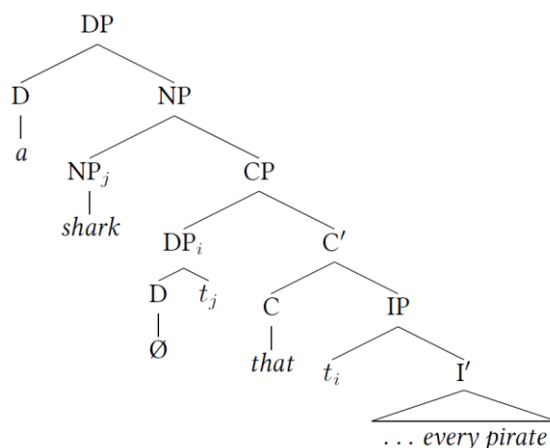
Figure 3.8: Head-raising analysis of relative clauses from Tsai et al. (2014), p. 10.

The problem cannot easily be avoided even without assuming Quantifier Raising. Also semantic accounts, such as Hendriks (1988, 1993), Steedman (2012), or Barker (2002), do not predict inverse readings in these contexts. However, as discussed above, island-boundedness is not an integral part of their systems, as is the case with QR. Therefore, these accounts can more easily accommodate the findings, essentially by just lifting the restrictions that were originally placed on the system to account for the supposed lack of inverse readings in the first place. I will discuss this in more detail in section 6.2.2. The unexpected availability of inverse readings in relative clauses found in E1 will be tested further in E2 and a follow-up study in the two subsequent sections 3.3 and 3.4.

(v)   By-participants: high variability

Figure 3.9 below shows the by-participant distribution for the neutral and IR-biased condition respectively. The bars represent the number of participants who chose the inverse reading to the amount

of cases shown on the x-axis. Each participant saw four items in each of the conditions. That is, the graph shows the number of participants who chose the inverse reading in 0 out of 4, 1 out of 4, 2 out of 4, 3 out of 4, and 4 out of 4 cases, respectively.
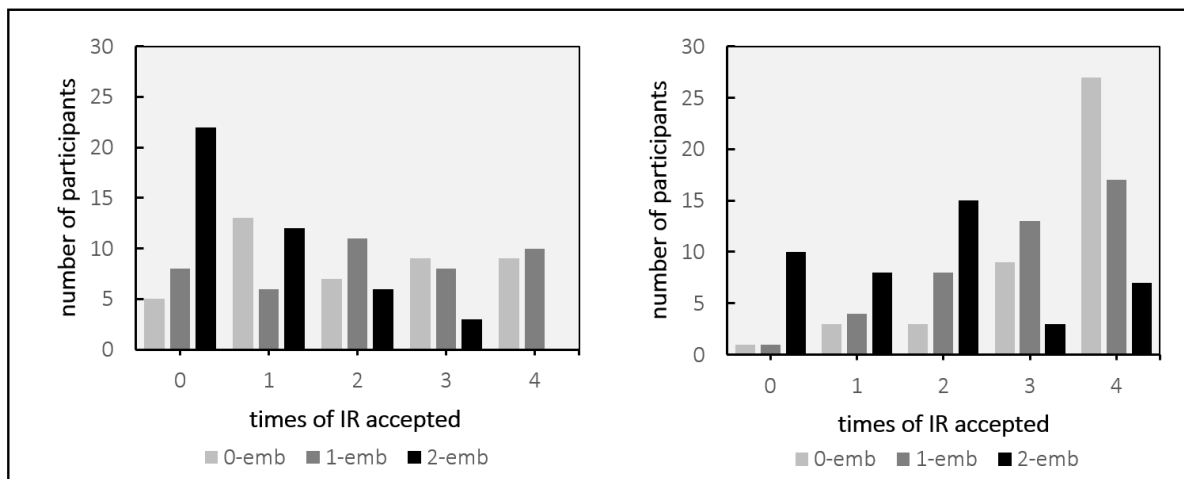
Figure 3.9: By-participant results of experiment E1 in the neutral (left) and biased (right) condition. X-axis shows how many times out of four the inverse readings was accepted.

In Figure 3.9 it can be seen that both in the 0-emb and 1-emb condition, participants are distributed over the whole scale instead of centred around the mean. In the 2-emb condition, on the other hand most participants reject the inverse reading altogether and no participant accepted it in all cases. The 2-emb condition shows a right-skewed unimodal distribution. However, there is still a certain amount of variability with some speakers accepting the inverse reading a number of times. The pattern looks almost opposite in the biased condition shown in Figure 3.9, where both in 0-emb and 1-emb most participants accept the inverse reading in all cases and there is a left-skewed unimodal distribution. In the 2-emb condition, on the other hand, participants are distributed across the whole scale. The left and right side of Figure 3.9 are thus in some sense the inverse of one another. In both cases, 0-emb and 1-emb pattern together and 2-emb is the odd one out. However, in the neutral condition it is 0-emb and 1-emb which show a lot of variability across participants, while 2-emb shows the skewed unimodal distribution. In the IR-biased condition, it is the 2-emb condition that shows a lot of variability, while 0-emb and 1-emb show the skewed unimodal distribution. The by-participant behaviour thus exactly matches the by-condition data, where the means for 0-emb and 1-emb also pattern together. That is, it seems like the inverse reading is generally available in English in both the single-embedded and unembedded case, but speakers vary a lot in how easy it is for them to obtain the inverse reading. In the biased-condition, this availability is boosted such that even speakers for whom it is difficult to obtain the inverse reading have this interpretation. The different pattern in the 2-emb condition may indicate that the inverse reading is syntactically excluded or at least strongly dispreferred and that participants struggle reconciling the syntactic difficulty of scope-inversion in a double-embedding with the IR-biasing pragmatic information. Some participants reject the inverse reading altogether despite the high implausibility of the surface reading. Other participants accept it in some or even all of the cases. Whether these participants indeed are able to obtain the inverse reading or if they simply ignore grammar for the sake of pragmatics cannot be concluded from the data available.

Unfortunately, it is difficult to compare these results to previous experiments in English, as most studies do not provide data specific to individual participants. However, the few exceptional cases seem to support the results obtained here. Gil (1982) ran an experiment on the scopal interaction of numerals in English and found that participants exhibit highly variable behaviour. Brasoveanu & Dotlačil (2015) also found large variability between participants in their study on quantifier scope in English. They identified three subgroups to which participants can be mapped. One subgroup had a surface reading bias, one subgroup had an inverse reading bias, and the last subgroup had no bias at all. The subgroup without bias was by far the largest one. This is slightly different from the study presented here, where participants are distributed almost uniformly across the spectrum in the neutral condition and no clear boundaries can be observed. Anderson reports some by-participant data for one of her experiments, where about 1/3 of the participants only ever chose the surface reading and no participant chose the inverse reading in more than roughly half of the cases. Thus, even though participants also vary in their responses with some participants rejecting the inverse reading altogether, her data seems to show a more uniform behaviour of participants than the data of the present study. However, this could be due to the difference in methods, since her study employed a forced-choice paradigm, where participants might choose the preferred surface reading more consistently. I will return to a more general discussion of variable by-participant behaviour in chapter 6.

(vi)   *Potential confounds*

In the following, I will discuss potential confounds of this experiment and explain why they do not seem to pose a problem for the interpretation of the results. These potential confounds are not all unique to the experimental design employed in E1 and the experiments to come, but variably apply to some of the previous experiments reported on in the literature as well. Excluding the possibility that these factors have shaped the results in E1 to a relevant degree therefore also enhances trust in previous experimental results on quantifier scope.

Bias of plural:

As described in section 3.2.1 of this chapter, the context of each item always contained both NPs in plural form which later reoccurred as QPs in the target sentence, see (3.27) repeated from (3.16) above.

(3.27)   The police officer hoped that the burglars might be recorded by **newly installed surveillance cameras**, and then, in fact **a newly installed surveillance camera** recorded every burglar.

There are two objections to this. First, one might argue that mentioning a plural set in the context biases participants towards an inverse reading. Second, and more severely, participants may respond with 'yes' to Q-MORE simply because context and target sentence get mixed-up or are misremembered. Participants may also do simple morphological matching without fully reading and processing the target sentence. While the context may very well bias participants towards the inverse reading, and therefore resemble Anderson's (2004) contextually biased items, I will argue that 'yes'-responses to Q-MORE can still be considered inverse interpretations and not mere effects of morphological matching or mix-up of context and target in memory. Filler conditions 2 and 4 are indicative for this. Filler 2, just like the target conditions, contained a plural NP in the context and a subsequent singular indefinite, see (3.28), repeated from (3.19) above. It differed from the target items in that instead of the universal

quantifier there was a definite singular NP. If participants opt for 'yes' to Q-MORE solely because of the mentioning of the plural NP, without actually having an inverse interpretation, then this should also happen in Filler 2. However, participants respond with 'yes' only in 6% of the cases. This is much lower than the values for the target conditions, and, most importantly, much lower than the minimally different doubly-embedded target sentences. Filler 4 shows the opposite case, see (3.29) repeated from (3.21) above. Here, both the context and the main sentence contain a morphological singular NP. However, participants are expected to reject a 'yes' response to Q-ONE due to the strongly distributive *each*. Indeed, participants give this incorrect response in only 13% of the cases. Finally, a third argument against this potential confound will be made in section 4.5 on German. I will therefore conclude that morphological matching or similar ways of shallow-processing only play a negligible role.

(3.28)   The secretary suggested that the missing letter might be hidden under **folders**, and then, in fact, there was **a folder** that was positioned in such a way that it covered the letter.

(3.29)   The tenants on the ground floor threatened to file **a complaint** about the drums on the 1st floor, and then, in fact, they filed **a complaint** <u>each</u>.

Type-token ambiguity:

One problem with indefinite expressions is that they are inherently ambiguous between a type and a token reading. For example, the word *camera* in a sentence like '*A camera recorded every burglar.*' can be interpreted as referring to an individual entity, which is usually the default (token) reading. Or it can be interpreted as a type of camera, i.e. making reference to a set of cameras with a certain property. Under such a type-reading, participants could in principle respond 'yes' to Q-MORE without actually having the inverse reading. Namely under an interpretation like: There exists this one type of camera that recorded every burglar, but there are several instances of this one type of camera. While this type-interpretation is not readily accessible in the first place, the presence of modifiers was intended to reduce this reading even more. In example (3.16), *a newly installed surveillance camera* already makes a specific type of camera explicit. It is thus rather unlikely that participants increase complexity even more to take types of types. Additional support is given from Filler 1, see (3.30) repeated from (3.18) above. These sentences contain an indefinite but no universal. If participants indeed respond with 'yes' to Q-MORE because of a type interpretation and without actually undergoing scope inversion, this should also happen without the presence of the universal quantifier. However, here too, participants respond incorrectly in only 8% of the cases. In this type of sentence, it is more likely that some of the incorrect answers are caused by an implicit *each* ('they did close a ski slope each'). I therefore consider any potentially confounding effects of a type-token ambiguity negligible.

(3.30)   The employees of the ski patrol announced they would temporarily close a ski slope due to the danger of avalanches, and then, in fact, they did close **a ski slope**.

Accommodation effects:

Another confound could be related to accommodation effects. Question Q-MORE in (3.31), repeated from (3.16) above, could in principle be answered with 'yes' even without scope inversion if one assumes that the participant accommodates that besides the one camera mentioned in the sentence, there

are yet more cameras which also recorded burglars. The target sentence merely asserts the existence of at least one camera, which does not logically exclude the possible existence of other cameras.

(3.31) The police officer hoped that the burglars might be recorded by newly installed surveillance cameras, and then, in fact **a newly installed surveillance camera** recorded every burglar.
Q-MORE: Can this sentence be understood to mean that, overall, **more than one** newly installed surveillance camera recorded the burglars?

However, accommodation is normally considered a rescue strategy. It is unclear, what participants would need to rescue here – if the state of affairs described in the question is at odds with the target sentence, they can simply choose the answer 'no' instead of investing mental resources into a rescue strategy. Further, participants were explicitly instructed to only judge the sentence itself without making additional assumptions: "[…] All sentences have been constructed to examine a specific aspect of the English language. It is enough that you tell us your opinion about the sentence in exactly the way it is written there. You do not need to modify anything […]". This should reduce any possible accommodation effects even more. The only reason why participants might accommodate here is if they have a general tendency to accept sentences as much as possible and say 'yes' in case of uncertainty. This would fall under the principle of charity (Wilson 1959, Davidson 1984). Section 4.5 on German presents two follow-up experiments that additionally control for this potential confound and show that the main observations do not change. I therefore conclude that this potential confound should not have a notable impact on the results or the interpretation thereof.

Difficulties with quantifiers

Some previous experiments have found that speakers of the same language vary in their individual grammars and that some of this variation is related to individual differences in education and cognitive abilities (for an overview see Dąbrowska 2012, 2015 and the references therein). Of particular relevance to the current experiment are findings that participants differ in their ability to correctly interpret sentences like (3.32) which contain the universal quantifier *every*[60] (Brooks & Sekerina 2005, 2006, Street & Dąbrowska 2010). A certain number of participants failed to correctly reject pictures in (3.32a), where several fish were in bowls, but one fish was not, as well as in (3.32b), where several bowls each had a fish in them, but one bowl was without a fish.

(3.32) a. Every fish is in a bowl.
        b. Every bowl has a fish in it.

A particularly worrisome result about those studies is that sentences involving two quantifiers seem to be generally difficult to understand and lead to more errors than e.g. passive sentences, and that such difficulty is mainly experienced by participants with lower education level. Therefore, there is a possibility that in the experiments presented in this thesis, the assumed availability of inverse interpretations is only apparent. The high acceptance rates might be caused by a certain subset of participants with lower education level who struggle interpreting doubly-quantified sentences in general and simply give incorrect responses. More importantly, simple relative clauses were shown to be

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[60] At least in experimental settings, but see Dąbrowska (2012) for discussion on that.

difficult for some participants as well. Considering that the experiments presented in here combine both double-quantification and relative clause embedding, there may be a real danger of such a confound. I therefore divided the participants of E1 into two groups, depending on their level of education (higher/lower: HE/LE). Table 3.9 shows these results of experiment E1.

	neutral			biased		
	0-emb	1-emb	2-emb	0-emb	1-emb	2-emb
Bachelor degree or higher (n=27)	50%	47%	19%	82%	73%	44%
High school degree or lower (n= 16)	56%	59%	19%	86%	76%	42%
All (n = 43)	52%	52%	19%	84%	74%	44%

Table 3.9: Results of experiment E1 in proportion of 'yes'-responses to Q-MORE by education level.

As can be seen, the results do not differ to a great extent in most conditions. If availability of inverse readings is only apparent because participants with lower degree of education have a harder time reading and understanding the sentences and corresponding questions, then we would expect the 'yes'-responses to Q-MORE to be lower in the group with higher education. While the results are indeed slightly lower for the HE group in E1, particularly in 1-emb, the acceptance rates are still very high. One difference to the results of the studies reported on above is that the differences in education were overall much smaller. While in most of the above studies, groups with particularly high or particularly low level of education were compared, most participants in the experiments in here fell in the normal range and had either a high school, bachelor's or master's degree. In E1, only three participants did not have at least a high school degree. Nevertheless, the additional comparison in Table 3.9 does not provide any indication that participants in E1 with lower education simply responded incorrectly because they were unable to understand complex sentences involving quantifiers. There is therefore no indication that the availability of inverse readings observed in E1 is only apparent. We will see in chapter 4 that the same is true for German.

3.3   Experiment E2: effects of task – testing preference over availability

This experiment was conducted to test for the effect of task on scope interpretation in English. There were two main research questions:

> **Q1**: Can the results of experiment E1 with respect to effects of pragmatics and embedding be replicated?

> **Q2**: What effect does the type of task have on the results of scope interpretation?

In section 3.1, where I presented previous experimental work on scope in English, I pointed out that the extent to which participants accept inverse readings varies a lot between different experiments. I hypothesized that, besides the potentially confounding factor of plausibility considerations, the specific task might play a role. This experiment will therefore be parallel to experiment E1, with the only difference being the task. More specifically, participants will be forced to choose between the surface and the inverse reading, a method which tests for *preference* rather than *availability* of readings. We will see that task does in fact play an important role and reduces the choice of inverse readings.

Nevertheless, experiment E2 will by and large replicate the results of experiment E1 concerning the effect of embedding and plausibility.

3.3.1 Methods

(i)   Materials

Design and stimuli were identical to experiment E1. The only difference was the task: instead of assessing the availability of a certain reading by asking two different kinds of questions (Q-ONE vs. Q-MORE), the forced-choice question in (3.33) appeared after each item (here shown for an example of the neutral/0-emb item). This type of question is borrowed from Anderson (2004), who employed the same task. The items were distributed on 3 lists via a Latin Square design, such that each participant saw a certain target item in only one of the three embedding conditions. Each participant saw 96 items in total, 48 target and 48 filler items.

(3.33) **Neutral/0-emb:**
   Context: The police officer hoped that the burglars might be recorded by newly installed surveillance cameras, and then, in fact, a newly installed surveillance camera recorded every burglar.
   Question: Overall, how many newly-installed surveillance cameras recorded the burglars?   *one / more than one*

(ii)   Participants

44 native speakers of English participated in the experiment. They were recruited through the online platform Prolific and received a compensation of 8£. 1 participant had to be excluded from the analysis because they did not reach the threshold of correctly answering 3/4 of the control filler conditions. Among the remaining 43 participants, 23 were female and 20 were male. They were 20-50 years old, with a mean age of 31.

(iii)   Procedure

The procedure was identical to experiment E1.

3.3.2 Predictions

The predictions are visualized in Figure 3.10. Experiment E1 tested the availability of inverse scope in English. Thus, participants were asked to judge whether a certain reading is possible at all. They did not have to make a choice between the two readings. The following experiment, on the other hand, forces participants to make a choice. If more than one reading is available to them, we expect them to choose the one that is preferred. Because the surface reading is generally known to be the preferred reading, we expect a shift of judgments in the direction of the surface reading across all conditions. If the results of experiment E1 are robust, they should be replicated in experiment E2 with the only

difference that across conditions, judgments in favour of the surface reading should be increased, while judgments in favour of the inverse reading should be decreased. The effect might be smaller in the IR-biased condition than in the neutral condition, as in the latter, the general bias for the surface reading is in opposition with a contextual bias for the inverse reading. For those reasons, in Figure 3.10., the values for the neutral condition are lowered in Q-MORE to add up to 100% with the values in Q-ONE, which are left unchanged. The values in the IR-biased condition are lowered to the same extent in Q-ONE and Q-MORE to add up to 100% to reflect the predicted conflict between general surface bias and contextual inverse bias.
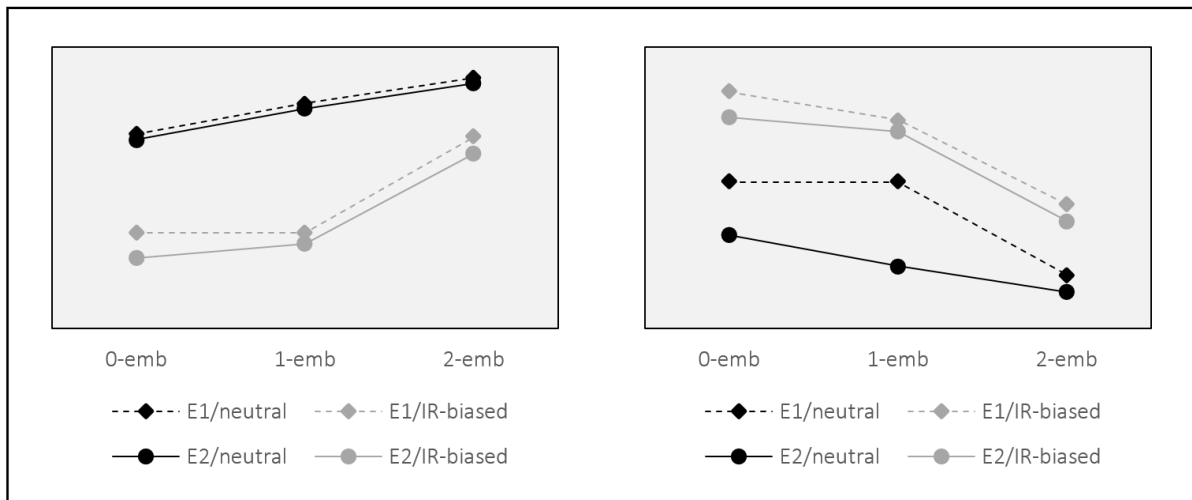
Figure 3.10: Predictions for experiment E2 (continuous lines) in comparison to experiment E1 (dashed lines) in proportion of SR-responses (left) and IR-responses (right).

3.3.3 Results

The results are visualized in Figure 3.11. The results of experiment E1 are represented by the dashed lines and the results for experiment E2 by the continuous lines. The left diagram shows how often participants chose the surface over the inverse reading, and the right diagram shows how often participants chose the inverse over the surface reading. Since this task was forced-choice, these numbers add up to 100%. In the neutral/0-emb condition, participants chose the surface reading in 61% (95% CI: 0.56-0.67) and the inverse reading in 39% (95% CI: 0.33-0.44) of the cases. The percentage of surface readings increased with deeper embedding to 68% (95% CI: 0.63-0.73) in 1-emb and 88% (95% CI: 0.84-0.91) in 2-emb, while the percentage of inverse readings decreased to 32% (95% CI: 0.27-0.37) in 1-emb and 12% (95% CI: 0.09-0.16) in 2-emb. In the biased contexts, participants chose the surface reading in 19% (95% CI: 0.15-0.23) and the inverse reading in 81% (95% CI: 0.77-0.85) of the cases when there was no embedding. The percentage of surface readings was almost the same in the 1-emb condition, with 17% (95% CI: 0.13-0.22) surface reading and 83% (95% CI: 0.78-0.87) inverse reading. In condition 2-emb, however, the percentage of surface readings increased to 55% (95% CI: 0.50-0.61), while the inverse reading was only chosen in 45% (95% CI: 0.39-0.50) of the cases.
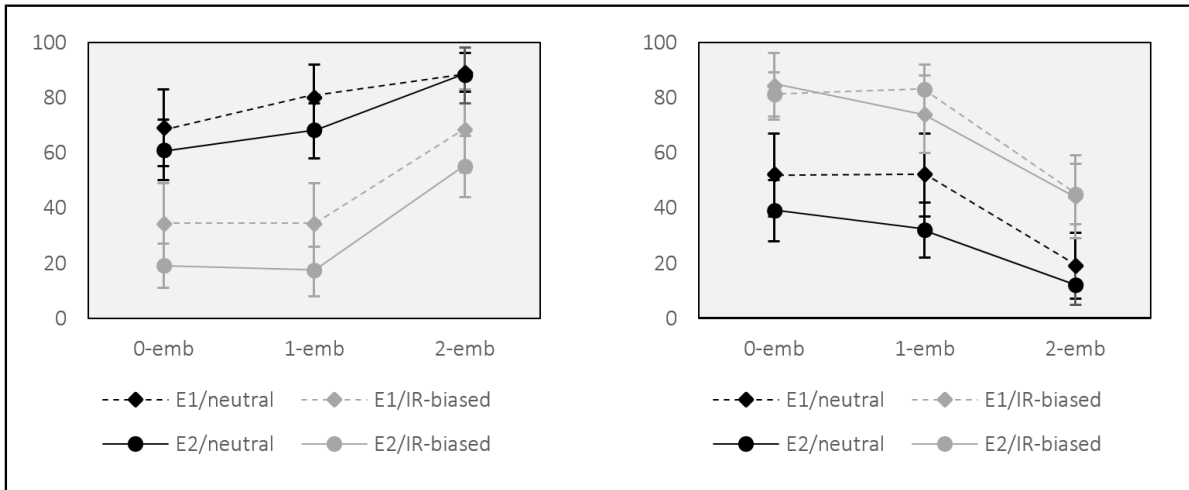
Figure 3.11: Results for experiment E2 (continuous lines) in comparison to experiment E1 (dashed lines) in proportion of SR-responses/'yes' responses to Q-ONE (left) and IR-responses/'yes' responses to Q-MORE (right). Error bars show 95% CI.

The results were again analysed using the free software R (version 3.6.1; R Core Team 2019) with a generalized linear mixed model fit by maximum likelihood using the package lme4 (Bates et al. 2015). Same as before, the factor plausibility was analysed with a treatment contrast with neutral as the baseline and the factor embedding was analysed with a sliding contrast, thereby comparing the 1-emb to the 0-emb and the 2-emb to the 1-emb condition. The analysis revealed a main effect of plausibility, with a significant difference between neutral and biased ($p < 0.01$, SE = 0.29) as well as a main effect of embedding with a significant difference between 2-emb and 1-emb ($p < 0.01$, SE = 0.22). However, the difference between 1-emb and 0-emb did not reach significance ($p = 0.83$, SE = 0.23). The interaction of neutral/biased and 2-/1-emb was significant ($p < 0.01$, SE = 0.32), but the interaction of neutral/biased and 0-/1-emb was not ($p = 0.1$, SE = 0.30).

The results for the filler items are given in Table 3.10 below.

	Filler 1: no∀	Filler 2: no∀, 2-emb	Filler 3: referential	Filler 4: each	Filler 5: ∀-∃	Filler 6: ellipsis
One	97%	98%	92%	15%	6%	73%
more than one	3%	2%	8%	85%	94%	27%

Table 3.10: Experiment E2 - proportion of answers types across all filler/control conditions

3.3.4 Discussion

(i)   Fillers

The results of the filler items go in the expected direction across the board and are similar to those of experiment E1. This indicates that the design worked well and that participants followed the task accordingly. As before, the level of incorrect responses serves as a baseline for the target items. This

baseline is again around 10% and may be caused by misreading, mis-clicking or the confounds discussed above. Values in the target items clearly above 10% will be taken as indicative of the respective scope reading. The ellipsis filler condition again showed that participants accepted the inverse scope in line with Anderson's (2004) results and in contrast to Fox' Scope Economy account. The current experiment used the same forced-choice paradigm as Anderson and thus serves as a more direct comparison. The choice of inverse readings is only slightly lower than in Anderson's experiments with 27% compared to 31-34%, indicating that the confound, if at all, had at best a marginal effect. However, there is still a possibility that the effect observed by Anderson and replicated in both E1 and E2 could simply be processing related. As can be seen in (3.34a), participants first encounter a complete clause, containing both the existential and the universal quantifier. By the time participants encounter the second clause with the ellipsis site, they may have already assigned a (inverse) meaning to the first clause and the parser does not reanalyse. A relevant case to test this in the future would be sentence (3.34b), where the order is reversed. Here, the first clause is unambiguous, i.e. when the participants encounter the second clause, there is no need for reanalysis of a potentially mistaken scope assignment.

(3.34)   a. [A spectator rewarded every elephant], [and the trainer did, too].
         b. [The trainer rewarded every elephant], [and a spectator did, too].

(ii)   Target items: partial replication

The results of previous forced-choice experiments on similar types of sentences show a lot of variation: 16% of inverse readings in Tunstall (1998), 19% in Anderson (2004) after an unbiased and SR-biased context and 53% after an IR-biased context, and 39% and 58% in two experiments in Gillen (1991). The results of this experiment fall somewhere in the middle with 39% in the comparable 0-emb/neutral condition. As can be seen in Figure 3.11, the values for the surface reading were not as high as predicted across the board. They were lower compared to E1 in both the neutral and the IR-biased condition, with a larger effect in the IR-biased condition. Compared to E1, the inverse reading in E2 was only reduced in the neutral condition, but not in the IR-biased condition, contrary to prediction. Even though the reduction in the neutral condition of E2 compared to E1 is greater for the surface reading than for the inverse reading, there are also some losses to the surface reading. This seems to indicate that the preference for surface readings is less strong than assumed. In some cases, participants choose the inverse over the surface reading even though they would have in principle also been able to obtain the surface reading. The fact that in the IR-biased condition only the surface reading but not the inverse reading was reduced indicates that the impact of pragmatic information outperformed the general bias for surface readings.

As for the factor embedding, experiment E2 replicated the results from experiment E1. Again, embedding into a relative clause had no impact on interpretation compared to the no-embedding condition. A double-embedding, on the other hand, significantly reduced the availability of inverse readings. In fact, the choice of inverse readings in this condition was not distinguishable from the unambiguous control items. This was different in experiment E1, where the 2-emb condition was still higher. This could indicate either that double-embeddings do indeed not allow for inverse readings at all, or that a task that forces participants to choose the preferred reading renders strongly dispreferred but available readings invisible.

(iii)   *By-participants: high variability*

Figure 3.12 below shows the by-participant distribution for the neutral and IR-biased condition.
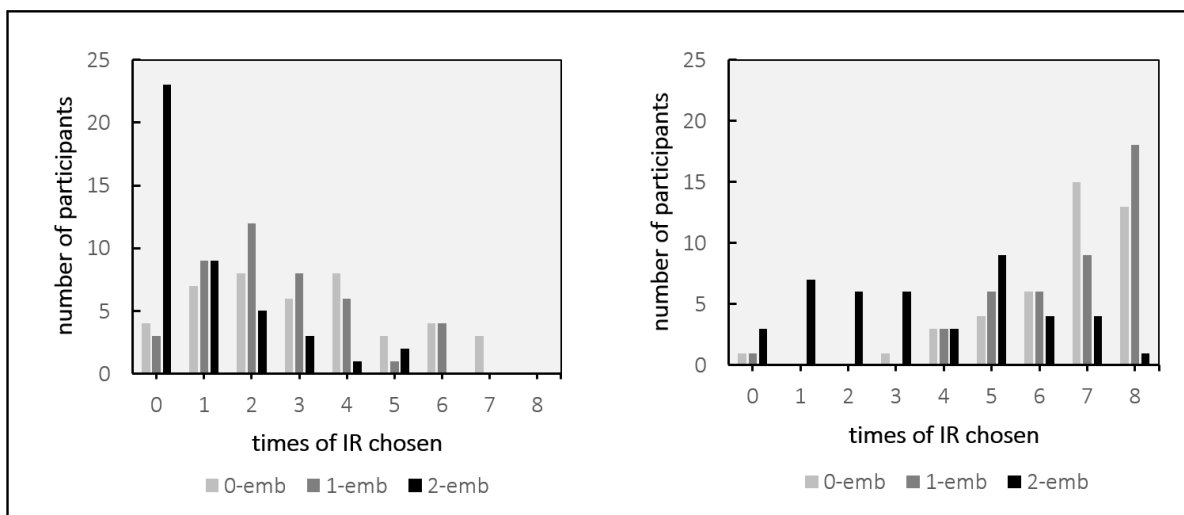
Figure 3.12: By-participants results of experiment E2 in the neutral (left) and biased (right) condition. X-axis shows how many times out of eight the inverse readings was chosen.

On the left side of Figure 3.12, it can be seen that participants are distributed according to a unimodal distribution in each of the conditions 0-emb, 1-emb, and 2-emb, even though there is also a lot of dispersion. On the right side of Figure 3.12, on the other hand, participants show a tighter unimodal distribution in 0-emb and 1-emb, while in 2-emb, they are distributed over the whole scale, resembling a bimodal pattern. As discussed in E1, this may indicate that there is a tension between pragmatics and structural constraints and that participants choose different strategies to resolve this tension. The pattern is overall very similar to experiment E1, with the one difference that 0-emb and 1-emb have a clearer peak in the neutral condition. The individual behaviour is thus in line with the discussion of E1. Only in the neutral condition, there is a shift towards the lower end of the scale and less variability between participants, as participants were forced to make a choice and thus often opted for the preferred surface reading.

3.4   Follow-up experiment: different types of embedding

In both experiment E1 and E2 we saw that participants accept scope inversion across a relative clause boundary, which is generally not predicted by theories on scope. Particularly under a covert movement approach, inverse readings should be completely banned in island environments. As discussed in section 3.2.4, Tsai et al. (2014) explain similar results, which they observed in in their own experiment, by assuming a head-raising analysis of relative clauses, thereby assuming that the ambiguity arises through reconstruction. While there are more profound problems from a theoretical perspective, as will be discussed in section 6.2.1, the follow-up study presented in this section aims at testing if the empirical predictions of such an analysis are borne out. In particular, if the results are related to reconstruction and inverse scope does in fact obey islands, then we expect inverse readings to only occur in relative

clause islands but not in other islands that lack a filler-gap dependency. Further, we expect a difference between object and subject relative clauses, since in the former but not the latter, reconstruction immediately results in the right surface order for a distributive reading. Additionally, the experiment tests for a prediction from Wurmbrand (2018). According to her, QR is not in fact clause-bound but still obeys island-boundaries. She predicts that inverse readings should be available to a certain degree in complement clauses and weak islands (which allow for overt extraction of arguments), but not in strong islands. This follow-up experiment further controlled for the confound that all relative clauses in experiment E1 and E2 were part of an existential construction ('*there was an X that…*'), as was the case in Tsai et al. (2014)/Scontras et al. (2017). The four research questions are:

Q1: Does the effect of relative clauses persist even in non-existential constructions?

Q2: Do object RCs allow for more inverse readings than subject RCs?

Q3: Do strong islands without filler-gap dependency allow for inverse readings?

Q4: Do (non-)finite complements allow for inverse readings?

3.4.1   Methods

(i)   Materials

There were five between-item conditions in this experiment, an example for each condition is presented in (3.35)-(3.39). There were six items in each condition, resulting in 30 items overall. The task was similar to experiment E1, but the wording was changed slightly. Instead of the two question types, participants agreed with or rejected a statement that disambiguated for the surface (S-ONE) and the inverse reading (S-MORE) respectively. Same as in experiment E1, participants only ever saw one type of statement at a time, i.e. they saw half of the items with S-ONE and half of the items with S-MORE. Participants were grouped into two lists.

(3.35) **Complex noun phrase[61] (CNP):**
  Context: The monk predicted that the fellows would occur in his dreams.
  Target: And then, in fact, the monk had <u>a dream</u> [that <u>every fellow</u> would leave].
  Statement: This sentence can be interpreted in the following way:
  S-ONE   In the end, the monk had had only a single dream about fellows leaving.
  S-MORE   In the end, the monk had had several dreams about fellows leaving.

(3.36) **Subject relative clause (sbjRC):**
  Context: The commander assured that the suspicious buildings would be surveilled by unmanned drones.
  Target: And then, in fact, the commander launched <u>an unmanned drone</u> [that surveilled <u>every suspicious building</u>].

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[61] Relative clauses are of course a form of CNPs. In the following, I use the expression CNP to refer to CNPs other than relative clauses.

Statement:	This sentence can be interpreted in the following way:
S-ONE	In the end, only a single unmanned drone had been launched to surveil suspicious buildings.
S-MORE	In the end, several unmanned drones had been launched to surveil suspicious buildings.

(3.37) **Object relative clause (objRC):**

Context:	The city council promised that the tourist hotspots would soon be serviced by special buses.
Target:	And then, in fact, the city council announced <u>a tourist hotspot</u> [that <u>every special bus</u> serviced].
Statement:	This sentence can be interpreted in the following way:
S-ONE	In the end, only a single tourist hotspot had been announced to be serviced by special busses.
S-MORE	In the end, several tourist hotspots had been announced to be serviced by special busses.

(3.38) **Finite complement (finComp):**

Context:	The doctor instructed that the wounds of the children should be bandaged by nurses.
Target:	And then, in fact, <u>a nurse</u> made sure [that <u>every wound</u> was bandaged].
Statement:	This sentence can be interpreted in the following way:
S-ONE	In the end, only a single nurse had made sure that wounds were bandaged
S-MORE	In the end, several nurses had made sure that wounds were bandaged.

(3.39) **Infinite complement (infComp):**

Context:	The university president feared that due to the recurring debates the controversial sculptures could get dismantled by students.
Target:	And then, in fact, <u>a student</u> tried [to dismantle <u>every controversial sculpture</u>].
Statement:	This sentence can be interpreted in the following way:
S-ONE	In the end, only a single student had tried to dismantle controversial sculptures.
S-MORE	In the end, several students had tried to dismantle controversial sculptures.

This experiment also had five different types of fillers, see (3.40). Two of the conditions were borrowed from experiment E1, namely the *Each* (3.21) and ∀-∃ condition (3.22). These conditions were included to avoid that some participants would always have to reject Q-MORE throughout the experiment in case they did not obtain the inverse reading at all. Even though these conditions do not fully exclude the possibility of 'yes' to Q-ONE, there is a very strong bias towards an interpretation that includes multiple entities. A rejection of Q-MORE in these conditions thus also served as a control. Two new conditions were included, which were similar to the previously used *No* ∀ condition, and were designed to only allow for a 'yes'-response to Q-ONE and thus also served as controls. They contained either two singular indefinites (3.40c) or a singular indefinite and a plural definite (3.40d). The fifth condition used a subset of the neutral target items from experiment E1 and E2 in 0-emb condition only, see (3.40e). This was included to check if the results from experiment E1 would be replicated or if the

difference in task/experiment would change the results. There were 30 fillers overall: 8 items in *Each* and ∀-∃, 4 items in *Ind* and *Def*, and 6 items in *neutral/0-emb*.

(3.40) a. *Each:*
      The sisters agreed to write a diary over the course of the next year. And then, in fact, they each wrote a diary.
    b. *∀-∃:*
      The gardener suggested that the trees be trimmed by volunteers. And then, in fact, every volunteer trimmed a tree.
    c. *Ind:*
      The jury of the competition "Young Researchers" announced that the winners might be by elite boarding schools. And then, in fact, an elite boarding school did accept a winner.
    d. *Def:*
      The security guards in the stadium threatened to kick out rioters. And then, in fact, a security guard did kick out the rioters.
    e. *neutral/0-emb:*
      The police officer hoped that the burglars might be recorded by surveillance cameras. And then, in fact, a surveillance camera recorded every burglar.

(ii)   Participants

48 native speakers of English participated in the experiment. They were recruited through the online platform Prolific and received a compensation of 5£. To avoid effects of dialect, the participant pool was restricted to US citizens, as before. 6 participants had to be excluded from the analysis because they did not reach the threshold of correctly answering 3/4 of the control filler conditions. Among the remaining 42 participants, 33 were female and 9 were male. They were 18-59 years old, with a mean age of 29.

(iii)   Procedure

The procedure was identical to experiment E1.

3.4.2 Predictions

If we assume that the inverse readings observed for relative clauses in E1 and E2 are related to reconstruction, then other islands should still block inverse readings. The CNP condition tests for this. This condition is similar to relative clauses in that the embedded clause modifies a noun. It differs from relative clauses in that only in the latter there is a dependency between that noun (the RC head) and a corresponding gap in the embedded clause. The reconstruction analysis also predicts a difference between subject and object relative clauses. This is because in the former, we not only need reconstruction of the head noun, but additionally clause internal QR to arrive at the right c-commanding relationship. This is not the case in object relative clauses, where reconstruction alone places the

relative clause head in a position c-commanded by the clause-internal QP. This is demonstrated in (3.41).

(3.41)   a. … an unmanned drone$_i$ [that t$_i$ surveilled <u>every suspicious building</u>].
   b. … a tourist hotspot$_i$ [that <u>every special bus</u> serviced t$_i$].

A second question targeted in this experiment is whether the notion of absolute islands for QR, as maintained in Tanaka (2015) or Wurmbrand (2018), can be supported, despite the findings for relative clauses in E1 and E2. This notion could be maintained if the results observed are unrelated to QR, but stem from reconstruction. Thus, we expect CNPs to block inverse readings, while both the infComp and the finComp condition, following Wurmbrand (2018), should exhibit inverse readings to a certain degree. We expect that the availability is clearly lower than in unembedded clauses like the neutral/0-emb condition in E1 and E2, but higher than in a strong island like a CNP, which should completely block inverse readings. According to Wurmbrand (2018), non-finite complement clauses should also give rise to more inverse readings than finite complement clauses due to the higher number of QR-steps. See also the summary of Wurmbrand (2018) in section 2.3.1. Finally, this experiment tests for the potential confound that inverse readings were only accepted in experiment E1 and E2 due to the use of a special existential construction. The sbjRC and objRC conditions thus do not contain these types of constructions anymore. If the existential construction had an effect in addition to reconstruction, then IR-availability in sbjRC should be reduced compared to the previous experiments. If the existential construction alone was responsible for the effect of relative clauses and reconstruction plays no role, then inverse readings in sbjRC and objRC should drop close to zero, on one level with CNPs. The predictions are summarized in Figure 3.13.
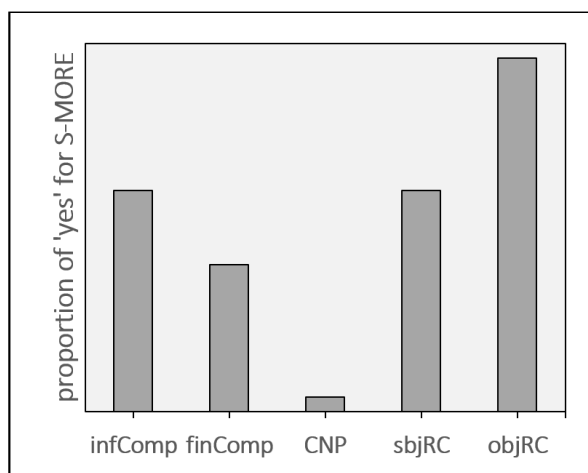
Figure 3.13: Predictions for follow-up experiment in proportion of 'yes'-answers across conditions for S-MORE.

3.4.3   Results

The descriptive results are shown in Figure 3.14 for S-ONE on the left and S-MORE on the right side. The left diagram shows how often participants accepted the surface reading, and the right diagram shows how often participants accepted the inverse reading. In non-finite complement clauses, the

surface reading was accepted in 89% (95% CI: 0.82-0.94) and the inverse reading in 23% (95% CI: 0.16-0.31) of the cases. In finite complement clauses, the surface reading was accepted in 94% (95% CI: 0.88-0.97) and the inverse reading in 25% (95% CI: 0.17-0.33) of the cases. In complex noun phrases, the surface reading was accepted in 90% (95% CI: 0.83-0.94) and the inverse reading in 30% (95% CI: 0.22-0.39) of the cases. In subject relative clauses, the surface reading was accepted in 79% (95% CI: 0.70-0.85) and the inverse reading in 37% (95% CI: 0.28-0.46) of the cases. Finally, in object relative clauses, the surface reading was accepted in 71% (95% CI: 0.62-0.78) and the inverse reading in 47% (95% CI: 0.38-0.56) of the cases.
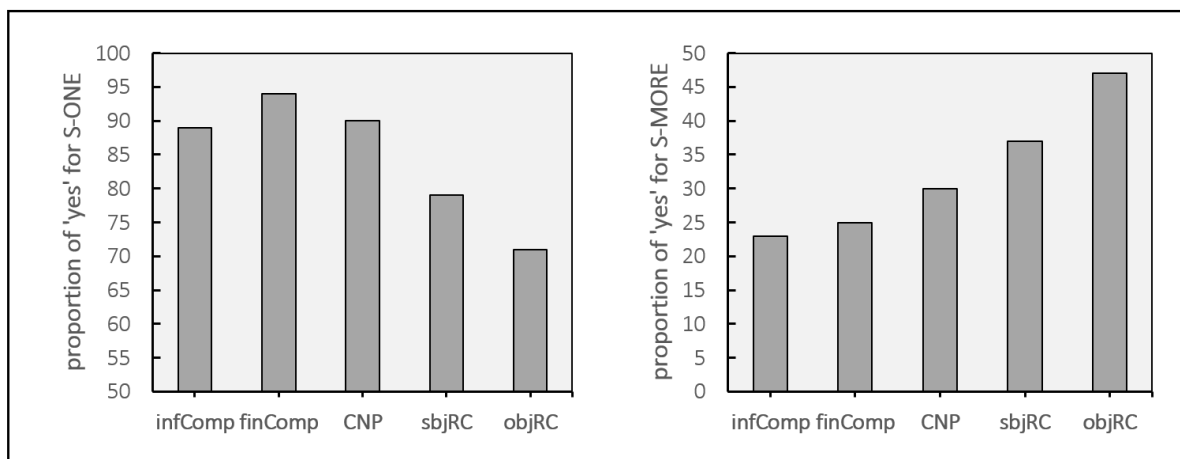
Figure 3.14: Results of English follow-up experiment in proportion of 'yes'-answers across conditions for S-ONE (left) and S-MORE (right).

The results were analysed using the free software R (version 3.6.1; R Core Team 2019) with a generalized linear mixed model fit by maximum likelihood using the package lme4 (Bates et al. 2015) using a sliding contrast. The two statement types were merged by collapsing 'yes'-answers to S-ONE with 'no'-answers to S-MORE and 'no'-answers to S-ONE with 'yes'-answers to S-MORE, see footnote 36 above for the reasoning behind this. The analysis revealed a significant difference between CNP and sbjRC ($p = 0.02$, SE = 0.22) and between sbjRC and objRC ($p = 0.02$, SE = 0.20). No significant difference was found between infComp and finComp ($p = 0.62$, SE = 0.25) or finComp and CNP ($p = 0.15$, SE = 0.24).

The results for the filler items are given in Table 3.11 below.

	Filler 1: no∀-def	Filler 2: no∀-ind	Filler 3: neut/0-emb	Filler 4: Each	Filler 5: ∀-∃
S-ONE	95%	83%	83%	11%	20%
S-MORE	7%	10%	48%	95%	96%

Table 3.11: Follow-up experiment - proportion of 'yes'-answers across all filler/control conditions.

3.4.4 Discussion

(i)   Fillers

In general, the outcome was in line with expectations, with 7-11% acceptance of the incorrect answer and 83-96% acceptance of the correct answer. In the ∀-∃ condition, which is not unambiguous but only known to have a strong preference for the distributive reading, the acceptance of S-ONE was a bit higher than in the previous experiments (20%). This might be related to the specific items used. A by-item check indeed revealed that the higher value was caused by only two items with exceptionally high values, where plausibility effects might have played a role. Similar to before, the baseline (the level of incorrect responses) in this experiment is again around 10%. Values in the target items that are clearly above ~10% will therefore be taken as indicative of the respective scope reading. The neutral/0-emb condition, which was a replication from experiment E1, shows similar results with 48% acceptance of inverse readings compared to 52% in E1. I take this as indicating that the slight change in task does not affect participants' ratings to a greater extent and that the results are comparable across experiments.

(ii)   Existential construction: boost of IR

The use of an existential construction does indeed seem to make a difference. The subject relative clauses in experiment E1 received an inverse reading in 52% of the cases but in the follow-up experiment only in 37% of the cases. This seems to indicate that inverse readings are easier to obtain in these environments. The results of the subject relative clauses plus existential constructions from experiment E1 are more comparable to the object relative clauses without existential construction in the follow-up experiment. However, this is a comparison of results between distinct experiments, therefore this finding is not fully conclusive. The follow-up experiment did not directly compare existential and non-existential environments, so a study that tests this in a more controlled way would be required, see also some further confounds discussed at the very end of this section. Nevertheless, the existential construction alone cannot explain inverse readings in relative clauses, since availability did not drop anywhere close to zero.

(iii)   Embedded clauses: variable availability

All five conditions had values higher than expected when one assumes a complete lack of ambiguity, as can be seen in comparison to the filler items. Thus, the results seem to indicate that inverse readings are at least marginally possible in all those environments. At the same time, acceptance of inverse readings differed greatly between the different conditions. The highest value was found in object relative clauses, which differed significantly from subject relative clauses. CNPs were again significantly lower than the two types of relative clauses, but were still accepted in 30% of the cases. The lowest rates were observed in the two types of complement clauses, even though the difference to CNPs did not reach significance. The fact that object relative clauses allow for inverse readings more readily than subject relative clauses was correctly predicted by the reconstruction account. However, if reconstruction alone causes inverse readings in relative clauses, we would expect CNPs to exhibit no inverse readings whatsoever. However, this is not what was found in the follow-up experiment. Further, the notion of absolute islands, maintained even in more gradual approaches to inverse scope like Tanaka (2015) or Wurmbrand (2018), was not observable in the follow-up experiment. Not only did the so-

called absolute islands allow for inverse readings, they even did so to a greater extent than the complement clauses. The follow-up experiment therefore provides additional support that inverse readings are available in island environments. Under a QR-based approach, this is a problem. If the data obtained in the previous experiments are reliable, we would either be forced to assume that covert movement does not obey the same constraints as overt movement. Or we would generally have to question the idea that scope is related to movement. As shown in section 2.3.2, there are several accounts of quantifier scope which do not rely on movement. Due to the supposed island-/clause-boundedness of quantifier scope, all these accounts have added mechanisms to block inverse readings in such environments. These additional mechanisms could be discarded, however, as they are not integral to the systems. In that case, the general reduction of inverse readings across clause-boundaries would need to be explained by other means, which do not impose a strict constraint. In section 6.2.2, I will elaborate on that topic in more depth.

(iv)   By-participants: moderate variability

Figure 3.15 below shows the by-participant distribution across all conditions in number of inverse readings accepted. We can observe a unimodal distribution, i.e. there is no indication that participants split into distinct groups depending on their interpretation strategy or willingness to accept inverse readings[62]. However, we also see that there is quite some variation in that some participants show a much greater acceptance of inverse readings than others. At the same time, there were only three participants who rejected inverse readings across the board in the five different types of target conditions and no participants accepted inverse readings in all cases.
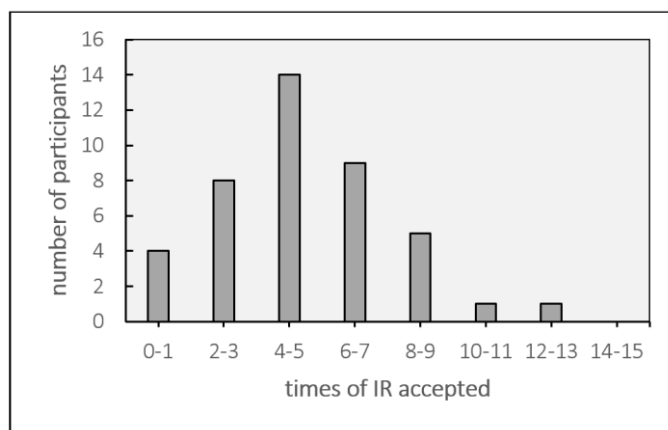
Figure 3.15: By-participant results of English follow-up experiment. X-axis shows how many times out of 15 the inverse readings was accepted.

(v)   Comparison to introspective judgments and similar experiments

Most introspective judgments in the literature have led to the conclusion that inverse readings are unavailable in the environments tested here. How can the dramatic difference between linguists' introspective judgments and naïve participants' behaviour in experiments be explained? First it is

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[62] A bi- or multimodal distribution was also not observed in any of the conditions individually. Therefore, for the sake of space, I show all conditions in the same plot.

important to note that even some judgments based on introspection in the literature have acknowledged the existence of inverse readings in various environments where they are traditionally said to be absent, such as finite complement clauses or relative clauses, as discussed in section 2.2.3. Second, the items in the experiments above were specifically designed to render an inverse readings plausible. This is not in fact an easy endeavour. The majority of naturally occurring sentences with an embedded clause simply do not have a plausible inverse reading. They are, in some sense, the opposite of inverse linking constructions, where it is the surface reading that often encompasses an implausible or at least less plausible scenario. Let's take one of the control items used in Tanaka (2015) in (3.42). The scenario that for each man, there is a different woman who loves this man and that John kissed all of these women is at least an odd one and certainly difficult to imagine.

(3.42)   I know that John kissed a woman who loves each man.[63]

(adapted from Tanaka 2015, p. 338)

Third, experiment E1 and the follow-up experiment did not ask how much participants *liked* a certain reading. Participants only indicated if they considered a certain reading possible *at all*. The method was used to specifically detect dispreferred or even strongly dispreferred readings. That is, participants were meant to only say 'no' if the reading was completely impossible, in all other cases 'yes'. The surprisingly high numbers are thus no indication of the extent to which speakers like those readings or perceive them as natural. They are an indication of the extent to which speakers are able to access the reading in question at all. This is an important distinction and might well be conflated it some of the judgments in the literature. Finally, also in the experiments above we could see that there is a notable amount of variability even between speakers of the same language, with some participants fully rejecting the inverse reading in a given environment or only accepting it in one or two exceptional items. That means that some of the linguists who gave introspective judgments might fall into the group of speakers who fully reject that reading or only except it with very exceptional items[64]. Others might belong to the larger group of participants who actually accept it in some cases, but the specific sentence the introspective judgment was based on is not one of them.

These reasons are also true for the differences between the experiments reported in here and experiments that tested for similar environments. Tsai et al. (2014)/Scontras et al. (2017) also tested inverse readings in relative clauses, but they let participants use a 7-point-scale. Even though they also found that inverse readings are marginally possible, the ratings for relative clauses were still lower than for simple clauses (3.1/7 vs. 4.5/7). In experiment E1, there was no difference between no embedding and a single embedding. The difference is again due to preference vs. availability. When participants use a 7-point-scale, they indicate how much they like a reading or how natural they find it. In experiment E1 and the follow-up study, participants had a binary choice between either accepting or completely rejecting a given reading. In principle, the 'yes'-response could encompass all responses on the 7-point-scale from 2 to 7. That is, in the binary experiment design, the difference between a reading that consistently receives around 3 points on the scale is not distinguishable from a reading that consistently receives around 5 points. A similar argument holds for Tanaka's (2015) study, who used a 5-point-scale. Tanaka maintained that relative clauses are absolute islands for scope and used them as filler/control items. The

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[63] The original item was "I know that John kissed a different woman who loves each man" in an attempt to disambiguate for the inverse reading. I omitted the modifier 'different' here.

[64] see also Brasoveanu & Dotlačil 2015 for a grouping of participants depending on their willingness to accept IR

ratings were indeed much lower than in the target conditions. However, the ratings were still not at flooring level (~2.4/5). Considering that Tanaka also included other types of filler/control items and conflated the results for all of them to one value, it could be that relative clauses on their own did in fact receive even a slightly higher value. In that case, the outcome would be comparable to the results of Tsai et al. (2014)/Scontras et al. (2017) and the same difference would apply as between the 7-point-scale and binary availability judgment task discussed above. Finally, note that there are also differences in the way the items were designed. In experiment E1 and E2, only non-agentive predicates were used in combination with an inanimate subject, which usually had the role of an experiencer. This is different from most embedding examples in the literature as well as other experiments. Thus, the differences between the experiments presented in this chapter and previous literature is not necessarily a contradiction.

(vi)   *Limitations*

The results of this experiment can only give an indication and have to be taken with a grain of salt. First, the experiment used a between-item design, which means that contexts differed greatly between one condition and the other. The reason for this between-item design was that some of the conditions are not minimally transformable into one another. While a minimal pair of object vs. subject relative clauses could be created, this is not possible for e.g. subject relative clauses and CNPs. Thus, in order to stay consistent across conditions and allow for comparability, all conditions were between-item. While it is not possible to design an experiment where all these five conditions are part of a within-item design, it would be possible to test the effect of a between-item compared to a within-item design by only picking out conditions that allow for minimal pairs such as subject and object relative clauses and test if results in the within-item design differ in major ways from the between-item design. Second, this experiment was not preceded by a plausibility pre-test. While effort was put in to create items in which both readings give rise to a plausible scenario, this still leaves a lot of room for variation. Considering the significant impact of pragmatics discussed in section 3.2.4, it would be useful to run a similar experiment with better controlled impact of plausibility considerations. Finally, the overall number of data points is rather low. A replication of this experiment with both more items and more participants would provide more reliable results. This would be especially important as this is, to my knowledge, the first experiment to specifically test the availability of inverse readings in these types of sentences and compare them to one another. More research about scope inversion in (apparent) island environments or embedded clauses in general is needed.

3.5   Summary

In this chapter, I presented three experiment on quantifier scope in English. The experiments were conducted with speakers of American English only, so it cannot be clearly said if the results extend to other varieties of English in the same way. All three experiments confirmed previous studies on quantifier scope in English in that inverse readings are dispreferred compared to surface readings but still readily available. Experiments 1-3 also consistently showed that participants accept inverse readings in relative clause embeddings, contrary to the general wisdom. This is in line with the findings of Tsai et al. (2014)/Scontras et al. (2017), even though the acceptability of inverse readings observed in here was greater than in their experiment. In fact, experiment E1 and E2 showed that acceptance rates

are not significantly reduced in a relative clause embedding compared to an unembedded sentence. A double-embedding, on the other hand, did reduce inverse readings significantly, and at least in experiment E2, pushed them down to the same level as unambiguous control sentences. The follow-up experiment was intended to investigate if the observed inverse readings in relative clauses could be explained by reconstruction, which would still be compatible with a QR-based account of scope. In line with such an assumption, we observed higher availability of inverse readings in object RCs compared to subject RCs. However, the results did not match the predictions in that inverse reading were also observed in other island environment, namely CNPs that lack a filler-gap dependency. They did, in fact, receive higher ratings than embedded clause that were not islands. This is contrary to all accounts based on Quantifier Raising, since parallel behaviour to overt wh-extraction is expected. However, more and better controlled studies would be needed to confirm whether the data found in the follow-up experiment is reliable, as discussed in section 3.4.4, so future research might shed some light on this issue. In experiments E1 and E2, I also showed how important plausibility considerations are in quantifier scope resolution and hypothesized that they could partly be responsible for the pronounced differences between previous experimental results. Nevertheless, pragmatics was not able to override general SR-biasing constraints completely. We also observed highly variable behaviour across participants. Particularly in the biased double-embedded condition, the conflict between structure and pragmatics was visible through a bimodal distribution. It cannot be said with certainty from the data at hand if the biased condition made an available but dispreferred inverse reading more prominent or if participants were simply willing to ignore grammar for the sake of plausibility. Nevertheless, we saw that the zero-embedding and single-embedding condition not only patterned together in the grand mean, but also in terms of the by-participants distribution.

4 Quantifier Scope in German

In this chapter, I will present two experiments on quantifier scope in German and three follow-up experiments. I will start out in section 4.1 by discussing three approaches that specifically target quantifier scope in German and move on to present previous experimental work on this topic in section 4.2. In section 4.3 and 4.4, I will then present two experiments of the same design as experiment E1 and E2 for English in the previous chapter, thereby testing for both *availability* and *preference*. These experiment were conducted to test for (i) the general (un-) availability of inverse readings in transitive sentences with ∃-∀ order of quantifiers in German, (ii) the impact of a relative clause embedding on the availability of inverse readings and (iii) the impact of plausibility on scope interpretation. In section 4.5, I will present three follow-up experiments to control for potential confounds and to test replicability of the main findings. While previous experimental work has uncovered important features of quantifier scope in German, the experiments presented in this chapter significantly add to those findings. First, basic transitive sentences of the kind used in here are predicted to block inverse readings by all theoretical approaches to quantifier scope in German. These particular sentence types have not been investigated in previous experiments. We will see that contrary to the predictions, inverse readings, while clearly dispreferred, are still available to speakers of German. This is a robust finding in all five experiments. Second, the impact of embedding and plausibility have not been investigated in any of the previous studies on German. We will see that inverse readings may in fact be marginally possible across a relative clause boundary in German, albeit to a much smaller degree compared to English. Same as in the case of English, however, plausibility will turn out to be an important driver of scope interpretation. Also, similar to English, German speakers will be shown to vary a lot with respect to how easily they obtain inverse readings and how much weight is placed on structural versus pragmatic factors in scope resolution. Additionally, the follow-up studies allow us to compare the effect of quantifier choice by using three different existential expressions, (i) the indefinite or numeral *ein* (= a/one), (ii) the abbreviated indefinite *'n* (= a), (iii) the modified numeral *genau ein* (= exactly one). Finally, by comparing the different experiments, I will show that different tasks can change the results in such a way that available but dispreferred readings appear to be non-existent. I will compare the findings of the German experiments to the findings of the English experiments throughout this chapter, but defer the more in-depth cross-linguistic discussion to chapter 6.

4.1   Theoretical background on quantifier scope in German

In contrast to English, discussed in the previous chapter, German has been claimed throughout the literature to only allow for inverse readings in very restricted contexts. The fact that German exhibits a lot more word order freedom than English is often taken to be the main reason for limited scope possibilities. Frey (1993) takes this in a strict sense, rejecting covert operations like Quantifier Raising for German altogether. He predicts inverse readings to only arise under reconstruction, i.e. when the first quantifier has been moved overtly from a position below the second quantifier. Pafel (2005) and Bobaljik & Wurmbrand (2012), on the other hand, consider this effect more gradual rather than categorical. These three accounts make diverging predictions for some sentence types and converging

predictions for other sentence types. We will see, however, that no account correctly predicts the results of the experiments presented in 4.3-4.5.

4.1.1   Frey (1993) & Lechner (1996): configurational account

Frey (1993) presents a configurational account on quantifier scope in German. The basis of his account is the so called *Scope Principle*. This principle says that a QP A has scope over a QP B, iff the head of chain A c-commands the base of chain B (cf. Aoun & Li 1989). Put differently, this means that QP A has scope over QP B, if either QP A c-commands QP B directly or if it c-commands the base position out of which QP B has been moved overtly. An operation like Quantifier Raising, which can change the c-command relationship at LF is not available. Therefore, according to the Scope Principle, German should only allow inverse readings in non-canonical word orders, where the (at surface) first QP has been moved out of a position below the second QP. Lechner (1996) essentially agrees with Frey that inverse readings in German only arise under reconstruction. He only deviates in that he assumes semantic rather than syntactic reconstruction. Frey gives numerous examples from German as evidence, but note that the judgments for these sentences are purely based on introspection[83]. An example along his lines is given in (4.1), which is supposed to show the contrast in inverse scope availability depending on word order.

(4.1)   a. … tatsächlich   hat   [mindestens   eine   Kamera]
        … in.fact   has   at.least   one   camera.NOM
        [fast   jeden   Einbrecher]   aufgenommen.
        almost   every   burglar.ACC   recorded
        '… in fact, at least one camera recorded almost every burglar.'
        Prediction: ✓∃∀; ✗∀∃
        b. … tatsächlich   hat   [mindestens   einen   Einbrecher]ᵢ
        … in.fact   has   at.least   one   burglar.ACC
        [fast   jede   Kamera]   [tᵢ]   aufgenommen.
        almost   every   camera.NOM   *recorded*
        '… in fact, almost every camera recorded at least one burglar.'
        Prediction: ✓∃∀; ✓∀∃

Sentence (4.1a) has canonical subject-before-object word order without application of movement. It is therefore predicted to unambiguously express the surface reading, with the existential scoping over the universal. (4.1b) on the other hand has the non-canonical object-before-subject word order, thereby allowing for both the surface reading and the inverse reading[84]. To get the inverse interpretation, the

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[83] The extent to which solely introspective judgments are a valid means in linguistic research has been under debate in the past years. See also section 3.4.4 on the difference between introspective data and experimental results in English. I also discuss this issue in more depth in section 6.3.1.

[84] Example (4.1b) is a case of movement in the German middle field, so-called scrambling. However, it is in fact under debate whether scrambling is a case of movement at all, as argued for in e.g. Stechow & Sternefeld (1988), Haider & Rosengren (2003), Sabel (2005), or if it is just base-generated (e.g. Abels 2015). Frey obviously works with the movement hypothesis.

object *fast jeden Einbrecher* (= almost every burglar) is reconstructed to its base position below the subject *mindestens eine Kamera* (= at least one camera).

Frey provides further pieces of evidence for the Scope Principle, e.g. topicalization effects of dative vs. accusative objects in German. It is important to note that Frey limits his analysis in two ways. Firstly, he points out that prosody may have an impact on scope interpretation (see e.g. the rise-fall-contour in Krifka (1998), making the inverse reading in (4.1a) available if the right intonation pattern is used. He therefore limits his account to sentences with verum focus, i.e. with intonation on the finite verb (see also Höhle 1982). Secondly, Frey has a very restrictive definition of quantifiers and his predictions only hold for sentences with quantifiers to which this definition applies. This excludes many of the most commonly used quantificational expressions. More specifically, he excludes existentials like *ein* (= a/some/one) because it can also receive a directly referential interpretation, under which it would be scope free. He also excludes universals like *jeder* (= every/each), because they, too, can receive a referential interpretation under a collective construal. Expressions that he would consider truly quantificational are the more complex, modified expressions like *mindestens ein* (= at least one) or *fast jeder* (= almost every). However, his definition of quantifiers is problematic for several reasons. Firstly, the very same argument that he uses to exclude expressions like *ein* or *jeder* can be made in the case of the modified expressions that he considers truly quantificational. For instance, it is possible to interpret the expression *mindestens ein* (= at least one) in a referential way as well. The sentence in (4.2), for instance, could be uttered in a situation in which I am talking about a specific burglar, about whom I know that he has been recorded, but I am unsure if besides him, there are yet more burglars who have been recorded. This effect is also described in Szabolcsi (1997/2012), where she explains this via reconstruction of the existential's witness set. The same can be said for the expression *fast jeder* (= almost every), which can be referred to anaphorically, as shown in (4.3b)[85].

(4.2) Die Kameras haben mindestens einen Einbrecher aufgenommen.
      the cameras have at.least one burglar recorded
      'The cameras recorded at least one burglar.'

(4.3) a. Fast jede Kamera hat den Einbrecher aufgenommen
        almost every camera.NOM has the burglar.ACC recorded
        'Almost every camera recorded the burglar.'
      b. Das waren die, die an der Vorderseite des Gebäudes hängen.
        that were those that at the front.side of.the building hang
        'These were the ones that are hanging at the front side of the building.'

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[85] The continuation in (4.3b) may sound a bit odd to some speakers of German. However, this is due to the morphological number-mismatch that occurs with *jeder* (= every), which takes a singular argument, but is referred to by a plural pronoun, because it typically describes a set with n>1. The key argument here is that the continuation of *fast jeder* is not less felicitous than with the bare universal *jeder*, see (i), as the morphological mismatch applies to both of them. See also Kamp & Reyle (1993), who discuss anaphoric reference to *jeder/every*.

  (i) Jede Kamera hat den Einbrecher aufgenommen.
      every camera.NOM has the burglar.ACC recorded
      Die hängen an der Vorderseite des Gebäudes.
      these hang at the front.side of.the building
      'Every camera recorded the burglar. They are hanging at the front side of the building.'

Further, as Radó & Bott (2018) point out, unmodified *jeder* and the modified version *fast jeder* pattern together in all possible respects, e.g. they both cannot be combined with collective predicates. Therefore, Frey's arguments for the restriction of quantifiers to only their modified versions does not seem to stand up to scrutiny. In my own experiments in section 4.3-4.5, I will therefore ignore these restrictions.

4.1.2 Pafel (2005): multi-factorial account

Pafel (2005) presents a multi-factorial account (see section 2.3.3), but specifically for German. According to his account, same as in most multi-factorial accounts, many different weighted factors interact with each other in a cumulative manner, thereby giving rise to different scope preferences. Thus, while the (non-)canonical word order, discussed in Frey's account, does play a role here too, it is only one out of many structural and non-structural factors. More specifically, each factor has a fixed value, which is then assigned to whatever QP in the sentence this factor applies to. These values are multiplied by five and then the total sum of the various factor values is calculated for each QP. Each QP thus ends up with a value that signals the degree to which it desires to take wide scope. However, it is not the absolute value that counts, but only the relative difference between the two QPs. If the difference is greater than or equal to five, the sentence is unambiguous in that only the QP with the higher value has wide scope. If the difference is smaller than five, the sentence is ambiguous – potentially with a preference for one reading or the other, if the values are not completely equal. An example of this calculation process is given in (4.4).

(4.4) a. Eine Kamera   hat   jeden Einbrecher   aufgenommen.
        a   camera.NOM has   every burglar.ACC   recorded
        'A camera recorded every burglar.'
        ∃:   1.5x5 (linear order) + 1x5 (grammatical function)   =12.5
        ∀:   1x5 (distributivity)   = 5
        Prediction: ✓∃∀; ✗∀∃
      b. Einen   Einbrecher   hat   jede   Kamera   aufgenommen.
        a   burglar.ACC   has   every camera.NOM   recorded
        'Every camera recorded a burglar.'
        ∃:   1.5x5 (linear order)   =7.5
        ∀:   1x5 (grammatical function) + 1x5 (distributivity)   = 10
        Prediction: ✓∃∀; ✓∀∃

In (4.4a), the existential receives the value for linear order, since it linearly precedes the universal. Additionally, it receives the value for grammatical function, since it is the subject and subjects preferably take wide scope (see also Ioup's 1975 grammatical function hierarchy). The universal only receives the value for distributivity, since the quantifier 'jeder' has an inherent preference to be interpreted as distributive (see also Ioup's 1975 quantifier hierarchy). The difference between the two resulting values (12.5 vs. 5) is greater than five. The sentence would thus be predicted to be unambiguous, only allowing for the surface reading. In (4.4b), on the other hand, the existential receives the value for linear order, while the universal receives the values for grammatical function and

distributivity. Since the difference between the two resulting values (7.5 vs. 10) is now smaller than five, the sentence would be considered ambiguous, with a preference for the inverse reading. Thus, for these two sentence types, Pafel makes the same predictions as Frey (1993).

The advantage of Pafel's account is that it can account for the influence of many different factors. It also does not make a simplified binary distinction, even though he still predicts a clear threshold for unambiguity. On the other hand, Pafel's account has the same weakness as Frey's, being solely based on introspective judgments. Additionally, it is not clear how exactly Pafel arrives at the different weights for the factors. It seems like this is just the result of a process of trial and error with introspective judgments.

4.1.3 Bobaljik & Wurmbrand (2012): local scope rigidity

While Frey (1993) and Pafel (2005) provide accounts specifically for scope in German, Bobaljik & Wurmbrand (2012) offer a cross-linguistic account. A general introduction to their account was already given in section 2.3.1, along with other syntactic accounts. However, since Bobaljik & Wurmbrand specifically make reference to German, I will include this part here in more detail. As discussed before, Bobaljik & Wurmbrand assume that Quantifier Raising is a universally available operation. They postulate the soft constraint ScoT, repeated in (4.5), which interacts with other language-specific constraints. Because ScoT is a soft constraint, it may be overridden by another, hard constraint.

(4.5) *Scope Transparency (ScoT):*
       If the order of two elements at LF is A››B, the order at PF is A››B.

                                        (Bobaljik & Wurmbrand 2012, p. 373)

German as a language with fairly free word order can satisfy ScoT by simply scrambling the two quantified elements into the order that aligns with the LF. Only when overt movement is blocked in German should inverse readings arise. A transitive sentence like (4.6a) is therefore predicted to not allow for inverse readings, as the object can simply be moved to a position above the subject, see (4.6b).

(4.6) a. Eine   Kamera   hat   jeden   Einbrecher   aufgenommen.
          a   camera.NOM   has   every   burglar.ACC   recorded
          'A camera recorded every burglar.'
          Prediction: ✓∃∀; ✗∀∃
       b. Jeden   Einbrecher   hat   eine   Kamera   aufgenommen.
          every   burglar.ACC   has   a   camera.NOM   recorded
          'Every camera recorded a burglar.'

In section 2.3.1, we discussed two exceptional cases, where even in German ScoT may be violated and inverse readings may arise due to the impossibility of overt movement. One example was the case of nested genitive DPs, where overt movement leads to ungrammaticality. Another example was the case of information structure: ScoT may be violated in order to satisfy certain information structural constraints that stand in opposition to ScoT. Thus, if the sentence in (4.6a) is given the right intonation

(rise-fall, Krifka 1998), the inverse reading is predicted to arise also under Bobaljik & Wurmbrand's account. For details on Bobaljik & Wurmbrand's account, the reader is referred to section 2.3.1.

4.2 Experimental background on quantifier scope in German

The body of experimental work on quantifier scope in German is considerably smaller than in English. However, the number of experiments on German has been growing in the past few years, mainly due to work by Radó and Bott (Bott & Radó 2007, Bott & Radó 2009, Radó & Bott 2012, Radó & Bott 2018) and Bott and Schlotterbeck (Bott & Schlotterbeck 2012, Bott & Schlotterbeck 2015). These studies mainly focus on the extent to which certain factors influence scope interpretation in German: linear order, syntactic configuration, lexical properties, and discourse anaphoricity. Additionally, they compared the validity of the theoretical accounts on German scope by Frey (1993) and Pafel (2005). In this chapter, I will give a summary of these experiments and their results. Again, I will ignore studies that are purely processing-oriented in nature. I will further only discuss experiments that involve scope between subject and object of a transitive verb and discard studies that investigate inverse linking.

4.2.1 Bott & Radó (2007)

Bott & Radó (2007) ran three studies with the goal of (i) comparing the validity of different methodologies for testing scope interpretation, and (ii) looking at the effect of linear order and the lexical properties on scope interpretation. They used two types of picture verification tasks, one of them with abstract sets diagrams and the other one with more natural pictures. Additionally, they used pairs of questions and answers, where participants had to judge if the target sentence matched the disambiguated question. The three methods had in common that they used some kind of disambiguating to avoid that participants were forced to decide between the two interpretations. The sentences were manipulated in terms of linear order (subject > object vs. object > subject) and quantifier (*jeder* = every/each vs. *alle* = all), see (4.7).

(4.7) a. Genau   einen   dieser   Professoren   {haben   alle   Studentinnen /
          exactly   *one.ACC of these*   *professors*   *have*   *all*   *fem. students /*
          hat   jede   Studentin}   angehimmelt.
          has   every   fem. student   *adored*
       b. {Alle   Studentinnen   haben / Jede   Studentin   hat}   genau   einen
          {all   *fem. students*   *have / every*   *fem. student*   *has}*   *exactly   one.ACC*
          dieser   Professoren   angehimmelt.
          of these   *professors*   *adored*
       '{All students / Every student} adored exactly one professor.'

<div align="right">(adapted from Bott & Radó 2007, p. 2)</div>

The results show that both linear order and quantifier type have an effect on scope interpretation in the picture verification task with abstract sets as well as in the task with question-answer pairs, but not so in the other picture verification task. The authors also report less between-speaker variability when abstract sets were used compared to the other methods. The authors take this as indicating that this is

the most reliable method. However, the higher variability in the task with the question-answer pairs might not actually be an inherent problem with the method but due to the fact that the allegedly disambiguating questions were in fact not fully unambiguous, as demonstrated in (4.8). This question is vague in that it could either mean that all the students adore the same one professor or that for each student there is a different professor that they adore. Additionally, the material used in the task with the 'natural' pictures was in fact not very natural either, but simply showed more distracting information than the abstract diagrams.

(4.8) Kann   man   eigentlich   von   jeder   Studentin   sagen,   dass   sie
       can   *one*   *actually*   *of*   *every*   *fem. student*   *say*   *that*   *she*
       genau   einen   Professor   angehimmelt   hat?
       exactly   *one*   *professor*   *adored*   *has*
       'Can it be said of every student that she adored exactly one professor?'

<div align="right">(Bott & Radó 2007, p. 3)</div>

4.2.2   Bott & Schlotterbeck (2012)

Bott & Schlotterbeck (2012) employed both an off-line truth-value-judgment task and an on-line self-paced-reading task with incremental truth-value-judgments to test scope interpretation of both SVO and OVS sentences in German. Example items for the tested configurations are given in (4.9).

(4.9) a. Genau   ein   Lehrer   lobte   jeden   dieser   Schüler
         exactly   *one*   *teacher.NOM*   *praised*   *each*   *of.these*   *students.ACC*
         voller   Wohlwollen.
         full.of   *goodwill*
         'Exactly one teacher praised each of these students full of goodwill.'
       b. Jeden   dieser   Schüler   lobte   genau   ein
         each   *of.these*   *students.ACC*   *praised*   *exactly*   *one*
         Lehrer   voller   Wohlwollen.
         teacher.NOM   *full.of*   *goodwill*
         'Exactly one teacher praised each of these students full of goodwill.'

<div align="right">(adapted from Bott & Schlotterbeck 2012, p. 9)</div>

In the off-line task, participants indicated on a 7-point-scale how well a sentence matched a set diagram (cf. Bott & Radó 2007). Participants strongly preferred the surface over the inverse reading and even more so in the OVS compared to the SVO condition. However, contrary to Frey (1993) and Pafel (2005), the inverse reading was possible with both word orders, not just in the OVS condition. In the on-line task, participants had to repeatedly indicate if they considered the sentence true with respect to a set diagram after each uncovered chunk of the sentence. While SVO sentences paralleled unambiguous control items in both judgments and reaction times, thereby showing no sign of ambiguity, OVS sentences were rejected less often than the unambiguous controls when the picture showed the inverse reading. These items also had longer reaction times compared to the controls, indicating that the participants accessed the inverse reading on-line. The authors interpret the results of these two experiments as showing that the inverse reading in the OVS sentences is due to reconstruction, an

operation which is available on-line, while the inverse reading in the SVO sentences is due to Quantifier Raising, which is only available post-interpretively. This would explain why the former lead to inverse interpretations in both experiments, while the latter only did so in the off-line task. The fact that inverse readings were not excluded for sentences like (4.9a) is particularly surprising about this experiment. Such sentences are predicted to not allow for inverse readings both by Frey (1993) and Pafel (2005), as discussed by Bott & Schlotterbeck. The account of Bobaljik & Wurmbrand (2012) would not predict this either. These results might nevertheless be explainable under any of those accounts, if the right prosodic pattern is assumed. Because prosody and/or information structure were not controlled for in this experiment, we do not know if this might be the case.

4.2.3   Radó & Bott (2018)

In their study from 2018, Radó & Bott tested the validity of configurational (e.g. May 1985, Frey 1993, Reinhart 1995, Beghelli & Stowell 1997, Heim & Kratzer 1998, Fox 2003) vs multi-factorial accounts (e.g. Kroch 1974, Ioup 1975, VanLehn 1978, Kuno 1991, Pafel 2005) for German. They ran three studies using again a picture verification task with abstract sets and sentences like (4.10) and (4.11).

(4.10) a. Genau einen Schüler   lobte   jeder Lehrer   voller   Wohlwollen.
            exactly one   pupil.ACC   praised   each   teacher.NOM   full-of   goodwill
            'Each teacher praised exactly one pupil full of goodwill.'
        b. Jeden   dieser Schüler   lobte   genau   ein   Lehrer   …
            each   these   pupils.ACC   praised   exactly one   teacher.NOM   ...
            'Exactly one teacher praised each of these pupils …'
        c. Genau   ein   Lehrer   lobte   jeden   dieser Schüler …
            exactly   one   teacher.NOM   praised each   these   pupils.ACC   ...
            'Exactly one teacher praised each of these pupils …'

(adapted from Radó & Bott 2018, p. 11)

(4.11) a. Genau   einen   dieser   Aufsätze   [hat   jeder   Student /
            exactly   one   of-these   papers.ACC   has   each   student.NOM   /
            haben   alle   Studenten]   gelesen.
            have   all   students.NOM read
            'Each student/All students read exactly one of these papers.'
        b. [Jeder   Student hat   /   alle   Studenten   haben]
            each   student   has   /   all   students   have
            genau   einen   dieser Aufsätze   gelesen.
            exactly   one   of.these papers.ACC   read.
            'Each student/All students read exactly one of these papers.'
        c. Genau   einen   Aufsatz   [hat   jeder   dieser Studenten   /
            exactly   one   paper.ACC   has   each   of.these students   /
            haben   alle   diese   Studenten]   gelesen.
            have   all   of.these   students   read
            'Each/All of these students read exactly one paper.'

(adapted from Radó & Bott 2018, p. 18 & 21)

In their first experiment, they employed a picture-matching task and let participants rate sentences like (4.10) on a 7-point-scale. They manipulated word order of subject and object and order of quantifiers. In experiment 2 and 3, they used a picture-matching task in combination with the Magnitude Estimation method. Sentences like the ones in (4.11) were used for experiment 2 and 3, manipulating word order, distributivity, and discourse anaphoricity. There were 48 participants in experiment 1, 56 participants in experiment 2, and 24 participants in experiment 3.

Bott & Radó found that linear order of quantifiers, distributivity, and discourse anaphoricity all have an effect of scope interpretation, a result that is not fully consistent with either of the accounts discussed in section 4.1. The sentences in (4.10c) with subject-before-object word order were predicted to lack the inverse reading altogether, but Bott & Radó found them to be marginally acceptable. The authors consequently tested if the inverse reading in (4.10c) might have been accepted only because participants silently assigned a biasing prosody pattern (Frey 1993, Büring 1997, Krifka 1998, see section 2.2.6 above). However, in their follow-up study, they could not find evidence for this assumption, since the acceptance of inverse readings was on a similar level, independent of the prosody pattern. Nevertheless, apart from this unexpected effect in subject-before-object sentences, the authors conclude that the results largely support multi-factorial accounts in the style of Pafel (2005) more than the account of Frey (1993). This is because their results showed additive effects, supporting the assumption that multiple factors play a role and interact with each other. However, in contrast to what Pafel assumes, there is no cut-off point for ambiguity. At the same time, neither account correctly predicted that sentences like (4.10c) with subject-before-object word order would marginally allow for inverse readings. Nevertheless, same as in the study of Bott & Schlotterbeck (2012), information structure was not controlled for, which could possibly explain this effect even in line with the claims of these theoretical accounts.

4.2.4   Summary

In conclusion, these studies provide evidence that surface readings are generally preferred over inverse readings. At the same time, they also show that inverse readings are still available in several tested configurations. This is the case even for the subject-before-object word order, for which previous accounts predicted a total lack of inverse readings. The distributive quantifier *jede/r/s* (= every/each) takes wide scope more easily than the non-distributive quantifier *alle* (= all). Also, discourse-linked elements like partitive constructions take wide scope more readily compared to non-discourse-linked ones. The results seem to favour a multi-factorial account in the spirit of Pafel (2005) over a structural account like Frey (1993). At the same time, several studies contain confounding factors, which question the validity of their results. More specifically, the surprising results in the subject-before-object sentences might arise because participants have a particular prosody in mind or accommodate a certain information structure. Frey (1993) specifically mentions prosody as a relevant factor and restricts his prediction to cases with verum focus. Even though Pafel (2005) does not specifically target this topic, a multi-factorial account always allows for the addition of further factors. Finally, Bobaljik & Wurmbrand (2012), which were not discussed in these experiments, specifically consider information structural constraints that can lift ScoT. In the following experiments, I will therefore test these types of sentences, also taking into account those factors. These experiments will show that even when these factors are controlled for, subject-before-object sentences still allow for inverse readings.

4.3 Experiment G1: effects of embedding and plausibility

This experiment was conducted to test for the availability of inverse readings in unembedded and embedded sentences with an existential subject and a universal object, as well as for the impact of pragmatics. The experiment was identical to experiment E1 on English. The research questions were:

Q1: To what extent is the inverse scope of a universal object over an existential subject available in a canonical, unembedded sentence?

Q2: To what extent does plausibility play a role in the availability of inverse readings?

Q3: To what extent are inverse readings available when the second quantifier is embedded inside a relative clause island?

Q1 draws on previous experiments, which found that such sentences allow for inverse readings, contrary to prediction. The following experiments aim at replicating those findings, specifically controlling for the potentially confounding factors prosody/information structure. The motivation for Q2 is the fact that embedding environments have not been experimentally investigated for German before. Relative clauses, same as other types of embeddings, are typically considered to block inverse readings cross-linguistically. In the case of English, relative clauses were unexpectedly found to allow for inverse readings. It is thus worthwhile to test for the same in German. The motivation for Q3 is the fact that plausibility has neither been tested nor controlled for in any experiment on German. Finally, the experiments in 4.3 and 4.4 are parallel to the English experiments from chapter 3, thereby allowing for a direct cross-linguistic comparison between English as an SVO language with strict word order, which is generally known to allow for inverse readings, and German as an SOV language with free word order, which has generally been assumed to block inverse readings in canonical sentences.

4.3.1 Methods

(i)   Materials

The experiment had the same design and materials as the English version presented in section 3.2, with *plausibility* (neutral vs. biased) and *embedding* (0-emb vs- 1-emb vs- 2-emb) as factors[86]. Examples are given in (4.12) for the neutral and in (4.13) for the biased condition together with the English translations repeated from section 3.2.1. Each item was preceded by a context that was stated as an assumption about the future and introduced the two NPs that were also used in the target sentence to assign both of them the information structural status *given*. Each item was followed by one of two possible questions, either targeting the availability of the surface reading (Q-ONE) or the inverse reading (Q-MORE). Thus, this experiment tested for general availability of inverse readings, not for preference of readings. The answer 'yes' to Q-ONE indicates that the surface reading was accessible to the participant for a particular item, while the answer 'yes' to Q-MORE indicates that the inverse reading was accessible to the participant.

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[86] See section 3.2.1 for the pre-test conducted to control for plausibility.

(4.12) **Neutral** (original version of the translated English item):

Context: Der Polizeibeamte hatte vermutet, dass die Einbrecher von neu angebrachten
Überwachungskameras aufgenommen worden sein könnten, und tatsächlich …
*'The police officer hoped that the burglars might be recorded by newly
installed surveillance cameras, and then, in fact …'*

0-emb … hat dann 'ne neu angebrachte Überwachungskamera
… has then a newly installed surveillance camera
<u>jeden Einbrecher</u> aufgenommen.
every burglar recorded
'… a newly installed surveillance camera recorded every burglar.'

1-emb … hat dort dann 'ne neu angebrachte Überwachungskamera
… has there then a newly installed surveillance camera
gehangen, die jeden Einbrecher aufgenommen hat.
hung that every burglar recorded has
'… there was a newly installed surveillance camera that recorded every
burglar.'

2-emb … war dort dann 'ne neu angebrachte Überwachungskamera
… was there then a newly installed surveillance camera
die so gehangen hat, dass sie jeden Einbrecher
that so hung has that it every burglar
aufgenommen hat.
recorded has
'… there was a newly installed surveillance camera which hung in
such a way that it recorded every burglar.'

Question: Kann man diesen Satz so verstehen, dass es hier insgesamt…
'Can this sentence be understood to mean that, overall, …'

Q-ONE … **nur eine einzige** neu angebrachte Überwachungskamera gab,
die die Einbrecher aufgenommen hat?   *ja/nein*
'… only a single newly installed surveillance camera recorded
the burglars?   *yes/no'*

Q-MORE … **mehr als eine** neu angebrachte Überwachungskamera gab, die
die Einbrecher aufgenommen hat?   *ja/nein*
'… more than one newly installed surveillance camera
recorded the burglars?   *yes/no'*

(4.13) **Biased** (original version of the translated English item):

Context: Die Polizei hatte vor dem Sturm davor gewarnt, dass die Zufahrten in die
Innenstadt durch umgestürzte Bäume blockiert werden könnten, und tatsächlich
'Before the storm the police made an announcement that the access
roads to the city center could be blocked by fallen trees, and then, in fact, …'

0-emb … hat dann 'n umgestürzter Baum jede Zufahrt blockiert.
… has then a fallen tree every entrance blocked
'… a fallen tree blocked every access road.'

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1-emb	… hat	dort	dann	'n	umgestürzter	Baum	gelegen,		der
	… has	*there*	*then*	*a*	*fallen*	*tree*	*lied*		*that*
	jede	Zufahrt		blockiert	hat.				
	every	*entrance*		*blocked*	*has*				

'… there was a fallen tree that blocked every access road.'

2-emb	… war	dort	dann	'n	umgestürzter	Baum,	der	so	gelegen
	… was	*there*	*then*	*a*	*fallen*	*tree*	*that*	*so*	*lied*
	hat,	dass	er	jede	Zufahrt	blockiert	hat.		
	has	*that*	*it*	*every*	*entrance*	*blocked*	*has*		

'… there was a fallen tree which was positioned in such a way that it blocked every access road.'

Question: Kann man diesen Satz so verstehen, dass es hier insgesamt …
   'Can this sentence be understood to mean that, overall, …'

Q-ONE … **nur einen einzigen** umgestürzten Baum gab, der die
   Zufahrten blockiert hat?   *ja/nein*
   '… only a single fallen tree blocked the access roads?'   *yes/no'*

Q-MORE … **mehr als einen** umgestürzten Baum gab, der die Zufahrten
   blockiert hat?   *ja/nein*
   '… more than one fallen tree blocked the access roads?'   *yes/no'*

Just as in English, the word order was canonical subject-before-object with a transitive, non-agentive predicate. The subject was an existential QP with the abbreviated form '*n(e)* of the indefinite article *ein(e)*[87], the object was a universal QP with the distributive *jede(r)*. The reason for the use of the abbreviated form of the indefinite was to control for prosodic effects. As described in section 4.1, Frey makes the specific prediction that inverse readings in sentences like (4.12) may be available under a particular type of intonation (rise-fall-contour, Krifka 1998), but should be unavailable under verum focus. The abbreviated indefinite cannot be accented in German, making it impossible for participants to read the sentence under a rise-fall contour. Secondly, the German indefinite, in contrast to the English indefinite, is morphologically identical to the numeral *one*. To allow for a more direct comparison between English and German and to avoid that participants receive a numeral or specific interpretation, the abbreviated, lexically unambiguous form was chosen.

Remember that in the discussion of the English experiment in 3.2.4, I pointed out some potential confounds with this particular design. These confounds apply in the same way to the German version of this experiment. These potential confounds might have led participants to say 'yes' to Q-MORE without actually having obtained the inverse reading. That could happen because (i) they are biased by the mentioning of a morphological plural in the context, (ii) they interpret the existential on a kind-level (several tokens of the same type), (iii) they accommodate the existence of further referents, not overtly mentioned. In 3.2.4, I provided several arguments as to why these potential confounds do not diminish the general findings of the experiment. Additionally, in section 4.5 of this chapter I will provide three

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[87] Since the abbreviated form of the indefinite is a more colloquial style of standard German, the items were created in such a way that they sounded more colloquial overall to avoid the indefinite from standing out. This was done, for instance, by using the colloquial, abbreviated form of other words like *ham* for *haben* (= to have) or using word that are more colloquial in the first place, like *schmeißen* (= to throw). See section 4.5 for a follow-up experiment on the potentially confounding factor of the abbreviated form of the indefinite.

follow-up experiments that independently control for those confounds, thereby supporting the main findings of the experiments presented in chapter 3 and 4.

The five different filler conditions used in experiment G1 are given in (4.14) to (4.18). These, too, were the original items for the translated English items in section 3.2.1. The English translations are repeated below. Filler 6 was omitted in the German experiment, as no claims about inverse scope in ellipsis sentences have been made for German in the way Fox (2000) did for English.

There were 24 items in the neutral and 24 items in the biased condition, resulting in 48 target items in total. The total number of filler items was 48. The items were distributed on 6 lists via a Latin Square design, such that each participant saw a certain target item in only one of the three embedding condition and that each item was only shown with one of the two possible question types. Each participant thus saw 96 items in total.

Filler 1: *No ∀*
This condition only contained an existential QP, but no universal QP.
(4.14)   Die Angestellten der Pistenwache ham wegen der Lawinengefahr angekündigt, 'ne
         Piste vorübergehend zu sperren, und tatsächlich ham sie dann auch 'ne Piste gesperrt.
         'The employees of the ski patrol announced they would temporarily close a ski slope
         due to the danger of avalanches, and then, in fact, they did close a ski slope.'
         Q: Kann man diesen Satz so verstehen, dass es hier insgesamt …
            'Can this sentence be understood to mean that, overall, there was ...'
         Q-ONE   … **nur eine einzige** Piste gab, die die Angestellten haben sperren lassen?
                       '...only a single ski slope that the employees had closed?'
         Q-MORE   … **mehr als eine** Piste gab, die die Angestellten haben sperren lassen?
                       '...more than one ski slope that the employees had closed?'
   ➔ Expected response: Q-ONE - **yes**; Q-MORE - **no**

Filler 2: *No ∀, 2-emb***:**
This condition only contained an existential QP, but no universal QP and were doubly embedded parallel to the 2-emb target items and served to control for confounds.
(4.15)   Die Sekretärin hat vorgeschlagen, dass der verschwundene Brief unter Mappen
         versteckt sein könnte, und tatsächlich war dort dann 'ne Mappe, [die so gelegen hat,
         [dass sie den Brief bedeckt hat]].
         'The secretary suggested that the missing letter might be hidden under folders, and then,
         in fact, there was a folder that was positioned in such a way that it covered the letter.'
         Q: Kann man diesen Satz so verstehen, dass es hier insgesamt …
            'Can this sentence be understood to mean that, overall, there was ...'
         Q-ONE   … **nur eine einzige** Mappe gab, die den Brief bedeckt hat?
                       '... only a single folder covered the letter?'
         Q-MORE   … **mehr als eine** Mappe gab, die den Brief bedeckt hat?
                       '... more than one folder that covered the letter?'
   ➔ Expected response: Q-ONE - **yes**; Q-MORE - **no**

Filler 3: *Referential*

This condition was identical to the target items, but with an additional sentence, in which a singular pronoun anaphorically referred back to the existential subject QP.

(4.16)   Die Reisenden ham verlangt, dass 'ne Fahrt an die Ostsee angeboten wird, und
tatsächlich hat dann 'ne Busfahrerin *jeden Reisenden* zur Ostsee gefahren. Ich hab' aber
<u>ihren</u> Namen vergessen.
'The travellers demanded that a trip to the Baltic Sea be offered, and then, in fact, a
bus driver drove every traveller to the Baltic Sea. But I forgot her name.'
Q: Kann man diesen Satz so verstehen, dass es hier insgesamt …
   'Can this sentence be understood to mean that, overall, there was ...'
   Q-ONE   … **nur eine einzige** Busfahrerin gab, die die Reisenden zur Ostsee
   gefahren hat?
   '...only a single bus driver who drove the travellers to the Baltic Sea?'
   Q-MORE   … **mehr als eine** Busfahrerin gab, die die Reisenden zur Ostsee
   gefahren hat?
   '... more than one bus driver who drove the travellers to the Baltic Sea?'
   ➔ Expected response: Q-ONE - **yes**; Q-MORE - **no**

Filler 4: *Each*

This condition contained the expression 'jeweils' (= *each*), distributing over the plural subject.

(4.17)   Die Mieter im Erdgeschoss ham gedroht, 'ne Beschwerde aufgrund des Schlagzeugs im
ersten Stock einzureichen, und tatsächlich ham sie dann auch <u>jeweils</u> 'ne Beschwerde
eingereicht.
'The tenants on the ground floor threatened to file a complaint about the drums on the
1st floor, and then, in fact, they filed a complaint each.'
Q: Kann man diesen Satz so verstehen, dass es hier insgesamt …
   'Can this sentence be understood to mean that, overall, there was ...'
   Q-ONE   … **nur eine einzige** Beschwerde gab, die die Mieter eingereicht haben?
   '... only a single complaint that the tenants had filed?'
   Q-MORE   … **mehr als eine** Beschwerde gab, die die Mieter eingereicht haben?
   '... more than one complaint that the tenants had filed?'
   ➔ Expected response: Q-ONE - **no**; Q-MORE - **yes**

Filler 5: ∀-∃

This condition was similar to the target sentence, but with the order of quantifiers reversed, i.e. with a universal subject QP and an existential object QP.

(4.18) Der Arzt hat angewiesen, dass die Krankenschwestern von Pflegern unterstützt werden
solln, und tatsächlich hat dann <u>jeder Pfleger 'ne Krankenschwester</u> unterstützt.
'The doctor ordered that the nurses should be supported by caregivers, and then, in
fact, each caregiver supported a nurse.'
Q: Kann man diesen Satz so verstehen, dass es hier insgesamt …
   'Can this sentence be understood to mean that, overall, there was ...'
   Q-ONE   … **nur eine einzige** Krankenschwester gab, die die Pfleger unterstützt
   haben?
   '... only a single nurse who the caregivers supported?'

Q-MORE … **mehr als eine** Krankenschwester gab, die die Pfleger unterstützt haben?

'... more than one nurse who the caregivers supported?'

➔ Expected response: Q-ONE - **no**; Q-MORE - **yes**

(ii)   Participants

There were 73 native speakers of German who participated in the experiment. They were recruited through the SONA participants pool of the University of Potsdam and received a compensation of either 8€ or 1h of course credit. Six participants had to be excluded from the analysis because they did not reach the threshold of correctly answering 3/4 of the control filler conditions. Among the remaining 67 participants, 59 were female and 8 were male. They were 17-58 years old, with a mean age of 24.

(iii)   Procedure

The procedure was identical to the English version of the experiment (see section 3.2.1).

4.3.2   Predictions

The theoretical literature on scope in German encompasses the multi-factorial account of Pafel (2005) and the structural account of Frey (1993), described in section 4.1 in the German-specific context, and the cross-linguistic structural account of Bobaljik & Wurmbrand (2012) described in section 2.3.1. All these accounts claim that inverse readings in German should only be available under very special circumstances. However, they vary in the specification of those circumstances. For Bobaljik & Wurmbrand (2012) it is possible when overt movement is blocked by another constraint. For Frey (1993) it is possible when reconstruction is an option or when a particular prosodic pattern arises. Lastly, for Pafel (2005) it is possible when the interaction of lexical, syntactic, and prosodic factors supports wide scope of the lower quantifier. For the specific types of sentences used in this experiment, however, all of these accounts predict that inverse readings should be unavailable in all six conditions. Nevertheless, they differ in the reasons as to why this should be the case. Frey (1993) assumes that inverse readings in German are only possible when a dislocated phrase is reconstructed into its original position. However, since the sentences described above have canonical subject-before-object word order and cannot be read with a special intonation that permits inverse readings, only the surface interpretation should be possible. This is the case for all conditions.

As for Bobaljik & Wurmbrand (2012), they assume that inverse readings are only possible when overt movement is prohibited, e.g. for reasons of syntax or information structure. Only then can their soft constraint ScoT, which requires word order in surface structure to parallel scope hierarchy at logical form, be violated. However, as can be seen in (4.19b), the scrambled version with the uncanonical object-before-subject word order does not result in unacceptability. Indeed, the information structure from the context would actually be preserved better with overt movement. The reason for this is that in the context, *die Einbrecher* (= the burglars) is definite and the subject of a passive construction, ticking typical boxes for topichood. The NP *Überwachungskameras* (= surveillance cameras), on the other hand, is indefinite and also does not have an accented indefinite determiner, thus not satisfying

requirements of topichood (Ebert & Hinterwimmer 2010). Finally, the NP *jeden Einbrecher* (= every burglar) anaphorically refers back to the definite DP *die Einbrecher* (= the burglars) in the context, giving it the status of definite and given (Krifka 2008). The general preference for topics preceding focus and definites preceding indefinites (Lenerz 1977) is preserved in (4.19b), where overt movement has applied, but not in (4.19a) without overt movement. However, even if the context is not read with the suggested information structure, there is no obvious reason, why (4.19a) should be preferred on the basis of information structure.

(4.19)   Der Polizeibeamte hatte vermutet, dass [die Einbrecher] von [neu angebrachten Überwachungskameras] aufgenommen worden sein könnten, und tatsächlich …
'The police officer hoped that the burglars might be recorded by newly installed surveillance cameras, and then, in fact …'

a.   … hat   dann   ['ne   neu   angebrachte   Überwachungskamera]
     … has   then   a   newly installed   surveillance.camera.NOM
     [jeden   Einbrecher]   aufgenommen.
     every   burglar.ACC   recorded

b.   … hat   dann   [jeden Einbrecher]   ['ne   neu   angebrachte
     … has   then   every burglar.ACC   a   newly installed
     Überwachungskamera]   aufgenommen.
     surveillance.camera.NOM   recorded
     '… a newly installed surveillance camera recorded every burglar.'

As for the embedding conditions, they should not allow for inverse readings under Bobaljik & Wurmbrand's account either, since Quantifier Raising is subject to both the usual island constraints that also apply to overt movement (May 1985) as well as the clause-boundedness constraint (Chomsky 1975). Therefore, the second quantifier cannot move covertly to a position above the first quantifier in order to take wide scope. Bobaljik & Wurmbrand (2012) do not mention pragmatic reasoning to be a factor that could override ScoT. Hence, in a strict sense, their account would not predict any difference between the neutral and the biased condition either. One might argue, however, that the account of Bobaljik & Wurmbrand (2012) could in principle encompass more factors that have the potential to override ScoT. That being said, it is unclear what those factors could be.

Finally, Pafel (2005) claims that inverse readings should be possible if the first quantifier is assigned a number in his system that is not greater than the number for the second quantifier by 5 or more. The numbers are the sum of all the different factors which contribute to a wide or narrow scope preference. Taking the factors specified in Pafel (2005), the following values should be assigned to the sentences in this experiment:

(4.20)   … hat dann ['ne neu angebrachte Überwachungskamera] [jeden Einbrecher] aufgenommen.
'… a newly installed surveillance camera recorded every burglar.'

a.   QP1 ($\exists$-subject):   linear order: 1.5x5 + grammatical function: 1x5 = 12.5
b.   QP2 ($\forall$-object):   distributivity: 1x5 = 5

The difference between the existential and the universal QP phrase is 7.5, with a higher value for the existential. This should result in an unambiguous existential wide scope interpretation in Pafel's system.

Since the factors specified in (4.20) remain unchanged throughout the three embedding conditions, inverse readings should be unavailable across the board. In fact, Pafel takes QPs to be phrase-bound, which would rule out the inverse reading in 1-emb and 2-emb altogether. However, as the inverse reading should be ruled out in 0-emb independent of this, we expect no difference across the three embedding conditions. As for plausibility, Pafel does not specifically list this as a factor. Thus, there should be no difference between the neutral and the biased condition. However, since Pafel's account is multifactorial, one could argue that additional factors could be added to the list, e.g. plausibility. In that case, the 0-emb/biased condition would be predicted to be ambiguous, while the two embedding conditions remain unambiguous due to the phrase-boundedness condition.

4.3.3   Results

The descriptive results are shown in Figure 4.1. In the neutral condition, participants accepted the surface reading in 83% (95% CI: 0.78-0.87) of the cases in the 0-emb condition. The acceptability increased with deeper embedding to 90% in 1-emb (95% CI: 0.86-0.94) and 93% (95% CI: 0.89-0.95) in 2-emb. In the biased condition, participants accepted the surface reading in 50% (95% CI: 0.44-0.56) of the cases in the 0-emb condition. The acceptability again increased to 73% (95% CI: 0.67-0.78) in the 1-emb and to 82% (95% CI: 0.77-0.86) in the 2-emb condition. As for the inverse reading, shown on the right, participants accepted it in 39% (95% CI: 0.33-0.45) of the cases in the 0-emb condition when the context was neutral. The acceptability decreased to 21% (95% CI: 0.16-0.26) in the 1-emb and to 16% (95% CI: 0.12-0.21) in the 2-emb condition. In the biased condition, participants accepted the inverse reading in 65% (95% CI: 0.59-0.71) of the cases in the 0-emb condition. The acceptability again decreased with deeper embedding to 50% (95% CI: 0.43-0.56) in the 1-emb and to 34% (95% CI: 0.28-0.40) in the 2-emb condition.
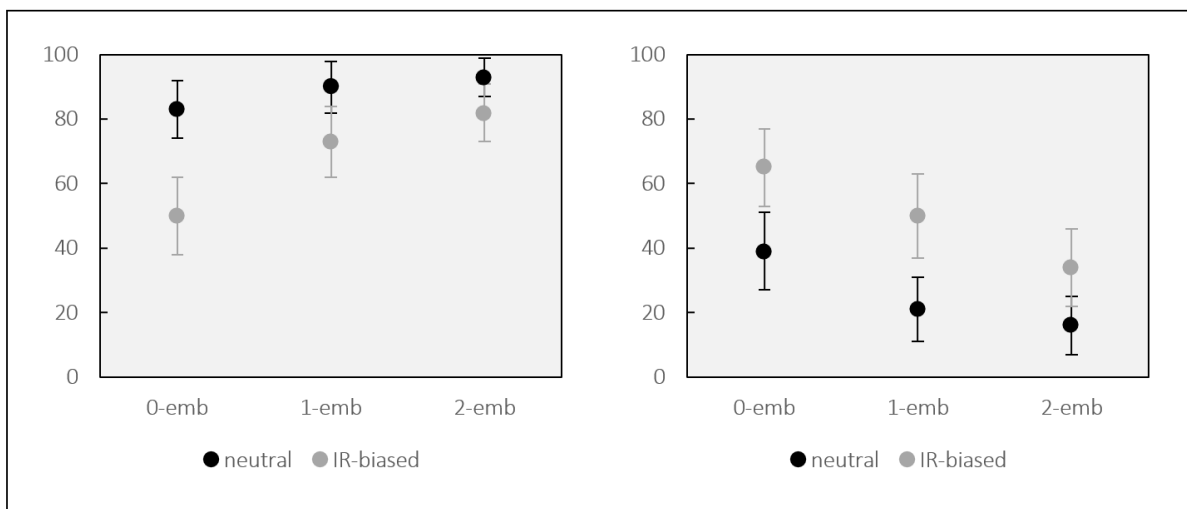
Figure 4.1: Results of experiment G1 in proportion of 'yes'-answers across conditions for Q-ONE (left) and Q-MORE (right). Error bars show 95% CI.

The results were analysed in the same way as the English version of the experiment in section 3.2.3. The analysis revealed a main effect of plausibility, with a significant difference between neutral and biased (p < 0.001) as well as a main effect of embedding with a significant difference between 1-emb

and 0-emb (p < 0.001) and 2-emb and 1-emb (p < 0.001). No interaction was significant. The results for the filler items are given in Table 4.1 below.

	Filler 1: no∀	Filler 2: no∀, 2-emb	Filler 3: referential	Filler 4: each	Filler 5: ∀-∃
Q-ONE	94%	95%	94%	8%	12%
Q-MORE	10%	11%	11%	89%	95%

Table 4.1: Results of experiment G1 in proportion of 'yes'-answers across all filler/control conditions.

4.3.4 Discussion

(i) Fillers

The outcome was in line with the expectations with 10-12% acceptance of the incorrect answer and 89-95% acceptance of the correct answer. Same as for the English version of the experiment, this is taken as indicative that the overall design worked as expected and that participants both understood the task and parsed the sentences in enough depth to answer to questions accordingly. Similar to the English filler results in section 3.2.4, the percentage of false replies is around 10%, which is again taken as the 'noise' threshold. Values in the target items that are clearly above this threshold, i.e. 20% or higher, are interpreted as indicating inverse scope readings. For details on this classification, see section 3.2.4. Filler 2 again shows that, just like in the English counterpart, participants were not biased towards the plural response solely due to the mentioning of a plural NP in the context, since the value is about the same as in Filler 1, which has no plural NP (see also the discussion in section 3.2.4).

(ii) Baseline condition: IR available

In the 0-emb/neutral condition, participants accepted the inverse reading in 39% of the cases and the surface reading in 82% of the cases. While the fact that the surface reading received much higher values than the inverse reading is in line with the expectation that the surface reading should be preferred, the inverse reading was accepted to a surprisingly high extent, which is in contradiction to all the theoretical accounts discussed in section 4.1. This experiment thus provides evidence that, contrary to the predictions made in the literature, German does indeed allow for inverse readings in the type of sentences tested here, where an existential subject and a universal object occur in canonical subject-before-object word order and with verum intonation. Since plausibility was specifically taken into account, pragmatic pressure cannot be the reason why participants accept the inverse reading in the neutral condition. More importantly, if participants mainly followed pragmatic considerations, thereby ignoring syntax, we would expect an even higher value for the unembedded IR-biased condition than the 65% attested, as in this condition, the surface reading was rendered highly implausible. I will therefore claim that we are dealing with true inverse interpretations, which, contrary to the general assumption, are in fact available in German. Interestingly, less pronounced but still similar to English, the surface reading did not show ceiling effects. In the unembedded condition, participants rejected it in 17% of the cases. This is surprising under the assumption that the surface reading as the preferred reading should always be available.

The results are in line with previous experiments on German presented in section 4.2, which also provided evidence that German speakers do in fact accept inverse readings. However, while the experiments presented above show this mainly for environments, where at least some of the theoretical accounts predict ambiguity, the experiment at hand does so for a type of construction in which scope inversion was considered to be excluded across the board. There is only one sentence type tested in Radó & Bott (2018) that is comparable to the items used here, shown in (4.21), repeated from (4.9a) above. Using a picture-matching task, the authors did indeed find that participants assign these sentences a slightly higher value on a 7-point-scale than unambiguous sentences. However, these types of sentences still differ in three important aspect from the items used for the present study. First, a modified numeral is used instead of the indefinite. Second, the universal is the head of a partitive construction including a demonstrative determiner. This is of special relevance as the authors themselves provide evidence that d-linking boosts inverse interpretations. Under a multi-factorial approach à la Pafel (2005), this additional factor should in fact predict (4.21) to be ambiguous. Finally, only the second QP is in the middlefield and intonation is not controlled for. Thus, a verum accent, which is a condition for Frey's (1993) predictions, cannot be guaranteed for. Radó & Bott did run a follow-up to test for effects of intonation, but they only did so using sentences with ∀-∃ order. This is first of all not the order used in (4.21), and second, as discussed in section 2.2.2, ambiguity cannot be distinguished from vagueness in these sentences. It is therefore not possible to estimate the potential impact of intonation through these results.

(4.21) Genau ein   Lehrer   lobte   jeden   dieser Schüler   voller Wohlwollen.
       exactly one   teacher.NOM praised each   these pupils.ACC   full-of goodwill
       'Exactly one teacher praised each of these pupils full of goodwill.'

                                                                    (adapted from Radó & Bott 2018, p. 11)

   (iii)   Plausibility: strong impact

The IR-bias lowered the availability of the surface reading by 20 percentage points (neutral: 87%; IR-biased: 67%) and boosted the inverse reading by 25 percentage points (neutral: 25%; IR-biased: 50%) across embedding conditions. The effect was strong enough to turn the inverse reading into the preferred reading for 0-emb. The effect is similar to the English experiment with Q-MORE, but less pronounced with Q-ONE in the two embedding conditions. That is, when the sentence was embedded, plausibility could only reduce the availability of the surface reading by 11-17 percentage points for the German participants. In the unembedded condition, on the other hand, the surface preference could easily be overcome. The results thus confirm the results from experiment E1 on English in that the perceived plausibility of the scenarios created by the inverse/surface interpretation respectively plays a big role in which reading speakers ultimately opt for, in line with claims in the literature (Gillen 1991, Kurtzman & MacDonald 1993, Saba & Corriveau 2001, Villalta 2003, Anderson 2004, Reinhart 2006, Srinivasan & Yates 2009).

   (iv)   Embedding: IR marginally available

Figure 4.1 shows that participants accept the inverse reading under a single embedding into a relative clause in 21% of the cases. This result is unexpected. As discussed above, there has been a general consensus in the theoretical literature on German scope that inverse readings are completely absent even

in the unembedded sentences of the structure presented here. Even taking into account the fact that we did attest inverse readings in the unembedded condition, there are additional, independent reasons on which grounds the inverse reading should be ruled out in the embedded condition. Bobaljik & Wurmbrand (2012) assume Quantifier Raising, which should be blocked in island environments. Under Frey's (1993) account, reconstruction of the RC-head underneath the embedded universal quantifier would be required for the inverse reading to arise, which is not possible[88]. Only under Pafel's (2005) approach can sense be made of the data. While Pafel predicts unembedded sentences to be unambiguous, there is no additional reason why a relative clause embedding should block inverse readings. Quite the opposite, Pafel specifically mentions relative clauses and their ability for scope inversion, albeit only for object relative clauses like (4.22). Thus, if Pafel's account is adapted to allow for inverse readings in the unembedded condition, then it may also predict them in the embedded condition.

(4.22) die Stücke,   die   jeder   bei der   Abschlussprüfung   gespielt   hat].
         the pieces   *that* *everyone at the*   *final exam*   *played*   *has*
        'The pieces which everyone played at the final exam.'

(Pafel 2005, p. 132)

Apart from the fact that we find values higher than noise-level for 1-emb/neutral, the embedding condition does in general have an effect in the expected direction – deeper embedding reduces the acceptability of inverse and increases the acceptability of surface interpretations across plausibility levels. This is different from the English version in experiment E1, where a single-embedding had no effect at all. In the double-embedded condition the results are not conclusive. The acceptance rate of 16% is slightly higher than the unambiguous control items. However, it is not high enough to clearly indicate ambiguity.

(v)   By-participants: high variability

Figure 4.2 below shows the by-participant distribution for the neutral and IR-biased condition respectively. Both sides show a considerable amount of variability between participants, but even more so in the IR-biased condition on the right side. The bars represent the number of participants who chose the inverse reading to the proportion shown on the x-axis. The left side of Figure 4.2 shows a right-skewed unimodal distribution for all three embedding conditions, but with more variability in 0-emb compared to 1-emb and 2-emb. The right side of Figure 4.2, on the other hand, shows a less clear picture. In 0-emb, even though the number of participants mostly increases with a higher number of inverse scope choices, there is also a distinctive group of 12 participants who reject inverse readings altogether.

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[88] It may be possible to assume reconstruction of the relative clause head into the relative clause under a raising analysis of relative clauses, where the relative clause head is base-generated inside of the relative clause and raises to its surface position. In section 6.2.1, I will show that reconstruction based on a raising analysis does not give the right result in general. However, even ignoring this, Frey's account would still predict only object relative clauses to be ambiguous, but not subject relative clauses, which are the ones used in the experiments at hand. In the case of a subject relative clause, even if the head is reconstructed into the relative clause, it will still be in a position above the second NP, as shown in (i).

(i)   … 'ne [Überwachungskamera]$_i$, die   t$_i$ jeden   Einbrecher   aufgenommen   hat.
         ... a   surveillance camera   *that*   *every   burglar*   *recorded*   *has*
         '...a surveillance camera that recorded every burglar.'

The 1-emb condition shows a centred unimodal distribution, even though there is a lot of variability. The 2-emb condition resembled a bimodal distribution, similar to the English experiment E1, indicating the potential conflict of structural versus pragmatic considerations for a number of participants.
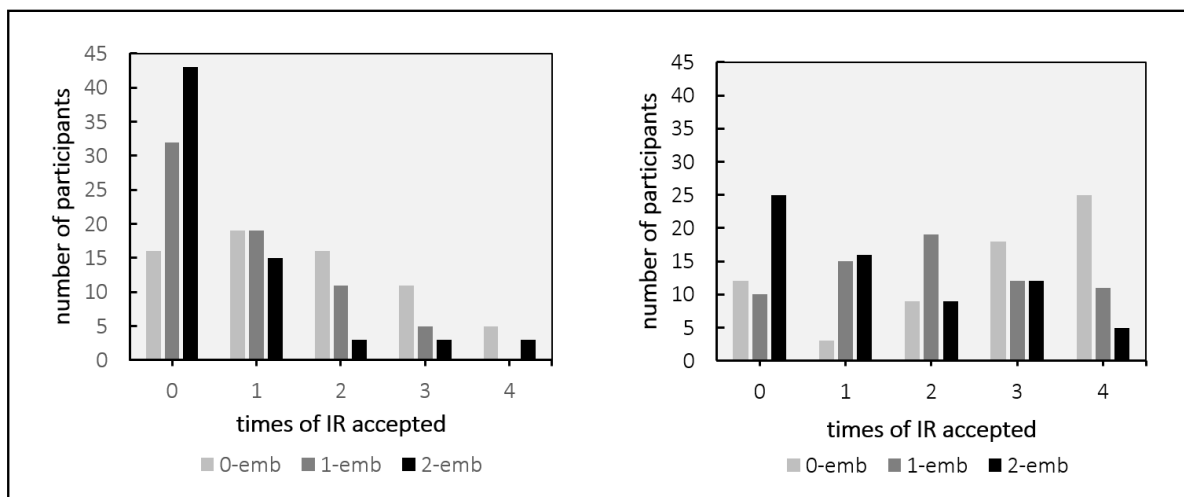
Figure 4.2: By-participant results of experiment G1 in the neutral (left) and biased (right) condition. X-axis shows how many times out of four the inverse readings was accepted.

(vi)   Potential confounds

Because this experiment was identical to the English experiment presented in section 3.2, it contains the same potential confounds. The description of those potential confounds and the arguments why they do not seem to impact the validity of the results can be found in section 3.2.4. In there, I also tested whether there may be an impact of education, as observed in Brooks & Sekerina 2006 and Street & Dąbrowska 2010. In that case, the inverse responses could only be apparent and would actually be incorrect responses from participants who struggle with quantifier interpretation in general. While in the English experiment E1, inverse responses were slightly higher for those participants with lower education, in the German experiment G1, the inverse responses are in fact somewhat higher for the group of participants with higher education, see Table 4.2. Thus, there is no evidence that inverse scope responses in this experiment are only illusory and reflect incorrect responses.

	neutral			biased		
	0-emb	1-emb	2-emb	0-emb	1-emb	2-emb
Bachelor degree or higher (n=20)	49%	26%	14%	71%	54%	33%
High school degree or lower (n= 47)	35%	19%	16%	63%	48%	34%
All (n = 67)	39%	21%	16%	65%	50%	34%

Table 4.2: Results of experiment G1 in proportion of 'yes'-responses to Q-MORE by education level.

There is one more potential confound in G1 that was not present in the English version of the experiment, namely the use of colloquial style speech. One may argue that the items used for the German experiment are somewhat unnatural in that they use a colloquial style, which is usually encountered in spoken, not written, speech. However, considering that through modern media, language

users often write in non-formal ways, such as in chats, forums, on platforms like Twitter, etc., being exposed to the colloquial style used in the items presented above is no longer so unusual. Participants were also prepared in the instructions that they would read colloquial speech and that this should not confuse them. They were instructed to imagine that someone was talking to them or that they were reading this in a social media context. Nevertheless, in order to ensure that the main results are valid independent of choice of speech style, I conducted a follow-up experiment in which the colloquial *'n(e)* was replaced by the full indefinite and any other traces of colloquial speech were removed. This is presented in section 4.5. The results are reassuring that this confound did not play a major role in the results overall, but that using the full indefinite had exactly those consequences that were the reason to replace it in the first place: it supports both a numeral and a specific reading, in contrast to the abbreviated indefinite, thereby reducing inverse scope interpretations.

4.4   Experiment G2: effects of task – testing preference over availability

This experiment was conducted to test for the effect of task on scope interpretation in German. There were two main research questions:

Q1: Can the results of experiment G1 with respect to effects of pragmatics and embedding be replicated?

Q2: What effect does the type of task have on the results of scope interpretation?

In chapter 3, I discussed task effects between experiments of English. The German experiment presented in the following section serves as a direct comparison to the English experiment E2. We will see that, same as in English, task has an effect on participants' responses in reducing the choice of inverse scope across the board. In fact, we will observe that a forced-choice task can completely hide an existent but strongly dispreferred reading. At the same time, it will be shown that results concerning the effect of embedding and plausibility can be replicated from experiment G1.

4.4.1   Methods

(i)   Materials

Design and stimuli were identical to experiment G1, but the task was different. Participants were asked the same kind of forced-choice question as in the English experiment in section 3.3, taken from Anderson (2004). An example for the neutral/0-emb item together with the English translation is given in (4.23). The items were distributed over three lists via a Latin Square design, such that each participant saw a certain target item in only one of the three embedding conditions. Each participant saw 48 target and 48 filler items, that is, 96 items in total. This experiment is parallel to the English experiment E2, see section 3.3.

(4.23) **Neutral/0-emb:**

Context: Der Polizeibeamte hatte vermutet, dass die Einbrecher von neu angebrachten Überwachungskameras aufgenommen worden sein könnten, und tatsächlich hat dann 'ne neu angebrachte Überwachungskamera jeden Einbrecher aufgenommen.

'The police officer hoped that the burglars might be recorded by newly installed surveillance cameras, and then, in fact, a newly installed surveillance camera recorded every burglar.'

Question: Wie viele neu angebrachte Überwachungskameras haben hier insgesamt die Einbrecher aufgenommen?   eine/mehre als eine

'Overall, how many newly-installed surveillance cameras recorded the burglars?   one/more than one'

(ii)   Participants

There were 48 native speakers of German participating in the experiment. They were recruited through the SONA participants pool of the University of Potsdam and could receive a compensation of either 8€ or 1h of course credit. One participant had to be excluded from the analysis because they did not reach the threshold of correctly answering 3/4 of the control filler conditions. Among the remaining 47 participants, 38 were female and 9 were male. The participants were between 19 and 39 years old, with a mean age of 25.

(iii)   Procedure

The procedure was identical to the previous experiments.

4.4.2   Predictions

Experiment G1 tested the availability of inverse scope in German parallel to the English experiment E1, where participants were not forced to choose between readings. The following experiment will test, parallel to the English experiment E2, how forcing participants to make such a choice changes the results. The predictions are the same as in the case of English: Because the surface reading is generally preferred, the judgments should shift in the direction of the surface reading and inverse readings should drop across the board. If the results of experiment G1 are robust, we should see a similar outcome in experiment G2, but with fewer judgments in favour of the inverse reading. Again, we predict this effect to be smaller in the IR-biased condition. Here, the general bias for surface reading is in competition with a pragmatic bias for inverse readings.

4.4.3   Results

Figure 4.3 shows the proportion of 'one'- and 'more than one'-answers in each of the six conditions in comparison to experiment G1. Because this task was forced-choice, the numbers add up to 100%. In the neutral/0-emb condition, participants chose the surface reading in 81% (95% CI: 0.77-0.85) and the

inverse reading in 19% (95% CI: 0.15-0.23) of the cases. In neutral/1-emb and 2-emb, the numbers were almost identical, with SR being chosen in 90% (95% CI: 0.87-0.93) and 92% (95% CI: 0.89-0.95) of the cases respectively, while IR was only chosen in 10% (95% CI: 0.07-0.13) and 8% (95% CI: 0.05-0.11) of the cases. In the biased/0-emb condition, participants chose the surface reading in 33% (95% CI: 0.28-0.38) and the inverse reading in 67% (95% CI: 0.62-0.72) of the cases. The proportion of surface readings increased and the proportion of inverse readings decreased with embedding to 55% (95% CI: 0.50-0.60) SR an 45% (95% CI: 0.40-0.50) IR in 1-emb and 69% (95% CI: 0.64-0.74) surface and 31% (95% CI: 0.26-0.36) inverse reading in 2-emb.
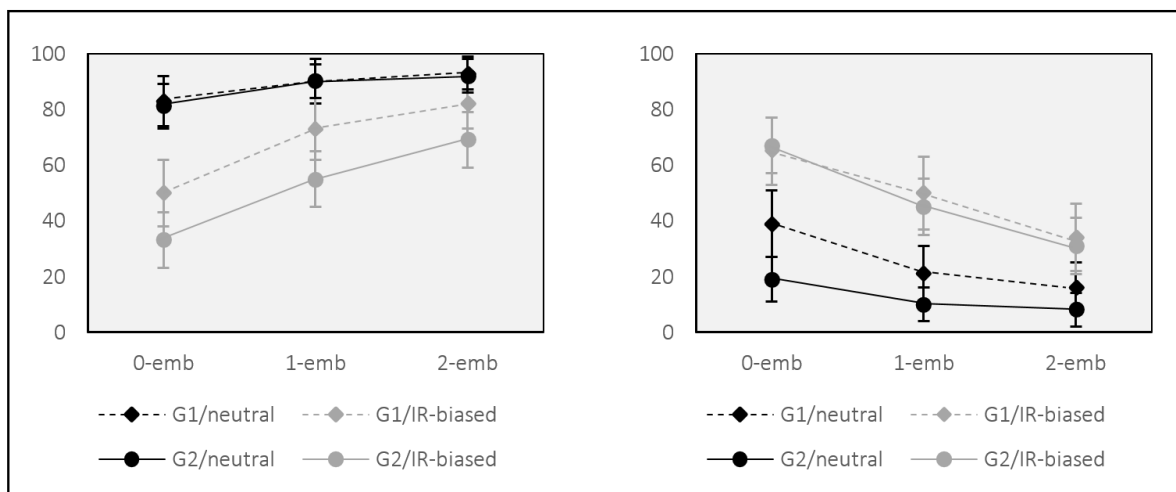
Figure 4.3: Results for experiment G2 (continuous lines) in comparison to experiment G1 (dashed lines) in proportion of SR-responses/'yes' responses to Q-ONE (left) and IR-responses/'yes' responses to Q-MORE (right). Error bars show 95% CI.

The results were analysed in the same way as experiment E2. The analysis revealed a main effect of plausibility, with a significant difference between neutral and biased (p < 0.001) as well as a main effect of embedding with a significant difference between 1-emb and 0-emb (p < 0.001) and 2-emb and 1-emb (p < 0.001). No interaction was significant.

The results for the filler items are given in Table 4.3 below.

	Filler 1: no∀	Filler 2: no∀, 2-emb	Filler 3: referential	Filler 4: each	Filler 5: ∀-∃
One	98%	98%	93%	10%	6%
more than one	2%	2%	7%	90%	94%

Table 4.3: Results of experiment G2 in proportion of 'one- and 'more than one'-answers across all filler/control conditions.

4.4.4 Discussion

(i)   Fillers

Same as in previous experiments, the outcome was in line with the expectations, with 2-7% acceptance of the incorrect answer and 90-98% acceptance of the correct answer. I will again take this as indication that the overall design worked as expected and that participants both understood the task and parsed the sentences in enough depth to answer to questions accordingly. As in previous experiments, I will take the level of incorrect responses as a baseline for the target items. The baseline in this experiment is around 5%, showing the 'noise' in participants' answer. Filler 2 is again reassuring that the mere mentioning of the plural set in the context does not bias towards a plural answer, since this answer was only chosen 2% of the time, which was not higher than in the conditions without plural set, such as filler 1 (2%). Values in the target items that are clearly above ~10% will be taken as indicative of the respective scope reading.

(ii)   Target items: partial replication

Figure 4.3 shows that most of the findings from experiment G1 could be replicated even with the forced-choice paradigm: (i) plausibility strongly influences interpretation, and (ii) deeper embedding reduces the availability of inverse readings. Same as in the previous experiment, the baseline condition neutral/0-emb allowed for scope inversion, contra claims in the literature. While the inverse reading was chosen in only 19% of the cases, this is still considerably higher than the unambiguous control items, which were all around 5% in this experiment. The 1-emb condition, on the other hand, which seemed to be marginally available in experiment G1, is indistinguishable from the 2-emb condition (10% vs. 8%) and also not notably higher than the unambiguous controls. The experiment thus shows that the choice of task has an important impact on the outcome. There results indicate that the forced-choice paradigm can make strongly dispreferred but available interpretations completely disappear. The paradigm used in experiment E1 and G1 seems thus better suited to detect such dispreferred interpretations.

Figure 4.3 shows another remarkable result: when participants are forced to choose between readings, rather than being able to just indicate plain availability, the dispreferred reading is the one that 'loses out'. In the neutral condition, the values for the surface reading are identical between experiments and the values for the inverse readings are lowered. However, we can only see this effect when world knowledge does not provide a bias for any of the readings. In the IR-biased condition, we see the exact opposite pattern: the values for the inverse reading remain unchanged, while the values for the surface reading are lowered. In both cases, this happens equally across embedding conditions. This again highlights both the strong impact of task and pragmatics. World knowledge can turn the surface reading from the preferred to the dispreferred reading. In the IR-biased condition, the inverse reading was chosen over the surface reading in 2/3 of the cases when there was no embedding and even under a single embedding, the values were on a comparable level of around ~50%. Only the double-embedding could really turn this around.

(iii)   *By-participants: high variability*

Figure 4.4 below shows the by-participant distribution for the neutral and IR-biased condition respectively. The left side of Figure 4.4 only shows little variability, while the right side shows a high degree of variability. The bars represent the number of participants who chose the inverse reading to the proportion shown on the x-axis. The left side of Figure 4.4 shows a right-skewed unimodal distribution for all three embedding conditions. The right side of Figure 4.4, on the other hand, shows a bimodal distribution for all three conditions 0-emb, 1-emb, and 2-emb, which is especially pronounced for the two embedding conditions. This may indicate that in the IR-biased condition, but not in the neutral condition, participants are faced with a conflicting situation and employ different strategies to solve it. That is, some participants are more driven by pragmatics and others by structural constraints.
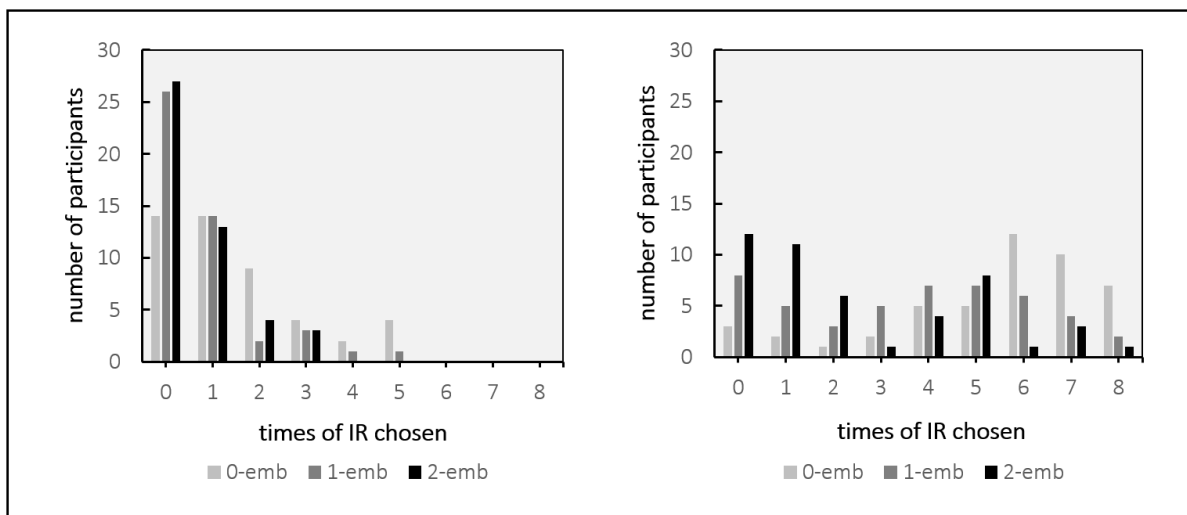
Figure 4.4: By-participant results of experiment G2 in the neutral (left) and biased (right) condition. X-axis shows how many times out of eight the inverse readings was chosen.

Unfortunately, there is no by-participant data being reported in previous experiments on German, therefore it is not possible to compare these results to other experiments. Nevertheless, a high degree of variability was also found in the English experiments in chapter 3 as well as previous experiments on English (Gil 1982, Brasoveanu & Dotlačil 2015). I will compare the respective patterns of by-participant behaviour in German and English in more depth in chapter 6.

4.5   Follow-up experiments

In section 3.2.4 and 4.3.4, I discussed a number of confounds that could potentially have influenced the results of the experiments. However, I also presented arguments why these factors are unlikely to change the main findings of the experiments. Nevertheless, to provide additional support for my arguments, in this chapter I will present three follow-up experiments that control for some of these confounds to provide additional evidence that these concerns are indeed not justified. The first experiment will test for the effect of colloquial speech and the use of the abbreviated rather than the full indefinite. The second experiment will test for the effect of choice of existential, the effect of colloquial speech and the effect of accommodation discussed in section 3.2.4. Finally, the third experiment will

test for accommodation and task-related effects. Because the three experiments are only minimally different from one another, I will present them all together instead of one after another.

4.5.1 Methods

(i)   Materials

The three follow-up experiments differed only minimally from experiment G1. In follow-up 1, the abbreviated indefinite *'n* was replaced by the full indefinite *ein*, which in German is morphologically identical to the numeral *one*. In follow-up 2, the abbreviated indefinite *'n* was replaced by the modified numeral *genau ein* (= exactly one). In both experiments, all colloquial expressions were removed. In follow-up 3, no change was made to the items, i.e. the abbreviated *'n* was kept, but the two questions were replaced by two abstract pictures in the style of Gillen (1991) or Bott & Radó (2007), as exemplified in Figure 4.5.
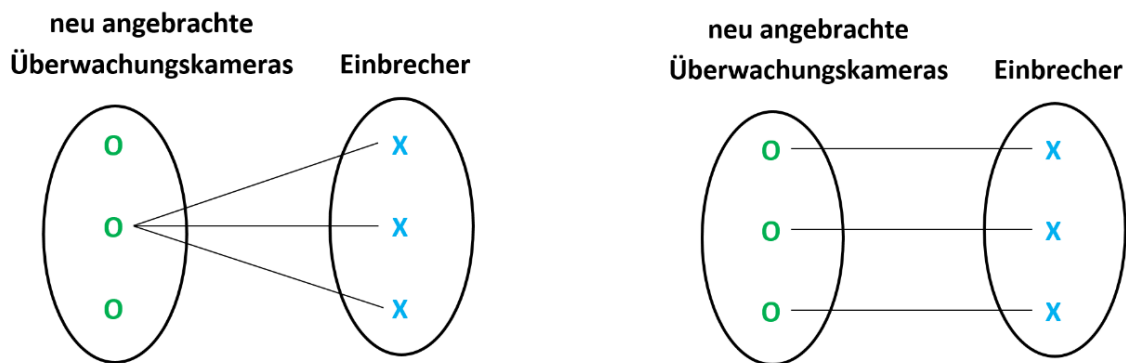
Figure 4.5: Picture materials P-ONE for SR (left) and P-MORE for IR (right) for follow-up 3.

(ii)   Participants

In follow-up 1, 29 native speakers of German participated. They were recruited through the SONA participants pool of the University of Potsdam and received a compensation of either 8€ or 1h of course credit. Three participants had to be excluded from the analysis because they did not reach the threshold of correctly answering 3/4 of the control filler conditions, thus resulting in 26 (22 female, 4 male) participants being analysed. They had a mean age of 29 (19-63) years. In follow-up 2, 31 native speakers of German participated. They were recruited through the SONA participants pool of the University of Potsdam and received a compensation of either 8€ or 1h of course credit. Four participants had to be excluded from the analysis because they did not reach the threshold of correctly answering 3/4 of the control filler conditions, thus resulting in 27 (21 female, 6 male) participants being analysed. They had a mean age of 25 (19-59) years. In follow-up 3, 36 native speakers of German participated. They were recruited through the online platform Prolific and received a compensation of £7. No participant had to be excluded from the analysis, thus resulting in 36 (11 female, 25 male) participants being analysed. They had a mean age of 28 (18-50) years.

(iii)   Procedure

The procedure of follow-up 1 and 2 was identical to experiment E1 and G1. In follow-up 3, participants were instructed to indicate if the picture represents a possible interpretation of the sentence.

4.5.2   Predictions

(i)   Follow-up 1

In follow-up 1, the abbreviated indefinite was replaced by a full-indefinite and no colloquial speech was used. The original reason in favour of the choice for the abbreviated form was to exclude a numeral or specific reading, which could artificially reduce the availability of inverse readings. A second reason was that it allowed to control for intonation, thereby excluding an IR-supporting prosodic pattern. If the full indefinite does indeed give rise to numeral and specific interpretations, we expect a reduction of inverse readings across the board, even though the effect should be strongest in the neutral condition. Considering the implausibility of the surface reading in the IR-biased condition, it is less likely that participants opt for a numeral or specific interpretation if it results in a highly unlikely scenario. Further, the effect of embedding in and of itself is already so strong that the additional effect of a numeral/ specific interpretation may play a smaller role compared to the unembedded condition. At the same time, if in the presence of the full indefinite, participants can silently read the sentences under an IR-boosting prosody (Krifka 1998), then we would actually predict an increase in inverse readings. This effect should occur across the board. However, as before, it should have the biggest effect in the unembedded condition, where inverse readings even without a special prosodic pattern are clearly available, as well as in the neutral condition, where prosody may counteract the general SR preference. If both of these factors – numeral/specific reading and IR-boosting prosody – have an impact, they might actually cancel each other out, resulting in a pattern similar to what we encountered in experiment G1. If colloquial-style speech indeed had a confounding factor, we should see it in a pattern different from any of the three possible outcomes described above. If, however, the results resemble one of the predictions described above, this supports the original choice of using the abbreviated form, which excludes the confounding factors of numeral/specific interpretations or prosody.

(ii)   Follow-up 2

In follow-up 2, the abbreviated indefinite was replaced by the modified numeral *genau ein* (= exactly one). This removed the potential issue of colloquial speech same as follow-up 1. At the same time, it also controls for the accommodation confound discussed in section 3.2.4. The expression *exactly one newly installed surveillance camera* excludes the possibility of accommodating more newly installed surveillance cameras which have not been explicitly mentioned in the context. At the same time, however, we expect a reduction of inverse readings due to the numeral. Tsai et al. (2014)/Scontras et al. (2017) show that even the bare numeral *one* in English leads to a severe reduction in scope inversion compared to the indefinite *a*. Thus, a reduction in inverse readings compared to experiment G1 would not directly allow for the conclusion that the responses interpreted as inverse readings were an illusion created by the accommodation confound. From this reduction effect alone we could not differentiate between the possible reasons for it – accommodation, numeral, or both. However, if participants still

accept inverse readings even with the IR-suppressing expression *exactly one*, this would provide strong support for the conclusion drawn from experiment G1 and G2 that German does indeed allow for scope inversion.

(iii)   *Follow-up 3*

Follow-up 3 used the same items as experiment G1 but the two question types were replaced by two picture types, shown in Figure 4.5 above, representing the surface and inverse reading. This experiment controlled for the accommodation confound, just like follow-up 2: this confound said that participants might have merely accommodated other cameras that are not explicitly mentioned in the context. In this case, they would give the 'yes'-response to Q-MORE without having an inverse interpretations at all. In follow-up 3, on the other hand, they should still reject the picture on the right side in Figure 4.5. Under the surface reading, even if there are accommodated cameras, there is still this one camera that records all burglars. Surface reading + accommodation should therefore only be true in a scenario like e.g. Figure 4.6.
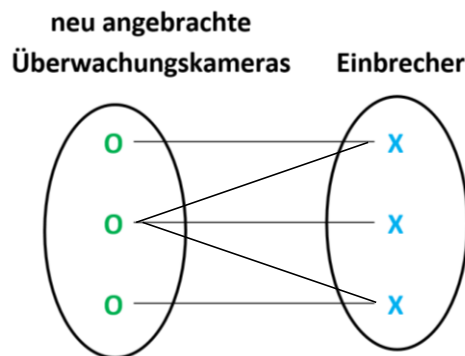
Figure 4.6: Visual representation of interpretation of surface reading + accommodation

Follow-up 3 had a second purpose in controlling for task effects or any possible misunderstandings about the questions. In the experiments presented so far, we found that speakers of German and English seem to obtain inverse readings even in contexts that were previously deemed unambiguous, such as relative clauses. How then can we be certain that the questions themselves do not also contain a hidden ambiguity? The questions Q-ONE and Q-MORE might have also been understood in more than one way, even though they were originally designed with the purpose to disambiguate. With the pictures, on the other hand, this problem is excluded, as no linguistic material is involved.

4.5.3   Results

The descriptive results for follow-up 1, 2 and 3 are shown in Figure 4.7 and 4.8. In follow-up 1, the surface reading was accepted in 80% (95% CI: 0.71-0.87), 87% (95% CI: 0.78-0.92), and 90% (95% CI: 0.83-0.95) in 0-, 1-, and 2-emb in the neutral condition, and in 54% (95% CI: 0.44-0.64), 71% (95% CI: 0.61-0.80), and 74% (95% CI: 0.65-0.82) in the IR-biased condition. The inverse reading was accepted in 25% (95% CI: 0.17-0.34), 17% (95% CI: 0.11-0.26), and 16% (95% CI: 0.10-0.25) in 0-, 1-, and 2-emb in the neutral condition, and in 68% (95% CI: 0.58-0.77), 50% (95% CI: 0.40-0.60), and 35% (95% CI: 0.26-0.45) in the IR-biased condition. The analysis of follow-up 1 revealed a main effect

of plausibility, with a significant difference between neutral and biased ($p < 0.001$) as well as a main effect of embedding with a significant difference between 1-emb and 0-emb ($p < 0.001$) and 2-emb and 1-emb ($p < 0.05$). No interaction was significant.
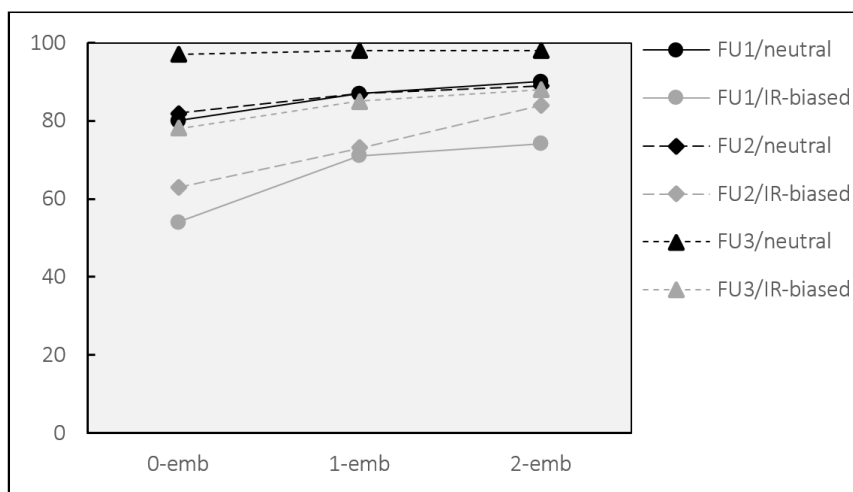
Figure 4.7: Results of follow-up 1 ('ein'), 2 ('genau ein'), and 3 (pictures) in proportion of 'yes'-answers across conditions for Q/P-ONE.
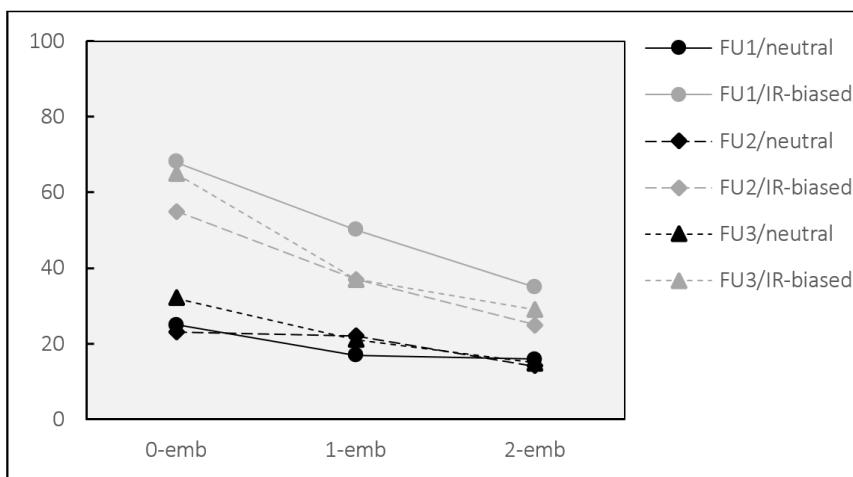
Figure 4.8: Results of follow-up 1 ('ein'), 2 ('genau ein'), and 3 (pictures) in proportion of 'yes'-answers across conditions for Q/P-MORE.

In follow-up 2, the surface readings was accepted in 82% (95% CI: 0.73-0.88), 87% (95% CI: 0.79-0.93), and 89% (95% CI: 0.81-0.94) in 0-, 1-, and 2-emb in the neutral condition, and in 63% (95% CI: 0.53-0.72), 73% (95% CI: 0.64-0.81), and 84% (95% CI: 0.76-0.91) in the IR-biased condition. The inverse reading was accepted in 23% (95% CI: 0.16-0.32), 22% (95% CI: 0.15-0.31), and 14% (95% CI: 0.08-0.22) in 0-, 1-, and 2-emb in the neutral condition, and in 55% (95% CI: 0.45-0.64), 37% (95% CI: 0.28-0.47), and 25% (95% CI: 0.17-0.34) in the IR-biased condition. The analysis of follow-up 2 revealed a main effect of plausibility, with a significant difference between neutral and biased ($p < 0.001$) as well as a main effect of embedding with a significant difference between 1-emb and 0-emb ($p < 0.001$) and 2-emb and 1-emb ($p < 0.01$). No interaction was significant.

In follow-up 3, the surface readings was accepted in 97% (95% CI: 0.92-0.99), 98% (95% CI: 0.94-1.00), and 98% (95% CI: 0.94-1.00) in 0-, 1-, and 2-emb in the neutral condition, and in 78% (95% CI: 0.71-0.85), 85% (95% CI: 0.79-0.91), and 88% (95% CI: 0.81-0.92) in the IR-biased condition. The inverse reading was accepted in 32% (95% CI: 0.24-0.40), 21% (95% CI: 0.15-0.28), and 15% (95% CI: 0.09-0.21) in 0-, 1-, and 2-emb in the neutral condition, and in 65% (95% CI: 0.57-0.73), 37% (95% CI: 0.29-0.45), and 29% (95% CI: 0.22-0.37) in the IR-biased condition. The analysis of follow-up 3 revealed a main effect of plausibility, with a significant difference between neutral and biased (p < 0.001) as well as a main effect of embedding with a significant difference between 1-emb and 0-emb (p < 0.001), but there was no significant difference between 2-emb and 1-emb. No interaction was significant.

4.5.4   Discussion

As can be seen above, the results of follow-up 1 were very similar to experiment G1. The acceptance of inverse readings dropped in the neutral/0-emb condition from 39% to 25%, while in the other conditions, the values remained at a similar level. This is in line with the predictions for an impact of specific/numeral readings. The effect is especially strong in the baseline condition, while in the IR-biased and the embedding conditions this effect was overpowered by the influence of pragmatics and syntax respectively. However, even under the force of the specific/numeral readings, participants accept the inverse readings in one out of four cases, which is far from the noise-threshold of about 10% that we find in the fillers. This experiment thus provides additional support that inverse readings do exist in the types of German sentences tested here. There is no sign that the colloquial register of experiment G1 caused any confusion for participants. The fact that inverse readings dropped in the critical neutral/0-emb condition just as predicted is additional support that the original choice of the abbreviated indefinite was justified.

Follow-up 2 shows similar results as follow-up 1 with the one difference that the modified numeral additionally caused the inverse readings to drop by about ten percentage points in the IR-biased condition across all three embedding conditions. This indicates that in contrast to the bare numeral/indefinite, the modified numeral has a stronger effect in that it even competes with the strong factor of pragmatic bias. However, in the critical neutral/0-emb condition participants again accepted the inverse reading in about one out of four times, just as in follow-up 1, strengthening the claim that scope inversion is possible in the German sentences tested here.

Follow-up 3 also provides similar results to experiment G1. This time, there is only a very small decrease of inverse readings in the neutral/0-emb condition from 39% to 32%. The only somewhat larger drop in inverse readings is in the IR-biased/1-emb condition. This shows that accommodation, if at all, did not play a major role and that the claim that inverse readings are possible in German can be maintained. In fact, the much more pronounced effect occurred with the picture depicting the surface reading. Here, in contrast to all previous experiments, we have the ceiling effect in the neutral condition that we originally predicted. Even in the IR-biased condition, the values have increased. This may be an indication that only Q-ONE, but not Q-MORE, was ambiguous in some way that caused the non-ceiling results. Another possibility is that,a picture might render the surface interpretation more

prominent. It could be that participants, when starting a new trial, first looked at the picture and then read the target sentence. In that case, they would have already conceptualized a scenario with the depicted reading before even reading the sentence. Since the surface reading is generally easier to obtain, the effect might have been particularly strong in that case.

4.6   Summary

Chapter 3 provided an overview of previous theoretical and experimental work on German quantifier scope and added two main experiments and three follow-up experiments to this body of work. There are a number of important findings. First, all five experiments provide support for the claim that inverse readings of a universal object over an existential subject are available in simple clauses in German. While there was some variation across experiments in the number of times participants accepted the inverse reading (19%-39%) – depending on the choice of task and existential quantifier – the findings still point in the same direction. Specifically experiments G1 and G2, where prosody was also taken into account, offer results that cannot be explained by any of the theoretical accounts on quantifier scope discussed in section 4.1. While both Pafel's (2005) and Bobaljik & Wurmbrand's (2012) account could in principle be modified by adding additional factors or constraints that make them align with the data at hand, this cannot be done with Frey's (1993) account. This is in line with experimental work of Bott & Schlotterbeck (2012) and Radó & Bott (2018), who provide data from other sentence constructions in German. Their results were also neither fully in line with the predictions in Pafel (2005) nor in Frey (1993), but still more so with the former than the latter.

The second important finding is that a relative clause embedding significantly decreased the availability of inverse readings. Whether or not inverse readings are available in relative clauses cannot conclusively be answered. While in experiment G2 the values were no different from unambiguous control items (10%), in the other four experiments the values were at least slightly above that level (17-22%). Thus, there is some evidence that scope inversion is not completely banned across relative clause boundaries, but additional research would be required. The results for the doubly-embedded sentences do not provide any evidence that inverse readings are available, since the acceptance rates were around the same level or only marginally higher than the unambiguous control sentences (8%-16%). A third important point is that the impact of pragmatics could be clearly seen across experiments and across conditions. However, as discussed in section 4.5.4, the influence of a pragmatic bias varies depending on other factors that may counteract it. While the by-participant data shows that for some participants pragmatics only boosted a reading that was already available but difficult to obtain, with other participants it is not clear whether the pragmatic bias made a dispreferred reading available or whether they were just willing to ignore grammar in their responses for the sake of plausibility. The by-participant data clearly revealed that there is a certain amount of variability between participants in that some speakers reject inverse readings across-the-board, while for others, they are marginally or even readily available.

5 Quantifiers and Quantifier Scope in Asante Twi (Akan)

The following chapter will depart from the previous two chapters on German and English in that I will take a much broader perspective on the phenomenon of quantifier scope in Asante Twi. Instead of conducting experiments parallel to chapter 3 and 4, I will provide fieldwork data on the quantifier scope phenomenon in Asante Twi in various environments. There are several reasons as to why this chapter is set up in this way. While for both German and English, several theoretical accounts have been proposed and numerous experiments have been conducted already, which provide a general background on quantifier scope, the same is not true for Asante Twi. Indeed, no work has been specifically dedicated to quantifier scope phenomena in Asante Twi before. While in German and English, I picked out specific research questions based on previous theoretical and experimental work, this cannot be done in the case of Asante Twi, where no such previous work exists. The approach I take here is therefore of more exploratory nature. I will, nevertheless, sketch out a proposal for a future experiment that parallels the experiments conducted for English and German in chapter 3 and 4[95]. To that extent, I will also target multiple issues that arise when trying to conduct a cross-linguistic study between unrelated languages, such as Asante Twi versus English/German, compared to closely related languages, like German and English. A second difference to the previous chapters is that I will not only look at quantifier scope specifically, but also at determiners/quantifiers in Asante Twi. The reason is, again, that quantifiers in Asante Twi are generally less extensively researched compared to similar expressions in English and German. In order to determine, which determiners can be used in which environments to study quantifier scope adequately, it is necessary to gain a basic understanding of the behaviour of these expressions. Since I cover such a wide range of phenomena in Asante Twi, I will provide a general background on the grammar of Asante Twi first, with an emphasis on those aspects that will also be picked up again in subsequent sections.

This chapter is structured in the following way: I will start with providing some general background information on the grammar of Asante Twi in section 5.1. I will then present the methods that I used in my fieldwork research in section 5.2. I will proceed to discuss certain aspects of the quantifier and determiner system in Asante Twi. Specifically, in section 5.3, I will present data on the indefinite article *bí*, which I will show is best treated as a contextually restricted existential quantifier. In section 5.4, I will present a unified analysis of the definite and indefinite use of bare NPs, claiming that it is best understood to always project a full DP, encompassing the meaning of an unrestricted existential quantifier. In section 5.5, I will discuss the quantifier *biara*, which is highly underspecified and can receive the interpretation of a universal quantifier, a free-choice item, and a negative polarity item, depending on the context. After having established the facts about the Akan determiner and quantifier system, I will then proceed to fieldwork on quantifier scope ambiguities in section 5.6. I will provide data on quantifier scope in different types of environments: transitive sentences, double object and serial verb constructions. I will also look at interpretational possibilities in more complex structures, such as

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[95] This thesis was originally planned to additionally comprise experiments in Asante Twi parallel to English and German. Unfortunately, it was not possible to actually conduct these experiments. Recurring travel restrictions due to the COVID-19 pandemic made it impossible to travel to Ghana to gather data from a large number of participants. Conducting these experiments online instead revealed additional difficulties that could not easily be resolved. In this thesis, I will therefore only provide a proposal for the planned experiments.

sentences with left-dislocated material (focus, ex-situ wh-questions) and subordinated clauses (complement clauses, relative clauses, temporal adjuncts). We will see that, generally, inverse readings are available in Akan, but highly dispreferred. They are more readily available, whenever reconstruction can take place. Inverse readings are usually rejected with the indefinite *bí*, but more readily available with the numeral *baako* and even more so with the bare noun. Inverse readings are mostly rejected across clause or island boundaries, but they still do not seem to be blocked across the board. In section 5.7, I will sketch out an experiment on quantifier scope in Asante Twi that has the potential to complement the German and English experiments presented in chapter 3 and 4. There, I will also target difficulties that arise with conducting cross-linguistic experiments between unrelated languages.

5.1   Overview of the grammar of Asante Twi (Akan)

This section is meant to provide a brief summary of the most important aspects of the Akan grammar, which Asante Twi is a subdialect of. Because I will cover a much broader range of topics in chapter 5 compared to chapters 3-4, a general background on the language will be helpful for readers unfamiliar with the Akan language to be able to follow the subsequent discussion. I will focus mostly on those aspect that will be relevant to the topics discussed in the remainder of this chapter.

Akan is a Kwa language, a branch of the Niger-Congo family, mainly spoken in Ghana and the Ivory Coast. Akan is the largest L1- and L2-language spoken in Ghana. There are two large dialectal groups with a number of sub-dialects: Twi and Fante. The three dialects Asante (Twi), Akuapem (Twi), and Fante have their own literary standard. Spelling can therefore vary between text sources and speakers. Akan is represented on many levels of public life in Ghana: it is the language of instruction throughout the first years of school, it is taught as a subject at schools and studied at universities. It is spoken in church, it is the primary language in trading, and it is used in various forms of media.

In subsequent sections, I will focus solely on the Asante Twi dialect, as I gathered data from speakers of this dialect only. I will therefore only talk about Asante Twi from here onwards, even though much of what is written in here may extend to other dialects of Akan or the Akan language in general.

(i)   Phonology

The Asante Twi alphabet is based on the Latin alphabet and consists of 22 letters (a b d e ɛ f g h i k l m n o ɔ p r s t u w y). The vowels follow a vowel harmony and divide into five tensed vowels (+ATR), five non-tensed vowels (-ATR), and five nasal vowels. There are also three tones: high, mid, and low. Even though there are only few minimal pairs, these tones can cause meaning distinctions on both the lexical as well as the grammatical level. A special feature of Asante Twi tones is tone terracing. Like many other authors (e.g. Boadi 1974, Saah 1994, Amfo 2010a/c, Ofori 2011) I will only mark tone where it is needed for disambiguation.

(ii)   Syntax & pronoun system

Asante Twi is an SVO language with strict word order. Noun phrases follow the order: Possessive/Demonstrative > Noun > Adjective > Numeral > Quantifier/Article > Preposition > Relative

Clause. Asante Twi has no case system, nouns are only marked for number. Asante Twi pronouns are inflected for person and number, but not for gender. Subject marking is obligatory, but 3rd person inanimate objects may be dropped.

(iii)   Serialization

Asante Twi has intransitive, transitive, and ditransitive verbs. Serialization is a phenomenon where two or more verbs occur in a series without any coordinating or subordinating markers. The verbs typically share the same subject, but there is variation as to sharing of the object. Semantically, the two actions described by the two verbs are not interpreted as to distinct, independent events. Instead, a serial verb construction (SVC) encodes a certain degree of semantic integration of the two (or more) events. Osam (1994) distinguishes two different types of serialization in Asante Twi: *clause chaining* (CC), see (5.1a), and *integrated serial verb constructions* (ISVC), see (5.1b). The difference between the two categories is the degree of semantic integration. In clause chaining, the different events occur successively or simultaneously, but their degree of integration is rather weak. This is also shown by the fact that conjunctions may be introduced without rendering the sentence ungrammatical. According to Osam, this is therefore not an actual form of SVC. ISVC, on the other hand, describes a unitary rather than sequential event, and many such verb sequences are lexicalized, e.g. *gye di* (= to believe, literally 'take eat'). Asante Twi only has a few ditransitive verbs that can be used without serialization construction, see (5.2a). However, even for these verbs, serialization is always an option too, see (5.2b). In serialized ditransitive constructions in Asante Twi, the word order is Theme > Goal. In non-serialized ditransitive constructions, this order is reversed. In both types of SVC, clause chaining and integrated serial verb construction, all verbs are marked for tense/aspect, apart from instances of grammaticalization (see also Duah 2013, Ansre 1966). The verb *de* is such a case, see the example (5.2b).

(5.1) a. Araba   **tɔ-ɔ**   nam   **kyew-ee**   ø   **tɔn-ee**   ø
          Araba   buy-PAST   fish   fry-PAST   3SG.OBJ   sell-PAST   3SG.OBJ
          'Araba bought fish, fried it, and sold it.'
      b. Akosua   **yɛ-ɛ**   asɔr   **ma-a**   Yaw
          Akosua   do-PAST   prayer   give-PAST   Yaw
          'Akosua prayed for Yaw.'

                                                                                    (adapted from Osam 1994, p. 194)

(5.2) a. Kofi   **ma-a**   Kwame   nwoma.
          Kofi   give-PAST   Kwame   book
          'Kofi gave Kwame a book.'
      b. Kofi   **de**   nwoma   **kɔ-ma-a**   Kwame.
          Kofi   take   book   go-give-PAST   Kwame
          'Kofi gave Kwame a book.'

(iv)   Aspect & tense

Asante Twi has a very pronounced aspectual system. Osam (1994) lists the following forms: completive/perfective, perfect, progressive/incompletive/imperfective, continuative, habitual, future, consecutive. They are mostly expressed through prefixes, tone change, or doubling. Osam (2008)

suggests that Asante Twi is a mainly aspectual language with only a two-way tense-distinction of future/non-future. Sakyi (2019) suggests an analysis according to which the different verbal affixes code both tense and aspect at the same time.

(v)   Topicalization and focalization

Asante Twi has a special syntactic construction for focused and topicalized elements, where the respective element is fronted. Almost all elements in a sentence can be placed in topic or focus position (Osam 1994). However, neither focused nor topicalized elements obligatorily appear fronted: the ex-situ focus position is associated with strong exhaustivity and contrastivity (Duah 2015, Grubic et al. 2019, Titov 2019). Only the subject appears ex-situ obligatorily (Saah 1994). The ex-situ topic position is fully optional and is also associated with contrastivity and exclusivity (Amfo 2010b). When the focused element appears ex-situ it is followed by the particle *nà* and a resumptive pronoun takes its base position[96], compare (5.3) to (5.4). The same holds for a topicalized element, but with the particle *deɛ* (Titov 2019, Korsah & Murphy 2020), see (5.5). Both a movement (Boadi 1974, Korsah 2017, Korsah & Murphy 2020) and a base generation account (Saah 1988, Saah 1994, Saah 2010, Ofori 2011) exist for the focus construction. Korsah (2017) and Korsah & Murphy (2020) argue that the topic construction, despite its superficial similarity to the focus construction, does not constitute an instance of movement.

(5.3)   Ama   tɔ-ɔ   nwoma.
         Ama   buy.PAST   book
         'Ama went home.'

(5.4)   Ama   **na**   ɔ-tɔ-ɔ   nwoma.
         Ama   FOC   3SG.buy.PAST   book
         'It is Ama who bought a book. / AMA bought a book.'

(5.5)   Ama   **deɛ**   ɔ-tɔ-ɔ   nwoma.
         Ama   TOP   3SG.buy.PAST   book
         'As for Ama, she bought a book.'

(vi)   Questions

Polar questions in Asante Twi have the same word order as assertions and are only marked with a tone change. Optionally, the question marker *anaa* is added to the end of the sentence. For wh-questions,

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[96] Boadi (1974) also mentions two other focus constructions, which have the structure of a cleft and a pseudo-cleft respectively, see (i) and (ii). In what way these different constructions may be derived from one another has been subject to debate (Boadi 1974, Ofori 2011). I will not discuss these constructions any further, since the following chapters will only target the basic focus construction.

(i)   Onipa   aa   ɔ-tɔ-ɔ   nwoma   ne   Ama.
        person   REL   3SG-buy-PAST   book   FOC   Ama
        'The person who bought a book is Ama.'

(ii)   Ɛ-yɛ   Ama   na   ɔ-tɔ-ɔ   nwoma.
        3SG-COP   Ama   FOC   3SG-buy-PAST   book
        'It is Ama who bought a book.'

there exists both an in-situ and an ex-situ strategy. In the former, the element in question is replaced by a wh-word, but the sentence stays syntactically the same, see (5.6a). In the latter, the question is formed via the focus construction, see (5.6b). The wh-element occurs sentence-initially, followed by the particle *na*. A resumptive pronoun appears in the base position of the questioned element, which is usually null for 3rd person inanimate[97]. While Boadi (1974) and Marfo & Bodomo (2005) argue that the two strategies are synonymous, Saah (1994) and Titov (2019) claim that they differ in their interpretive properties. The speakers consulted for this thesis generally had a preference for the ex-situ strategy and some of them accepted the in-situ strategy only with certain elements or as an echo-question. As with other fronting constructions in Asante Twi, some authors assume a base generation account for the fronted wh-questions (Saah 1988, Saah 1994, Saah 2010, Ofori 2011), while others have suggested a movement account (Boadi 1974, Korsah 2017, Korsah & Murphy 2020).

(5.6) a. Ama   kan-n   **dɛn**?
          Ama   read-PAST   what

      b. **Dɛn**   na   Ama   kann-n yɛ?
          what   FOC   Ama   read-PAST
          'What did Ama read?'

(vii)   Relative clauses

Relative clauses in Asante Twi are head-initial, i.e. the relative clause follows the relative clause head. The relative clause marker (relativizer) is *áà*. Same as in the topic or focus construction as well as in wh-questions, a resumptive pronoun occurs inside the relative clause, occupying the canonical position of the relativized element, see (5.7a) for a subject and (5.7b) for an object relative clause[98]. The head noun can be a bare, a definite or a specific-indefinite noun, as well as a proper name. Also, similar to other embedded clauses, a clausal determiner (no/yi)[99] appears clause-final, which has to match semantically with the head noun (see e.g. Saah 1994, Bombi et al. 2019). Relativization is possible with subjects, direct and indirect objects, possessors, and locative and temporal adjuncts.

(5.7) a. [IP Me-hu-u [NP ɔbaa [CP **aa** [IP Kofi   ware-e   **no**]   no]]].
          1SG-see-PAST   woman   REL   Kofi   marry-PAST   3SG.OBJ   CD
          'I saw the woman whom Kofi married.'

      b. [IP [NP Ɔbaa] [CP **aa** [IP ɔ-ware-e   Kofi]   no]   fi   Aburi].
          woman   REL   3SG.SBJ-marry-PAST   Kofi   CD   be.from   Aburi
          'The woman who married Kofi is from Aburi.'

                                                              (adapted from Saah 2010, p. 92)

(viii)   Quantifier & determiner system

Asante Twi has a three-way article system with the bare noun, the indefinite article *bi*, and the definite article *no,* see Table 5.1. The most common quantificational determiners are given in Table 5.2. The

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[97] See Korsah (2017) and Korsah & Murphy (2020) for details on resumptive pronoun deletion.

[98] In the case of an inanimate antecedent of an object relative clause, the resumptive pronoun is usually null (Saah 1994, Korsah 2017).

[99] These are identical to the distal and proximal demonstratives in Akan.

definite *no* is said to encode familiarity (Arkoh & Matthewson 2013, Owusu 2020), but see also Amfo (2007) and Bombi (2017) for a uniqueness-based account. The indefinite *bi* is considered to encode specificity (Boadi 2005, Amfo 2010a). The bare noun is interpreted as non-specific indefinite in object position, but also as a definite for globally or locally unique elements (Arkoh & Matthewson 2013, Bombi 2017). In subject position, it has been said to either receive a definite interpretation for globally or locally unique elements or result in ungrammaticality otherwise, i.e. it cannot receive an indefinite interpretation in subject position (Bombi 2017, Bombi et al. 2019, Owusu 2020).

determiner	translated as	Interpretation
bi	a (certain) / some	specific indefinite
no	the	familiar definite
bare noun	a / the	non-specific indefinite / definite

Table 5.1: Determiner system in Asante Twi.

Asante Twi	English
NP$_{PL}$ no nyinaa (collective)	all the NP$_{PL}$
NP$_{SG}$ biara (distributive)	every/each/any NP$_{SG}$
NP$_{PL}$ bebree	many/several/a lot/much/most NP$_{SG/PL}$
NP$_{PL}$ pii	many/several/a lot/much/most NP$_{SG/PL}$
mass-NP$_{SG}$ kakra count-NP$_{PL}$ kakra bi	(a) little NP$_{SG}$ (a) few NP$_{PL}$
NP$_{SG/PL}$ bi	some NP$_{SG/PL}$

Table 5.2: Most common quantificational determiners in Asante Twi.

Asante Twi does not have independent negative quantifiers like *no X* in English. Instead, negative quantification is typically expressed via the combination of the negated verb and the universal quantifier. It is also possible to express the same meaning by using the negated verb together with a bare noun. However, the variant with the universal quantifier puts more emphasis on it, similar to putting stress on *any* or adding *at all* or *whatsoever* in English, see (5.8a) and (5.8b). Finally, Asante Twi allows for the combination of multiple determiners in certain cases (Bombi et al. 2019, Owusu 2020), see e.g. (5.9).

(5.8)　a. Ama　　a-n-kan　　　　nwoma.
　　　　　 Ama　　PRF-NEG-read　book
　　　　　 'Ama didn't read a/any book.'
　　　 b. Ama　　a-n-kan　　　　nwoma　　biara.
　　　　　 Ama　　PRF-NEG-read　book　　　every/any
　　　　　 'Ama didn't read any books at all.' / 'Ama read no books whatsoever.'

(5.9) Abaayewa   no   hwɛhwɛ-ɛ   safoa   **bi**   **no**.
       girl   *DEF*   *search-PAST*   *key*   *IND*   *DEF*
       'The girl looked for that particular key.'

5.2 Methodology

(i)   Language consultants

All judgments in the remainder of this chapter stem from four native speakers of Akan who grew up in Ghana and were living in Germany at the time of the study. Due to the COVID-19 related travelling restrictions, local fieldwork or experimental work in Ghana was not possible. All language consultants stated that Akan was their native language and that both their parents were native speakers of Akan as well. All four of them natively spoke the Asante Twi dialect of Akan. Two consultants reported to also speak a second dialect of Akan on a native or native-like level. All speakers spoke English fluently as an L2-language. Three speakers reported at least one additional L2-language with beginner to intermediate proficiency. The consultants were between 24 and 34 years old at the time of testing, three of them were male and one was female. Three of them had a linguistic training background, while one of them had no previous linguistic training. All four speakers had a higher education with a degree of BSc level or higher at the time of the study.

(ii)   Tasks

I used varying types of tasks to elicit the judgments presented in the following sections, depending on the question under investigation. The data on Asante Twi quantifiers in section 5.3-5.5 was often elicited with acceptability/grammaticality judgments. I further used felicity judgments, where a grammatical sentence was judged as felicitous or infelicitous with respect to a preceding sentence, presented in Asante Twi, or with respect to a context providing background information, presented in English. In a few cases, translation tasks were used as well.

The scope data in section 5.6 was mostly elicited with picture-matching tasks, where the availability of a reading was judged by accepting/rejecting an abstract representation of the reading in question, such as in Figure 5.1. Further, truth-value-judgment tasks were employed, where participants judged whether a doubly-quantified sentence truthfully described the scenario in the context. In a few cases, participants also judged if an English sentence was an adequate paraphrase of the doubly-quantified Asante Twi sentence. Finally, besides testing for general availability, I further used forced-choice tasks, similar to the English and German experiments E1 and G1, where participants had to choose between the two readings, thereby providing their preferred interpretation for each item.

Whenever contexts with background information were used, they were presented in English. This was done to avoid using particular structures or expressions in Asante Twi, which could influence the interpretation of the target sentence in an undesired way. The participants did not report to have difficulties with switching between the English context and the Asante Twi target sentence. I largely followed the guidelines provided in Matthewson (2004) for fieldwork in semantics.
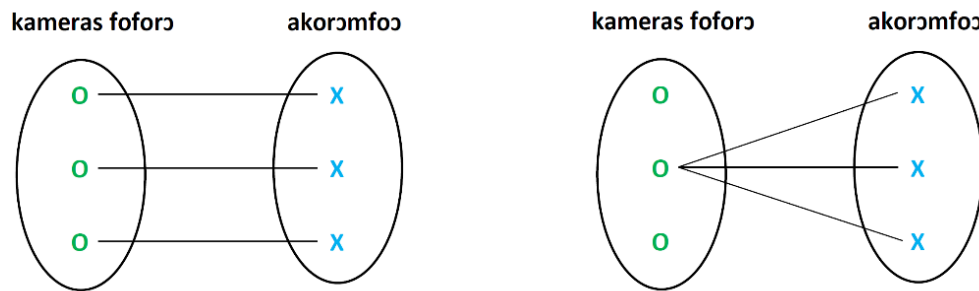
Figure 5.1: Pictures used for picture-matching task in studies on quantifier scope in Asante Twi.

(iii) *Glossing*

Next to sentence examples from my own fieldwork, this chapter will contain many examples from previous literature as well. In order to make it easier for the reader to follow the examples, I adapt glosses from the literature by changing terms and abbreviations to a single standard used throughout this chapter. For example, I will consistently change INDEF/IND for the indefinite article to IND, PERF/PFR for perfect aspect to PRF, etc. I will usually gloss complex expressions which have gone through a lexicalization/grammaticalisation process in their intended meaning, not in their literal meaning, unless the latter is relevant for a particular example. For example a complex verb like *gye di*, which consists of the two verbs *gye* (= 'take/accept') and *di* (= 'eat'), will be glossed with its lexicalized meaning 'believe'. Adaptions of examples from the literature will only affect the glosses, while the example itself, along with its orthographic standard in the original, as well as the English translation will be left unchanged. The glosses and their meaning can be found in the list of glosses at the beginning of this book.

5.3 Indefinite article *bí*

In the previous section we saw an overview of the determiners in Asante-Twi. In this section we will take a closer look at the indefinite determiner *bí*. I will first give a short descriptive overview and then present a number of different analyses that have been put forward in previous literature. I will complement this with data from my own fieldwork, which provides a number of interpretational patterns not discussed in the literature before. I will show that these patterns do not favour an analysis of *bí* as a choice function over an analysis as existential quantifier, as was claimed in previous literature (e.g. Arkoh 2011, Owusu 2020, Duah et al. 2021). I will provide an analysis of *bí* as an existential quantifier, as such an analysis more satisfyingly covers all the data available. Further, such an analysis better matches the pattern of the determiner system of Asante Twi overall, as will become clear in comparison to the bare noun and the universal quantifier *biara*. While a choice function analysis may also capture the data presented in this section, the existential quantifier analysis provides a simpler semantics. I will further claim that additional meaning components suggested in the literature, such as an epistemic, noteworthiness, or identifiability component (Owusu 2019, 2020) are not part of the semantics of the expression itself but all follow on a pragmatic level.

5.3.1 Background on *bí*

The expression *bí* is used as an indefinite article, which has been said to be inherently specific or referential (Amfo 2010a, Arkoh 2011, Duah et al. 2021). Bombi et al. (2019) show that *bí* is indeed a marker of indefiniteness, in contrast to *no*, which is a marker of definiteness. They do this by applying three standard tests of (in)definiteness from Matthewson (1999): (i) *bí* allows plural antecedents, (ii) *bí* can introduce new referents, (iii) *bí* can refer to two different entities of the same kind. The article *bí* can combine both with a singular as well as a plural argument, similar to English *some*. *Bí* can also be found as a morpheme in a number of other quantifiers or quantificational determiners, both existentials as well as universals, which are listed in Table 5.3 below. In this and the subsequent sections, however, I will mainly focus on determiners.

	existentials		universals	
	Asante Twi	**English**	**Asante Twi**	**English**
quantificational determiner	$N_{sg/pl}$ bí	some $N_{sg/pl}$	N_{sg} biara	every / any / each N_{sg}
quantifier	Obi	someone	obiara	every- / anyone
	ebi / biribi	something	ebiara / biribiara	every- / anything

Table 5.3: Quantificational expressions in Asante Twi with *bi* as a morphological root, based on Amfo (2010c), p. 105.

The indefinite determiner has been studied and analysed in varying ways. Amfo (2010a) demonstrates that *bi* can occur with a high (*bí*) or low (*bì*) tone, depending on whether it is used as a determiner or as a pronominal, respectively. The latter can only be used in object position, while in subject position, *obi* or *ebi* have to be used.

	subject	**object**
Bì		x
Obi	x	x
Ebi	x	

Table 5.4: Syntactic positions of the existential pronominal quantifiers in Asante Twi.

According to Amfo, *bi* occupies the position of *referential* or higher on the givenness hierarchy of Gundel et al. (1993), see Table 5.5. This hierarchy orders the different cognitive levels an entity can occupy in the addressee's mind. According to Amfo, when *bi* is used, the speaker has a specific referent in mind, (yet) unknown to the addressee. *Bi* is interpreted as an existential quantifier, quantifying over the set of entities that correspond to the type expressed by the argument (in case of the determiner *bí*) or the antecedent (in case of the pronominal *bì*). Amfo says that the determiner *bí* is more similar to the English expression *a certain* rather than *some* in that it does not only have the function of existentially

quantifying but also expressing relational specificity[100]. It is commonly used in introductory sentences, introducing a novel entity to the discourse. This is in contrast to pronominal *bì*, which does not introduce entities, but only quantifies over entities that belong to the type expressed in the antecedent. Amfo claims that pronominal *bì* is not identical in its properties to the forms *ebi* or *obi* (see Table 5.3 and 5.4 above): *obi* is not inherently specific and *ebi* cannot introduce novel entities, i.e. obligatorily requires an antecedent. According to Amfo, all expressions containing *bi* have obligatory wide scope over negation. Specifically, she states that "[…] *bi*, like English *some*, encodes the information that the quantifier it represents is outside the scope of negation." (Amfo 2010c, p. 107).

in focus	activated	Familiar	uniquely identifiable	referential	type identifiable
currently the centre of attention	currently in short-term memory	represented in the memory	referent can be identified via the noun's semantics	particular object	type of object
ɔ- (he/she) ɛ-/Ø (it) nò (him/her)	ɔno (he/she) ɛno (it/that) N + yi (this N) eyi (this)	saa + N + nó (this N)	N + nó (the N)	N + bí (a certain N) bì (one)	N (an N)

Table 5.5: Givenness hierarchy of Gundel et al. (1993) and the corresponding expressions according to Amfo (2010a), adapted from p. 1791.

In contrast to Amfo (2010a), Arkoh (2011)[101] considers pronominal *bì* to be toneless, since its tone varies depending on its position in the sentence. Similar to Amfo, she defines pronominal *bì* as a specific indefinite pronoun, following the definition of specificity described in Enç (1991). Both mass and count nouns can serve as antecedents, similar to the English pronominal use of *some*/*one*, see (5.10). However, this does not apply to contrastive one-anaphora, which is only expressed with a bare modifier rather than *bì* in Asante Twi, see (5.11).

(5.10) Ésí   tó-ɔ̀   àsòmàdzí.   Máá-só   mì-tó-ɔ̀   **bì**.
       Esi   buy-PAST   earrings   *1SG-too*   *1SG.SBJ-buy.PAST*   *some*
       'Esi bought earrings. I bought one too.'

(adapted from Arkoh 2011, p. 25)

(5.11) Kwésí wò   mpɔbòwá   tùmtúm.   Yaw   wò   fítáá.
       Kwesi have   shoes   *black*   *Yaw   have   white*
       'Kwesi has black shoes. Yaw has white ones.'

(adapted from Arkoh 2011, p. 26)

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[100] In my own fieldwork, native speakers have often intuitively translated *bi* with *a certain*.
[101] Note that the judgments in Arkoh (2011) and Arkoh & Matthewson (2013) are mainly based on judgments from speakers of the Fante dialect. While one speaker from the Asante Twi dialect was consulted, too, there might still be some limitations in extending their results to other dialects.

As for the determiner *bí*, Arkoh claims it to be referential in the way described in Fodor & Sag (1982). According to Fodor & Sag, indefinites in English are ambiguous between a quantificational and a referential reading. In Asante Twi, however, these two meanings are expressed in two different ways: the bare noun is quantificational and *bí* is referential. Referentiality in the sense of Fodor & Sag entails scopelessness. Arkoh takes the examples in (5.12) as evidence for *bí*'s scopelessness, showing that it cannot be in the scope of *kakra* (= few/a few) or *nyinaa* (= all). That is, in both (5.12a) and (5.12b), the interpretation is that there is only a single child, which was caned by several/all teachers.

(5.12) a. Àkyìrèkyírènfʊ́ **kàkrá** hwí-ì àbòfrá **bí**.
        teachers *few* *cane-PAST* *child* *IND*
        'Few teachers caned a (certain) child.'
     b. Àkyìrèkyírènfʊ́ **nyìnáá** hwí-ì àbòfrá **bí**.
        teachers *all* *cane-PAST* *child* *IND*
        'All (the) teachers caned a (certain) children.'

(adapted from Arkoh 2011, p. 40-41)

Arkoh also claims that *bí* has to adhere to Ionin's (2006) condition of noteworthiness, comparable to the indefinite use of English *this* (as in "There is this girl…"). That is, *bí* is infelicitous if there is nothing 'special' or 'noteworthy' about the entity it refers to. Arkoh analyses *bí* as a skolemized choice function à la Winter (1997), Reinhart (1997) or Kratzer (1998). The main argument for a choice function analysis is the intermediate scope interpretation that Arkoh claims to be apparent in sentences like (5.13). Under this reading, the books vary with the teachers but not with the children. That is, for each teacher, there is a different book for which it is the case that any child who reads this book receives a gift.

(5.13) Kyìrèkyírènyí **bíárá** kyɛ́-ɛ̀ àbòfrá **bíárá** áà ò-káǹ-n
        teacher *every* *give-PAST* *child* *any* *COMP* *3SG.SBJ-read-PAST*
        búúkùú **bí** àdzí.
        book *IND* *thing*
        'Every teacher gave any child who read a (certain/specific) book a gift.'
        ✓∀ (teacher) > ∃ (book) > ∀ (child)

(adapted from Arkoh 2011, p. 46)

Arkoh shows that when *bí* is c-commanded by *biara*, it can be interpreted with narrow scope, see (5.14). Arkoh therefore follows Kratzer (1998) in claiming that the *bí*-DP contains an implicit variable, the skolem variable. This variable can be bound by another quantifier like *biara,* which then gives rise to the dependent (= narrow-scope) reading. Or it can remain free (bound under contextual assignment), giving rise to the referential (= wide-scope) reading.

(5.14) Kyìrèkyírènyí **bíárá** hwí-ì àbòfrá **bí**.
        teacher *every* *cane-PAST* *child* *IND*
        'Every teacher caned a (certain/specific) children.'
        ✓biara > bi

(adapted from Arkoh 2011, p. 43)

Bombi et al. (2019) follow Arkoh (2011) in analysing *bí* as a choice function rather than as an existential quantifier. This is mainly based on the exceptional wide scope behaviour of *bí* (see also section 2.2.4). An example is given in (5.15). Conditional clauses are islands for movement and do not allow quantifiers to take scope from a position outside of the clause. Nevertheless, such a reading is available in Asante Twi[102]. The sentence can mean that there is this one elder such that, if he comes, we will pass the law. Further, as discussed in Reinhart (1997), a true quantificational wide-scope reading in conditionals should also give rise to a distributive reading, which according to Bombi et al. is not the case in Asante Twi, as shown in (5.16). The sentence cannot mean that if *any* of these three elders come, we will pass the law.

(5.15) **Sɛ** ɔpanyin **bi** ba a, yɛ-bɛ-hyɛ mmra no.
if elder IND come COND 1PL.SBJ-FUT-force law DEF
'If a (certain) elder comes, we will pass the law.'

(adapted from Bombi et al. 2019, p. 12)

(5.16) **Sɛ** mpanyinfoɔ **mmiɛnsa bi** ba a, yɛ-bɛ-hyɛ mmra no.
if elders three IND come COND 1PL.SBJ-FUT-force law DEF
'If three elders come, we will pass the law.'

(adapted from Bombi et al. 2019, p. 13)

Bombi et al. also point out that even though *bí* always takes wide scope with negation, this is not necessarily the case with other operators. In the case of an intensional verb like *pɛ* (= want), both a narrow and a wide scope reading are available, see (5.17). This would be unexpected under an analysis of *bí* as an inherently referential/specific existential quantifier.

(5.17) Ama **pɛ** sɛ ɔkyerɛkyerɛni **bí** ware no.
Ama want COMP teacher IND marry 3SG.OBJ
'Ama wants a teacher to marry her.'
✓pɛ>bí; ✓bí>pɛ

(adapted from Bombi et al. 2019, p. 12)

Finally, Bombi et al. discuss that *bí* can co-occur with the definite determiner *no* as in (5.18). In this way, *bí* resembles more an adjective than a determiner. They take this as another piece of evidence that *bí* cannot be a quantifier.

(5.18) **Pàpá bí nó** bìsá-à mè mè nɔ́mà
man IND DEF ask-PAST 1SG 1SG.POSS number
'After the party, that certain man asked me for my number.'

(adapted from Bombi et al. 2019, p. 8)

Owusu (2020) follows Arkoh (2011) in analysing *bí* as a skolemized choice function. However, she makes three changes to the analysis: (i) *bí* is an epistemic indefinite, (ii) *bí* carries two felicity

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[102] Bombi et al. (2019) admit, though, that Asante Twi seems to allow for overt extraction out of certain islands as well (as was claimed in Saah 1994), which weakens this arguments somewhat. See also section 5.6 on more data on overt extraction and scope inversion in island environments in Asante Twi.

conditions, (iii) *bí* carries a skolem world variable. By adding these further meaning components, she can account for a wider range of data than Arkoh (2011). I will discuss these three assumptions in the following.

First, Owusu (2019, 2020) takes *bí* to be an epistemic indefinite. The epistemic meaning component relates to a lack of full information on the side of the speaker about the entity referred to. This is shown in (5.19), where the question 'guess who?' is infelicitous, since it implies that the speaker knows the exact identity of the referent. Owusu (2019) assumes that this meaning component is a presupposition.

(5.19)   Ama   a-ware   professor   **bi**.
         Ama   *PRF-marry*   *professor*   *IND*
         #wo-hwɛ   a   ɛ-yɛ   hwan?
         2SG.OBJ-look   *COMP*   *3SG-COP*   *who*
         'Ama has married some professor, guess who?'

<div align="right">(adapted from Owusu 2019, p. 268)</div>

Owusu (2019) also claims that *bí* carries two felicity conditions, namely *identifiability* and *noteworthiness* in the sense of Ionin & Matushansky (2006) and Ionin (2013). In the case of noteworthiness, she follows Arkoh (2011), who made the same claim. According to Owusu, only one of these conditions has to be satisfied for a felicitous use of *bí*. She shows this by contrasting *bí* with English *this*, which necessarily has to obey the noteworthiness condition. Therefore, in (5.20), the continuation sentence is odd, while the Asante Twi version in (5.21) is felicitous. This is because, despite violating noteworthiness, (5.21) still satisfies identifiability.

(5.20)   #Mary wants to see this new movie; I don't know which movie it is.

<div align="right">(Ionin & Matushansky 2006, p. 183)</div>

(5.21)   Ama   pɛ   sɛ   ɔ-kɔ-hwɛ   sini   foforɔ **bi**   a   a-ba.
         Ama   *want*   *COMP* *3SG-go-watch*   *movie*   *new*   *IND*   *REL*   *PRF-come*
         Me-n-nim   sini   koro   mpo.
         1SG-NEG-know   *movie*   *one*   *even*
         'Ama wants to see a certain new movie. I don't even know what movie.'

<div align="right">(adapted from Owusu 2019, p. 266)</div>

Owusu (2020) provides a slightly modified version of this analysis, referring to Aloni & Port (2013, 2015) and Aloni (2001, 2008). Here, the property of identifiability is directly related to the analysis of *bí* as an epistemic indefinite. Owusu adopts the previous analysis of Aloni & Port of epistemic indefinites. They claim that identification can happen via the context or via the indefinite and that different methods for identification exist (description, naming, ostension). An epistemic indefinite can only be used felicitously when the method for identification varies between context and indefinite. That is, it can only be used when the speaker cannot name the method of identification required by the context and provides a different method of identification through the indefinite. In order words, *bí* can only be used felicitously, if the speaker has some, but not all the knowledge about the referent to clearly identify her. This is demonstrated in (5.22), where the speaker has enough knowledge to describe certain properties of the referent, but cannot name her. These properties need to be noteworthy. Thus, this

analysis of the specific indefinite *bí* partly goes against the common ad hoc description of specificity as the speaker having a referent in mind, which the hearer cannot be expected to know, e.g. Hawkins (1978), Hellan (1981), Lyons (1999), Mojapelo (2007). Ionin (2006) has argued against this view before: the speaker only has to know *something*, while the state of knowledge of the hearer is irrelevant. It is only about what the speaker considers to be noteworthy.

(5.22) Me-re-hwɛ-hwɛ   professor   bi,   ɔno   na
        1SG.SBJ-PROG-search   *professor*   *IND*   *3SG.SBJ*   *FOC*
        ɔ-yɛ   head of department,   me-n-nim   ne   din.
        3SG.SBJ-COP   *head of department* *1SG.SBJ-NEG-know*   *3.SG-POSS*   *name*
        'I am looking for some professor, he is the head of department but I don't know his name.'
                                                                    (adapted from Owusu, 2020, p. 75)

Owusu (2020) also provides data on how the specificity component of *bí* relates to four different types of specificity that are prominently discussed in the literature: (i) epistemic specificity, (ii) scopal specificity, (iii) referential specificity, and (iv) discourse prominence. *Epistemic specificity* refers to what is commonly described as 'the speaker having a particular referent in mind' (Karttunen 1968, Fodor & Sag 1982, and many others), which was also pointed out in Amfo (2010a) for Akan *bí*. Owusu shows that *bí* can be used for cases where the speaker has a particular referent in mind, but it is not necessary:

(5.23) Sukuuni   bi   wɔ   Kofi   class   a-wia   adeɛ.
        student   *IND*   *be.located* *Kofi*   *class* *PRF-steal*   *thing*
        'A certain student in Kofi's class stole something.'
        Yɛ-frɛ   no   Kofi.
        3PL.SBJ-call *3SG.OBJ*   *Kofi*
        'He is Kofi.'
        Nanso   me-n-nim   nipa   koro.
        but   *1SG.SBJ-NEG-know*   *person*   *one*
        'But I do not know who it is.'
                                                                    (adapted from Owusu, 2020, p. 54)

We are talking about *scopal specificity* when the expression takes obligatory wide scope. However, we have already seen in previous examples that *bí* can take both wide and narrow scope, depending on the operator. This is also pointed out by Owusu. *Referential specificity* means that the referent is fixed. This can be tested with intensional contexts and the respective de-re/de-dicto ambiguities. A referentially specific expression would only allow for the de-re reading. Owusu shows that again, *bí* does not show a clear pattern. In example (5.17) from Bombi et al. (2019) above, we could see that with intensional verbs, both a de-re and a de-dicto reading are available. Finally, regarding *discourse prominence*, Owusu shows that *bí* is preferred over the bare noun to introduce new discourse referents. In this sense it behaves like a typical specificity encoding expression.

Owusu (2020) points out that the analysis in Arkoh (2011) cannot account for the unexpected non-specific properties of *bí*, such as its scopal behaviour with intensional verbs as pointed out by Bombi et al. (2019). Owusu shows that a narrow scope reading is also available in conditionals. She therefore

proposes that the denotation of *bí* should contain a skolem world variable in addition to the individual skolem variable proposed by Arkoh (2011). When the world variable remains free, it gives rise to the transparent (= de re/specific) reading, and when it is bound by a higher operator, such as an intensional verb or a conditional operator, it gives rise to the opaque (= de dicto/non-specific) reading. Owusu predicts that inverse readings should be absent in sentences where *bí* is in subject and *biara* in object position, as in (5.24). This is because in Chierchia's (2001) approach, a skolem index behaves like a pronoun. A weak crossover effect should therefore arise when a structurally lower quantifier binds the skolem index in a higher position.

(5.24) Ɔbaa   bi   kane-e   nhoma biara.
        woman   *IND*   *read-PAST*   *book*   *every*
        'A woman read every book.'

<div align="right">(adapted from Owusu, 2020, p. 65)</div>

Overall, we see that with the exception of Amfo (2010a), who treats *bí* as an existential quantifier, subsequent authors have consistently treated it as a skolemized choice function (Arkoh 2011, Bombi et al. 2019, Owusu 2020, Duah et al. 2021). The main reason for this is the exceptional wide scope behaviour observed of *bí*.

5.3.2   More non-specific readings

In the last section, I presented previous literature on the specific indefinite determiner *bí*. In this section, I will add some more data to the picture. I will talk in more detail about the scopal behaviour of *bí*, i.e. specific vs. non-specific interpretations. I will show that *bí* can be interpreted in a non-specific way in even more environments. If we want to maintain the popular choice function analysis, additional assumptions would need to be made to capture this data. I will show that by treating *bí* as an existential quantifier, as originally proposed in Amfo (2010a/c), the data can satisfyingly be captured.

(i)   Modal and intensional contexts

We saw that *bí* does not obligatorily take wide scope with intensional verbs, as first pointed out by Bombi et al. (2019), see example (5.17) above. Owusu also argues that a narrow scope reading is available with conditionals. This is indeed the case, as shown with the example in (5.25) below.

(5.25) a. Sɛ   sukuuni   bi   twa   nsɔhwɛ   no   aa
           COMP   *student*   *IND*   *cut*   *exam*   *DEF*   *REL*
           ɔykerɛykerɛni   no   ani bɛgye.
           teacher   *DEF*   *FUT-happy*
           'If a (certain)/any student passes the exam the teacher will be happy.'
        b. Sɛ   Kwame   bɛ-kan   nwoma   bi   aa
           COMP   *Kwame*   *FUT-read*   *book*   *IND*   *REL*
           ɔkyerɛkyerɛni   no   ani bɛgye.
           teacher   *DEF*   *FUT.happy*
           'If Kwame read a (certain)/any book the teacher would be happy.'

However, these are not the only cases where *bí* can receive a narrow scope interpretation. Owusu (2019) claims that in a sentence with a deontic modal, only the specific reading of *bí* is available, see (5.26). According to her, this sentence allows only for the reading, where it is one specific professor that Ama has to marry. However, other speakers do in fact obtain a narrow-scope reading of *bí* in such sentences. In example (5.27) with the modal expression *must,* though the specific reading is more prominent, both readings seem to be available, with some speakers obtaining the specific and others the non-specific reading. Thus, under the non-specific reading, Kwame fulfils his duty if he reads a book, no matter which one. It does not have to be one specific book. There may be variation with respect to certain lexicalizations or contexts, which render one reading more prominent than another.

(5.26) Ɛsɛ sɛ Ama ware professor bi.
       must Ama marry professor IND
       'Ama must marry some professor'

                                 (adapted from Owusu 2019, p. 268)

(5.27) Ɛsɛ sɛ Kwame kan nwoma bi.
       must Kwame read book IND
       'Kwame must read a (certain) book.'

Further, Owusu (2019) claims that *bí* is infelicitous when it co-occurs with a negated intensional verb, as in (5.28). However, sentence (5.28) and similar sentences were judged as acceptable by the speakers consulted for this thesis, with some of them obtaining the specific and others obtaining the non-specific reading. It is unclear what this difference in judgment could be related to.

(5.28) Kofi n-hwɛhwɛ CD bi.
       Kofi NEG-search CD IND
       'Kofi is not looking for a certain CD.' / 'Kofi is not looking for any CD.'

                                 (adapted from Owusu 2019, p. 262)

In (5.29), *bí* co-occurs with the sentence-initial modal adverb *ebia*[103] (= perhaps/maybe). The preferred interpretation of these sentences is the non-specific one. Thus, in (5.29a), the speaker's speculations will not only turn out to be true if Esi will sing this one specific song. Instead, the speaker has made the correct assumption if Esi will sing any song at all.

(5.29) a. Ebia, Esi bɛ-to dwom bi.
         maybe Esi FUT-sing song IND
         'Maybe, Esi sang a (certain) song.'
       b. Ebia, abaayewa bi bɛ-to dwom.
         maybe girl IND FUT-sing song
         'Maybe, a (certain) girl sang a song.'

In (5.30), the sentence contains the exclusive particle *nko ara* (= only), which requires the focus construction. This sentence, too, can have both a specific and a non-specific interpretation. Under the

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[103] It is worthwhile to point out that *ebia* seems to contain *bi* as a morphological root as well.

specific reading, there is this one particular exam that only Yaw passed and no one else passed, but other students may have passed other exams. Under the non-specific reading, Yaw is the only one who passed an exam and the other students did not pass any exam.

(5.30) Yaw   nko ara   na   ɔ-twa-a   nsɔhwɛ   bi.
Yaw   only   FOC   3SG.SBJ-cut-PAST   exam   IND
'Only Yaw passed a (certain) exam.'

The example in (5.31) contains a negative factive predicate. This sentence, too, seems to allow for both readings. Und the specific reading, there is this one specific exam that Kofi was surprised Ama passed, but he was not surprised about the passing or failing of any other exam. Under the non-specific reading Kofi expected Ama to fail all the exams and he was surprised that she passed any exam at all.

(5.31) Ɛ-yɛ   Kofi   nwonwa   sɛ   Ama   twa-a   nsɔhwɛ   bi.
3SG.SBJ-COP   Kofi   surprising   COMP   Ama   cut-PAST   exam   IND
'Kofi was surprised that Ama passed a (certain) exam.'

The examples in (5.25)-(5.31) above show that the non-specific reading is in fact available in a large number of non-veridical contexts. These sentences are generally ambiguous between a specific and a non-specific reading. If a speaker wishes to unambiguously express the specific reading, the complex expression *N bí no* or sometimes *N baako bi* can be used. A non-specific reading, on the other hand, can be made more prominent by the use of *N no mu bi*. Nevertheless, these examples are still in line with the choice function analysis presented in Owusu (2020). All these examples can be analysed as ranging over possible worlds. The skolemized choice function, as proposed by Owusu, carries a world variable that can be bound by a higher operator. In the following two sections, however, I will present further cases of non-specific interpretations, which cannot as readily be explained by a bound world variable.

(ii)   Questions

When *bí* occurs in polar questions in Asante Twi, it is usually interpreted as non-specific. In (5.32) we find *bí* in simple yes/no-questions, with *bí* either in subject (5.32a) or object (5.32b) position. In both cases, the consultants interpret these questions in a non-specific way. That is, in (5.32a), the speaker does not want to know for some specific child if she drew a picture. Instead, the speaker wants to know if any one of the children drew a picture. In (5.32b), similarly, the speaker's query is not about a specific book and whether Ama read it. The speaker wants to know if Ama has ever read any book whatsoever. In (5.32c), where *bí* is used in a partitive construction, the prominent reading of the questions is a non-specific one, too. That is, the speaker does not have 'a particular referent in mind' when asking the question, in contrast to what Amfo (2010a) claimed for basic episodic affirmative sentences. The questions are thus best translated with the use of *any*. In order to unambiguously ask for a specific book, the complex expression *bí no* needs to be used, similar to the cases discussed above (see Bombi et al. 2019 and Owusu 2020 for more details on this combination of determiners). In fact, when my consultants were asked to translate polar *any*-questions from English to Asante Twi, they typically

provide a question containing *bí*. Thus, the non-specific use of *bí* seems to be the standard way of expressing an *any*-reading in polar questions[104].

(5.32) a. Akwadaa **bi** drɔ-ɔ mfonin?
        child   *IND*   *draw-PAST*   *picture*
        'Did a child draw a picture?'

     b. Ama a-kan nwoma **bi** (da)?
        Ama *PRF-read*   *book*   *IND*   *ever*
        'Has Ama (ever) read a book?'

     c. Ama a-kan nwoma **no** **bi**?
        Ama *PRF-read*   *book*   *DEF* *IND*
        'Has Ama read some/any of the books?'

     d. Ama a-kan nwoma **bi** **no**?
        Ama *PRF-read*   *book*   *IND*   *DEF*
        'Has Ama read a particular book?'

In wh-questions, on the other hand, the more common interpretation is a specific one, see (5.33). Here, most speakers interpret (5.33a) as the speaker asking who read a particular book.

(5.33) a. Hwan na ɔ-kan-n nwoma bi?
        who   *FOC* *3SG.SBJ-read-PAST* *book*   *IND*
        'Who read a (certain) book?'

     b. Dɛn na sukuuni bi kan-n yɛ?
        what   *FOC*   *student*   *IND* *read-PAST*
        'What did a (certain) student read?'

It is important to note that even though the use of *bí* is grammatical in questions like (5.33) above, where it receives a specific interpretation, it would still be considered an odd question when asked out of the blue. The reason is that the speaker remains vague about the exact identity of the book or the student. For the addressee, it is not really possible to answer such a question, as it is unclear, which particular book or student the speaker is requesting information about. My language consultants report that they could only respond to such a question by asking back "Which book?" (5.33a) or "Which student?" (5.33b). A similar effect can be observed in imperatives, which are also judged as odd by a number of speakers. Here, too, it violates pragmatic principles that the speaker demands the addressee to read a particular book, while remaining vague about its exact identity.

(5.34) Kan nwoma bi.
        read   *book*   *IND*
        'Read a certain book.'

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[104] The Asante Twi expression *biara*, which is also interpreted as a free-choice item similar to *any* in many environments, does not usually receive the free-choice interpretation in polar questions, but instead the universal quantifier interpretation. See also the subsequent section.

(iii)   *Negation*

As mentioned further above, Amfo (2010c) claims that *bí* and any expression containing *bí* take obligatory wide scope over negation. Thus, according to her, a sentence like (5.35) can only mean that there is a particular book that Ama didn't read, a statement that is compatible with her possibly having read other books. The sentence cannot mean that Ama didn't read any book whatsoever.

(5.35) Ama   a-n-kan   nwoma   bi.
        Ama   PRF-NEG-read   book   IND
        ✓'Ama didn't read a (certain) book.'
        ✗'Ama didn't read any book.'

However, this rule is not without exception. In (5.36), where the *bí*-constituent occurs in the site of a negated *na*-cleft, the non-specific interpretation arises. This cleft construction is known to enforce wide scope of negation over any fronted element (Amfo 2010c). Under a choice-function analysis of *bí*, however, it is less obvious why wide scope of *bí* would not also be a possibility. The main reason why choice functions were introduced in the first place, replacing previous quantificational approaches, is the feature of being able to take arbitrarily wide scope. The scope in (5.36), however, is restricted. While a choice-function analysis in this case might still work under particular assumptions, under a quantifier analysis, this effect falls out naturally.

(5.36) Ɛ-n-yɛ   abaayewa   bi   na   ɔ-tɔ-ɔ   atadeɛ.
        3SG.SBJ-NEG-COP   girl   IND   FOC   3SG.SBJ-buy-PAST   dress
        'It is not a (certain) lady that bought a dress.'

There is more evidence to indicate that *bí* does not *obligatorily* take wide scope over negation. Even though it is almost always interpreted in this way, it is possible to construct examples, where speakers obtain a narrow scope interpretation. In (5.37), for example, where negation is in a higher matrix clause, speakers of Asante Twi interpret this sentence to mean that the teacher did not meet any student. One speaker also understood example (5.38) under the narrow scope reading. That is, Ama scolded all students who did not read any book at all.

(5.37) Ɛ-n-yɛ   nokorɛ   sɛ   ɔkyerɛkyerɛni   no   hyia-a
        3SG.SBJ-NEG-COP   true   COMP   teacher   DEF   meet-PAST
        sukuuni   bi.
        student   IND
        'It is not true that the teacher met a student.'

(5.38) Ama   ka-a   sukuuni biara   aa   w-a-n-kan
        Ama   scold-PAST   student every   RC   3SG.SBJ-CMPL-NEG-read
        nwoma bi   anim.
        book   IND   scold
        'Ama scolded every student that did not read a (certain) book.'

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(iv)   Quantifier scope

A further piece of evidence favouring an analysis of *bí* as an existential quantifier comes from quantifier scope. As described above, Owusu (2020) claims that inverse readings should be impossible when *bí* is structurally higher than the universal quantifier *biara*. She argues, following Chierchia (2001), that the skolem index of *bí* behaves like a pronoun and should therefore give rise to a weak crossover effect when a structurally lower quantifier binds the skolem index in a higher position. As will be discussed in more depth in section 5.6, inverse readings, albeit strongly dispreferred, are not completely absent when *bí* is structurally higher than *biara*. Two examples are provided below. The sentence in (5.39) can be interpreted to mean that each child was terrified by a different scary thing. And (5.40) can be interpreted to mean that on each tree, there was a different bird.

(5.39) Adeɛ   huhuuhu bi   hunahuna-a   akwadaa biara.
        thing *scary* *IND* *terrify-PAST* *child* *every*
        'A (certain) creepy thing terrified every child.'
        ✓∃>∀; ✓∀>∃

(5.40) Ama   hu-u   anoma bi   wɔ   dua   biara so.
        Ama   *see-PAST* *bird* *IND* *at*   *tree* *every* *on*
        'Ama saw a (certain) bird on every tree.'
        ✓∃>∀; ✓∀>∃

5.3.3   Analysis of *bí*

In this section, I will present an analysis of *bí* as an existential quantifier rather than a choice function. While some of the novel data presented above could also be captured by a choice functional analysis (non-specific readings in modal/intensional contexts and questions), other data points are unexpected under such an analysis and would require additional assumptions or modifications (inverse scope, narrow scope in negated clefts). I will show that the quantifier analysis can cover the data more easily than the choice function analysis. It can also capture the use of *bí* in relation to the bare noun (as will become more clear in section 5.4). I will also show how additional meaning components that have been proposed in the literature can be reconciled with the analysis suggested in here and how these meaning components can fall out from the same underlying property.

(i)   Bí as an existential quantifier

In section 5.3.2, I presented novel data regarding the use and interpretational possibilities of the indefinite article *bí*. I showed that some of this data does not straightforwardly follow under a choice function analysis as proposed by Arkoh (2011), Bombi et al. (2019) and Owusu (2020). More specifically, the choice function analysis as proposed in previous literature both under- and overgenerates: Some readings which are not predicted by this analysis are in fact attested (inverse scope, non-specific readings under negation), while some readings which are predicted by this analysis are not attested (specific readings in negated clefts). The fact that choice functions tend to overgenerate readings is not specific to Asante Twi and has been pointed out by other authors for languages like

English or German (e.g. Winter 1997, Geurts 2000, Schwarzschild 2002, Endriss 2009). Beyond that, choice functions generally carry a number of theoretical and empirical problems that have been discussed in depth (Geurts 2000, von Stechow 2000, Schwarzschild 2002, Endriss 2009), see also section 2.2.4. I will not discuss the details of the criticism regarding choice functional approaches in more detail, as this goes beyond the purpose of this chapter. The reader is referred to the references mentioned above. The point here is that there are numerous arguments why a choice function analysis is not desirable – both arguments that are specific to Asante Twi, as shown in the previous section, as well as arguments that apply to choice functions in general. I will therefore refer back to the original proposal in Amfo (2010a/c) of *bí* as an existential quantifier. That is, I assume that *N bí* is of the semantic type ‹‹e,t›,t› rather than ‹e›. Further, I assume that *bí* requires a contextual restriction, which is situated on the D-head, similar to the situation pronoun proposed by Büring (2004) or Schwarz (2012). This is demonstrated in (5.41) and (5.42) below.

(5.41) $[[bí]] = \lambda C.\lambda P.\lambda Q.\ \exists x[P(x) \wedge C(x)]: Q(x)$

(5.42)

DP

NP — D'

C — D
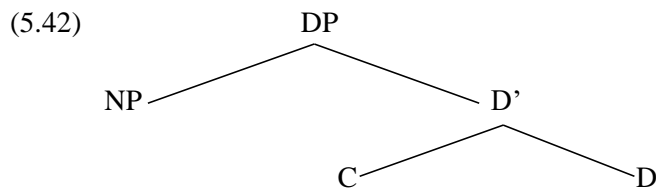
Various proposals of contextual domain restriction can be found in the literature (e.g. von Fintel 1994, Kratzer 1998, Stanley 2000, Stanley & Gendler-Szabó 2000, Portner & Yabushita 2001, Schwarzschild 2002, Martí 2003, Breheny 2003). Domain restriction is known to occur on a pragmatic level with all quantifiers, including universals. In the case of *bí* in Asante Twi, I will claim that this domain restriction is obligatory and part of its lexical semantics. The exact nature of the domain restriction is of course still purely pragmatic and at the discretion of the speaker. However, the use of *bí* forces the speaker to commit to *some* kind of non-empty domain restriction, whatever its exact nature may be. The domain can potentially be restricted to any possible size, but we will see that the default is a singleton set (Kratzer 1998, Portner & Yabushita 2001, Schwarzschild 2002, Breheny 2003). When left with a set that contains only a single member, NP *bí* receives a specific interpretation. This can not only account for the data above but also for the distribution of *bí* in comparison to the bare noun, which I propose to have the semantics of an existential quantifier *without* domain restriction. This interaction will be discussed in more detail in the subsequent section 5.4. In the following, I will explain how this analysis of *bí* can cover the data observed before.

  (ii)   Scope

One important argument made by previous authors in favour of a choice function analysis of *bí* is its ability to take exceptional wide scope. However, exceptional wide scope can also be accounted for by domain restriction, more specifically, maximal domain restriction to a singleton set (Kratzer 1998, Portner & Yabushita 2001, Schwarzschild 2002, Breheny 2003). This gives the illusion of wide scope, but actually, scope is merely *neutralized* (Schwarzschild 2002). Thus, exceptional wide scope readings of *bí* in Asante Twi, as demonstrated in (5.15) above, can be explained by contextual domain restriction. Domain restriction can also explain why (5.16) does not give rise to a distributive interpretation under

the apparent exceptional wide scope reading. If the specific reading arises due to contextual restriction and not because the *bí*-phrase moves above the conditional operator, then this effect logically follows (see also Schwarzschild 2002). *Bí* can obtain a non-specific reading in conditionals as well as other possible world environments, as presented in the previous section, because its domain restriction and thereby reference can vary with worlds. In the same way, the universal quantifier *biara* can take scope over *bí*, giving rise to a distributive reading, see (5.14) above. This follows from Schwarzschild's (2002) system of singleton indefinites, where the domain restriction can contain a bound variable[105], such that the restriction co-varies with a higher operator. Schwarzschild illustrates this with examples like (5.43). Here, the year for which it is the case that every crop failed may vary with farmers. The only difference to Schwarzschild's description of indefinites is that in the case of *bí*, domain restriction is obligatory.

(5.43)   Every farmer remembers at least one year when every crop failed.

In comparison to the choice function analysis, the existential quantifier approach can also account more easily for the fact that inverse readings of *biara* over *bí* – albeit clearly dispreferred – are available in certain contexts, see (5.39) and (5.40) above. If *bí* is a regular existential quantifier, it can interact scopally with other quantificational elements. The fact that inverse readings over *bí* are generally difficult to obtain (see also section 5.6) is attributed to the pragmatic inferences that come with the contextual restriction of *bí*. These will be discussed at the end of this section.

(iii)   Negation

If we assume obligatory domain restriction of *bí*, the strong tendency of *bí* to apparently take wide scope over negation follows naturally. *Bí* is not required to undergo QR to give rise to the specific interpretation. Even under narrow scope, the domain restriction to a singleton set gives rise to a specific reading. However, contrary to Amfo's (2010c) claim that *bí* obligatorily takes wide scope with respect to negation, I presented some exceptional cases in the previous section, where *bí* can also receive a narrow scope reading. In example (5.37)[106], we have negation in a matrix clause, taking scope over the whole embedded assertion, thereby negating the truth of this assertion. I argue that such a reading arises when the domain is not restricted to a singleton set. While restriction to a singleton set may be the default case and in fact be conventionalized to a large degree, the domain can possibly also be wider. Under this assumption, the sentence in (5.37), under its $\neg\exists$ meaning, will still be contextually restricted, but not to a singleton set. It may, for instance, be restricted to the students of the teacher's class.

(iv)   Questions

Polar questions and wh-questions differ in that in the former, the whole assertion is questioned, while in the latter, only the wh-element is questioned. That means, in wh-questions the remaining material excluding the wh-expression is presupposed. This is reflected in standard approaches to wh-questions, which are taken to evoke alternatives (see Hamblin 1973 and subsequent work), as exemplified in (5.44).

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[105] Following Heim (1991), Cooper (1993, 1996), von Fintel (1994), Stanley & Gendler-Szabó (2000).
[106] The case of example (5.36) will be discussed at the end of this section.

(5.44)   "Who read a book?"
         Alternatives: {Esi read a book, Kofi read a book, Kwame read a book, …}
         Presupposition: someone read a book

In Asante Twi, this is made prominent by the fact that the fronted wh-element obligatorily occurs as part of a *na*-cleft construction. In fact, polar questions also give rise to the specific reading of *bí* when they involve a clefted element, thereby employing the same cleft construction as used for wh-questions, see (5.45). Here, again, the clefted element is questioned and the material in the cleft site is presupposed. Because the material in the cleft site is presupposed, the existence of the *bí*-element is also presupposed. This gives rise to the specific reading and this, in turn, gives rise to the pragmatic oddity of such a question when asked out-of-the-blue, as described in the previous section.

(5.45)   Ama   na   ɔ-kan-n   nwoma   bi   (anaa)?
         Ama   *FOC*   *3SG.SBJ-read-COMPL*   *book*   *IND*   *QM*
         'Is it Ama who read a (certain) book?'
         Alternatives: {Esi read a book, Kofi read a book, Kwame read a book, …}
         Presupposition: someone read a book

In polar questions, the question operator applies to the proposition as a whole. A polar question is often represented as evoking the two possible answers as alternatives (Hamblin 1973), see (5.46).

(5.46)   Did Ama read a book?
         Alternatives: {Ama read a book, ¬Ama read a book}

We have seen above that negation over the whole clause does quite readily give rise to a narrow scope reading of *bí* with respect to negation, see (5.37) above. So it is no surprise that the non-specific reading is also available in polar questions, where a question operator is situated at the clause edge, taking scope over the whole clause. But why does the specific reading not usually arise with polar questions, too? I argue that the reason is of pragmatic nature. As discussed above, in wh-questions, focus constructions, and imperatives, the specific interpretation leads to an utterance that violates pragmatic principles. The speaker refers to a specific entity and demands information or action from the addressee with respect to this entity. At the same time, he does not reveal the full identity of this entity, thereby remaining too vague for the addressee to follow his demand. This violates Grice' maxim of quantity (Grice 1975). Thus, the specific reading in question is only excluded on a pragmatic, not a grammatical, basis and may therefore still arise in particular contexts and judgments may vary depending on the speaker.

   (v)   Further inferences at the level of pragmatics

The literature on *bí* offers a whole number of meaning components or inferences that arise with the use of *bí*. Arkoh (2011) and Owusu (2019) assume a noteworthiness felicity condition for *bí*. Owusu (2019) additionally assumes an identifiability felicity condition, but she claims that only one of those must be fulfilled to felicitously use *bí*. Amfo (2010a) takes *bí* to express that the speaker has a particular referent in mind. Owusu (2019) takes *bí* to be an epistemic indefinite that carries an ignorance presupposition. Owusu (2020) also classifies *bí* as an epistemic indefinite and refers to the ignorance, noteworthiness,

and identifiability inferences, without specifying their exact status. I will argue in the following that these meaning components all arise at the level of pragmatics and are not part of the semantics of *bí*.

In my proposal, the difference between *bí* and the bare noun consists in the presence versus absence of contextual restriction[107]. If *bí* is used instead of the unrestricted bare noun, the speaker must restrict the domain is some way or other. Thus, the speaker must be able to distinguish the referent from other members of the set provided by the noun. This is what gives rise to the identifiability or noteworthiness inference mentioned in Arkoh (2011) and Owusu (2019, 2020). The speaker must be able to identify the referent in order to narrow down the domain, which is then perceived as a noteworthy property. This also leads to the impression that the speaker has a particular referent in mind, as discussed in Amfo (2010a). See also Kratzer (1998), Portner & Yabushita (2001), Schwarzschild (2002), Breheny (2003), who discuss implicit domain restriction and claim that the speaker must know of some salient/identifying property in order to narrow down the domain. However, we have seen above that *bí* can give rise to non-specific interpretations in various contexts, namely when *bí* takes narrow scope with respect to another operator. Thus, in these contexts, the speaker does not need to have a particular referent in mind or be able to identify a particular referent in order to use *bí*. This shows that these inferences are solely situated in the realm of pragmatics and are not separate aspects of the lexical semantics of *bí* in the form of presuppositional or assertive meaning.

I will now take a closer look at Owusu's (2019, 2020) classification of *bí* as an epistemic indefinite, carrying an ignorance inference. The example in (5.19), discussed above and repeated as (5.47) below, serves as evidence for this assumption. Such a sentence is considered pragmatically odd, because the question 'guess who?' implies that the speaker knows the exact identity of the referent.

(5.47) Ama   a-ware   professor   bi.
        Ama   PRF-marry   professor   IND
        #wo-hwɛ   a   ɛ-yɛ   hwan?
        2SG.OBJ-look   COMP   3SG-COP   who
        'Ama has married some professor, guess who?'

<div align="right">(adapted from Owusu 2019, p. 268)</div>

Owusu (2019) gives this ignorance inference presuppositional status[108]. However, this classification as a presupposition is merely stipulated. Owusu does not provide tests to determine the presuppositional status of the epistemic inference. As discussed further above, Owusu adopts the approach in Aloni & Port (2013, 2015) to epistemic indefinites for *bí*, according to which its use is only felicitous when the method of identification required by the context cannot be provided by the speaker, an example of which was given in (5.22). However, the judgments do not in fact seem so clear-cut. In fact, (5.47) was not considered odd by my consultants. Further, when presented with the English sentence and asked to how this would be expressed in Asante Twi, the consultants provided the exact same sentence judged as odd by Owusu (2019). Further, example (5.48) was judged as fully acceptable by my language consultants. Here, the referent is introduced with *bí* in the first sentence. In the second sentence, the speaker reveals

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[107] The arguments for an analysis of the bare noun as an unrestricted existential quantifier will be presented in the subsequent chapter.
[108] Owusu (2020), on the other hand, does not provide information on the presumed semantic or pragmatic status of this inference.

the full identity of this referent. According to Owusu (2019, 2020), the use of *bí* should be infelicitous here, as the speaker can fully identify the referent. After all, it is the speaker's own sister.

(5.48) Me-frɛ-ɛ   abusuani   bi   nnora.   Na   ɛ-yɛ
         1SG.SBJ-call-PAST   *relative*   *IND*   *yesterday.* *PRT*   *3SG.SBJ-COP*
         me   nuabaa   Akosua.
         1SG.POSS   *sister*   *Akosua*
         'I called a (certain) relative yesterday. It was my sister Akosua.'

Duah et al. (2021) provide the sentence in example (5.49). According to the authors, the *bí*-expression can refer back to Ama, as indicated by the index. Here, too, the speaker seems to know the exact identity of the person that came home. The speaker's goal in this example seems to be to simply express the logical entailment that if Ama came home, then there exists at least one person that came home.

(5.49) Ama$_i$ kɔ̀-ɔ̀   fíé   èǹtí   ònípá   bí$_i$ bà-à   fíé.
         Ama   *go-PAST*   *home*   *therefore*   *person* *IND*   *come-PAST*   *home*
         'Ama$_i$ went home, therefore, someone$_i$ came home.'

(adapted from Duah et al. 2021, p. 242)

I will therefore say that the ignorance inference identified by Owusu, same as the other inferences discussed above, is merely an implicature that arises due to the obligatory contextual restriction and can be cancelled by the context. In many cases, the use of *bí* indeed implies that the speaker cannot fully identify the referent – otherwise she would simply name the referent directly. However, there are other reasons as to why the speaker may choose to use *bí*. For example, the speaker may simply introduce a new referent to the common ground, knowing the full identity of this referent. The speaker may have full knowledge of the referent, but the addressee may not. This is why *bí* is commonly used at the beginning of stories to first introduce the referents (Amfo 2010a). Another reason for a speaker to use *bí* while still having full knowledge over the identity of the referent may be a situation where the speaker does not want to reveal this identity to the addressee. This is exemplified in (5.50). Here, the speaker seems to know exactly who this student is, but because she gave a promise to not reveal that this student has cheated, she remains purposefully vague.

(5.50) Me-hu-u   sɛ   sukuuni bi   aa   ɔ-wɔ   yen   nhyiamu
         1SG.SBJ-meet-PAST   *COMP*   *student* *IND* *REL*   *3SG.SBJ-at*   *1PL.POSS*   *seminar*
         no   ase   sisi-i   wɔ   nsɔhwɛ no   mu,   nanso   me-hyɛ-ɛ
         DEF   *under*   *cheat-PAST*   *at*   *exam*   *DEF* *in*   *but*   *1SG.SBJ-promise-PAST*
         no   bɔ   sɛ   me-rɛ-n-ka   n-kyerɛ   obiara.
         3SG.OBJ   *promise*   *COMP*   *1SG.SBJ-FUT-NEG-tell*   *NEG-show*   *anyone*
         'I saw a student in our seminar cheat in an exam, but I promised him/her I will not tell anybody.'

Similarly, in (5.51), the speaker could have said right from the start 'I met my teacher at the conference'. However, in order to add emphasis to how unexpected it was to meet her teacher there, she first remains vague and only in the second sentence reveals the person's identity. One speaker stated that uttering (5.51) in that way adds some "drama" to the story. Something similar may be possible in the example (5.47) from Owusu, which was not considered odd by my language consultants. Thus, these examples

show that the ignorance inference is only an implicature that can be cancelled. As we will see in the next section, the bare noun cannot receive an indefinite specific interpretation and therefore cannot be used in the examples discussed in this subsection. The definite article requires familiarity (Arkoh & Matthewson 2013, Owusu 2020), which will also be discussed in more depth in the next section. Because the speaker refers to an unfamiliar specific entity in examples like (5.47)-(5.51), *bí* is in fact the only possible choice, thereby licensing implicature cancellation.

(5.51)   Me-hyia-a   nipa   bi   wɔ   nhyiamu   no   ase.
         1SG.SBJ-meet-PAST   person   IND   at   conference   DEF   under.
         Na   na   ɛ-yɛ   me   ɔkyerɛkyerɛni.
         PRT   PRT   3SG.SBJ-COP   1SG.POSS   teacher
         'I met a (certain) person at the conference. It was my teacher.'

   (vi)   Negating inferences

I will now discuss the case of *bí* occurring in negated *na*-clefts, as in example (5.36), and the readings this gives rise to. If we assume obligatory domain restriction for *bí*, in contrast to the unrestricted bare noun, then the use of *bí* will give rise to an exhaustivity inference. In particular, if the speaker uses *bí*, the addressee will infer that the predication only applies to the referent(s) introduced by *bí*, i.e. to the set created by the domain restriction. This is similar to the *some/all* alternation in English. When a speaker utters (5.52a), the addressee will conclude that the teacher met *some, but not all* students. Otherwise, the speaker could have simply used the stronger expression *all*. This exhaustivity inference can be cancelled as in (5.52b), which typically requires stress on *some* in English.

(5.52)   a. The teacher met some student.
         b. The teacher did not meet SOME student. He met all the students.

Similarly, in Asante Twi, a sentence continuation as in (5.53) is judged as acceptable. This example can be used in a scenario, where someone incorrectly assumed that the teacher only met *some* student and is being corrected by the speaker of (5.53). This reading can even arise when negation occurs in the same clause, as in (5.54) and facilitated by *kɛkɛ* (= 'just').

(5.53)   Ɛ-n-yɛ   nokorɛ   sɛ   ɔkyerɛkyerɛni   no   hyia-a
         3SG.SBJ-NEG-COP   true   COMP   teacher   DEF   meet-PAST
         sukuuni   bi.   Ɔ-hyia-a   sukuuni   biara.
         student   IND   3SG.SBJ-meet-PAST   student   every
         'It is not true that the teacher met a certain student. He met every student.'

(5.54)   Ɔkyerɛkyerɛni   no   a-n-hyia   sukuuni   bi   (kɛkɛ),
         teacher   DEF   PRF-NEG-meet   student   IND   just
         ɔ-hyia-a   sukuuni   biara.
         3SG.SBJ-meet-PAST   student   every
         'The teacher didn't meet a certain student, he met with every student.'

This can only be the case, if the exhaustivity inference arising through the use of the contextual restriction is negated. Under a wide scope interpretation of *bí* in (5.53), the first sentence would assert that there is one student that the teacher did not meet, and thus be in contradiction to the continuation sentence. Under an ordinary narrow scope interpretation, the first sentence would assert that the teacher did not meet any student, again in contradiction to the second sentence. Particularly, when *bí* occurs in the negated *na*-cleft, see (5.36) above, this interpretation is the only one available. Again, this is verified by adding a continuation sentence that is only compatible with this interpretation, as in (5.55). This is again similar to English *some*.

(5.55) Ɛ-n-yɛ   fie   bi   na   Kwaku   kyerɛ-ɛ   Kofi.
        3SG.SBJ-NEG-COP   *house*   *IND*   *FOC*   *Kwaku*   *show-PAST*   *Kofi*
        Ɛ-yɛ   fie   no   nyinaa
        3SG.SBJ-COP   *house*   *DEF*   *all*
        'It's not a (certain) house that Kwaku showed to Kofi. It's all the houses.'

Further evidence for the claim that we are dealing with a negated implicature here comes from the interaction of negation with *baako* (= 'one'). A numeral like *one* is taken to assert 'one or more'. The meaning of 'exactly one' only arises due to an implicature. When *baako* occurs in a *na*-cleft, it also only gives rise to a narrow-scope interpretation with its implicature being cancelled. Thus, (5.56) can only mean that it is not one, but more than one exam, which Ama passed. It cannot mean that Ama passed no exam or that there is this one exam that Ama did not pass. If *baako* occurs in a basic negated sentence, like (5.57), it can have two readings. The most prominent reading is that there is one exam that Ama did not pass (i.e. apparent wide scope of *baako* over negation). The less prominent reading, which may require a special tone pattern and becomes more prominent with a correcting continuation sentence as in (b), is again the one where the implicature is cancelled, i.e. that Ama did not pass just one exam, but more than one exam.

(5.56) Ɛ-n-yɛ   nsɔhwɛ   baako   na   Ama   twa-a yɛ.
        3SG.SBJ-NEG-COP   *exam*   *one*   *FOC*   *Ama*   *SBJ-pass-PAST*
        'It is not one exam that Ama passed.'
        ➔ Interpretation 1: Ama passed more than one exam. (implicature cancelled)

(5.57) a. Ama   a-n-twa   nsɔhwɛ   baako.
           Ama   *PRF-NEG-pass*   *exam*   *one*
           'Ama didn't pass one exam.'
        ➔ Interpretation 1: There is one exam that Ama did not pass. (wide scope of *baako*)
        ➔ Interpretation 2: Ama passed more than one exam. (implicature cancelled)
        b. (Ɔ-twa   nsɔhwɛ   bebere.)
           3SG.SBJ-pass   *exam*   *many*
           'She passed many exams.'

5.3.4   Summary

In this section, I have argued for a quantifier analysis rather than a choice function analysis of the indefinite article *bí* in Asante Twi, in line with Amfo (2010a/c). I provided novel data on the interpretational possibilities of *bí*, showing that it can be interpreted in a non-specific or narrow-scope way in more contexts than acknowledged in the literature before. I showed that this behaviour can be captured better with an analysis of *bí* as an existential quantifier with obligatory domain restriction. Additional inferences that have been proposed in the literature naturally follow on a pragmatic level under such an analysis. While the data at hand might also be possible to capture with a modified choice function analysis, the quantifier analysis offers a simpler semantics without the need of stipulating another linguistic category. As will become clear in the subsequent sections, this analysis also captures the distribution of *bí* compared to the bare noun (5.4) and allows for a unified analysis of *bi*-expressions in Asante Twi in general, including the universal quantifier *biara* (5.5).

5.4   Bare noun

In this section, I will discuss the bare noun in Asante Twi. The bare noun is known to exhibit an unusual behaviour in that it is sometimes interpreted as definite and sometimes as indefinite. Its distribution is also restricted, depending on the respective interpretation. When the bare noun occurs in subject position it is usually rejected, unless it refers to a globally unique referent and is interpreted as definite. In the following, I will first provide some background on how other authors have treated the Asante Twi bare noun. I will then proceed to show that the bare noun in its indefinite use does not show any characteristics of (pseudo-)incorporation and is best said to project a full DP with a silent D-head (cf. Longobardi 1994). Further, I will show that the definite and indefinite use of the bare noun should not be attributed to ambiguity but rather to the same underlying semantics. The varying interpretations and the varying acceptability depending on the syntactic position of the bare noun can be derived from general principles of information structure.

5.4.1   Background

The bare noun in Asante Twi can receive both a definite and an indefinite interpretation and shows an asymmetric behaviour in that in subject position, only the definite interpretation seems to be allowed, while in non-subject positions, both definite and indefinite interpretations are available (Arkoh & Matthewson 2013, Bombi 2017, Bombi et al. 2019). According to most authors, bare nouns in subject position are only allowed if they refer to a globally or locally uniquely identifiable entity, e.g. 'the pope', 'the sun', 'the president' (Arkoh & Matthewson 2013, Bombi 2017, Bombi et al. 2019). Uniqueness here refers to uniqueness inherent to the noun and thereby excludes cases where uniqueness is purely accidental in a certain context (Šimík 2021). With unique reference, the bare noun is interpreted as definite. If this condition is not met, the sentence is usually judged as ungrammatical. Sometimes, speakers will accept the sentence under the pragmatically odd interpretation that the bare noun is the name of a person, see (5.58). The bare noun in object position is accepted unconditionally and is usually interpreted as indefinite. However, in cases of global uniqueness, the same definite

interpretation arises as in subject position, see (5.59a)[109]. In cases of local uniqueness, such as (5.59b), both the indefinite and the definite interpretation may arise, but some speakers prefer to add the definite article in the latter case. With indirect objects, the bare noun in locally unique settings is often rejected and speakers correct it by adding a definite determiner, see (5.59c).

(5.58) *Sukuuni   boa   ɔkyerɛkyerɛni   no.
        student   *help*   *teacher*   *DEF*
        *'Student helps the teacher.'
        → Pragmatically odd interpretation: A person called 'student' helps the teacher.

(5.59) a. Ama   hu-u   ɔsram.
          Ama   *see-PAST*   *moon*
          'Ama saw the moon.'
        b. Ama   hyia-a   sukuu panin.
          Ama   *meet-PAST*   *head-of-the-school*
          'Ama met the head of the school.'
        c. Ama   ma-a   sukuu panin   krataa   bi.
          Ama   *give-PAST*   *head-of-the-school*   *document*   *IND*
          'Ama gave the head of the school a certain document.'

Singular bare nouns can also receive a generic interpretation, as in (5.60), see also Bombi et al. (2019). The generic reading can also be achieved with a bare plural, but not with an overt definite article, as in English.

(5.60) Ɔsono   yɛ   aboa   kɛsɛɛ.
        elephant   *COP*   *animal*   *big*
        'The elephant is a big animal.'

Amfo (2010a) categorizes the bare noun in the givenness hierarchy of Gundel et al. (1993) as occupying at least the lowest position of the hierarchy *type identifiable,* see Table 5.5 in the previous section. Arkoh (2011) analyses the bare noun as being purely quantificational in the sense of Fodor & Sag (1982), in contrast to the indefinite *bí*, which is purely referential. Arkoh defends the unambiguously quantificational status of the bare noun by giving examples such as (5.61), in which the bare noun cannot be anaphorically referred to[110].

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[109] One consultant did in fact read this sentence with indefinite interpretation. They commented: "It's not specific, it means that Ama saw a moon. Maybe there are a lot of moons?" In every day's speech we often refer to 'the moon' as a unique entity, i.e. there is an implicit restriction to planet earth. Under a modern astronomic perspective, however, the moon is of course not a unique entity in the whole universe and this is probably why the indefinite reading was available to the consultant. Similar effects may occasionally arise with other entities that we usually classify as globally unique, e.g. the pope, who is only globally unique at a specific point in time.

[110] In my own fieldwork, anaphoric reference to bare nouns was accepted by all speakers, as will be shown further below. Besides the fact that this might be a dialectal difference (see footnote 54), I will speculate that the reason why (5.61) was judged as infelicitous in Arkoh (2011) is that the first sentence establishes the teacher in subject position as the default topic (Lambrecht 1994). It is generally assumed that a topic in one sentence is likely to also be the topic in the subsequent sentence, known as the topic chain (Givón 1983). Usually, a topic change will be marked overtly in some way or other. Since no such change is marked in (5.61), the animate subject pronoun ɔ- in the second sentence in (5.61) will probably be interpreted as referring back to the teacher. In my own examples,

(5.61) # Kyìrɛ̀kyírɛ̀nyí Bàá   hwí-ì   àbɔ̀frá.   Ɔ̀-yɛ̀   bùbúáfʊ
        teacher   *Baah*   *cane-PAST*   *child*   *3SG-COP*   *cripple*
        'Teacher Baah caned a child. S/he is a cripple.'

<div align="right">(adapted from Arkoh 2011, p. 35)</div>

In contrast to most other authors, Arkoh considers the use of the bare noun in subject position with a quantificational interpretation to be grammatical, see (5.62)[111].

(5.62) Kyìrɛ̀kyírɛ̀nyí   hwí-ì   àbɔ̀frá   bí.
        teacher   *cane-PAST*   *child*   *IND*
        'A teacher caned a (certain) child.'

<div align="right">(adapted from Arkoh 2011, p. 40)</div>

Arkoh & Matthewson (2013) claim that the bare noun does not project a full DP and has the semantics of asserting existence. The definite use is not derived from a silent weak definite determiner. They argue instead that the bare noun is underspecified for uniqueness, which is why it can occur both with unique and non-unique entities.

Bombi et al. (2019) propose a type-shift account for bare nouns based on Chierchia (1998). The basic bare noun is of type ‹e,t›. They say that the ∃-type-shift to type ‹‹e,t›,t› should in principle be available, since no overt determiner with this type exists (*bí* is not analysed as an existential quantifier here). They note, however, that this is not supported by the data, as the ∃-type would predict the occurrence of wide scope, which is not found. The ι-type-shift for a definite reading, on the other hand, should be blocked due to existence of the overt definite determiner *no*. However, they follow Dayal (2004) in that the ι-type-shift can in fact occur and that only the definite reading, but not the generic/kind-reading, is blocked by *no*. They further suggest that the restricted instances of definite interpretation of the bare noun should be analysed as proper nouns (i.e. of type e), not as actual cases of definiteness, see also Bombi (2017). This is the reason why this interretation only occurs with globally unique entities. However, Owusu (2020) argues that, while the proper noun analysis may be applicable for words like *president*, the same is not possible with superlatives, where the bare noun is used as well, see (5.63) and (5.64)[112].

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such as (5.66) below, the inanimate pronoun *ɛ-* in the second sentence can only refer back to the object bare noun. Firstly, because it is marked as inanimate and secondly, because the pragmatics of the sentence makes any other interpretation implausible.

[111] This is also at odds with most speakers' judgments in my own fieldwork, who consistently reject the bare noun in subject position apart from some exceptional cases discussed further above and in section 5.4.4 below. While this may be a dialectal effect (see footnote 54), section 5.4.4 discusses another possible explanation of this effect.
[112] Note that Asante Twi does not have a dedicated superlative marker. As the glossing indicates, the adjectives in (5.63) and (5.64) on their own only mean 'very tall' and 'very big'. However, the context specifies if the phrase should be interpreted as superlative. In (5.63), Afajato is not just a tall mountain in Ghana, but indeed the tallest. In (5.64), the additional relative clause 'in the world' makes the superlative interpretation obvious. This can be seen when translating the hash marked version of the sentences with the definite article, which also sound odd in English: "#The very tall mountain in Ghana is Afajato." and "#The very big book in the world is in this library.". Further, only a superlative interpretation licenses the use of the bare noun in these examples in the first place, as will become clear from the discussion in section 5.4.3.

(5.63) Bɛpɔ   (#nó)   aa   ɛ-wa   paa   wɔ   Ghana ne   Afadjato.
        mountain   *DEF*   *REL* *3SG.SBJ-tall*   *very* *at*   *Ghana COP   Afadjato*
        'The tallest mountain in Ghana is Afajato.'

           (adapted from Owusu 2020, p. 31)

(5.64) Nhoma keseɛ paa   (#nó)   áa   ɛ-wɔ   wiase wɔ   library ha.
        book   *big*   *very* *DEF*   *REL* *be.located*   *world be.located*   *library here*
        'The biggest book in the world is in this library.'

           (adapted from Owusu 2020, p. 31)

To sum up, previous literature on the bare noun has provided descriptive data on the distribution of the bare noun and the corresponding interpretations. Several ways of analysing it have been implemented. However, none of them could provide a satisfying explanation of the complete paradigm. In the next section, I will argue that the bare noun projects a full DP and encompasses the semantics of a regular existential. I will make this argument by comparing the bare noun in Asante Twi to bare nouns in various other languages where they do not project a full DP and are treated as a type of noun-incorporation.

5.4.2   Internal structure: DP, NumP, NP or N?

Cross-linguistically, bare nouns are often analysed as instances of some form of (quasi-/pseudo-) incorporation (e.g. Kiefer 1990, Modarresi 2014, Massam 2009, Dayal 2011, and others), especially when the bare noun occurs in direct object position, adjacent to the verb. When a bare noun is an instance of some type of (pseudo-)incorporation, it has the syntactic status of an N head, NP, or NumP, but not a DP, see Dayal (2011). I will show that the Asante Twi bare noun lacks properties that are typically associated with these different levels of incorporation, thereby showing that we must be dealing with a full DP. I will mainly make reference to the properties of incorporation described in Massam (2009), Dayal (2011) and Driemel (2020a, 2020b). Certain properties discussed in Driemel (2020a, 2020b) cannot be tested in Asante Twi, namely case marking and scrambling, because Asante Twi does not exhibit either phenomenon.

    (i)   *Discourse anaphora*

Incorporated nouns cannot be referred to anaphorically. As can be seen in (5.65) and (5.66), it is possible to refer back to the bare noun in Asante Twi via a definite NP or a pronoun. These sentence continuations were accepted by all four speakers consulted. These judgments, however, are in contrast to Arkoh (2011), who claimed that anaphoric reference is not possible, see footnotes 54 and 63 for a possible explanation for this difference in judgment. In the following, I will take anaphoric reference to be acceptable with bare nouns.

(5.65) Kofi   a-twerɛ   krataa. Krataa   no   yɛ   tenten.
        Kofi   *PRF-write*   *letter*   *letter*   *DEF*   *COP*   *long*
        'Kofi has written a letter. The letter is long.'

(5.66) Yaw   re-soa   pono.   Ɛ-mu   yɛ   duru.
       Yaw   PROG-carry   table   3SG-inside   COP   heavy
       'Yaw is carrying a table. It is heavy.'

In that sense, bare nouns show a characteristic property of DPs, namely the ability to introduce discourse referents. Even though the indefinite determiner *bí* is the most common and preferred way of introducing a new referent (Amfo 2010a, Arkoh 2011, Owusu 2020), it is not excluded with the bare noun either[113]. However, Owusu (2020) provides the example in (5.67) to show that bare nouns are infelicitous for introducing discourse referents.

(5.67) Da   #(bi),   ɔbea   #(bi) ne   ne   ba   ɔsoɔdenfo
       day   IND   woman   IND   CONJ   3SG.POSS   child   stubborn
       #(bi)   tena-a   ase.
       IND   stay-PAST   under
       'Once upon a time, there was a certain woman and her stubborn child.'
       (Lit.: A certain day, a certain woman and her stubborn child lived)
                              (adapted from Owusu 2020, p. 57; originally from Amfo 2010a, p. 1786)

As we have seen in the previous section, *bí* is claimed to carry additional meaning components. These conditions on *bí* may not always be fulfilled to justify its use. The discourse referents in (5.67) are specific, they are at-issue, and they fulfil the felicity requirement of *bí*, such as noteworthiness. However, there may be instances of first-mention of a referent, without the referent having any noteworthy property and the new referent might also not be the topic of the sentence. For example, a bare noun may be used when the introduced referent is part of the background. In (5.66), for example, without any context, the default topic would be Yaw as the subject. As I will show in more detail in the next section, the bare noun encompasses a very weak semantics that entails both the semantics of the definite article *no* and the indefinite article *bí*, which have a much stronger semantics. Whenever a presupposition or felicity condition of the overt articles is not met to license their use, the bare noun is used instead. Thus, even though *bí* is the standard way of introducing a new at-issue referent, there are cases when the bare noun can be used for first mention. And as we see in (5.65) and (5.66), it allows anaphoric reference thereafter, which shows that it has become part of the set of discourse referents.

(ii)   Number neutrality

Incorporated nouns are typically number neutral. Number neutrality is here understood in the sense that the number of referents is underspecified in upward-entailing contexts despite the morphological form of the noun being singular. This does not apply to Asante Twi, however, since the bare singular is generally interpreted as singular and the bare plural is generally interpreted as plural. It also does not seem like aspect or telicity have any impact here, as is the case in pseudo-incorporated nouns in Hindi (Dayal 2011). The judgments are the same independent of which aspect is used in sentences like (5.68)[114]. Thus, referring back to the sentence in (5.68) with a plural expression as in (5.68b) is not

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[113] This is similar to Hausa bare nouns (Zimmermann 2008).
[114] In the habitual form in (5.68), it is certainly possible to obtain a distributive reading due to the use of the temporal quantification *often*, such that it is a different chair each time Yaw fixes one. However, this is an ambiguity that also holds in English and which has nothing to do with the bare noun itself receiving a plural

possible, unless some kind of accommodation is applied to make sense of the sentence at all. Similarly, in (5.69), speakers are reluctant to answer the question containing a bare singular with 'yes' when the context has made several entities explicit. Doing so would imply that Yaw only saw a single bird, which is not true. At the same time, speakers are aware of the logical entailment relationship which makes a 'yes' answer not false in the logical sense. A simple 'no' answer, on the other hand, would carry the incorrect implication that Yaw didn't see any bird, same as in English. Speakers will thus try to correct the implied false assumption of the speaker – that Yaw only saw a single bird – in their response, as exemplified in (5.69). In (5.70), too, speakers judge the sentence as pragmatically odd, because it is difficult to imagine how it could take someone two hours to ask a single question. Thus, the singular interpretation persists even when it is highly implausible.

(5.68)   Yaw [taa siesie / re-siesie / siesie-e / a-siesie]   akonwa.
         Yaw [often fix.HAB/PROG-fix/fix-PAST/PRF-fix]   chair
         'Yaw [often fixes/is fixing/fixed/has fixed] a chair.

    a. Akonwa   no   so.
       chair   DEF   big
       The chair is/was big.'

    b. #Nkonwa   no   so.
       chairs   DEF   big
       'The chairs are/were big.'

(5.69)   *Context:* When Yaw went for a walk today, he saw some birds sitting in the tree.
    Yaw   hu-u   anomaa   nnɛ?
    Yaw   see-PAST   bird   today
    'Did Yaw see a bird today?'
    One consultant's comment: "I'm not sure how to answer this with just 'yes' or 'no'. Strictly speaking, if he saw several birds, he also saw one bird. I would correct you in some way, like 'No, he saw several birds.' or 'Yes, but actually he saw several birds.'"

(5.70)   #Akosua   de   dɔnhwere   mmienu   bisa-a   asɛmmisa[115].
    Akosua   take   hours   two   ask-PAST   question
    'Akosua took two hours to ask a question.'

As a final piece of evidence, the bare singular noun can also not be combined with inherently collective verbs, see (5.71). The verb *sesa* can have several meanings, some of which are applicable to singular nouns ('change'/ 'adjust'), and some of which are not ('collect' / 'gather'). The sentence in (5.71) cannot receive the latter interpretation.

(5.71)   (#)Esi   sesa-a   adaka.
    Esi   collect-PAST   box
    'Esi collected a box.'

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interpretation. The habitual version of (5.68) thus cannot be interpreted as meaning that at each time of chair-fixing, Yaw fixes multiple chairs.

[115] Some speakers prefer using the phrase 'bisa asɛm' over 'bisa asɛmmisa'.

I take the examples (5.68)-(5.71) as indicative that the bare singular count noun in Asante Twi cannot receive a plural interpretation. It is important to note, though, that Asante Twi has many nouns which are morphologically identical in the singular and the plural form[116]. Consequently, they are ambiguous for number and the judgments in (5.68)-(5.71) will not apply there. However, the relevant nouns used in the examples above all have a distinct singular and plural form.

(iii)   Conjunction

Incorporated nouns typically do not allow for conjunction. However, in Asante Twi the bare noun can occur in conjunction with another bare noun, as shown in (5.72a). The bare noun can also occur in conjunction with names and with nouns headed by an overt determiner, see (5.72b-d). Conjunction normally requires the two conjuncts to be of the same category, indicating that the bare noun is also of DP level.

(5.72)   a. Esi   tɔ-ɔ   atadeɛ   ne   ɛkyɛ.
              Esi   buy-PAST   dress   CONJ   hat
              'Esi bought a dress and a hat.'
          b. Yaw   hyia-a   Kwame   ne   sukuuni.
              Yaw   meet-PAST   Kwame   and   student
              'Yaw met Kwame and a student.'
          c. Esi   kan-n   kowaa krataa   ne   nwoma   bi.
              Esi   read-PAST   newspaper   and   book   IND
              'Esi read a newspaper and a (certain) book.'
          d. Kofi   kan-n   krataa   no   ne   nwoma.
              Kofi   read-PAST   letter   DEF   and   book
              'Kofi read the letter and a book.'

(iv)   Modification

Incorporated nouns typically cannot be modified. In Asante Twi, however, this is possible both with adjectives (5.73) as well as with relative clauses (5.74). The fact that the bare noun can be used as the head of a relative clause in the first place is further evidence that it has proper argument status.

(5.73)   Afua   hu-u   ɔkra   tuntum.
            Afua   see-PAST   cat   black
            'Afua saw a black cat.'

(5.74)   Kwame   te-e   akwadaa aa   ɔ-re-su   no
            Kwame   hear-PAST   child   REL   3SG-PROG-cry   CD
            'Kwame heard a child that was crying.'

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[116] For example *akyɛdeɛ_{sg}/akyɛdeɛ_{pl}* (= gift/gifts) or *mpaboa_{sg}/mpaboa_{pl}* (= shoe/shoes) have the same singular and plural form. Words like *adaka_{sg}/nnaka* (= box/boxes) or *anomaa_{sg}/nnomaa_{pl}* (= bird/birds) have a different singular/plural form.

(v)   Extractability/verb-adjacency

The bare noun can be dislocated and thus separated from the verb. As shown in (5.75), it is grammatical in the focus position. This is again unusual under incorporation, even though there are also some cases of incorporated nouns which do not have to occur directly adjacent to the verb, see Driemel (2020a). The use of the focus in (5.75) invokes alternatives of things other than a letter that can be read, such as {a newspaper, a book, an email, …}. This is because the bare noun cannot receive a specific interpretation and therefore, when using the bare noun, it is irrelevant which particular letter was read. This is on contrast to the use of the specific indefinite article *bí* in the same sentence, which invokes alternatives of the same type: {letter1, letter2, letter3, …}.

(5.75) Krataa   na   Ama   kan-n yɛ.
        letter   FOC   Ama   read-PAST
        'It is a letter that Ama read.'

(vi)   Binding

The bare noun in Asante Twi can bind a possessive pronoun, as in (5.76). This would also be unexpected under (pseudo-)noun incorporation. Note that the sentences in (5.76) are ambiguous, as indicated by the indices, in that the possessive pronoun can have either the subject or the object as antecedent.

(5.76) a. Akosua$_i$ de   akyɛdeɛ$_j$ to-o   ne$_{i/j}$ adaka   no   mu.
            Akosua   take   gift   put-PAST   3SG.POSS   box   DEF   in
            'Akosua$_i$ put a gift$_j$ in her$_i$/its$_j$ box.'
        b. Yaw$_i$ de   mpoma$_j$ to-o   ne$_{i/j}$ mponnua   no   mu.
            Yaw take   window   put-PAST   3SG.POSS   frame   DEF   in
            'Yaw$_i$ put a window$_j$ into his$_i$/its$_j$ frame.'

(vii)   Control

Incoroporated nouns do not usually occur in control position, such as the position of the causee in causative constructions. In Asante Twi, however, such sentences are grammatical, as example (5.77) shows.

(5.77) a. Yaw   ma-a   sukuuni   si-i   nnoɔma   no.
            Yaw   give-PAST   student   wash-PAST   clothes   DEF
            'Yaw made a student wash the clothes.'
        b. Akosua   hyɛ-ɛ   sukuuni   ma   ɔ-yɛ-ɛ   adwuma   no.
            Akosua   force-PAST   student   give 3SG.SBJ-do-PAST   work   DEF
            'Akosua forced a student to do the work.'

(viii)   Scope

Incorporated nouns obligatorily receive narrow scope. In Asante Twi, indeed, the bare noun cannot take wide scope (see also Bombi et al. 2019). The sentence in (5.78) is rejected as contradictory when used

with the bare noun, but accepted with the specific indefinite *bí,* indicating that in the latter, but not in the former, case can the indefinite NP take scope over negation.

(5.78) Kofi   a-n-kan   krataa #(bi),   nanso ɔ-kan-n
       Kofi   PRF-NEG-read. paper (IND)   but   3SG.SBJ-read-PAST
       nkrataa foforɔ no   nyinaa.
       paper   new   DEF   all
       'Kofi didn't read a (certain) paper, but he read all the new papers.'

Similarly, (5.79) cannot mean that there is one specific key that Ama is looking for, i.e. the bare noun cannot take wide scope over the intensional verb *hwehwɛ* (= to search). The sentence is therefore judged as odd by native speakers, as typically, when someone is trying to find a key, they need a specific one.

(5.79) Ama   hwehwɛ-ɛ   safoa. ɔ-hu-u   wɔ   adaka bi   mu.
       Ama   search-PAST key   3SG.SBJ-find-PAST   at   box   IND   in
       'Ama searched for a key. She found it inside a box.'

Nevertheless, speakers are able to construct scenarios, where this sentence is acceptable. One language consultant comments: "The sentence is not actually grammatically wrong, but it sounds weird that she's just looking for ANY key. Maybe she wants to use it for art work.". Another speaker comments: "The sentence means that she is looking for a key, but it doesn't matter which one. For example, if there is a room that can be opened by any key.". The comments thus show that the speakers still read the sentence as meaning that Ama is searching for a key (i.e. she only needs one), it just doesn't matter which one exactly it is. This is in contrast to common instances of incorporated nouns, where the interpretation would be that Ama is in a general process of key-searching. It is important to note that the lack of a wide-scope reading for bare nouns cannot easily be taken as a piece of evidence that the bare noun does not project a full DP. The reason is the competition with the overt indefinite article *bí*, which is a specific indefinite and has a strong preference for wide scope (Amfo 2010a, see also section 5.3). While in the previous section, I showed that there are exceptions to this, there is still a strong tendency. Importantly, a wide-scope indefinite will always receive a specific/referential interpretation. The bare noun thus has a direct competitor, namely *bí,* which provides this specific meaning as a part of its semantics, see the previous section. As a consequence, a wide-scope reading of the bare noun will simply be blocked by the stronger semantics of *bí*. This blocking effect will be discussed in the following section.

We have seen that in all except one of the eight properties tested above, the bare noun does not pattern with any form of incorporation. I conclude that the Asante Twi bare noun does not behave like a typical instance of either full incorporation or pseudo-incorporation. It should thus not be analysed as bare N-head, NP or NumP, but instead as a full DP with a silent D-head. However, besides the empirical evidence presented so far there is also a theoretical argument to be made in favour of a full DP analysis of the bare noun. As mentioned in the introduction above, the bare noun sometimes receives a definite interpretation. As a definite expression it must project a full DP. If we wish to claim that the bare noun in its indefinite use does not project a DP, then we have to assume ambiguity of the bare noun. That would mean that Asante Twi has two bare nouns, one that is interpreted as definite and one that is interpreted as indefinite, with a different internal structure assigned to the two variants (DP vs. no DP). This is not only rather unfavourable from a theoretical perspective, it would also leave open many

questions about the restricted and often complementary distribution of the two interpretations and is thus not motivated by the data available. In section 5.4.4, I will in fact show that it is not necessary to assume two distinct types of bare nouns and that the distributional and interpretive patterns can be explained by positing a single underlying structure that interacts with general linguistic principles in pragmatics and information structure.

5.4.3 Blocking effect

In the previous section, I argued that the bare noun projects a full DP and should be treated as an existential quantifier. This is thus partly in line with Arkoh (2011), who defines bare nouns as inherently quantificational. It is also in line with the claim in Arkoh & Matthewson (2013) in that the bare noun has a highly underspecified semantics of merely asserting existence and no lexical specification of any kind of (weak) definiteness. However, while Arkoh & Matthewson (2013) reject the possibility of a null-determiner altogether, I claim that the bare noun does in fact project its own DP with a silent D-head, since it behaves like a regular DP element in all respects apart from the fact that it cannot take wide scope. However, as mentioned further above, this scope effect can be explained due to the direct competition with the semantically stronger overt indefinite *bí*. In the following, I will describe how the stronger semantics of *bí* and *no* blocks certain interpretations of the bare noun. I will essentially follow the line of reasoning Heim (2011) put forward for article-less languages. She suggests that the DPs of languages that do not mark (in)definiteness overtly are not in fact ambiguous between a definite and an indefinite reading. Rather, they are purely indefinite, but can be used in definite contexts via the entailment relationship between the semantics of indefiniteness and the stronger semantics of definiteness. The only reason why the indefinite cannot be used in definite contexts in languages like English is the fact that an overt definite marker exists and is in competition with the indefinite article. In a similar way, I will claim that the bare noun encompasses a weak semantics of asserting existence and can be used both in definite and indefinite contexts whenever the use of the overt articles *bí* and *no* would be too strong.

In section 5.3, we discussed that *bí* can be treated as an existential quantifier with obligatory domain restriction, including all meaning components that arise through this restriction. The bare noun, on the other hand, can be treated as a plain existential quantifier without such a domain restriction. This is represented in Figure 5.2.
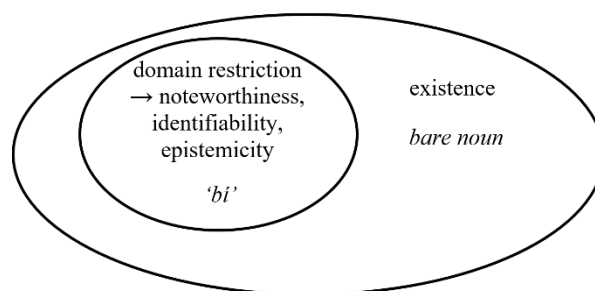

Figure 5.2: Entailment relationship between bare noun and indefinite article *bí*.

In section 5.3, we discussed that *bí* is usually interpreted as specific due to its obligatory domain restriction. The bare noun, under its indefinite interpretation, cannot be interpreted as specific, as this interpretation is blocked by the semantically stronger overt determiner *bí*. For that reason, the bare noun can only every receive a non-specific indefinite interpretation. This is also what leads to the bare noun's inability to take wide scope. A wide scope interpretation necessarily gives rise to a specific interpretation, or, in the terms of section 5.3, to a domain restricted interpretation, which is blocked by stronger *bí*.

I will now turn to the definite interpretation of the bare noun. As discussed in section 5.4.1, Bombi (2017) and Bombi et al. (2019) suggest that in those instances where the bare noun can receive a definite interpretation, it should be analysed as a proper noun and not as an actual case of definiteness. They claim that this explains why it only occurs with globally unique entities. However, as discussed further above, Owusu (2020) provides counterevidence to this assumption, showing that in cases of superlatives the bare noun is used as well, and superlatives can clearly not be treated as proper nouns, see examples (5.63)-(5.64) in section 5.3.1. I will therefore also reject this line of reasoning. Instead, I propose that the bare noun only contains a silent D-head expressing existence. Due to its weak semantics, it can in principle also express definiteness, but does so only when not blocked by the overt definite determiner *no*. This is represented in Figure 5.3.
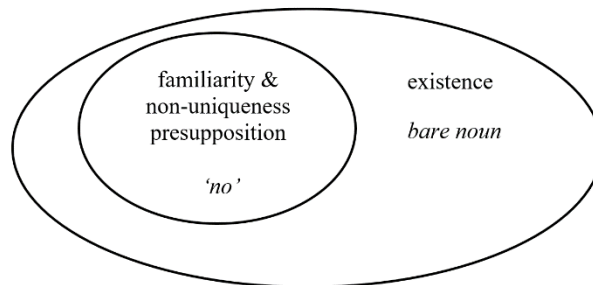

Figure 5.3: Entailment relationship between bare noun and definite article *no*.

I follow Owusu (2020) in her analysis of the definite article *no* as presupposing both familiarity and non-uniqueness. While the familiarity presupposition is less controversial, as it has been proposed by previous authors (Arkoh & Matthewson 2013), the non-uniqueness presupposition is in sharp contrast to certain previous accounts which in fact assume the exact opposite – a uniqueness presupposition (Amfo 2007, Bombi 2017). A non-uniqueness analysis of the definite article would mean that the use of the definite article *no* results in presupposition failure in contexts of uniqueness[117], i.e. its use in such contexts is infelicitous. Therefore, when referring to unique entities, we require the bare noun to fill this gap. In contrast to the proper noun analysis, this explains a much broader range of definite uses of the

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[117] Non-uniqueness here means global non-uniqueness, or also local non-uniqueness in larger situation uses (Bombi 2017). The definite article *no* is certainly used for referents that are unique in a specific context. This concept is described in the terms "inherent" vs. "accidental" uniqueness by Šimík (2021). For example, there are many presidents in the world, but at a given time and for a given country/institution, there is only exactly one president, so there is a notion of inherent uniqueness about it. This is different from a noun like *student*. Even though in a particular situation, there may only be one student present, making him the unique student in that situation, there is nothing inherently unique about a student, it just happens to accidentally be the case in that situation. Thus, the non-uniqueness presupposition would more precisely be called a non-inherent-uniqeness presupposition.

bare noun, including the superlative examples of Owusu (2020) in (5.63)-(5.64) above, the use of the bare noun for generic interpretations as in (5.60), as well as relational nouns (to be discussed below).

A superlative refers to the one unique element occupying the topmost position of a spectrum. As that, it is unique and using *no* would lead to a presupposition failure. Therefore, the use of the bare noun in contrast to *no* also helps in identifying superlatives despite the lack of a dedicated morphological form (see footnote 65 above). The sentence in (5.80), adapted from (5.64) above, shows that even when the context allows for both a superlative and non-superlative interpretation, the choice of article disambiguates.

(5.80) a. Nhoma   keseɛ   paa   nó   wɔ   library   ha.
            book   big   very   DEF   at   library   here
            'The (previously mentioned) very big book is in this library.'
        b. Nhoma   keseɛ   paa   wɔ   library   ha.
            book   big   very   at   library   here
            'The biggest book is in this library.'

In the case of genericity, if we are talking about a species as in (5.81a), repeated from (5.60) above, then this species is globally unique. Thus, again, the definite article cannot be used as this would violate its non-uniqueness presupposition. Using the definite article can therefore only give rise to the meaning that an individual, contextually familiar elephant is big, see (5.81b). Therefore, only the bare noun can be used, quantifying over kinds in this case. In languages like English, however, the indefinite article also allows for generic readings. Why can *bí* not be used for generic interpretations in Asante Twi instead of the bare noun? Recall that in the analysis proposed in here, *bí* requires obligatory domain restriction. A unique entity is a singleton set and therefore cannot be further restricted. The indefinite *bí* can therefore only be used for sets with more than one element such that domain restriction can apply. Using *bí* in a context like (5.81c) implies that there are other elephants in the larger domain and *bí* refers to a particular one of them.

(5.81) a. Ɔsono   yɛ   aboa   kɛsɛɛ.
            elephant   COP   animal big
            'The elephant (as a species) is a big animal.'
        b. Ɔsono   no   yɛ   aboa   kɛsɛɛ.
            elephant   DEF   COP   animal big
            'The (previously mentioned) elephant is a big animal.'
        c. Ɔsono   bi   yɛ   aboa   kɛsɛɛ.
            elephant   IND   COP   animal big
            'Some (contextually identified) elephant is a big animal.'

Owusu also provides examples like (5.82) with relational nouns of unique reference. The referent of *mother* relative to each person is globally unique. Here, the use of the definite article is infelicitous. Owusu (2020) points out that the definite article in (5.82) is in fact also felicitous in a scenario, where *mother* is not used to mean the biological mother (e.g. in the case of adoption). This, in fact, strengthens her point of a non-uniqueness presupposition, as this is a case where *mother* is not globally unique. In example (5.83), on the other hand, *no* is felicitous, because it is possible to have more than one sister.

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Again, this pattern is explained if we follow Owusu's analysis of *no* as presupposing non-uniqueness. The bare noun then 'steps in' whenever uniqueness is entailed, as in the case of *mother* in (5.82).

(5.82) Abofra nó   maame   (#nó) ba-a   ha.
        child DEF   mother   DEF   come-PAST   here
        'The child's mother came here.'

(5.83) Abofra nó   nua   baa   (nó)   ba-a   ha.
        child DEF   sibling woman DEF   come-PAST   here
        'The child's sister came here.'

<div align="right">(adapted from Owusu 2020, p. 32)</div>

Owusu provides further evidence for the non-uniqueness presupposition, see (5.84). According to her, the definite article is optional in this example. However it is interpreted in two different ways, depending on whether the definite article is present or not. With the definite article, the statement is true, because it does not refer to the sun as a unique entity in this world, but to the specific instance of the sun in the book, where the sun might very well be painted in green. With the use of the bare noun, on the other hand, the statement would be false, because it can only refer to the sun as a unique entity of the world, which does not have a green colour. Thus, even when both the bare noun and the definite determiner are acceptable, the particular interpretation differs depending on which one is used.

(5.84) *Context:* A parent is showing a child a book on the solar system. They open a page with a picture of the sun.
        Awia   (no)   yɛ   green.
        sun   DEF   COP   green
        'The sun is green'

<div align="right">(adapted from Owusu 2020, p. 38)</div>

In conclusion, this section showed how the weak semantics of the bare noun interacts with the stronger semantics of the overt articles *bí* and *no*. The bare noun is used in exactly those contexts, where both *bí* and *no* are too strong. In the next section, I will move on to explaining how the particular distribution of the definite versus indefinite interpretation of the bare noun comes about by making reference to information structure, or, more specifically, to the notion of topichood.

5.4.4   Interaction with information structure

In section 5.4.1, I mentioned the varying interpretation of the bare noun depending on its position in the sentence as either subject or object. The indefinite interpretation has been said to only be available in object but not in subject position. I will claim that this apparent pattern is related to grammatical role only indirectly. Instead, the underlying reason has to do with general principles of information structure.

Topics are said to have a tendency to occur sentence-initially (Halliday 1967, Gundel 1985, Molnár 1993). In an SVO language like Asante Twi, the subject is sentence-initial and therefore prone to be the topic. In fact, the subject is usually considered the default topic of a sentence (Kuno 1972, Strawson

1974, Lambrecht 1994). Topicality is generally associated with referentiality (e.g. Kuno 1972, Dahl 1974, Fodor & Sag 1982, Lambrecht 1994, Portner & Yabushita 1998, 2001, Endriss 2009). In fact, according to Lambrecht, the topic of a sentence is always referential. Therefore, in subject position, the bare noun in Asante Twi cannot simply be interpreted as a non-referential indefinite, as this clashes with the default topicality and therefore referentiality requirement of the subject. This way of reasoning is also in line with Endriss (2009), who says that a non-specific indefinite in subject position cannot serve as an aboutness topic. It also cannot be interpreted as a referential indefinite, as this interpretation is blocked by *bí* qua Chierchia's (1998) Blocking Principle (see above). Thus, whenever the bare noun occurs in subject position as default topic, it can only be interpreted as definite. This is possible whenever the referent is unique and therefore violates the non-uniqueness presupposition of the definite article *no*. Recall from example (5.58) above that if the bare noun in subject position is not inherently unique, it receives the odd interpretation of a proper name, thereby again satisfying uniqueness.

The analysis put forward in this section makes two predictions: First, the bare noun should be ungrammatical whenever it is a topic, independent of whether it is subject or object (unless, of course, it refers to a globally unique entity). As shown in (5.85), this is indeed the case. In (5.85a), the bare noun object is fronted and marked as topic. Whether the bare noun occurs in a plain left-dislocated structure or whether it is overtly marked with *de(ɛ)*[118], which is considered a topic marker in Asante Twi (Amfo 2010b, Titov 2019), most speakers reject these sentences. The very same sentences are accepted when the noun is followed by a definite article (5.85b).

(5.85)   a. *[Krataa]_{TOPIC} (deɛ),   Ama   kan-n yɛ.
             document   TOP   Ama   read-PAST
             '(As for) Document, Ama read it.'
         b. [Krataa   no]_{TOPIC} (deɛ),   Ama   kan-n yɛ.
             document   DEF   TOP   Ama   read-PAST
             '(As for) The document, Ama read it.'

The second prediction is that the bare noun should be grammatical and interpreted as indefinite in subject position if the subject is clearly *not* a topic. This is also true, as can be seen in (5.86).

(5.86)   a. [Krataa   no]_{TOPIC} (deɛ),   sukuuni   kan-n yɛ.
             document   DEF   TOP   student   read-PAST
             '(As for) the letter, a student read it.'
         b. [Akwadaa   no]_{TOPIC} (deɛ),   ɔkraman   ka-a   no.
             child   DEF   TOP   dog   bite-PAST 3SG.OBJ
             '(As for) the child, a dog bit it.'

Here, the object is fronted and marked as topic and the subject is a bare noun. This sentence is accepted by most speakers under an interpretation of the bare noun as indefinite and non-specific. That is, in (5.86a), whoever the person was who read the letter, he or she was a student (and not, for example, a

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[118] Some speakers pointed out that the marker *deɛ* is not very common in their speaker community and they do not like its use all that much in general. They do accept the plain, unmarked left-dislocated structure, though. Either way, the contrast between (5.85a) and (5.85b) is still apparent also for those speakers, in that (5.85a) is worse than (5.85b), with and without *deɛ*.

teacher)[119]. The sentence in (5.86b) expresses that the child was bitten by a dog, but which dog exactly is unknown and irrelevant. The same holds for (5.87), where the bare noun in subject position is overtly marked with the focus marker *na*. Because it is marked as focus, it loses its default interpretation as topic. Again, we see that this sentence is acceptable under an indefinite interpretation of the bare noun. The bare noun expresses that it was a dog (and not, for example, a snake) which bit the child. It does not make reference to any particular dog, which would require the use of *bí*.

(5.87) Ɔkraman na   ɔ-ka-a   akwadaa no.
        dog   *FOC* *3SG.SBJ-bite-PAST* *child*   *DEF*
        'It is a dog that bit the child.'

Finally, the indefinite interpretation of the bare noun in subject position can be improved even in a simple unmarked clause when a preceding context clearly establishes another referent as the aboutness topic. In (5.88) for example, the whole preceding context is about the books that were brought to school.

(5.88) *Context:* The teacher for English literature has brought some of his novels to school hoping that they would inspire people to read more. The novels are from various authors and eras. They are sitting on a shelf at the entrance of the building.
        Sukuuni a-kan   nnwoma   no   aa   ɔkyerɛkyerɛni
        student *PRF-read* *book*   *DEF* *REL* *teacher*
        no   de   ba-a yɛ.
        DEF *take* *come-PAST*
        'A student has read the books that the teacher brought.'

In this context, the bare noun in subject position is improved compared to an out-of-the-blue mention and can receive an indefinite interpretation. This is because the books, which have been established as a topic, are very likely to continue being the topic also in the target sentence (Givón 1983). The student is part of the background in the target sentence and in a potential continuation of this sentence, we would not expect the speaker to talk about the student any further. If the particular student who read the book was any relevant for the subsequent discourse, the article *bí* would be used. The fact that the bare noun under indefinite interpretation is actually accepted in subject position under specific information structural circumstances might explain why Arkoh (2011) judged such sentences as acceptable in contrast to the claims in much other work (e.g. Bombi 2017, Bombi et al. 2019), see example (5.62) above. But as mentioned in footnote 54, we may also simply be dealing with dialectal variation, as Arkoh (2011) mainly cites data from Fante.

Summing up, we saw that the bare noun under its indefinite interpretation can only be placed in subject position if it is clear that it is not a topic. This is because the subject position is the default position for

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[119] One speaker rejected the sentence in (5.85a), though, and corrected it in the following way:
(i)   Krataa no,   sukuuni na   ɔ-kan-n yɛ.
        letter *DEF* *student* *FOC* *3SG.SBJ-read-PAST*
We can see that the subject is still a bare noun, but now it is overtly marked with the focus marker *na,* similar to what I show for (5.87). That is, even in this version of the sentence, the subject is not a topic and accepted as indefinite bare noun. This therefore still supports the main claim of this section.

topics and therefore leads to a referential interpretation, which is blocked for the bare noun due to overt *bí*. At the same time, the bare noun is also rejected in non-subject positions, if they are marked as topic.

5.4.5 Summary

In this section, I proposed that the bare noun cannot be analysed as any instance of incorporation and is best regarded as a regular indefinite projecting a full DP with the weak semantics of asserting existence. The only apparent counter-evidence to this analysis was the fact that the bare noun cannot take wide scope. However, I suggested that this effect can be explained through direct competition with the overt indefinite *bí,* which has a stronger semantics in that it encodes specificity. Further, I argued that the bare noun steps in whenever the two possible overt alternatives *bí* and *no* are too strong and would give rise to presupposition failure. Finally, I showed that the distribution of the definite vs. indefinite interpretation of the bare noun does not in fact vary with grammatical function, as it seems on first sight, but is related to information structure, or more specifically, topichood.

5.5 Universal quantifier *biara*

In the two previous sections, we took a closer look at indefinite expressions. In this section, we will move on to universal quantification. There are two determiners that express universal quantification in Asante Twi: (i) *(no) nyinaa* and (ii) *biara.* The former is similar to English *all (the)* in that it is collective. The latter is closer to English *every* in that it is distributive. However, *biara* encompasses a much wider range of possible meanings than English *every*. It does not only cover the meaning of a universal quantifier, but also that of a free-choice item (FCI) or negative polarity item (NPI) similar to English *any,* as pointed out by Amfo (2010c) and Owusu (2019). In the following, I will first give some general background on FCIs and NPIs and present some background information on the expression *biara*. I will then provide descriptive data about the distribution and possible interpretations of *biara* and compare them to similar items in other languages. Specifically, I will show that *biara* behaves very similar to the Hausa expression *koo*-wh (Zimmermann 2009). However, I will also show that the analysis put forward in Zimmermann (2009) cannot explain a number of data points observed for Asante Twi *biara*. I will argue for an underspecification account, where *biara* covers the semantics of a universal quantifier, a free-choice item, and a negative polarity item.

5.5.1 NPIs & FCIs

Negative polarity items and free-choice items show some overlap in their behaviour and cannot always be teased apart easily. NPIs are polarity sensitive, meaning they show restricted distribution and are only licensed in contexts that are not episodic-affirmative, under the broadest definition (Giannakidou 2008). Examples of such licensing contexts are negation, downward entailing contexts, questions, modal expressions or intensional operators, which are subsumed under the term *non-veridical* in Giannakidou (2001, 2008). All NPIs are licensed under negation. Strict NPIs are only licensed under negation, but not in any other non-veridical environments mentioned above, while broad NPIs are

licensed under both negation and other non-veridical operators (Giannakidou 2008). An example of an NPI in English is given in (5.89).

(5.89)   a. Anna didn't read this book and Peter didn't read it **either**.
        b. *Anna read this book and Peter read it **either**.

FCIs are mainly identified through the property of expressing freedom of choice (Vendler 1967), indifference (von Fintel 2000, Giannakidou 2001) or arbitrariness (Lee 1996), such as *any/anybody/anything* in English, see (5.90)[120].

(5.90)   a. Peter would read **any** book.
        b. *Peter read any book.

FCIs are almost always polarity sensitive too, requiring a non-veridical context to be licensed. However, in contrast to NPIs, FCIs are usually *not* acceptable under negation in episodic contexts (Giannakidou 2001, Giannakidou & Cheng 2006, Giannakidou 2008). For a more detailed discussion of NPIs and FCIs see e.g. Ladusaw (1979), Horn (1989, 2000), Kadmon & Landman (1993), Giannakidou (1998, 2001, 2008), Chierchia (2013), Dayal (1998, 2013).

5.5.2   Background on *biara*

Biara is used as a post-nominal determiner in Asante Twi, expressing *every* or *any,* depending on the context. As shown in (5.91), *biara* is part of many derived forms all expressing universal quantification and free-choice. Notably, all these expressions contain the indefinite *bí* as a root and parallel the corresponding existential expressions *obi/ebi/bì/...* (Amfo 2010a), see also section 5.1. In the remainder of this section, I will restrict myself to a discussion of just the determiner *biara*.

(5.91)   o-/ebiara   =   every-/anyone
        biribiara   =   every-/anything
        baabiara   =   every-/anywhere
        biarabiara   =   anyhow
        berɛ biara   =   always/anytime

The determiner *biara* shows typical properties of a genuine quantifier. It cannot occur in existential constructions, same as English *every*, see (5.92a)[121]. It can take wide scope over negation, see (5.92b). And it does not give rise to quantificational variability effects, see (5.92c).

(5.92)   a. *Adidibea   biara   wɔ   hɔ.
         restaurant   every   at   there
         'There is/exists every/any restaurant.'

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[120] Note that English *any* is in fact both used as an FCI and as an NPI.
[121] Note that some speakers find this sentence acceptable by accommodating a local rather than existential reading along the lines 'every type of restaurant is in this area'. That is, a context where the speaker is trying to express that one can find all kinds of restaurants there: Italian, Vietnamese, …

b. Ama a-n-tɔ aduaba biara.
Ama PRF-NEG-buy fruit every
'Ama didn't buy any fruit.'

c. Ɔkra biara taa kyere nkura.
cat every often catch mouse
'Every cat usually catches mice.'
×Most cats catch mice.'

Even though *biara* shows many properties of a regular universal quantifier, it can be interpreted in different ways, depending on the environment it occurs in. It shows properties of a distributive universal quantifier, of an NPI, and of an FCI, as mentioned in previous literature (Amfo 2010c, Owusu 2019). The literature on *biara* is rather sparse, however. Owusu (2019) identifies *biara* as an NPI, which "[…] like *any* has a free-choice interpretation that is licensed in positive sentences." (Owusu 2019, p. 262). Amfo (2010c) points out that "[t]he Asante Twi lexicon does not differentiate between the domain-restricted kind of universal quantification illustrated by the English 'every' series of quantifiers and the so-called 'free choice any' quantification, which is a totally unrestricted, exception-free kind of universal quantification […]" (Amfo 2010c, p. 107). Amfo (2010a) analyses *biara* and all related expressions as quantifying over an unrestricted domain, which is only constrained via the conceptual semantics of the argument (*biara*) or the context (*o-/e-/biribiara*). According to Amfo (2010a), *biara* can obtain both the universal quantifier and the free-choice interpretation in any possible context: "[…] the addressee relies on contextual information in determining which of the two uses is intended by a speaker on a particular occasion." (Amfo 2010a, p. 1788). Even though this broad semantics of *biara* has been noted by previous authors, no work has been specifically dedicated to investigate this expression in more depth. The following section aims to fill this gap.

5.5.3 Distribution of *biara*

In the following, I will show to what extent *biara* is accepted in various different environments and which interpretation is usually obtained. These environments include the kinds of environments subsumed in Giannakidou (2001) under the term 'non-veridical', which are the kinds of environments that license free-choice items.

Biara is accepted in basic affirmative episodic environments, where it typically receives a universal quantifier (UQ) interpretation, as in (5.93).

(5.93) Sukuuni biara kan-n nwoma.
student every read-PAST book
'✓Every/×Any student read a book.'

However, the free-choice interpretation of *biara* is not completely absent from affirmative episodic environments. Sometimes, speakers obtain a free-choice reading in such environments, e.g. (5.94a)[122].

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[122] At this point, I have no explanation why sometimes a speaker only obtains the free-choice reading in affirmative episodic contexts but not the universal quantifier reading, and then rejects the sentence as a whole, even though the same sentence is accepted under the universal quantifier interpretation by other speakers.

Nevertheless, whenever this happens, the sentence is rejected, as would be expected with free-choice items in veridical contexts (Giannakidou 2001). The sentence is then corrected by replacing *biara* with *no nyinaa*. This free-choice reading is particularly prominent when *biara* is used in a partitive construction, as in (5.94b).

(5.94) a. (*)Abaayewa   biara   kan-n   biribi.
        girl   every   read-PAST   something
        '✓Every/*Any girl read something.'
    b. (*)Mmayewa   no   mu   biara   kan-n   biribi.
        girl   DEF   in   every   read-PAST   something
        '*Any of the girls read something.'

In combination with a negation marker, the universal *biara* can only be interpreted with wide scope (Amfo 2010c), henceforth written as ¬∃/∀¬. This is shown in (5.95a), where *biara* is in subject position, structurally higher than negation, and (5.95b), where *biara* is in object position, structurally lower than negation. The interpretation is always equivalent to a negative quantifier, independent of whether or not *biara* is c-commanded by the verbal negation marker. The only exception is when *biara* occurs in a negated *na*-cleft, as in (5.95c).

(5.95) a. Nenua   biara   a-n-ba.
        sibling   every   PRF-NEG-come
        'No sibling came.'
        ✗'Not every sibling came.'
    b. Ama a-n-kan   nwoma   biara.
        Ama   PRF-NEG-read   book   every
        'Ama didn't read any book.'
        ✗'Ama didn't read all the books (but some)'
    c. Ɛ-n-yɛ   nwoma   biara   na   Ama   a-n-kan
        3SG-NEG-COP   book   every   FOC   Ama   PRF-NEG-read
        'It is not every book that Ama read.'

In polar questions, *biara* typically receives the interpretation of a universal quantifier, even though the free-choice interpretation does not seem to be completely excluded. The most natural interpretation for (5.96a) is that the speaker wishes to know whether Ama read every single one of the books and not just any of them. In wh-questions like (5.96c) we get the same universal interpretation as in polar questions.

(5.96) a. Ama   kan-n   nwoma biara?
        Ama   read-PAST   book   every
        'Did Ama read ✓every/(✓)any book?'
    b. Akwadaa   biara   kan-n   nwoma?
        child   every   read-PAST   book
        'Did ✓every/(✓)any child read a book?'
    c. Dɛn   na   sukuuni biara kan-n?
        what   FOC student every read-PAST
        'What did ✓every/(✓)any student read?'

In conditional clauses the pattern in reversed. Here, the interpretation is almost always free-choice. Sentence (5.97) means that the teacher will be happy if any of the students passes the exam, no matter who or how many. For the interpretation that the teacher will only be happy if every single one of the students passes the exam, the collective universal quantifier *nyinaa* would usually be used.

(5.97) Sɛ   sukuuni   biara   twa   nsɔhwɛ no   aa
        if   student   every   pass   exam   DEF   REL
        ɔykyerɛkyerɛni no   ani bɛ-gye.
        teacher   DEF   FUT-happy
        'If (✓)every/✓any student passes the exam the teacher will be happy.'

When *biara* occurs in a sentence with a modal expression, both a universal and a free-choice interpretation are available (see also Amfo 2010a). This is independent of whether *biara* occurs above the modal expression, as a subject, or below it, as an object, see (5.98). There is no strong preference for either interpretation. A sentence like (5.99a) can be disambiguated by replacing *biara* with *no nyinaa* for the universal reading (5.99b) or by using the complex expression *no mu biara* (5.99c) for the free-choice reading.

(5.98) a. Sukuuni   biara   be-tumi   a-twa   nsɔhwɛ no.
           student   every   FUT-can   CONS-pass exam   DEF
           '✓Every/✓Any student can pass the exam.'
        b. Ama   be-tumi   a-twa   nsɔhwɛ   biara.
           Ama FUT-can   CONS-pass   exam   every
           'Ama can pass ✓every/✓any exam.'

(5.99) a. Ɛsɛ sɛ Ama   twa   nsɔhwɛ biara.
           must Ama   pass   exam   every.
           'Ama must pass ✓every/✓any exam.'
        b. Ɛsɛ sɛ Ama twa   nsɔhwɛ no   nyinaa.
           must Ama   pass   exam   DEF   all.
           'Ama must pass all of the exams.'
        c. Ɛsɛ sɛ Ama   twa   nsɔhwɛ no   mu   biara.
           must Ama   pass   exam   DEF   in   every.
           'Ama must pass any of the exams.'

Intensional verbs like *pɛ* (= want) also allow for both readings:

(5.100) Ama   pɛ   sɛ   ɔ-tɔ   nwoma biara.
        Ama   want   COMP 3SG.SBJ-buy book   every
        'Ama wants to buy ✓every/✓any book.'

The same is true when *biara* occurs with imperative mood. Such a sentence can be interpreted both with a universal and a free-choice reading:

(5.101) Siesie   akonwa   biara.
        fix   *chair*   *every*
        'Fix ✓every/✓any chair.'

In (5.102), *biara* co-occurs with the expression *ebia* (=maybe/perhaps). When *biara* occurs in subject position, only the universal quantifier interpretation seems to be available. Thus, in (5.102a), the speaker assumes that every single one of the girls sang a song and would thus be proven false if only one or a few of the girls sang a song. When *biara* occurs in object position, as in (5.102b), both interpretations are available.

(5.102) Ebia,   abaayewa   biara   bɛ-to   dwom.
        maybe   *girl*   *every*   *FUT-sing*   *song*
        'Maybe, ✓every/×any girl will sing a song.'
        Ebia,   abaayewa   no   bɛ-to   dwom biara.
        maybe   *girl*   *DEF*   *FUT-sing*   *song* *biara*
        'Maybe, the girl will sing ✓every/✓any song.'

Sentence (5.103) provides an example with the exclusive particle *nko ara* (= only), which obligatorily requires the focus construction. In this case, only the universal quantifier reading of *biara* seems to be available.

(5.103) a. Yaw   nko ara   na   ɔ-twa-a   nsɔhwɛ biara.
           Yaw   *only*   *FOC*   *3SG.SBJ-pass-PAST*   *exam*   *every*
           'Only YAW passed ✓every/×any exam.'
       b. Yaw   na   ɔ-twa-a   nsɔhwɛ biara.
           Yaw   *FOC*   *3SG.SBJ-pass-PAST*   *exam*   *every*
           'It is YAW who passed ✓every/(✓)any exam.'

In the case of a factive predicate in (5.104), the free-choice interpretation is completely absent. In the case of a negative factive predicate in (5.105), both interpretations are possible, with a preference for the universal quantifier.

(5.104) Ama   bofu   yɛ   sɛ   akwadaa biara re-kasa.
        Ama   *angry*   *COP*   *COMP*   *child*   *every*   *PROG-talk*
        'It angered Ama that ✓every/×any child was talking.'

(5.105) Ɛ-yɛ   Kofi   nwonwa   sɛ   Ama twa-a   nsɔhwɛ   biara.
        3SG.SBJ-COMP   *Kofi*   *surprising*   *COMP*   *Ama*   *pass-PAST*   *exam*   *every*
        'It surprises Kofi that Ama passed ✓every/(✓)any exam.'

Table 5.6 provides an overview of the different environments tested so far and the respective interpretations that are available for *biara* as either a universal quantifier or a free-choice item.

	interpretation of *biara*	
	universal quantifier	**FCI/NPI**
affirmative episodic	✓	✗
exclusive particle	✓	✗
factive verb	✓	✗
polar/wh-question	✓	(✓)
na-focus	✓	(✓)
negative factive verb	✓	(✓)
modal adverb	✓	✗(sbj) / ✓(obj)
conditional	(✓)	✓
modal	✓	✓
intensional verb	✓	✓
imperative mood	✓	✓
negation[123]	✗	✓

Table 5.6: Overview of the interpretation of *biara* as universal quantifier or as free-choice depending on the environment it occurs in.

First of all, we saw that in contrast to conventional free-choice items, *biara* is accepted in all contexts except from existential constructions. Second, the universal quantifier interpretation seems to be available across the board and in a number of cases it is the preferred or even the only available interpretation. Only in conditionals is it the less preferred reading. The free-choice interpretation on the other hand is more limited. As expected, it is either absent in affirmative episodic contexts, or, when this reading is in fact obtained, the sentence is rejected. The free-choice reading is also absent in the scope of a factive predicate and the exclusive particle, and also under the adverb *ebia* (= maybe) if *biara* occurs in subject position. The free-choice reading is readily available with conditionals, modals, intensional verbs and imperatives, and under the adverb *ebia* (= maybe) if *biara* occurs in object position. The NPI reading occurs with negation and is marginally available under questions, negative factive predicates and focus constructions.[124,125] The absent FCI/NPI reading of *biara* with the exclusive

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[123] It would also be possible to tick the box with 'universal quantifier' meaning, if we assume that the universal quantifier takes obligatory wide scope. This would be equivalent to an NPI interpretation. However, I inserted a cross to make visible that we only ever get one interpretation and that we do not get a regular universal quantifier interpretation that can be in the scope of negation. I will also show later in this section that an obligatory wide scope analysis of the universal quantifier does not make the right predictions.

[124] Thanks to Joana Serwaa Ampofo (p.c.) for pointing out that aspect might also have an impact on the interpretation of *biara* as either a universal quantifier or free-choice item. I have not investigated this potential effect and leave it for future research. The reader is referred to the ongoing research of Ampofo.

[125] Which interpretation is available or preferred also hinges to a great degree on the specific context. Thus, sometimes a speaker will reject one of the readings as unavailable in a certain grammatical environment with

particle and the factive verb can be expressed by the non-specific use of *bí* (see also section 5.3). This reading can also be made more prominent in the case of questions and negative factive verbs in the same way. Alternatively, the use of the partitive construction *N no mu biara* typically disambiguates towards the FCI reading, while the use of *no nyinaa* disambiguates towards the UQ reading.

5.5.4   Comparison: *Koo*-wh in Hausa (Zimmermann 2009)

In this section, I will compare the interpretational possibilities of *biara* to a similar item *koo*-wh in Hausa presented in Zimmermann (2009). I will also give a summary of the analysis put forward by Zimmermann to account for the behaviour of *koo*-wh. *Koo*-wh is claimed to only have a universal quantifier reading, with all other interpretations arising due to scopal interaction with other elements in the sentence.

The behaviour of *biara* shows striking similarity in its behaviour of the *koo*-wh expressions in Hausa as described in Zimmermann (2009), see Table 5.7 below.

	interpretation of *biara*		interpretation of *koo*-wh	
	universal quantifier	**free-choice**	**universal quantifier**	**free-choice**
affirmative episodic	✓	✗	✓	✗
exclusive particle	✓	✗		
factive verb	✓	✗		
polar/wh-question	✓	(✓)	✓	✗
na-focus	✓	(✓)		
negative factive verb	✓	(✓)		
modal adverb	✓	✗(sbj) / ✓(obj)		
Conditional	(✓)	✓		
Modal	✓	✓	✓	✓
intensional verb	✓	✓	✓	✓
imperative mood	✓	✓	✓	✓

Table 5.7: Overview of the interpretation of Asante Twi *biara* as universal quantifier or as free-choice depending on the environment it occurs in and the interpretation of Hausa *koo*-wh in the same environments as reported in Zimmermann (2009).

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lexicalization A, but not with lexicalization B. As the examples (5.93)-(5.105) usually only show one lexicalization, they may not be representative. The indicated judgments are a summary of a variety of lexicalizations and several speakers, not of this one specific lexicalization.

These *koo*-wh expressions, too, show features of universal quantifiers, free-choice items, and NPIs. These different interpretations arise in the same environments as it is the case for Asante Twi: Zimmermann (2009) shows that the free-choice interpretation is absent in episodic affirmative contexts and arises only in modal and intensional contexts in Hausa, thereby giving rise to the same ambiguity between UQ- and FCI-reading as it is the case for Asante Twi. Further, when *koo*-wh occurs with negation, it always gives rise to a ¬∃ interpretation, independent of the surface c-command relationship, just like *biara* in Asante Twi.

According to Zimmermann, the marker *koo* on its own has multiple functions in Hausa: (i) disjunction marker, (ii) question marker in polar questions, and (iii) emphatic scalar expression. Zimmermann lists a number of other languages, both related and non-related, that also employ the combination of a disjunction marker and a wh-word to generate some type of quantificational expression, e.g. Malayalam, Kannada, Japanese, Korean, and a range of Chadic languages. Zimmermann calls these items wh-DISJ. However, the interpretation of these elements varies cross-linguistically: they can have existential or universal force. Hausa *koo*-wh shows universal force. Following a similar approach as Giannakidou & Cheng (2006) for FCIs in Greek and Chinese, Zimmermann (2009) suggests that the meaning of these wh-DISJ expressions can be derived compositionally: In the case of Hausa and Korean, where the wh-DISJ expression has universal rather than existential force, the disjunction marker and the the wh-expression combine in such a way that the former "[…] acts as a maximizing element by inducing set union […]" (Zimmerman 2009, p. 5).

Zimmermann (2009) shows that *koo*-wh expressions have the typical properties of lexical quantification, such as (i) ungrammaticality in existential constructions, (ii) no quantificational variability effects, (iii) cannot serve as antecedent, (iv) can take wide scope over negation. Zimmermann argues that *koo*-wh in Hausa should not be treated as a case of lexical ambiguity. Instead, it should only be treated as a universal quantifier[126], with the free-choice interpretation arising due to scopal interaction with intensional operators. One argument in favour of this analysis is the fact that the UQ reading is available across the board. Further, the fact that quantificational variability effects are absent with *koo*-wh expressions even under the free-choice interpretation with intensional operators is taken as evidence against an ambiguity account. If *koo*-wh elements were lexically ambiguous, this effect would be unexpected, as FCIs do typically give rise to quantificational variability effects (Giannakidou 2001).

Zimmermann (2009) suggests that the different interpretations of *koo*-wh in Hausa as universal quantifier or free-choice can be reduced to a matter of scope. He claims that the apparent FCI-reading arises solely due to scopal interaction of the universal quantifier with the modal/intensional operator. That is, in modal or intensional contexts, the UQ-reading arises whenever *koo*-wh scopes under the operator, and the FCI-reading arises whenever *koo*-wh scopes over the operator at LF. Zimmermann exemplifies this with a sentence like (5.106), where a *koo*-wh expression co-occurs with the modal *can*. The logical representation in (5.107i) aligns with the FC interpretation in (5.106i) and the logical representation in (5.107ii) aligns with the UQ interpretation in (5.106ii).

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[126] See Dayal (1998, 2004), Aloni (2007) for a similar approach based on universal quantification for *any* in English, and Menéndez-Benito (2005) and Sæbø (2001) for FCIs in Spanish and Scandinavian, respectively.

(5.106) a   cân   anàa   iyaa   kòoya-n   koo-wànè   harshèe
      at   *there*   *one-Prog*   *can*   *learn-of*   *DISJ-which*   *language*
      i. There, one can learn *any* language
      ii. There, one can learn *every* language (of those that are on offer).
                       (adapted from Zimmermann 2009, p. 37)

(5.107) i. $\forall z$ [language'(z) $\rightarrow \exists w$ [R(w,w$_0$) $\wedge \exists x$ [person'(x,w) $\wedge$ learn'(x,z,w)]]]
      = For each language z, there is a world w accessible from w$_0$ such that a person in w
      learns z in w
      ii. $\exists w$ [R(w,w$_0$) $\wedge \exists x$ [person'(x,w) $\wedge \forall z$ [language'(z) $\rightarrow$ learn'(x,z,w)]]]
      = There is a world w accessible from w$_0$ such that a person in w learns every language
      in w
                       (adapted from Zimmermann 2009, p. 41-42)

Zimmermann further argues that the apparent NPI-reading with negation comes from the fact that *koo*-wh undergoes obligatory QR at LF for type reasons (see section 2.1.3), thereby always scoping over negation at LF, independent of whether it occurs in subject or object position[127]. This is exemplified in (5.108). Zimmermann further provides sentences like (5.109) as evidence for the assumption that *koo*-wh has no function as an NPI. In such focus constructions, where the focussed *koo*-wh expression is fronted and negated, negation takes obligatory wide scope over the quantifier. This would be unexpected for an NPI, as the c-commanding negator should in principle be able to serve as a licenser for an NPI.

(5.108) a. bà-n   ga   koo-waa   ba.
         NEG-1SG   *see*   *DISJ-who*   *NEG*
      b. **koowaa**$_1$ [bà-n [ga **t**$_1$] ba]
      c. 'For every person x, I did not see x.' = 'I did not see anybody.'
                 (Zimmermann 2009, p. 42; originally from Newman 2000, p. 624)

(5.109) **bàa**   [**koo-waa** [$_{VP}$ kèe   sô-n   wannàn jàr̃iidàa]]   **ba**.
      NEG   *DISJ-who*   *PROG.REL*   *like-of* *this*   *newspaper*   *NEG*
      'Not EVERYONE likes this newspaper.'
               (adapted from Zimmermann 2009, p. 36; originally from Newman 2000, p. 624)

In contrast to *koo*-wh and the other wh-DISJ expressions discussed in Zimmermann (2009), *biara* shows a different morphological setup. According to Owusu (2019), *biara* is a combination of the specific indefinite article *bí* and the emphatic particle *ara*. The former was discussed in more depth in the previous section. It is morphologically distinct from wh-words in Asante Twi[128]. Wh-words and indefinites are semantically related, though, and coincide or overlap in a variety of languages (= wh-indefinites), e.g. in Chinese (Huang 1982, Aldrige 2007, Dong 2009, Liu & Yang 2021), Korean (Yun 2013), Greek (Postma 1994, Haspelmath 1997), or Dutch (Postma 1994). The second part of *biara*, the

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[127] Note that there are also independent empirical and theoretical reasons to reject the idea of QR in order to resolve type mismatch altogether, see Blok (2019).
[128] *dɛn* = what, *hwan* = who, *bɛn* = which

emphatic particle *ara,* occurs in combination with various other elements in Asante Twi, a few examples of which are given in (5.110). It is thus similar to the emphatic use of *koo* in Hausa. The disjunction marker in Asante Twi is *anaa*, which can also be used as a question marker, same as *koo* in Hausa. The two expressions *ara* and *anaa* might in fact share a common root, a possibility that I will not investigate in any more depth, though, as it goes beyond the scope of this thesis. Thus, even though the morphological setup of *biara* is different from the wh-DISJ expressions discussed in Zimmermann (2009), there is still notable semantic overlap of the elements involved. Thus, the similarity in interpretation may not be too surprising. The compositional derivation of the lexical meaning of wh-DISJ expressions in Zimmermann could therefore in principle be extended to Asante Twi: the emphatic particle *ara*, which commonly shows maximizing properties[129], combines locally with the indefinite *bí*, giving rise to universal force.

(5.110) nko ara   =   alone/only

seesei ara   =   right now

saa ara   =   also/same

pa ara   =   a lot/very

anim-anim ara   =   immediately

me ara   =   I myself

However, despite the compelling similarity between Hausa *koo*-wh and Asante Twi *biara*, the analysis in Zimmermann (2009) is not applicable to Asante Twi. In the remainder of this section, I will show that even though *biara* behaves very similar to the Hausa expression *koo*-wh, the analysis put forward in Zimmermann (2009) cannot explain a number of data points observed for Asante Twi *biara*. I will show that *biara* does indeed encompass the meaning components of all three UQ, FCI and NPI. Neither can the FCI component be reduced to scopal interaction of the universal quantifier with a modal/intensional operator, nor can the NPI component be reduced to scopal interaction of the universal quantifier with negation. The analysis in here is thus more in spirit to the previous informal descriptions of *biara* as being underspecified for a UQ and FCI interpretation (Amfo 2010c) or an NPI and FCI interpretation (Owusu 2019).

5.5.5   Can we do without an FCI component for *biara*?

On first sight, the analysis in Zimmermann (2009) for Hausa seems to transfer to Asante Twi. In fact, if we take the equivalent sentences of (5.106) – (5.109) above in Asante Twi, the analysis works perfectly well. A number of problems arise once we look at other environments, though. In the following, I will show that the assumption that the free-choice reading arises from interaction of the universal with a modal/intensional operator runs into a number of problems. I will conclude that *biara* requires a separate free-choice component that cannot be analysed along the lines proposed in Zimmermann (2009) for *koo*-wh, despite the strong similarity between the two expressions.

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[129] Amfo (2010b) provides a wider range of uses of *ara*, namely as "[…] a restrictive marker, a scalar marker, a marker of simultaneity and one of continuity." (Amfo 2010b, p. 211). Amfo points out the difficulty of finding a common underlying meaning for all of these uses.

Zimmermann (2009) assumes that the free-choice reading in Hausa arises due to wide scope of the universal quantifier over modal/intensional operators. Asante Twi *biara*, however, does not only give rise to the free-choice reading in contexts with a modal or intensional operator. In particular contexts, the free-choice reading can arise with negation[130]. An example is provided in (5.111). These sentences are understood with a free-choice interpretation despite the lack of a modal or intensional operator. Further, as Giannakidou (2001) notes, universal quantifiers are generally considered ungrammatical in predicative uses like (5.111a). In English, it is not possible to say "He is (not) every teacher". Assuming a UQ-only analysis of *biara* therefore poses a problem for such sentences.

(5.111) a. Ɔ-n-yɛ   ɔkyerɛkyerɛni   biara   (kɛkɛ),   ɔ-da mu fua.
        3SG-NEG-COP   *teacher*   *every*   *(just)*   *3.SG-is.special*
        'He is not (just) any teacher, he is special/different.'
     b. Ama   a-n-twerɛ   nwoma   biara   (kɛkɛ),
        Ama   *PRF-NEG-write*   *book*   *every*   *(just)*
        ɔ-twerɛ-ɛ   nwoma   aa   ɛ-da mu fua.
        3SG.SBJ-write-PAST   *book*   *REL*   *3SG.SBJ-special*
        'Ama did not write (just) any book, she wrote a book that is special/different.'

Finally, the analysis given in (5.107) runs into problems even in modal contexts, once we replace the possibility modal *can* with the necessity modal *must,* as in (5.112). Here, the scopal interaction of universal quantifier and modal operator cannot derive the free-choice reading. The modal *must* can be represented as universal quantification over deontic possible worlds. The two representations in (5.112i) and (5.112ii) are logically equivalent. (5.112i) says that for every book it is true that in all possible worlds Kofi is required to read it. And (5.112ii) says that in every possible world, Kofi is required to read every book. The free-choice reading, however, says something else. The free-choice interpretation says that Kofi must read a book, but it doesn't matter which one. There is no requirement for him to read all books. The representation in (5.112i) is thus not equivalent to the free-choice interpretation of (5.112).

(5.112) Ɛsɛ sɛ   Kofi   kan   nwoma   biara.
        must   *Kofi*   *read*   *book*   *every*
        'Kofi must read every/any book.'
        i. $\forall z$ [book'(z) $\rightarrow \forall w$ [R(w,w$_0$) $\rightarrow$ read'(Kofi,z,w)]]
        = For each book z it is true that each possible world w accessible from w$_0$ is such that
        Kofi reads z in w
        ii. $\forall w$ [R(w,w$_0$) $\rightarrow \forall z$ [book'(z) $\rightarrow$ read'(Kofi,z,w)]]
        = Each possible world w accessible from w$_0$ is such that for each book z it is true that
        Kofi reads z in w

The same is true for intensional verbs (5.113) or imperatives[131] (5.114). An intensional verb like *want* in (5.113) can be represented as universal quantification over possible worlds of desire. When the

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[130] so-called 'indiscriminative' contexts (Horn 2000, Giannakidou 2001), see also section 5.5.6 below.
[131] There are different types of imperatives, e.g. commands, wishes, or advice, some of which have stronger modal force than others. Nevertheless, rephrasing (5.114) as universal quantification over an existential modal does not give us the right interpretation. When (5.114) is uttered under an FC interpretation, speakers expect that at least

universal quantifier takes scope over *want*, it means that for every book it is true that in all possible worlds Kofi wishes to read it. When *want* takes scope over the universal quantifier, it means that every possible world is such that Kofi wishes to read every book in it. Whether or not the universal quantifier takes scope over or below *want*, we arrive at a logically equivalent meaning. The free-choice reading, however, says that Kofi wishes to read a book, but he doesn't care which one.

(5.113) Kofi   pɛ   sɛ   ɔ-kan   nwoma   biara.
         Kofi   want   COMP   3SG.SBJ-read   book   every
         'Kofi wants to read every/any book.'

(5.114) Kan   nwoma   biara!
         read   book   every
         ʹRead every/any book!'

I conclude that the UQ-only analysis of Zimmermann (2009) for Hausa *koo*-wh cannot capture the free-choice interpretation of Asante Twi *biara* in a number of different contexts. Instead, the data suggest that *biara* lexically encompasses a free-choice component that cannot be reduced to a regular universal quantifier meaning.

5.5.6   Can we do without an NPI component for *biara*?

I will now move on to the question of whether the behaviour of *biara* can be reduced to only a universal quantifier and a free-choice component or if it also includes an NPI component. I will first present arguments in favour of an NPI analysis and then discuss if there are any arguments against an NPI analysis, making reference to the counterarguments put forward in Zimmermann (2009).

    (i)   Arguments in favour of an NPI analysis

First, I will draw a comparison to English *any,* which has long been argued to also involve both an NPI and an FCI component. The arguments from the debate around *any* transfer to Asante Twi. These arguments mainly surround the variable behaviour of *any* as an NPI versus FCI. Horn (2000), for example, points out that FCI *any* can be modified with adverbs like *almost* or *absolutely*, but NPI *any* cannot, see (5.115). Such modifiers are normally compatible with universals but not with existentials (Horn 1972, Carlson 1981).

(5.115) a. Absolutely anyone can cook Peking duck.
       b. *Kim didn't see absolutely anyone.

                                      (Horn 2000, p. 160)

Further, several authors have pointed out that NPI *any,* but not FCI *any,* can occur in existential constructions (e.g. Horn 1972, Fauconnier 1975), see (5.116a-b) below. This appeals to a more general pattern that weak but not strong quantifiers are acceptable with there-insertion (Milsark 1974, 1977, see

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one book *must* actually be read (it just does not matter which one). However, an existential paraphrase like "You can read any book." analysed as ∀>∃ ("For every book it is the case that you can read it.") does not entail that the addressee actually must read a book.

also section 2.1.2 above). For the same reason, a universal quantifier can also not occur in existential constructions, see (5.116c).

(5.116) a. There isn't anybody that can swim the Channel.
      b. *There is anybody that can swim the Channel.
      c. *There is everybody that can swim the Channel.

<div align="right">(adapted from Horn 2000, p. 161)</div>

Asante Twi does not have a modifier equivalent to *almost* (Ampofo 2015) or *absolutely* (according to my language consultants), so the first effect cannot easily be tested for *biara*. The effect shown in (5.116), however, arises in the same way in Asante Twi, see (5.117). The sentence in (5.117a) is grammatical. Here, *biara* co-occurs with negation in an existential construction and would thus be licensed as an NPI. In (5.117b), however, there is no negation and the sentence is ungrammatical. The fact that (5.117a) is grammatical implies that *biara* can have existential force. This is therefore an additional argument against deriving all occurrences of *biara* from a regular universal quantifier, as it would be unclear where the existential force comes from to license its NPI occurrence in negated existential constructions. In section 5.5.8 below, I will instead make reference to an account of FCIs by Chierchia (2013) and Dayal (2013), where universal force is derived from existential force.

(5.117) a. Nipa   biara   n-ni   hɔ   aa   ɔ-be-tumi   a-twa
         person   *every* *NEG-have*   *there*   *REL*   *3SG.SBJ-FUT-can*   *CONS-pass*
         nsɔhwɛ no.
         exam   *DEF*
         'There isn't any person who can pass the exam.'
      b. *Nipa   biara   wɔ   hɔ   aa   ɔ-be-tumi   a-twa
         person   *every* *have* *there* *REL*   *3SG.SBJ-FUT-can*   *CONS-pass*
         nsɔhwɛ no.
         exam   *DEF*
         'There is every/any person who can pass the exam.'

A second argument is the fact that *biara* is marginally licensed under negation across clause-boundaries, see (5.118). This sentence is ambiguous. It can have the salient reading that Kofi knew that some children were asleep but he didn't know that all of them were asleep, i.e. negation takes scope over the universal quantifier *biara*. Or it can have the less salient reading that Kofi didn't know that any child was asleep, i.e. he thought that all children were awake. Note that this reading was only accepted by some speakers, so while the clause boundary may not completely block this reading, it is only marginal.

(5.118) a. Kofi nim   sɛ   akwadaa   biara   re-da.
         Kofi *know* *COMP*   *child*   *every* *PROG-sleep*
         'Kofi knows that every child is sleeping.'
      b. Kofi n-nim   sɛ   akwadaa   biara   re-da.
         Kofi *NEG-know* *COMP*   *child*   *every* *PROG-sleep*
         'Kofi doesn't know that every/any child is sleeping.'

If we assume that the less salient reading in (5.118b) arises because the universal *biara* takes wide scope over negation, then we would need to claim that it can take scope across a clause boundary. However, scope data does not provide evidence that this is the case. In sentence (5.119), *biara* can be interpreted both with the *every* and *any* interpretation, but the universal quantifier cannot take wide scope over the existential *obi* in the matrix clause. *Obi* occurs in between the two negated verbs. Thus, if the universal could take scope above negation, a distributive reading of the universal over *obi* should be available too. This is not the case, though.

(5.119) Ama n-nye obi n-ni sɛ akwadaa
   Ama NEG-believe somebody NEG-believe COMP child
   biara re-da.
   every PROG-sleep
   'Ama doesn't believe somebody that every/any child is sleeping.'
   ✓∃>∀; ×∀>∃

The relevant reading of (5.118b) can also not be reduced to a free-choice interpretation, for the two following reasons. First of all, free-choice items are known to be notoriously odd under negation in episodic contexts (Giannakidou 2001, Giannakidou & Cheng 2006, Giannakidou 2008). Second, wide scope of negation over an FCI does not give us the correct interpretation of (5.118b). As shown in (5.120), repeated from (5.111) above, a free-choice interpretation under negation is accepted in a special kind of context, called 'indiscriminative' (Horn 2000). These contexts are a cross-linguistically observed exception for the no-FCIs-with-negation rule (Giannakidou 2001). In these sentences, it is the free-choice item that is negated, giving essentially rise to the opposite of a free-choice meaning ('you can NOT just freely choose')[132]. The sentence in (5.121) with *na*-cleft makes it clear that the scope relation in (5.120) must indeed be NEG>FCI. The sentence in (5.121) receives the exact same interpretation as (5.120b). As noted further above, it is a well-known fact that in Asante Twi, negation in a *na*-cleft *always* takes wide scope with respect to the clefted element (Amfo 2010c). Thus, the second reading in (5.118b) cannot be explained through narrow scope of a free-choice item, exceptionally licensed by negation, as this would give rise to a different interpretation. That means, we need to assume that *biara* also encompasses an NPI component and that as an NPI it can be licensed by negation without direct c-command and marginally across clause-boundaries. Even though this second aspect is unusual for NPIs in Asante Twi, it is not completely absent, as demonstrated with data from Ampofo (2015) further above.

(5.120) a. Ɔ-n-yɛ   ɔkyerɛkyerɛni biara (kɛkɛ), ɔ-da mu fua.
    3SG-NEG-COP teacher   every (just) 3.SG-is.special
    'He is not (just) any teacher, he is special/different.'
   b. Ama a-n-twerɛ nwoma biara (kɛkɛ),
    Ama PRF-NEG-write book every (just)
    ɔ-twerɛ-ɛ   nwoma aa ɛ-da mu fua.
    3SG.SBJ-write-PAST book REL 3SG.SBJ-special
    'Ama did not (just) write any book, she wrote a book that is special/different.'

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[132] Note that both the ¬∃ and ∀¬ reading are either pragmatically odd or contradictory in sentences like (5.120) and (5.121), thereby enforcing the NEG>FCI reading as the only way of making sense of the sentence at all.

(5.121) Ɛ-n-yɛ   nwoma   biara   na   Ama   twerɛ-ɛ yɛ.
        3SG.SBJ-NEG-COP   *book*   *every*   *FOC*   *Ama*   *write-PAST*
        Ɛ-da mu fua.
        3SG.SBJ-special.
        'It is not (just) any book that Ama wrote. It is special/different.'

(ii)   *Arguments against an NPI analysis?*

Now that we have discussed some arguments in favour of *biara* as an NPI, I will proceed to discuss if there is also counterevidence. The main argument put forward in Zimmermann (2009) against *koo*-wh being treated as an NPI is the fact that *koo*-wh does not *always* give rise to the ¬∃ reading under negation. When the *koo*-wh expression occurs in a negated *na*-cleft, the interpretation is ¬∀, see (5.109) above. We find the same in Asante Twi, as was demonstrated in (5.95a) further above. This sentence cannot mean that no student passed the exam. However, as shown in Amfo (2010c), there is actually *no* element in Asante Twi that can ever take wide scope in a negated *na*-cleft. Ampofo (2015) describes the negated *na*-cleft sentence as a general strategy in Asante Twi to resolve ambiguity surrounding negation in ordinary clauses. This strategy is also known from other language. One might thus argue that there is a peculiarity with the *na*-cleft construction which leads to the lack of a ¬∃ (= NPI) reading. In fact, cross-linguistically, NPIs are not always felicitous in negated clefts, see (5.122) for a few examples from English. These NPIs in a negated cleft are either ungrammatical or at least odd, whereas the positive counterparts are acceptable. One might thus argue that the NPI reading under a negated *na*-focus does not arise because the NPI is simply ungrammatical, thereby only leaving the other possible meaning components of *biara*.

(5.122) a. ?It's not any exam that Peter passed.
           ✓It's every exam that Peter passed.
      b. ?It's not ever that Peter reads books.
           ✓It's quite often that Peter reads books.
      c. ?It's not in ages that Peter met John.
           ✓It's a long time ago that Peter met John.

If we look at NPIs in Asante Twi, we can see that there are both NPIs which are licensed in *na*-clefts, such as *hwee* and *ni gyina*, and NPIs, which are not licensed in *na*-clefts, such as *si aga* (Ampofo 2015). *Biara* might therefore simply be one of those NPIs in Asante Twi, which are ungrammatical in the *na*-focus.

Let us now turn to licensing of NPIs in subject position. As described above, Hausa gives rise to the ¬∃ reading when *koo*-wh occurs with negation, independent of whether *koo*-wh appears in object or subject position, that is, independent of the surface c-command relationship between quantifier and negation (Zimmermann 2009). Based on that, Zimmermann rejects an NPI analysis for *koo*-wh in Hausa. The reason is that NPIs usually have to be overtly c-commanded by negation in order to be licensed (Giannakidou 2008). However, overt c-command is not an obligatory requirement cross-linguistically. In fact, Ampofo (2015) demonstrates that while some NPIs like *huu* are not licensed in subject position in Asante Twi, other NPIs like *hwee* are, see (5.123) below.

(5.123) a. *__Huu__   __n__-yɛ   Kofi.
           nothing   NEG-do   Kofi
           'nothing will happen to Kofi.'
     b. __Hwee__   re-__n__-hia   no.
           nothing   PROG-NEG-need   3SG.OBJ
           'He is needful of nothing.'

                                 (adapted from Ampofo 2015, p. 72 & 74)

Ampofo argues that in Asante Twi, NPIs only have to occur within the same clause as negation in order to be licensed, they do not necessarily have to be c-commanded by it. Negation in another clause, however, cannot serve as a licenser, see (5.124).

(5.124) a. [Me-nim   [sɛ   ɔ-__m__-fa   *hwee*   ho]].
           1SG-know   COMP   3SG-NEG-take anything   self
           'I know that s/he doesn't care about anything.'
     b. *[Me-__n__-nim   [sɛ   ɔ-fa   *hwee*   ho]].
           1SG-NEG-know   COMP   3SG-take   anything   self
           'I don't know that s/he cares about anything.'

                                 (adapted from Ampofo 2015, p. 85)

However, we have seen in (5.118) above that the NPI reading is marginally available even with a clause-boundary. That is, *biara* does not seem to pattern with other NPIs in this case. It must be noted that Ampofo, too, mentions an exceptional case of cross-clausal NPI-licensing with *hwee*, namely the unconditional in (5.125)[133].

(5.125) [wo-yɛ   no   *hwee*   a,   [ɛ-__n__-yɛ   yie]].
           2SG-do   3SG.OBJ   anything   COND   3SG-NEG-do   well
           'Whatever you do to him/her, it will not work.'

                                 (adapted from Ampofo 2015, p. 86)

Ampofo speculates that this might be due to the resumptive pronoun *ɛ-* in the matrix clause that is co-indexed with the NPI in the embedded clause. In the complement clause (5.118b), however, there is no resumptive pronoun and no movement. That is, the co-indexation explanation of (5.125) it is not applicable to the case of *biara* in (5.118). However, it is questionable if the movement explanation is even viable. If a resumptive pronoun that occurs with negation can license a clause-external, co-indexed NPI, then it is surprising that this does not also apply to *na*-clefts or standard relative clauses. As can be seen in (5.126), the NPI *hwee* is not licensed despite the resumptive pronoun *ɛ-* and negation of the lower verb. Thus, despite the strong tendency for NPIs in Asante Twi to only be licensed with clause-mate negation, this is not a rule without exception. *Biara* might thus be an NPI that can also be licensed by negation in a higher clause, at least for some speakers. After all, licensing from a higher clause is only a marginal reading even with *biara*.

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[133] Note that according to Ampofo (2015), *hwee* is a strict NPI, i.e. is only licensed by negation and not, for example, by a conditional.

(5.126) a. *Hwee*   na   ɛ-m-fa   ne ho.
           anything   *FOC*   *3SG.SBJ-NEG-take*   *self*
           'It is ANYTHING that doesn't bother him/her.'
     b. *Wo-be-tumi*   ka   hwee   aa   ɛ-m-fa   ne ho.
           2SG.SBJ-FUT-can   *say*   *anything*   *REL*   *3SG.SBJ-NEG-take*   *self*
           'You can say anything that doesn't bother him/her.'

Overall, we see that the general behaviour of *biara*, albeit not completely typical*,* is not in contradiction to other NPIs in Asante Twi and therefore does not constitute counterevidence against an NPI-analysis of *biara*. On the other hand, I provided several arguments that the NPI meaning of *biara* cannot simply be derived through variable scope-taking behaviour of UQ or FCI *biara*. I therefore conclude that *biara* does in fact encompass the semantics of an NPI.

5.5.7   Three meaning components of *biara*

In the previous section, I provided several pieces of evidence for an analysis of *biara* as being underspecified between a universal quantifier, a free-choice item, and a negative polarity item. This section will summarize this evidence and spell this out the analysis in some more detail.

Section 5.5.3 established that the universal quantifier reading of *biara* is available across the board, while the free-choice reading is more restricted. More specifically, *biara* as a universal quantifier occurs in episodic affirmative sentences. Following Zimmermann (2009), this indicates that the universal reading cannot be derived from an underlying free-choice meaning *biara*. Further, wide scope of negation over *biara*, which occurs in negated *na*-clefts, gives rise to two distinct readings (5.95c vs. 5.121), despite the NPI reading being unavailable in this context.

Section 5.5.5 showed that it is impossible to derive all possible occurrences of free-choice in Asante Twi from an underlying universal quantifier interacting with a modal/intensional operator. Free-choice readings also occur with questions (5.96), focus constructions (5.103b) and negation under indiscriminative uses (5.120). Further, the scopal interaction analysis only gives rise to the correct semantics with possibility modals, but not with necessity modals. *Biara* in Asante Twi does not only have universal force but also existential force, the latter being associated with free-choice items (Giannakidou 2001). Finally, it is also not possible to derive all FCI occurrences from an NPI component of *biara*. The reason is that wide scope of negation over *biara* does not always only result in either the $\neg\exists$ or $\neg\forall$ interpretation, but can also give rise to a third reading in indiscriminative uses (5.120 & 5.121). Also, Ampofo (2015) shows that all NPIs in Asante Twi are licensed by negation only. Thus, *biara* would be a lonely exception as an NPI in Asante Twi if it was also licensed by all the non-veridical environments established in section 5.5.3. NPI *biara* can in fact arise in a few contexts besides negation, such as questions, negative factive verbs, and *na*-focus. However, these contexts all contain an implicit negation. Further, the NPI-reading – though not completely ruled out – is clearly the dispreferred interpretation here. The preferred reading in all of these contexts is that of a universal quantifier.

Finally, section 5.5.6 established that we can also not reduce the NPI component of *biara* to either the universal quantifier or the free choice semantics. We saw that there is a compelling analysis along the lines of Amfo's (2010c, 2010a) generalization about *bi*-expressions. All *bi*-expressions (being quantifiers) have a wide-scope requirement over negation as a part of their semantics and this requirement is overridden only by the strict semantics of *na*-clefts, where the clefted element is always in the scope of the higher negation. Under this analysis, we could explain (i) why we always get the same ¬∃ reading with *biara* and negation independent of surface order, (ii) why we only get the opposite ∀¬ reading in *na*-clefts, and (iii) why *bí* and *biara* pattern alike with negation in all respects. Nevertheless, we saw that there is a problem with this account. *Biara* is accepted as an NPI in contexts where FCI and UQ are clearly excluded. Thus, it is not possible to derive the NPI meaning from the UQ component of *biara* alone. It can also not be derived from the FCI component, for two reasons. First, FCIs are known to be generally bad with negation (Giannakidou 2001, Giannakidou & Cheng 2006, Giannakidou 2008). Second, exceptional narrow scope of an FCI under negation gives rise to a different meaning.

Now, if we assume that *biara* does indeed encompass all three meaning components, UQ, FCI, and NPI, then we still need to answer two questions:

(i)   Why do we always get the same interpretation under negation in simple clauses?
(ii)   Why do we not get an NPI meaning in *na*-clefts?

In order to answer the first question, we have to explain both the lack of a NEG>FCI reading and the lack of a NEG>UQ reading. First, an FCI reading is generally unavailable because FCIs are cross-linguistically known to be bad under negation in episodic environments. The examples in (5.120) and (5.121) are a cross-linguistically well-known exception from this rule and FCIs in negation are restricted to this very special use in Asante Twi. Concerning the lack of a NEG>UQ reading, it is plausible that we are simply dealing with a conventionalized meaning here. Ampofo (2015) establishes clause-mate negation as the licensing property for NPIs in Asante Twi. I suggest that clause-mate negation actually *enforces* the NPI reading of *biara*. This might be a strategy to reduce ambiguity in sentences with a highly underspecified element like *biara*. Licensing of NPIs through negation in a higher clause is generally a dispreferred strategy in Asante Twi (Ampofo 2015). With other NPIs, it is either completely absent or occurs only in some cases. NPI *biara* might be licensed via negation in a higher clause, but it still matches with other NPIs in that it is clearly a dispreferred reading. Now, if clause-mate negation enforces the NPI interpretation of *biara*, then why is this reading completely absent in *na*-cleft constructions? As discussed further above, it is not an uncommon phenomenon that NPIs are rejected in clefts. There are other NPIs in Akan, which cannot occur in a *na*-cleft construction either (Ampofo 2015). This phenomenon can be attested in other languages as well, see (5.122) for English. Thus, I will claim that *biara* as an NPI belongs to the group of NPIs that are unacceptable in clefts. There might in fact also be a pragmatic reason for this effect: As discussed further above, *na*-clefts are a general strategy in Asante Twi to enforce wide-scope of negation thereby removing ambiguity (Amfo 2010c, Ampofo 2015). Accepting NPI *biara* in *na*-clefts, however, would in fact *increase* ambiguity. This is because in simple clauses, the ¬∃ reading is the only available reading anyway. A speaker could just use a simple clause if they wish to express the ¬∃ reading unambiguously. It would be uncooperative to choose a more complex construction, which is normally used to resolve ambiguity, in order to express

a meaning that can be expressed unambiguously in a simpler structure, but leads to more ambiguity in the complex structure.

In this section, I have summarized the data regarding *biara* in Asante Twi and provided an explanation for a couple of open questions regarding the interpretational possibilities of *biara*. While the data shows that *biara* cannot simply be reduced to one meaning component, such as a universal quantifier, we would still expect a shared common root of these three meaning components. That is, these meaning components most likely do not just accidentally share the same surface expression *biara*, but must have some common root or shared feature. The following section will pick up on that and put *biara* into a broader cross-linguistic perspective of FCIs.

5.5.8 An attempt of unification

In this chapter, I have argued so far that the UQ, FCI, and NPI component of *biara* cannot simply be collapsed by deriving the various interpretations from different scope-taking properties with respect to other operators. I mainly compared *biara* to Hausa *koo*-wh and the respective account put forward in Zimmermann (2009), due to their highly similar behaviour. In this section, I will take a more general, cross-linguistic perspective on free-choice items. I will show that recent approaches to account for the cross-linguistically observable patterns of NPIs and FCIs (Chierchia 2013, Dayal 2013) can be extended to *biara* with its additional UQ meaning.

English *any* has long known to be used both in FCI and NPI contexts. While some languages also have only one expression that expresses a wide range of meanings, such as Japanese (Kratzer & Shimoyama 2002), Hindi (Lahiri 1998), or Korean (Haspelmath 1997), other languages have separate items to express the range of meanings encompassed by *any*, e.g. Greek (Giannakidou 2001), Spanish (Dayal 1998), or Italian (Dayal 2013). Some authors have therefore proposed that *any* is ambiguous (e.g. Horn 1972, Fauconnier 1975, Ladusaw 1979, Carlson 1981, Dayal 1998). Others have attempted to argue for more unified accounts, whereby *any* has both been treated as an underlying universal (Vendler 1967, Horn 1972, Eisner 1994) and as an underlying indefinite (Kadmon & Landman 1993, Lee & Horn 1994, Lahiri 1995, Aloni 2007, Chierchia 2013, Dayal 2013). A unified account obviously has the appeal that it can provide an explanation for the cross-linguistic pattern that many languages express the same meaning components with items of a similar lexical setup and a similar distribution. In the following, I will provide a sketch of how the three meaning components of *biara* as UQ, FCI, and NPI might be unified. I will start out with presenting an account put forward by Chierchia (2013) and Dayal (2013), which treats FCIs and NPIs as being derived from the same underlying root, namely an indefinite. While the main ideas stem from Chierchia (2013), I will largely use the relevant explanations and representations from Dayal (2013), as I think they are easier to follow for the purpose of this section. I exemplify this procedure below and then show how the UQ interpretation of Asante Twi *biara* can also arise in such an account.

Chierchia (2013) and Dayal (2013) claim that both NPIs and FCIs trigger alternatives, which is similar in spirit to previous alternative-based approaches in e.g. Kratzer & Shimoyama (2002), Menéndez-Benito (2005, 2010), and Aloni (2007). The idea of alternatives is not new – earlier accounts that treated FCIs as indefinites have often taken them to give rise to a set of scalar alternatives with the FCI

occupying the highest or lowest point on the scale (e.g. Fauconnier 1975, Lee & Horn 1994, Lahiri 1995). This is a plausible approach, as many FCIs contain some kind of emphatic/scalar particle, which is also the case with *biara* in Asante Twi (Amfo 2010b). Older accounts have faced some problems and could not explain the whole picture though. Chierchia (2013) suggests that NPIs are derived from ordinary indefinites, differing from them in their ability to invoke a set of alternatives[134]. FCIs are further derived from NPIs by invoking a set of *exhaustified* alternatives. These exhaustified alternative propositions are stronger than the asserted proposition. To illustrate the concept of exhaustified propositions, take the assertion in (5.127b) with the set of students in that world in (5.127a). The two exhaustified propositions are then 'only student a danced' and 'only student b danced' as in (5.127c).

(5.127) a. Set of students: $\qquad$ $student_w = \{a, b\}$

     b. Assertion: $\qquad$ $\exists x [student_w(x) \wedge danced_w(x)]$

     c. Exhaustified alternatives: $\qquad$ {ONLY $[student_w(a) \wedge danced_w(a)]$,

$\qquad$ ONLY $[student_w(b) \wedge danced_w(b)]$}

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ (adapted from Dayal 2013, p. 97)

Let us now see why in Chierchia's and Dayal's logic, *any* cannot occur in an episodic sentence like (5.128a) but is acceptable in a modal sentence like (5.129a). The unacceptable sentence in (5.128a) gives rise to two implicatures. The first implicature is shown in (5.128d) and is the standard scalar implicature arising from the use of an ordinary indefinite (which FCIs/NPIs are derived from in Chierchia's system). The second implicature is shown in (5.128f) and is a universal force implicature, arising through the fact that the (weaker) assertion was picked over the (stronger) exhaustified alternatives. The universal implicature is the reason for the fact that FCIs, but not NPIs, pattern with universals in many ways. These two implicatures are the crucial point for the unacceptability of (5.128a). Comparing them directly, we see that the universal implicature ($\forall$) clashes with the scalar implicature ($\neg\forall$) introduced by the indefinite. This clash of implicatures is what makes FCIs unacceptable in an episodic context like (5.128a).

(5.128) a. *Any student danced.*

     b. Set of students: $\qquad$ $student_w = \{a, b\}$

     c. Assertion: $\qquad$ $\exists x [student_w(x) \wedge danced_w(x)]$

     d. Scalar implicature of $\exists$: $\qquad$ $\neg\forall x [student_w(x) \rightarrow danced_w(x)]$

     e. Exhaustified alternatives: $\qquad$ {ONLY $[student_w(a) \wedge danced_w(a)]$,

$\qquad$ ONLY $[student_w(b) \wedge danced_w(b)]$}

     f. Universal implicature of FCI[135]: $\qquad$ $[p_a \vee p_b] \wedge \neg [p_a \wedge \neg p_b] \wedge \neg [p_a \wedge \neg p_b]$

$\qquad\qquad\qquad\qquad\qquad$ $= p_a \vee p_b \wedge p_a \rightarrow p_b \wedge p_b \rightarrow p_a$

$\qquad\qquad\qquad\qquad\qquad$ $= \forall x [student_w(x) \rightarrow danced_w(x)]$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ (adapted from Dayal 2013, p. 97)

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[134] This is not to say that *all* FCIs cross-linguistically are derived that way, but that this is a common pattern, which can also be observed in cross-linguistic data.

[135] p_a and p_b represent the two propositions: $p_a = student_w(a) \wedge danced_w(a)$; $p_b = student_w(b) \wedge danced_w(b)$
The first line in (5.128f) shows the conjunction of the assertion $[p_a \vee p_b]$ with the negated form of the two exhaustified alternatives $[p_a \wedge \neg p_b]$ and $[p_a \wedge \neg p_b]$

Now, why is the sentence in (5.129a) acceptable? On first sight, in (5.129d) and (5.129e), we get the exact same two contradictory implicatures as in (5.128). According to Chierchia (2013), this effect is due to *Modal Containment*. Once possible worlds are introduced through a modal, the implicatures can act on different modal bases. The scalar implicature (5.129d) acts on a smaller set of worlds accessible to the speaker through her subjective evidence. The universal implicature (5.129e) acts on a larger set of worlds accessible to both speaker and addressee through their intersubjective evidence. This is illustrated in Figure 5.4. The scalar implicature is satisfied in the scalar modal base containing only *w1* and *w2*, the universal implicature is satisfied in the larger FC modal base containing also *w3*. In (5.128), on the other hand, where we are talking about the real world *w* and no possible worlds *w'*, there is no way to resolve these contradictory implicatures in the same way.

(5.129) a. *Any student can dance.*
      b. LF: [any student$_i$ [can [t$_i$ dance]]]
      c. Assertion: $\exists x$ [student$_w$(x) $\land$ $\exists w'$: ACC(w,w'). dance$_{w'}$(x)]
      d. Scalar implicature of $\exists$: $\neg\forall x$ [student$_w$(x) $\to$ $\exists w'$: ACC(w,w'). dance$_{w'}$(x)]
      e. Universal implicature of FCI: $\forall x$ [student$_w$(x) $\to$ $\exists w'$: ACC(w,w'). dance$_{w'}$(x)]
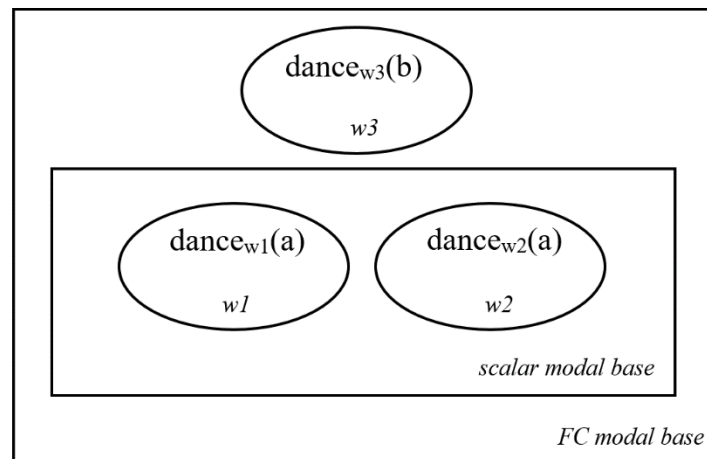   (adapted from Dayal 2013, p. 98)

Figure 5.4: Modal Containment satisfying both the scalar and the universal implicature.

Note that in Chierchia's approach, the FCI takes wide scope over the modal by default. Dayal (2013) largely takes the same perspective with the only difference that she additionally assumes a Viability Constraint that acts on the alternatives triggered by the FCI, which I will not discuss in more detail here.

Going back to *biara*, the NPI and FCI meaning along with their respective distributions can essentially be derived in the exact same way. As described further above, *biara* is derived from the indefinite article *bí* and the emphatic particle *ara*. *Bí* provides the indefinite assertion, *ara* triggers a set of exhaustified alternatives, giving rise to the scalar[136] and universal implicature which can only both be satisfied under possible worlds. However, in contrast to English *any*, *biara* is allowed under a free-choice interpretation with necessity modals. Following Chierchia, the free-choice interpretation should be unavailable with

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[136] Note that in the analysis of *bí* proposed earlier, the scalar implicature naturally follows from the obligatory contextual restriction. For details see section 5.3.

necessity modals as they necessarily give rise to an implicature clash, see (5.130). The crucial difference to (5.129) is that now we have universal quantification over possible worlds through the necessity operator *must*, i.e. the modal bases cannot differ anymore – both contain all possible worlds.

(5.130) a. *Any student must dance.*

    b. LF: [any student$_i$ [must [t$_i$ dance]]]

    c. Assertion: $\exists x$ [student$_w$(x) $\wedge$ $\forall w'$: ACC(w,w'). dance$_{w'}$(x)]

    d. Scalar implicature of $\exists$: $\neg\forall x$ [student$_w$(x) $\rightarrow$ $\forall w'$: ACC(w,w'). dance$_{w'}$(x)]

    e. Universal implicature of FCI: $\forall x$ [student$_w$(x) $\rightarrow$ $\forall w'$: ACC(w,w'). dance$_{w'}$(x)]

                                        (adapted from Dayal 2013, p. 98)

There might be a solution to this problem, though, if we look at imperatives, which allow for free-choice *any* in English, too. According to Chierchia (2013), the imperative operator, which is a necessity operator, occurs too high in the syntactic structure for the FCI to take wide scope over it. In that case, exhaustification takes place below the imperative operator. As can be seen in (5.131), the implicatures are not contradictory and thus the sentence is acceptable.

(5.131) a. *Push any button.*

    b. LF: [! any button$_i$ [push (you, t$_i$)]]]

    c. Assertion: $\forall w'$ $\exists x$ [button$_w$(x) $\wedge$ push$_{w'}$ (you, x)]

    d. Scalar implicature of IND: $\forall w'$ $\neg\forall x$ [button$_w$(x) $\wedge$ push$_{w'}$ (you, x)]

    e. Universal implicature of FCI: $\forall x$ [button$_w$(x) $\rightarrow$ $\exists w'$ [push$_{w'}$ (you, x)]]

                                        (adapted from Dayal 2013, p. 98)

In Asante Twi, not only do imperatives allow for free-choice readings, but necessity modals, too[137]. However, the necessity modal expression in Asante Twi differs from *must* in English in that it does not occur in verbal position but at the left edge, see (5.132), repeated from (5.99a) above. It is in fact a bi-clausal structure literally meaning "It is fit that…"[138] (Owusu 2015), as indicated in the glossing in (5.132). Even though this construction is grammaticalised and loses its literally meaning in this context (Owusu 2015), it may be argued that, similar to imperatives, the necessity modal in Asante Twi occurs too high in the structure. Another question that is left is how this approach can be reconciled with the indiscriminative use of *biara* in sentences like (5.120) or (5.121), repeated here as (5.133).

(5.132) a. **Ɛ-sɛ**   **sɛ**   Ama   twa   nsɔhwɛ biara.

       3SG-be.fit   *COMP*   *Ama*   *pass*   *exam*   *every.*

       'Ama must pass ✓every/✓any exam.'

(5.133) Ɔ-n-yɛ   ɔkyerɛkyerɛni biara (kɛkɛ), ɔ-da mu fua.

     3SG-NEG-COP   *teacher*   *every (just)* *3.SG-is.special*

     'He is not (just) any teacher, he is special/different.'

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[137] This is also the case in some other languages. Giannakidou (2001), for example, reports for Greek that the FCI is marginally available under the necessity modal.

[138] The construction *ɛsɛ sɛ* is also not the only necessity construction that can be used in Asante Twi. According to Owusu (2015), the verb *wɔ* (= 'have') can also fill the verb slot to express necessity.

First of all, the approach presented above, which takes the FCI derive from an underlying indefinite, correctly predicts the felicitous use of FCI *biara* in predicative position. Second, this sentence can still be maintained to be underlying modal, quantifying over possible worlds. For simplicity, I will take a non-negated variant of this sentence. The sentence 'He is just any teacher.' could be paraphrased as meaning something like 'He could just as well be any other teacher'. The representation in (5.134) shows that Chierchia's approach for possibility models shown in (5.129) is applicable to such a sentence.

(5.134) a. *He is just any teacher.*

    b. LF: [any teacher$_i$ [just [t$_i$ he is]]]

    c. Assertion: $\exists x$ [teacher$_w$(x) $\wedge$ $\exists w'$: ACC(w,w'). is$_{w'}$(he, x)]

    d. Scalar implicature of IND: $\neg\forall x$ [teacher$_w$(x) $\rightarrow$ $\exists w'$: ACC(w,w'). is$_{w'}$(he, x)]

    e. Universal implicature of FCI: $\forall x$ [teacher$_w$(x) $\rightarrow$ $\exists w'$: ACC(w,w'). is$_{w'}$(he, x)]

Let us turn to the UQ use of *biara*. As we can see in (5.128), the account presented by Chierchia (2013) and Dayal (2013) naturally renders the use of FCIs in episodic environments ungrammatical. The Asante Twi version of the sentence in (5.128) is grammatical, see (5.135), but can only give rise to a UQ interpretation. The account thus makes the correct prediction that the FCI reading is unavailable, but where does the UQ reading come from?

(5.135) Sukuuni   biara   sa-a yɛ.

       student   every   dance-PAST

       'Every/*Any student danced.'

To answer this question I will make reference to Zimmermann (2009) again. As discussed in section 5.5.4, Zimmermann argues that the universal interpretation in Hausa *koo*-wh arises because the operator combines locally with the NP denotation, while there are other languages, where the wh-DISJ element has existential force and acts on the sentence level. The latter is similar to what we have in (5.128) and (5.129) above. The operator acts on the sentence level, giving rise to exhaustified alternatives of propositions. We saw that the NPI and FCI interpretation in Asante Twi cannot be reduced to the UQ semantics of *biara*. Thus, these interpretations cannot be derived from the operator acting locally and instead require an analysis based on alternative propositions. The UQ reading, however can still be derived by the emphatic particle *ara* acting locally, as proposed in Zimmermann (2009) for Hausa. This is in line with the general variable property of the particle *ara*, which, according to Amfo (2010b) "[…] is not restricted to phrases, but […] may cover whole clauses or utterances as well." (Amfo 2010b, p. 212). This is exemplified in (5.136) for the sentence in (5.135).

(5.136) a. [[sukuuni bi] ara]

    b. Set of students: [[sukuuni bi]]$_w$ = {a, b, c}

    c. Alternatives invoked by *ara*:   {{a}, {b}, {c}, {a $\wedge$ b}, {a $\wedge$ c}, {b $\wedge$ c}, {a $\wedge$ b $\wedge$ c}}

    d. Maximal element: {a $\wedge$ b $\wedge$ c}

The operator *ara* takes the DP *sukuuni bi* and triggers a set of alternatives. The scalar property of *ara* (see section 5.5.4 above) picks out the maximal element of the set, giving rise to the universal meaning. Sentence (5.135) is grammatical under the universal reading, because *ara* does not give rise to a set of

exhaustified alternative propositions as in (5.128), which is what caused the clash of implicatures in there. Table 5.8 summarizes the different applications of *ara* acting as an operator on indefinites.

	UQ	NPI	FCI
***ara* acts**	locally	sentence-level	sentence-level
***ara* invokes**	alternatives	alternatives	exhaustified alternatives

Table 5.8: Three different ways of how the operator *ara* gives rise to the meaning components that arise with the use of *biara*.

5.5.9   Summary

To sum up this section, we have seen that the three meaning components UQ, FCI, and NPI of *biara* are real meaning components that cannot be derived from a simple universal quantifier interacting scopally with other elements. This does not mean, however, that *biara* is truly ambiguous in the sense of polysemy (cf. Haspelmath 1997). Instead, as suggested in the final section, we can still provide a common root to the three meaning components applying the approach of Chierchia (2013). With that approach, we can explain how each meaning component can be derived from the other meaning component by a slight lexical shift of the operator *ara*.

5.6   Quantifier scope in Asante Twi

In the previous sections 5.3-5.5, I established a basic understanding of certain determiners/quantifiers in Asante Twi, which exhibit a peculiar behaviour and do not have a simple counterpart in English. Now that we have an understanding of how these elements work, we can take a look at potential quantifier scope ambiguities, arising from scopal interaction between universal expressions such as *biara* (= 'every'/'any') or *nyinaa* (= 'all') and existential expressions such as the bare noun, the indefinite *bí* (= 'a'/'some'), and the numeral *baako* (= 'one'). This section is structured as follows: I will first present an overview of quantifier scope phenomena in Asante Twi. I will provide some background information from previous literature in section 5.6.1 and then proceed to fieldwork data on quantifier scope ambiguities in various types of sentences: scope between subject and object of a transitive verb (5.6.3) and scope between the two objects in double object and serial verb constructions (5.6.4). I will also look at more complex structures, such as complement clauses (5.6.5) and syntactic islands (5.6.6). I will show that inverse readings are generally available in Asante Twi, but very dispreferred. They are readily available whenever reconstruction is involved. Inverse readings are mostly blocked with the indefinite article *bí*, but more available with the numeral *baako* and even more so with the bare noun[139]. Inverse readings are usually rejected across clause or island boundaries, but they are marginally available with relative clauses and temporal adjuncts.

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[139] The bare noun was not tested for all constructions, though. The bare noun was not used in subject position due to the additional difficulties with interaction of information structure and definiteness, see section 5.4.

5.6.1   Background

Previous research on quantifier scope in Asante Twi is very limited. While it has been used as a tool of diagnostics for other phenomena, no work has been specifically dedicated to quantifier scope ambiguities. In the following, I will give an overview of the limited treatment of quantifier scope in previous work. I will then proceed to discuss what more general theories of quantifier scope might predict about quantifier scope in Asante Twi.

In the previous sections, I have already discussed certain scope phenomena pertaining to the quantificational expressions discussed in there. We have seen that the determiner *bí* and all expressions containing it take obligatory wide scope over negation when presented within the same clause, as claimed in Amfo (2010c). Amfo (2010a) and Arkoh (2011) argue that this is because *bí* is inherently specific/referential. Arkoh refers to the definition of referentiality in Fodor & Sag (1982), which would entail that *bí* is scopeless. Arkoh shows that besides negation, *bí* also always takes wide scope with respect to the bare noun and the quantificational expressions *kakra* (= few/a few) and *nyinaa* (= all). Arkoh generalizes from this data that *bí* always takes wide scope. She points out, however, that *bí* can take both wide and narrow scope when c-commanded by the universal quantifier *biara*, see (5.137b). When *bí* is structurally higher, *biara* cannot take wide scope over it, though, see (5.137a).

(5.137) a. Kyìrὲkyírὲnyí   bí   hwí-ì   àbòfrá   bíárá
          teacher   *IND* *cane-PAST*   *child*   *every*
          'A (certain) teacher caned every child'
     b. Kyìrὲkyírὲnyí   bíárá   hwí-ì   àbòfrá   bí
          teacher   *every* *cane-PAST*   *child*   *IND*
          'Every teacher caned a (certain/specific) child'

<div align="right">(adapted from Arkoh 2011, p. 43)</div>

Further, according to Arkoh, *bí* can take both widest and intermediate scope in sentences like (5.138). This data lead Arkoh to claim that *bí* must be a skolemized choice function with an individual variable.

(5.138) Kyìrὲkyírὲnyí bíárá kyέ-ὲ   àbòfrá bíárá áà   ò-kàn   búúkùú bí   àdzí
        teacher   *every give-PAST child* *any REL 3SG-read-PAST book*   *IND   thing*
        'Every teacher gave any child who read a (certain/specific) book a gift.'

<div align="right">(adapted from Arkoh 2011, p. 46)</div>

We have seen in section 5.3, however, that there are more environments where *bí* can take narrow scope. First, Bombi et al. (2019) and Owusu (2020) show that *bí* can be interpreted with narrow scope (i.e. as non-specific) with intensional verbs and in conditional clauses. Owusu (2020) therefore analyses *bí* as a skolemized choice function with both an individual and a world variable. If the world variable is bound, the narrow scope reading arises. Owusu predicts that this account should exclude inverse readings in sentences like (5.139a). This is because according to Chierchia (2001), a skolem index behaves like a pronoun and consequently, a weak crossover effect is expected when a higher skolem variable is bound by a lower quantifier, see the LF structure in (5.139b).

(5.139) a. Ɔbaa   bi   kane-e   nhoma biara.
         woman   IND   read-PAST   book   every
         'A (certain) woman read every book.'
         ✓∃>∀; ✗∀>∃

                              (adapted from Owusu, 2020, p. 65)

     b. [nhoma **biara**]$_1$ [ɔbaa **bi**] kane-e   **t$_1$**

Owusu (2020) also shows that in downward entailing contexts involving a bound pronoun, such as (5.140), only one reading arises. This sentence can mean that for each student, there is one letter that they didn't submit. It cannot mean that no student submitted any letter of theirs. Remember, however, that I have shown in section 5.3 that non-specific interpretations of *bí* can arise in multiple other non-veridical contexts, including questions. I also showed that even with negation, there are exceptional cases where *bí* does not take wide scope. I concluded that *bí* is in fact better captured by an analysis as existential quantifier with obligatory domain restriction. Under this assumption, inverse readings might not actually be excluded from environments like (5.139). I will provide data on this in the next section.

(5.140) Sukuuni biara a-m-fa   krataa bi   aa   ɔ-kyere-e a-n-kɔ.
         student   every PRF-NEG-take letter IND REL   3SG-write PRF-NEG-go.
         'No student$_i$ sent a certain letter she$_i$ wrote.'

                              (adapted from Owusu, 2020, p. 66)

Korsah & Murphy (2020) use scope data from Asante Twi to argue for a movement analysis of focus constructions, relative clauses, and adverbial clauses. They claim that a sentence like (5.141a), where the universal quantifier is embedded in a complement clause, only the surface reading is available. The absence of an inverse reading in such sentences is commonly observed cross-linguistically (clause-boundedness, see also section 2.2.3). Korsah & Murphy argue, however, that sentences like (5.141b) with an ex-situ wh-word allow for two readings[140]. That is, the question can either ask for one particular person who is loved by every child, according to Kofi. Or the question can ask: for each child, which person did Kofi say that this child loves (i.e., Kofi said that child 1 loves person 1, child 2 loves person 2, etc.). The authors take this as evidence that these sentences involve movement, and not base-generation, of the wh-word. If the wh-word reconstructs to its lower position, filled by the resumptive pronoun *no* in (5.141b), then it is in the scope of the universal quantifier.

(5.141) a. **Obi**   ka-a   [$_{CP}$ sɛ́   abɔfrá **bíárá**   dɔ   Kofí].
         someone say-PAST that child   every   love Kofi
         'Someone said that every child loves Kofi.'
         ✓∃>∀; ✗∀>∃
     b. **Hwáń**$_1$ na   Kofí ká-a   [$_{CP}$ sɛ́ abɔfrá **bíárá**   dɔ   **no$_1$**]?
         who   FOC Kofi say-PAST that child   every   love 3SG.OBJ
         'Who did Kofi say that every child loves?'
         ✓Wh>∀; ✓∀>Wh

                      (adapted from Korsah & Murphy 2020, p. 852)

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[140] Wh-phrases have long been taken to be quantificational (Baker 1968, Chomsky 1975, Karttunen 1977, May 1977, 1985, and thereafter), thereby also interacting scopally with other quantificational elements in the clause.

5.6.2   Predictions

While no account to quantifier scope exists for Asante Twi in particular, I will give a sketch of what one might expect to find in a language like Asante Twi according to a number of theoretical accounts that have been proposed for other languages. I will do so based on what is known about the language Asante Twi and based on what has been said about other languages and cross-linguistic patterns relating to scope. Particularly, I will look at (i) the cross-linguistic QR-based economy account of Bobaljik & Wurmbrand (2012) discussed in section 2.3.1, (ii) the configurational account of Frey (1993) originally proposed for German and discussed in section 4.1.1, and (iii) multi-factorial accounts in the style of e.g. Pafel (2005) as discussed in section 2.3.3 and 4.1.2.

Bobaljik & Wurmbrand (2012) present a cross-linguistic account on quantifier scope that is supposed to extend also to other languages not specifically discussed in their paper (see section 2.3.1). In the following, I will attempt to apply their account to Asante Twi. Bobaljik & Wurmbrand (2012) claim that the operation of Quantifier Raising is universally available. Inverse readings are restricted by the soft constraint of Scope Transparency (ScoT), which says that the order of quantifiers at PF should parallel the order of quantifiers at LF. This constraint may be violated to satisfy another constraint. Their account predicts that, cross-linguistically, languages with more word order freedom should be more restrictive in scope possibilities than languages with less word order freedom. This is because in the former, overt movement can apply to satisfy ScoT. In the latter, overt movement is blocked, thereby allowing ScoT to be violated in order to be able to express a certain LF. Asante Twi is an SVO language with strict word order. It does not only lack scrambling but also has no passive voice. We would therefore expect inverse readings to be readily available, comparable to e.g. English. There is one possibility of changing the order of quantifiers overtly in Asante Twi, which is via left-dislocated structures, such as the focus or topic construction. However, these require a certain type of cleft-construction and are both syntactically complex and pragmatically marked. As neither passive voice[141] nor left-dislocated structures in English such as in (5.142) are considered viable alternatives that could block inverse readings in Bobaljik & Wurmbrand (2012), I will assume the same for left dislocated structures in Asante Twi. Inverse readings are thus expected to be readily available between subject and object in Asante Twi.

(5.142) a. A camera recorded every burglar.
　　　　 b. Every burglar was recorded by a camera.
　　　　 c. It is every burglar that was recorded by a camera.

As mentioned in section 5.1, Asante Twi allows for two types of constructions when two objects are involved, namely a double-object and a serial verb construction. The order of objects is reversed in the two constructions. Thus, inverse readings are predicted to be blocked in those sentences, as the order of quantifiers can be changed overtly, thereby satisfying ScoT. As for embedded clauses, Asante Twi has in fact been claimed to allow for overt extraction in certain island environments such as relative clauses (Saah 1994). However, QR is not only assumed to be blocked by island boundaries but by all clause boundaries, even those, where overt movement is licensed. Thus, under an account like Bobaljik & Wurmbrand's or any other account assuming QR (e.g. Reinhart 1995, 2006 or Fox 1995, 2000, as

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[141] For a different point of view, see Szendrői (2012).

discussed in section 2.3.1), inverse readings should be blocked across all types of embedding in Asante Twi. In fact, this is also predicted by most accounts that are not based on QR such as Hendriks (1993) or Steedman (2012) as discussed in section 2.3.2. At the same time, chapter 3 and 4 have shown that the ban of inverse readings across clause boundaries seems to be less strict than previously assumed in the case of both English and German. This effect may thus extend to Asante Twi as well.

Let us turn to the configurational account of Frey (1993) originally proposed for German (see section 4.1.1). Under Frey's account, inverse readings in German can only arise if the higher quantifier has been overtly moved from a position below the lower quantifier. That is, a quantifier A can only take wide scope over another quantifier B if A c-commands either B itself or the base position of B. This is similar in spirit to the Scope Principle of Aoun & Li (1989), with the only difference that Frey solely considers overt movement, whereas Aoun & Li's account also extends to covert movement. If we apply an approach similar to Frey's approach to German to Asante Twi, we would expect inverse readings only in those environments, where overt movement may have applied, i.e. in left-dislocated constructions such as focus or topic constructions. That is, in (5.143a) an inverse reading would be predicted, but not in the unfocussed variant of this sentence in (5.143b) or in the variant where the subject is focussed (5.143c) and the base position of the moved element is still above the second quantifier. As Asante Twi is very limited in its overt movement possibilities, in contrast to German, inverse readings would generally be predicted to arise in very limited cases, even more limited than in German.

(5.143) a. [Nwoma baako]$_i$ na sukuuni biara kan-n yɛ **t$_i$**.
    book one FOC student every read-PAST
    'It is one book that every student read.'
  b. [Sukuuni baako]$_i$ kan-n nwoma biara.
    student one read-PAST book every
    'One student read every book.'
  c. [Sukuuni baako]$_i$ na ɔ$_i$-kan-n nwoma biara.
    student one FOC 3SG.SBJ-read-PAST book every
    'It is one student that read every book.'

Coming from a multi-factorial perspective (such as Ioup 1975, VanLehn 1978, Kuno 1991, Kurtzman & MacDonald 1993, Pafel 2005), we expect to find variation in inverse scope availability not only with respect to overt or covert c-command but also depending on the particular choice of quantifier, the semantic or grammatical role, contextual factors, etc. In Asante Twi, particularly, we expect to find inverse readings more with the distributive universal *biara* compared to the collective universal *no nyinaa*. Further, with respect to existentials, we expect to find more inverse readings over the bare noun than over the numeral or *bí*[142]. As discussed in section 5.3, Owusu (2020) actually predicts that inverse readings over *bí* should be impossible. This is because she takes *bí* to be a skolemized choice function, which gives rise to a weak crossover effect if bound by a lower quantifier. Under the analysis that I have developed in section 5.3, which takes *bí* to be an existential quantifier, inverse readings should not be completely blocked. They would still be expected to be hard to obtain, though, as the contextual

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[142] At least in structures where this can be tested, see the problem with bare nouns in subject position discussed in section 5.4

restriction causes the pragmatic effect of rendering the referent noteworthy in some way or other, typically giving rise to a specific interpretation. Several hierarchies have been proposed in the literature with the intention to apply cross-linguistically. Ioup (1975) for example proposed a quantifier hierarchy and a grammatical function hierarchy, based on data from various languages and Kurtzman & MacDonald (1993) proposed a thematic hierarchy (see also section 2.2.6). These hierarchies are repeated in (5.144) below. The representation in (5.145) shows Ioup's quantifier hierarchy being applied to the equivalent Asante Twi quantifiers that were listed in Table 5.2 above.

(5.144) a. *Grammatical function hierarchy:*
　　　　topic > deep and surface subject > deep or surface subject > indirect object >
　　　　prepositional object > direct object
　　　b. *Thematic hierarchy:*
　　　　agent > experiencer > theme
　　　c. *Quantifier hierarchy:*
　　　　each > every > all > most > many > several > some$_{pl}$ > a few

(5.145) *Quantifier hierarchy applied to Asante Twi:*
　　　　biara (= 'every/each') > nyinaa (= 'all') > bebree/pii (= 'many/most/several') >
　　　　bi$_{PL}$ (= 'some/several') > kakraa bi (= 'a few')

5.6.3　Simple transitive clauses

As discussed above, both Arkoh (2011) and Owusu (2020) claim that simple sentences with a transitive verb, an existential subject and a universal object only allow for the surface reading. They argue that this is due to *bí* being a skolemized choice function, where the skolem index can only be bound by a higher operator. However, this is a lexical restriction with respect to the indefinite article *bí*. I provided evidence that an analysis of *bí* as an existential quantifier is in fact preferable over an analysis as a choice function. In that case, inverse readings would not be excluded categorically. However, inverse readings might still be dispreferred due to the pragmatic inferences that *bí* gives rise to. Further, Owusu's prediction does not extend to other existential expressions. As discussed in section 5.3, the bare noun in Asante Twi is usually rejected in subject position and requires a very specific information structure to be acceptable. For this reason, I did not test scope readings with a bare noun in subject position. However, a third option is the numeral *baako* (= 'one'). In the German experiments in chapter 4, however, we saw that the use of a numeral reduces the availability of inverse readings compared to an indefinite. The same has been shown for English in Tsai et al. (2014)/Scontras et al. (2017). Indeed, both with *bí* and *baako*, the consultants rejected the inverse reading in transitive sentences the majority of the time. At the same time, the inverse reading did not seem to be completely absent either as it was accepted in a few cases. The particular item or context seem to play a role in the extent to which a certain reading is available. In (5.146), same as in multiple other examples, the inverse reading was rejected across the board. No speaker obtained the inverse reading, neither with *bí* nor with *baako*. However, the inverse scenario is also not all that likely: It is not very common to have a larger number of cats in the house, such that each mouse could have been caught by a different cat.

(5.146) Ɔkra [bi / baako] kye-e akura biara wɔ efie no mu.
      cat   IND / one   catch-PAST   mouse every at   house DEF in
      'A (certain)/One cat caught every mouse in the house.'
      ✓∃>∀; ×∀>∃

In the case of (5.147) below, the inverse reading was marginally available. There was one speaker who accepted the inverse reading with *bí* but not with *baako* and another speaker who accepted the inverse reading with *baako* but not with *bí*. Two speakers did not obtain the inverse reading in either case. The speaker who accepted the inverse reading with *baako* comments that the sentence can be fully disambiguated by putting the subject into the fronted focus position, as in (5.148). This is expected, as in this case an additional clause barrier intervenes between the subject and the object, see also section 2.2.3 on clause-boundedness.

(5.147) Ɔkraman [bi / baako] ka-a akwadaa biara.
      dog   IND / one   bite-PAST   child   every
      'A (certain)/One dog bit every child.'
      ✓∃>∀; (✓)∀>∃

(5.148) Ɔkraman [bi / baako] na ɔ-ka-a akwadaa biara.
      dog   IND / one   FOC   3SG.SBJ-bite-PAST   child   every
      'It was a (certain)/one dog that bit every child.'
      ✓∃>∀; ×∀>∃

While the inverse reading in (5.147) seems to be available only marginally, the language consultants accepted the inverse reading in (5.149) more readily[143]. This was the case both with *bí* and with *baako*. It might play a role that the subject is animate in (5.146-5.147) but inanimate in (5.149). Animacy has sometimes been proposed to play a role in scope preferences in that animate referents have a stronger tendency to take wide scope than inanimate referents (e.g. Micham et al. 1980), see section 2.2.6.

(5.149) Adeɛ huhuuhu [bi / baako] hunahuna-a akwadaa biara.
      thing   scary   IND / one   terrify-PAST   child   every
      'A certain/One creepy thing scared every child.'
      ✓∃>∀; ✓∀>∃

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[143] One potentially confounding factor in this example might be that the predicate *hunahuna* shows reduplication morphology. However, this is not a case of productive but of lexicalized reduplication. That is, the sentence is not interpreted as involving repeated instances of getting scared, thereby giving rise to distribution over events. Instead, each child is continuously scared by a certain creepy thing. Further, as shown in (i), where the universally quantified NP is replaced by a definite plural DP, the predicate alone, without the universal quantifier, cannot give rise to a distributive reading, where the different children would be scared by different things. Thus, the ambiguity in (5.149) must be due to the interaction of the existential und universal expression, not due to the predicate.
    (i)   Adeɛ   huhuuhu [bi / baako] hunahuna-a   nkwadaa no.
          thing   scary   IND / one   terrify-PAST   children DEF
          'A certain/One creepy thing scared the children.'

In (5.148), we saw that focussing the subject results in an unambiguous surface reading. However, when it is the object that is placed in focus position, see the example in (5.150), we see the reverse effect: it is easier to obtain the inverse reading. Only one speaker rejected the inverse reading in this sentence. This may be indicative of some kind of reconstruction effect, as the base position of the object is c-commanded by the universally quantified subject. As discussed further above, the focus construction in Asante Twi has both been treated as base-generated and as involving movement.

(5.150) Krataa   bi   na   sukuuni   biara   kan-n yɛ   ø.
         document   *IND*   *FOC*   *student*   *every*   *read-PAST*   *3SG.OBJ*
         'It is a document that every student read.'
         ✓∃>∀; ✓∀>∃

In fact, Korsah & Murphy (2020) have previously shown that wh-ex-situ sentences give rise to scope ambiguities, see example (5.141) above. They take this as additional evidence that movement is involved in that *na*-focus construction. The same is shown in example (5.151) below, without an additional embedding as it was the case with (5.141). The pair-list reading is available both in (5.151a), where the wh-word is moved overtly, as well as in (5.151b), where the wh-word remains in-situ. In (5.152), on the other hand, where the wh-word is the subject of the sentence, a pair-list reading is not available[144]. This subject/object asymmetry is the same as in the focus examples (5.148) and (5.150) above. As expected, the inverse reading was rejected across the board when the distributive universal was replaced with the collective universal *nyinaa*.

(5.151) a. Dɛn   na   obiara   tɔ-ɔ yɛ   ø?
           what   *FOC*   *everyone*   *buy-PAST*
           'What did everyone buy?'
     b. Abusuani   biara   tɔ-ɔ   dɛn?
           f*amily.member*   *every*   *buy-PAST*   *what*
           'What did every family member buy?'
           ✓Wh>∀; ✓∀>Wh

(5.152) Dɛn   na   ɛ-ka-a   akwadaa biara   aa   ɔ-wɔ   ekuro?
         what   *FOC*   *3SG.SBJ-bite-PAST*   *child*   *every*   *REL*   *3SG.SBJ-have*   *wound*
         'What bit every child with a wound?'
         ✓Wh>∀; ✗∀>Wh

To sum up, we saw that the inverse reading is strongly dispreferred but still marginally available between the subject and object of a transitive verb, largely depending on how easy it is to imagine the scenario created by the inverse reading. According to Arkoh (2011) and Owusu (2020), the inverse reading should be completely ruled out with *bí* in subject position, though. Owusu predicts that a weak crossover effect would arise when trying to bind *bí* in subject position. One may argue that the marginal availability observed is because it is only a weak and not a strong crossover violation. However, the language consultants did obtain the inverse reading with *baako* only slightly more often. If there was a

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[144] A wh-in-situ strategy for subjects is ungrammatical in Asante Twi. Therefore, only the wh-ex-situ variant is provided in (5.152).

weak crossover effect with *bí*, then we would expect inverse readings to be much more readily available with *baako,* where no weak crossover occurs. Instead, it seems like inverse readings are just generally dispreferred in these types of sentence in Asante Twi. Considering the fact that Asante Twi has strict SVO word order and does not allow for scrambling, we expected it to be more similar to English under Bobaljik & Wurmbrand's (2012) approach, in allowing for inverse readings readily. This does not seem to be the case though. One may argue that Asante Twi employs strategies like focus clefting to change the order of constituents overtly. However, these strategies are marked, give rise to additional meaning inferences and involve a complex syntactic structure. Further, English also has the option of clefting and in contrast to Asante Twi, it even has the option of passive voice. Thus, the possibilities of overt constituent reordering are still severely limited and marked in Asante Twi.

5.6.4   Double object construction

Asante Twi has a number of ditransitive predicates which allow for two objects. At the same time, however, the same meaning can also be expressed using two predicates in a serial verb construction (SVC), which is the more common form in Asante Twi. In this section, I will look at these environments, where two objects are present. When looking at minimal pairs of ditransitive predicates and the respective SVC variant, the order of objects is reversed: with ditransitive predicates, the Goal precedes the Theme, whereas in SVCs, the Theme appears first. This is represented in (5.153) and exemplified in (5.154). Note that this is similar to the dative alternation of English with prepositional vs. double object dative. I will use this parallelism by making the Theme/Goal order transparent in the English translation of each sentence.

(5.153) a. *Ditransitive*:   Sbj   V   Goal   -   Theme
           b. *SVC*:   Sbj   V1   Theme   V2   Goal

(5.154) a. *Ditransitive*:
           Ama   kyerɛ-ɛ   Kofi   mfonin   no.
           Ama   show-PAST   Kofi   picture   DEF
           'Ama showed Kofi the picture.'
        b. *SVC*:
           Ama   de   mfonin   no   kyerɛ-ɛ   Kofi.
           Ama   take   picture   DEF   show-PAST   Kofi
           'Ama showed the picture to Kofi.'

In ditransitive structures like (5.155a)[145], inverse readings seem to be almost completely unavailable. With *baako* and *bí*, the inverse reading was rejected across the board, with the bare noun[146], it was accepted sometimes. In examples of SVC, on the other hand, the inverse reading, albeit still dispreferred, is much easier to obtain (5.155b). Again, it is easier with *baako* than with *bí*, even though it is not completely excluded in the latter case either. One language consultant comments: "I find it

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[145] Note that some speakers seem to not like the ditransitive construction all that much and either generally (or at least with some items) prefer the SVC construction. Other speakers fully accept the ditransitive constructions.
[146] Note that some speakers reject sentences with the bare noun as the Goal, particularly when uttered out of the blue.

difficult to read the sentence in that way. But it's not impossible. It's not as clear-cut as it is when I use 'nyinaa' instead of 'biara'." As also implied by this comment, the inverse readings was rejected with the use of *nyinaa* by most speakers. Again, some speakers found inverse readings easier to obtain than others.

(5.155) a. *Ditransitive:*

Esi	kyerɛ-ɛ	sukuuni	[bi / baako / ø]	mfonin	biara.
Esi	*show-PAST*	*student*	*IND / one*	*picture*	*every*

'Esi showed a (certain)/one student every picture.'

✓∃>∀; ✗∀>∃

b. *SVC*:

Kofi	twerɛ-ɛ	krataa	[bi / baako / ø]	kɔ-ma-a	adamfo	biara.
Kofi	*write-PAST*	*letter*	*IND / one*	*go-give-PAST*	*friend*	*every*

'Kofi wrote a (certain)/one letter to every friend'

✓∃>∀; ✓∀>∃

One confounding factor might be that in the example in (5.155) and in fact in most examples with two objects, the Theme is inanimate and the Goal is animate. This is particularly relevant in Asante Twi, because only an animate object leaves an overt resumptive pronoun. However, the difference in scope availability between (5.155a) and (5.155b) is not related to animacy, as it pertains when the Goal is replaced with an inanimate referent (5.156) or when the Theme is an animate referent, see (5.157).

(5.156) a. *Ditransitive*:

Esi	kyerɛ-ɛ	sukuuni	baako	mfonin	biara.
Esi	*show-PAST*	*student*	*one*	*picture*	*every*

'Esi showed one student every picture.'

✓∃>∀; ✗∀>∃

b. *SVC*:

Kofi	twerɛ-ɛ	krataa	baako	kɔ-ma-a	adwumakuo	biara.
Kofi	*write-PAST*	*letter*	*one*	*go-give-PAST*	*company*	*every*

'Kofi wrote one letter to every company.'

✓∃>∀; ✓∀>∃

(5.157) a. *Ditransitive*:

Ama	kyerɛ-ɛ	sukuuni	baako	anomaa	biara.
Ama	*show-PAST*	*student*	*one*	*bird*	*every*

'Ama showed one student every bird.'

✓∃>∀; ✗∀>∃

b. *SVC*:

Ama	de	anomaa	baako	kyerɛ-ɛ	sukuuni	biara. .
Ama	*take*	*bird*	*one*	*show-PAST*	*student*	*every*

'Ama showed one bird to every student.'

✓∃>∀; ✓∀>∃

In a ditransitive construction, when the Theme is put into focus position, the inverse reading becomes available. When the Goal is put into focus position, however, the inverse reading is, if at all, only very marginally available. Example (5.158) shows the direct contrast. Note that the determiners are switched in (5.158a) vs. (5.158b) to ensure that the existential expression precedes the universal quantifier in both sentences (see the discussion on entailment in section 2.2.2). Therefore, the inverse reading we are after is switched as well.

(5.158) a. *Ditransitive – 2ⁿᵈ obj/Theme fronted:*

Mfonin baako na Esi kyerɛ-ɛ sukuuni biara **ø**.
picture one FOC Esi show-PAST student every
'It is one picture that Esi showed to every student.'

✓∃>∀: There is a single picture that was shown to all students.

✓∀>∃: Each student got to see a different picture.

b. *Ditransitive – 1ˢᵗ obj/Goal fronted:*

Sukuuni baako na Esi kyerɛ-ɛ **no** mfonin biara.
student one FOC Esi show-PAST 3SG.OBJ picture every
'It is one student that Esi showed every picture to.'

✓∃>∀: There is a single student who got to see all pictures.

×∀>∃: Each picture was shown to a different student.

This result is similar to what we saw with transitive verbs in the previous section. If we assume that the focus construction is an instance of movement, then the existential in (5.158a) can reconstruct to a position below the universal quantifier, thereby giving rise to the inverse reading, see (5.159a). In (5.158b), on the other hand, even under reconstruction, the existential will still be in a position above the universal, see (5.159b).

(5.159) a. [Mfonin **baako**] na Esi kyerɛɛ sukuuni **biara** [*mfonin baako*].
    b. [Sukuuni **baako**] na Esi kyerɛɛ [*sukuuni baako*] mfonin **biara**.

It is important to note that in the case of the direct object being fronted, there was a lot of variation as to how difficult speakers found it to obtain the inverse reading, depending on the particular item. In (5.158a) above, only some speakers accepted the inverse reading. In (5.160) below, it was generally easier to obtain the inverse reading.

(5.160) *Ditransitive – 2ⁿᵈ obj/Theme fronted:*

Adaka [bi / baako] na Ama ma-a abusuani biara ø.
box IND / one FOC Ama give-PAST family.member every
'It is a (certain)/one box that Ama gave to every family member.'

✓∃>∀; ✓∀>∃

As for SVCs, since the order of objects is reversed in SVCs compared to ditransitives, we would expect also the pattern of scope availability to reverse. This is not the case, though. In fact, we see the exact same pattern as with ditransitives when we place an element in the *na*-cleft: when the Theme is fronted, as in (5.161a), it can give rise to an inverse reading. When the Goal is fronted, however, this is

impossible (5.161b). This is surprising under the speculations undertaken above that the base-position of the fronted element plays a role. As can be seen in (5.161a), in the case of the Theme, the base-position still precedes the universal, thus reconstruction does not seem to cause the inverse reading here, see (5.162a). Reversely, in the case of the Goal in (5.161b), the base position is preceded by the universal, see (5.162b).

(5.161) a. *SVC – 1ˢᵗ obj/Theme fronted:*

Mfonin baako na Esi de ø kyerɛ-ɛ adamfo biara.
picture one FOC Esi take 3SG.OBJ show-PAST friend every
'It is one picture that Esi showed to every friend.'

✓∃>∀: There is a single picture that was shown to all friends.

✓∀>∃: Each friend got to see a different picture.

b. *SVC – 2ⁿᵈ obj/Goal fronted:*

Adamfo baako na Esi de mfonin biara kyerɛ-ɛ no.
friend one FOC Esi take picture every show-PAST 3SG.OBJ
'It is one friend that Esi showed every picture to.'

✓∃>∀: There is a single friend who got to see all pictures.

×∀>∃: Each picture was shown to a different friend.

(5.162) a. [Mfonin **baako**] na Esi de [*mfonin **baako***] kyerɛɛ adamfo **biara**.

b. [Adamfo **baako**] na Esi de mfonin **biara** kyerɛɛ [*adamfo **baako***].

Again, the unavailability of inverse readings in (5.162b) cannot be due to the presence of an overt singular resumptive pronoun. In (5.163) below, the fronted goal is inanimate and thus does not leave an overt resumptive pronoun in its base position. Nevertheless, the inverse reading is completely unavailable.

(5.163) a. *SVC – 2ⁿᵈ obj/Goal fronted:*

Adwumakuo baako na Kofi twerɛ-ɛ krataa biara kɔ-ma-a yɛ ø.
company one FOC Kofi write-PAST letter every go-give-PAST
'It is a (certain)/one company that Kofi sent every letter to.'

✓∃>∀; ×∀>∃

b. *SVC – 2ⁿᵈ obj/Goal fronted:*

Aduaba baako na Kwame de fertilizer biara ma-a yɛ ø.
crop one FOC Kwame take fertilizer every give-PAST
It is a (certain)/one crop that Kwame gave every fertilizer to.

✓∃>∀; ×∀>∃

Generally, while the judgments for the fronted Goal were fully consistent across speakers and items, there was some variation in the case of the fronted Theme both across speakers and items, same as in other constructions discussed.

Pair-list readings in wh-questions show the same pattern as above: the inverse reading is available when the Theme is questioned, independent of whether its base position follows (5.164a, ditransitive) or

precedes (5.165a, SVC) the universal quantifier. The inverse reading is unavailable when the Goal is questioned, again unaffected by the reversed order of elements in ditransitive (5.164b) versus SVC (5.165b). However, the pair-list reading is acceptable for some speakers in (5.165b) when the universal quantifier is changed to a partitive construction: *fertilizer no mu biara* (= lit. 'every in the fertilizers').

(5.164) a. *Ditransitive – 2ⁿᵈ obj/Theme fronted:*

[Dɛn / Akyɛdeɛ ben] na Ama ma-a abusuani biara ø?
what / gift which FOC Ama give-PAST family.member every
'What/Which present did Ama give to every family member?'
✓Wh>∀; ✓∀>Wh

b. *Ditransitive – 1ˢᵗ obj/Goal fronted:*

[Dɛn / Aduaba bɛn] na Kofi ma-a no fertilizer biara?
what / plant which FOC Kofi give-PAST 3SG.OBJ fertilizer every
'What/Which plant did Kofi apply every fertilizer to?'
✓∃>∀; ✗∀>∃

(5.165) a. *SVC – 1ˢᵗ obj/Theme fronted:*

[Dɛn / Akyɛdeɛ ben] na Ama de ø ma-a abusuani biara?
what / gift which FOC Ama take give-PAST family.member every
'What/Which present did Ama give to every family member?'
✓Wh>∀; ✓∀>Wh

b. *SVC – 2ⁿᵈ obj/Goal fronted:*

[Dɛn / Aduaba bɛn] na Kofi de fertilizer biara ma-a yɛ ø?
what / plant which FOC Kofi take fertilizer every give-PAST
'What/Which plant did Kofi apply every fertilizer to?'
✓Wh>∀; ✗∀>Wh

The representation in (5.166) provides an overview of the availability of inverse readings in this section. The pattern observed with ditransitive verbs can be explained with reconstruction, as discussed further above. The case of serial verb constructions does not fit that explanation, though. If we assume, same as with ditransitive verbs, that the inverse reading is only available under reconstruction, then we would in fact expect exactly the opposite pattern for serial verb constructions: inverse readings should be unavailable in the basic form and when the Theme is fronted, and available when the Goal is fronted.

(5.166) *Ditransitive*

a. No fronting:		**Goal∃**	**Theme∀**	✗∀>∃
b. 1ˢᵗ obj/Goal fronted:	**Goal∃**	t_Goal	**Theme∀**	✗∀>∃
c. 2ⁿᵈ obj/Theme fronted:	**Theme∃**	**Goal∀**	t_Theme	✓∀>∃

SVC

d. No fronting:		**Theme∃**	**Goal∀**	✓∀>∃
e. 1ˢᵗ obj/Theme fronted:	**Theme∃**	t_Theme	**Goal∀**	✓∀>∃
f. 2ⁿᵈ obj/Goal fronted:	**Goal∃**	**Theme∀**	t_Goal	✗∀>∃

One might speculate that this pattern arises because in the underlying syntax of these types of serial verb constructions, the second object (Goal) is in fact in a structurally higher position than the first object (Theme), i.e. it is essentially a left-branching structure. In that case, the Goal would follow the Theme on the surface, but c-command it in the underlying structure. However, this would be at odds with the general syntax of Asante Twi as an SVO and mostly right-branching language. Albeit Asante Twi exhibits phrases of both head-initial and head-final order, head-final phrases are normally confined to the nominal realm, with determiners and prepositions occurring to the right, while VP and CP are head-initial (cf. Arkoh 2011). It would also be at odds with standard approaches to SVCs. Finally, data from binding does not give any indication that this is in fact the underlying structure, as can be seen in (5.167). If a reversed c-command structure gave rise to the pattern of SVCs in (5.166), then a reflexive pronoun in the position of the first object should be bound by a proper name in the position of the second object, see (5.167). A syntactic explanation along these lines of the pattern in (5.166) is therefore not viable.

(5.167) Ama$_i$ de   ne ho$_{i/*j}$ kyerɛ-ɛ   Kofi$_j$ ahwehwɛ   no   mu.
        Ama   *take*   *self*   *show-PAST*   *Kofi*   *mirror*   *DEF*   *in*
        ✓'Ama pointed out herself to Kofi in the mirror.'
        ✗'Ama showed Kofi to himself in the mirror.'

Another possibility would be to say that in the case of the SVCs, there is a silent instance of the Theme in a position below the Goal. This could be motivated by the fact that the verb that is used as V2 in the serial verb construction is the same as the verb that can be used without a serial verb construction, i.e. as a ditransitive verb with two object arguments. This is represented in (5.168), adapted from (5.166) above. This could explain why the inverse interpretation is available in the basic form and when the Theme is fronted. In both cases, the Goal c-commands the silent Theme.

(5.168) *SVC*

a. No fronting:		**Theme$_\exists$**	Goal$_\forall$	(t$_{\text{Theme}}$)	✓∀>∃
b. 1st obj/Theme fronted:	**Theme$_\exists$**	t$_{\text{Theme}}$	Goal$_\forall$	(t$_{\text{Theme}}$)	✓∀>∃
c. 2nd obj/Goal fronted:	Goal$_\exists$	**Theme$_\forall$**	t$_{\text{Goal}}$	(t$_{\text{Theme}}$)	✗∀>∃

This is in fact what Campbell (1996) proposes. In his account to SVCs in Akan, he argues that the Theme originates from a position below V2. In order to receive structural case, it moves to its surface position above V2. This is not only assumed for instances of two objects, but for other cases of shared object SVCs, too (see also Aboh 2009, Martin 2010 for similar claims of a moved object). This account is in contrast to base-generation accounts, as proposed by e.g. Baker (1989). Evidence comes from sentences like (5.169)[147]. In (5.169a), the sentence gives the appearance of a shared verb, but in sentence (5.169b), where the object is animate, a resumptive pronoun occurs in sentence-final position. Thus, this follows the usual pattern of resumptive pronoun deletion with most inanimate, but not animate, objects. The proposed structure from Campbell (1996) is given in Figure 5.5, where [e]$_i$ is an empty category coindexed with the moved NP and is a complement to V2.

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[147] Note that these are examples from the Kwawu and Akuapem dialect of Akan, respectively.

(5.169) a. Yaw   kyere-e   biribi   di-iɛ.
          Yaw   catch-PAST   something   eat-PAST
          'Yaw caught something to eat (and ate it).'

                                                 (adapted from Campbell 1996, p. 85)

     b. Kofí   bɔ-ɔ   Amma   ku-u   no.
          Kofi   strike-PAST   Amma   kill-PAST   3SG.OBJ
          'Kofi hit Ama and killed her.'
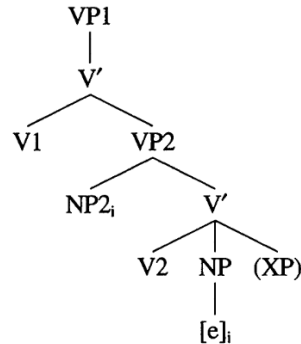
                                                 (adapted from Campbell 1996, p. 90)

Figure 5.5: Structure of non-accusative SVCs as proposed by Campbell (1996), p. 100.

Campbell also specifically discusses SVCs with two objects. In (5.170b) the shared argument is a whole CP. While the NP object in (5.170a) occurs immediately after the first verb, the CP occurs in sentence-final position – exactly where we would expect the base position of the moved object in (5.170a).

(5.170) a. Kofi **ka-a**   [anansesɛm]   **kyerɛ-ɛ**   Yaw.
          Kofi say-PAST   story   show-PAST Yaw
          'Kofi told Yaw a story.'

     b. Kofi **ka**   **kyerɛ-ɛ**   me   [sɛ   Yaw   bɛ-kɔ   Nkran].
          Kofi say   show   1SG.OBJ   COMP   Yaw   FUT-go   Accra
          'Kofi told me that Yaw will go to Accra.'

A final piece of evidence for Campbell's analysis are double-object SVCs with the verb *de* (= 'take'). This verb is commonly used as the first verb in double-object SVCs. Campbell refers to this verb as a "dummy element" (Campbell 1996, p. 91). It does not inflect for tense or aspect and cannot occur on its own, i.e. without a second, lexical verb. Campbell suggests that this verb is only used to "fill the V1 slot […] and assign structural Case to the NP that it governs." (Campbell 1989, 1996, p. 92). Thus, according to Campbell, this verb cannot assign θ-roles (see also Campbell 1992, Aboh 2009). As evidence for this claim, he shows that there are too many different θ-roles that can occur with the object of *de* to "[…] isolate any thematic content for it." (Campbell 1996, p. 92).

Nevertheless, while this approach can explain the first two rows of the SVC pattern, see (5.166d-e), it is surprising that inverse readings are absent when the Goal is fronted, see (5.166f). After all, the Theme in its surface position c-commands the Goal's trace/resumptive pronoun. We would expect inverse readings to be at least marginally available, considering the fact that in all other environments we have seen so far, where reconstruction into a position below the second quantifier was a possibility, the

inverse reading did in fact arise. However, in the case of the fronted Goal in SVCs, the inverse reading was rejected by the language consultants across the board. A possible explanation for this effect might be semantic role. Looking at (5.166) again, we can observe that across the board, the Goal can take inverse scope over the Theme, but the Theme cannot take inverse scope over the Goal[148]. As discussed in the introductory section 2.2.6, semantic role has been claimed to be an important factor in the availability of scope readings. In Kurtzman & MacDonald's (1993) thematic hierarchy above, Theme takes the lowest position on the hierarchy. Also, on Ioup's (1975) grammatical function hierarchy, the indirect object is positioned above the direct object. While in Asante Twi, the possibility of reconstruction makes inverse readings much more available, it is still clearly dispreferred compared to the surface reading. Thus, the cost of reconstruction may be acceptable with elements that preferably take narrow scope due to their grammatical and semantic role. But the cost for narrow scope of an element that is prone to take wide scope due to its grammatical and semantic role may be too high. This would be a claim along the lines of multi-factorial accounts (e.g. Ioup 1975, VanLehn 1978, Kuno 1991, Kurtzman & MacDonald 1993, Pafel 2005).

I conclude that the scope data of double object constructions in Asante Twi provide further support for movement accounts along the lines of Campbell (1996), Aboh (2009), Martin (2010). We can explain the availability of inverse readings only if we assume that overt movement has taken place. Only then reconstruction is an option and can apply in the same way as in other instances of inverse reading via reconstruction in Asante Twi. At the same time, this also promotes the assumption that SVC happens via complementation in the type of double object SVC discussed in here, and that it cannot happen via coordination or adjunction. Movement is generally blocked from coordinated elements (Coordinated Structure Constraint, CSC, Ross 1967) and adjuncts (Condition on Extraction Domains, CED, Huang 1982). If the second VP was part of a coordinated structure or an adjunct, we could not postulate movement and the pattern of inverse interpretations would be left unexplained.

5.6.5   Complement clauses

Inverse readings are generally taken to be blocked across clause boundaries, even in complement clauses, where overt movement is grammatical. However, in certain examples, the inverse reading seems to be marginally available (e.g. VanLehn 1978, Reinhart 1997, Fox 2000), see section 2.2.3. In Asante Twi, we find the same pattern. Korsah & Murphy (2020) provide an example of a complement clause, which they claim to only give rise to the surface reading, see (5.141) further above. Similar to English, I found that inverse readings are rare, but not completely impossible. Examples are given in (5.171) and (5.172). Inverse readings are very difficult to obtain here, speakers reject such readings in most cases. For some speakers, however, the reading seems to be marginally available in certain items. One language consultant comments: "These sentences are tricky. Hearing them first, I interpret it as a single thing, but thinking about it again, it can also be that it is different things." However, the inverse reading was never obtained with the indefinite *bí*, but only with the numeral *baako*. Two speakers rejected the inverse reading across all items.

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[148] Note that in English prepositional vs. double object dative constructions, it is also the Goal which can take inverse scope over the Theme, but not the other way round.

(5.171) Ɔyaresafoɔ baako hwɛ-ɛ sɛ ɔyarefoɔ biara
doctor *one* *ensure-PAST* *COMP* *patient* *every*
bɛ-gye aduro.
FUT-take *drug*
'A (certain)/one doctor made sure that every patient would take a drug.'
✓∃>∀; ?(✓)∀>∃

(5.172) Abaayewa baako hwɛ-ɛ sɛ akwadaa biara bɛ-da
girl *one* *ensure-PAST* *COMP* *child* *every* *FUT-sleep*
'A (certain)/One woman made sure that every child would sleep.'
✓∃>∀; ?(✓)∀>∃

5.6.6 Syntactic islands

Quantifier scope out of embedded sentences is a particularly interesting in Asante Twi. This is because Asante Twi has been said to allow for overt movement out of at least some types of island environments (Saah 1994, Saah & Goodluck 1995, Korsah 2017, Bombi et al. 2019, Hein & Georgi 2020). If inverse readings arise due to Quantifier Raising, a type of covert movement that behaves in parallel to overt movement, then we should expect that in Asante Twi, inverse readings are relatively easy to obtain out of island environments, as overt movement is available in those environments as well. At the same time, there are two caveats about this prediction. First, Quantifier Raising is long known to not fully mirror overt movement. Overt movement out of complement clauses is fully grammatical in languages like English, but inverse readings are not (already noted in Chomsky 1975). That is, the mere fact that overt movement is available in a certain environment does not mean that inverse readings are available, too. Second, in the two chapters on German and English we saw that inverse readings are in fact at least marginally available out of relative clause islands and in English also out of other islands (see also Tsai et al. 2014/Scontras et al. 2017, Tanaka 2015). This was an unexpected result in face of the general assumption that Quantifier Raising is blocked across island boundaries, parallel to overt movement. On the other hand, Tanaka (2015) maintains this parallelism by presenting evidence that overt movement, too, is marginally available across island boundaries, at least in the case of adjunct islands. In this section, I will add more data to the picture by testing inverse scope possibilities in Asante Twi, a language that exhibits different behaviour of overt extraction compared to languages like English or German.

    (i)   Overt movement

Saah (1994) and Saah & Goodluck (1995) claim that Asante Twi allows for overt extraction out of different types of islands, providing experimental evidence for their claim. However, only the results of one of the three experiments that were conducted did in fact support this claim. The first two experiments, where only relative clause islands were tested, no evidence for acceptability of overt extraction was found. The third experiment tested relative clauses, temporal clauses, and wh-complements and employed an acceptability rating task, where participants judged the acceptability of sentences on a scale. While sentences involving overt extraction out of islands did not receive a high rating, they were still judged as better compared to strong grammatical violations such as incorrect word

order. Bombi et al. (2019) report that wh-movement out of conditional clauses is judged as acceptable, see (5.173). Korsah (2017) reports provides examples like (5.174) and (5.175) to show that focussing an element from within a relative clause or a wh-island is grammatical.

(5.173) Hwan na sɛ ɔ-ba a yɛ-bɛ-hyɛ mmra no?
who FOC if 3SG.SBJ-come REL 1PL-FUT-force law DEF
(lit.) 'Who, if he comes, we will pass the law?'

(adapted from Bombi et al. 2019, p. 13)

(5.174) [Kŕataá nó] na Kofi hú-u [sukúuní áa ɔ-bɛ́-káé nó].
book DEF FOC Kofi see student REL 3SG-FUT-read CD
'Kofi saw the student who will read THE BOOK.'

(adapted from Korsah 2017, p. 116)

(5.175) Amma na Kofi bísá-a sɛ [hwán na ɛ-dɔ nó nó]
Amma FOC Kofi ask-PAST COMP who FOC 3SG.SBJ-love 3SG.OBJ CD
'Kofi asked who loves AMA.'

(adapted from Korsah 2017, p. 117)

Considering the mixed results concerning overt extraction out of syntactic islands in the experiments in Saah (1994) and Saah & Goodluck (1995), I first tested the acceptability of wh-movement out of different island environments with my four language consultants and then proceeded to test scope availability. This was done in order to obtain a better understanding of the extent to which speakers accept wh-movement out of islands in general, but also to be able to compare individual speakers' judgments of overt movement compared to inverse readings.

I tested overt extraction out of three different environments: relative clauses, wh-islands, temporal adjuncts. Examples are given in (5.176)-(5.179). The number below each example shows how many speakers accepted this type of extraction. Four speakers were consulted in total. Several items were tested for each conditions, but the individual speakers were fully consistent in their respective judgments across items.

Subject relative clause:
(5.176) a. Hwan na wo-hu-u ahoma no aa ɔ-twa-a yɛ?
who FOC 2SG.SBJ-see-PAST rope DEF REL 3SG.SBJ-cut-PAST
(lit.) 'Who did you see the rope that cut?'
Accepted: 1/4
b. Adwumayeni no na me-hu-u ahoma no aa
rope DEF FOC 1SG.SBJ-see-PAST rope DEF REL
ɔ-twa-a yɛ.
3SG.SBJ-cut-PAST
(lit.) 'It is the worker that I saw the rope that cut.'
Accepted: 3/4

Object relative clause:

(5.177) a. Dɛn   na   wo-hu-u   nipa   no   aa   ɔ-twa-a yɛ?
        What   FOC   2SG.SBJ-see-PAST   person   DEF   REL   3SG.SBJ-cut-PAST
        (lit.) 'What did you see the person who cut?'
        Accepted: 1/4

   b. Ahoma   no   na   me-hu-u   nipa   no   aa
      rope   DEF   FOC   1SG.SBJ-see-PAST   person   DEF   REL
      ɔ-twa-a yɛ.
      3SG.SBJ-cut-PAST
      (lit.) 'It is the rope that I saw the person who cut.'
      Accepted: 3/4

Wh-island:

(5.178) a. Dɛn   na   Ama   bisa-a   sɛ   hwan   na   ɔ-faa yɛ?
        what   FOC   Ama   ask-PAST   COMP   who   FOC   3SG.SBJ-take.PAST
        (lit.) 'What did Ama ask who took?'
        Accepted: 2/4

   b. Nwoma   no   na   Ama   bisa-a   sɛ   hwan   na
      book   DEF   FOC   Ama   ask-PAST   COMP   who   FOC
      ɔ-faa yɛ?
      3SG.SBJ-take.PAST
      (lit.) 'It is the book that Ama asked who took.'
      Accepted: 3/4

Temporal adjunct:

(5.179) a. Dɛn   na   Kofi   hiya-a   n'adamfo   ansa na   ɔ-tɔ-ɔ yɛ?
        What   FOC   Kofi   meet-PAST   his-friend   before   3SG.SBJ-buy-PAST
        (lit.) 'What did Kofi meet his friend before he bought?'
        Accepted: 3/4

   b. Hyɛn   bi   na   Kofi   hiya-a   n'adamfo   ansa na   ɔ-tɔ-ɔ yɛ.
      vehicle   IND   FOC   Kofi   meet-PAST   his-friend   before   3SG.SBJ-buy-PAST
      (lit.) 'It is a (certain) vehicle that Kofi met his friend before he bought.'
      Accepted: 1/4

The results obtained show a mixed picture. While some speakers accepted island violations and found them well-formed and easy to interpret, others judged them as completely ungrammatical and were in fact unable to interpreted these sentences at all. However, no speaker rejected all instances of island violations, i.e. every speaker judged at least some instances of island violations as acceptable. At the same time, no speaker accepted all instances of island violations. Those speakers who found the sentences acceptable naturally translated them to a grammatical and less literal version in English. For example, in the case of the temporal adjunct, meaning *before*, the consultants would consistently translate it with the opposite preposition *after,* thereby switching the order of the two clauses. That is, for (5.179a): "What did Kofi buy after meeting his friend?". Or in the case of a focus marker, they would provide an English translation with strong intonation rather than with a cleft structure, i.e. for (5.177b): "I saw the person who cut the ROPE." On the other hand, speakers who judged the sentences

as ungrammatical also provided a literal, i.e. ungrammatical translation in English. Speakers who rejected wh-extraction with relative clauses corrected the sentences by putting the wh-expression in its base-position, thereby changing it to a wh-in-situ question, see example (5.180). However, they pointed out that this sentence is still marked in that it can only be used as an echo question and not out-of-the-blue.

(5.180) Wɔ-huu nipa no aa ɔ-twa-a dɛn?
2SG.SBJ-see-PAST person DEF REL 3SG.SBJ-cut-PAST what
(lit.) 'You saw the person who cut what?'

Table 5.9 provides an overview of how each speaker (anonymized as S1-S4) judged the sentences.

		S1	S2	S3	S4
relative clause	*na*-focus	✗	✓	✓	✓
	wh-extraction	✗	✗	✓	✗
wh-island	*na*-focus	✗	✓	✓	✓
	wh-extraction	✗	✗	✓	✓
temporal adjunct	*na*-focus	✗	✓	✗	✗
	wh-extraction	✓	✓	✓	✗

Table 5.9: Acceptance of overt extraction out of relative clause, temporal adjunct, and wh-islands in Asante Twi across speakers S1-S4.

It can be seen that overall, the four consultants were quite accepting in most of the cases, with the exception of S1. There is also no clear pattern that extraction was generally more accepted or rejected in one island type than in another. Surprisingly, even though *na*-focus and wh-extraction are considered to be the result of the same mechanism, the judgments were not necessarily parallel in one and the same speaker. For example, S4 accepts extraction of an element our of relative clauses into the focus position, but not if it is a wh-element. Acceptance of each condition was tested with multiple items, but each speaker was fully consistent in their judgments across different items of the same condition. A possible reason for this variability will be discussed in section 6.1.4.

(ii)   Inverse scope

Relative clauses:

In relative clauses, it was difficult but not impossible to obtain the inverse reading. The specific context plays a major role. In (5.181) for example, all consultants rejected the inverse reading. In (5.182) and (5.183) they found it easier. The inverse reading was found with the bare noun, *bí*, and *baako*. However, the consultants generally found it easiest with the bare noun and hardest with *bí*.

(5.181) Kwame hwɛ-ɛ sɛ sukuuni [bi / baako] wɔ hɔ aa
Kwame ensure-PAST that student IND / one at there REL
ɔ-kan nwoma biara.
3SG.SBJ-read book every
'Kwame made sure that there is a (certain)/one student who reads every book.'
✓∃>∀; ×∀>∃

(5.182) Kwame hwɛ-ɛ sɛ adwumayɛni wɔ hɔ aa
Kwame ensure-PAST COMP worker at there REL
ɔ-soa adaka biara.
3SG.SBJ-carry box every
'Kwame made sure that there was a worker who cut every rope.'
✓∃>∀; (✓)∀>∃

(5.183) Ama gye di sɛ barima [bi / baako] wɔ hɔ aa
Ama believe COMP man IND / one at there REL
ɔ-siesie-e hyɛn biara.
3SG.SBJ-repair-PAST vehicle every
'Ama believes that there is a (certain) man who repaired every vehicle.'
✓∃>∀; (✓)∀>∃

The sentences in (5.181)-(5.183) are all subject relative clauses involving an existential construction. In chapter 3 we saw that in the case of English, inverse readings were easier to obtain when an existential construction was involved. However, this does not explain the availability of inverse readings in (5.181)-(5.183) alone. The examples in (5.184) and (5.185) below show object relative clauses without existential construction, where the inverse reading, too, is marginally available. The content of (5.185) makes it a lot easier to interpret the sentence under the inverse reading compared to the context in (5.184). Again, it is easiest to obtain the inverse reading with a bare noun. It is also acceptable that a universal embedded inside the relative clause scopes over a definite RC-head. (5.186) shows this for a singular RC-head and (5.187) for a plural RC-head.

(5.184) Me-hu-u ahoma [bi / baako / ø] aa adwumayɛni biara twa-a yɛ
3SG.SBJ-see-PAST rope IND / one REL worker every cut-PAST
'I saw a (certain)/one rope that every worker cut.'
✓∃>∀; ?(✓)∀>∃

(5.185) Me-kan-n krataa [bi / baako / ø] aa sukuuni biara twerɛ-ɛ yɛ
3SG.SBJ-read-PAST letter IND / one REL student every write-PAST
'I read a (certain)/one letter that every student wrote.'
✓∃>∀; (✓)∀>∃

(5.186) Akatua no gyina adwuma no aa adwumayɛni biara yɛ so.
salary DEF depend work DEF REL worker every COP on
'The salary depends on the work that every worker does.'

(5.187) Mfonin no   kyerɛ   mmoa   no   aa   ɛ-wɔ   ɔman   biara   mu.
       picture DEF   show   animal DEF   REL   3PL-at country every   in
       'The picture shows the animals that live in every country.'

This effect has been reported also for other languages such as English, both in the case of relative clauses as well as inverse linking constructions (Fiengo & Higginbotham 1981, May 1985, Bott & Radó 2009). Such sentences have often received a special treatment. For example Sharvit (1999) treats them as involving a particular function and Schwarz (2009) attributes this effect to a dynamically situation-bound pronoun that is introduced by the definite expression, see also the discussion in section 6.2.

Wh-islands:

In the case of wh-islands, as exemplified in (5.188), speakers rejected the inverse reading across the board. This was independent of the particular context and the quantifiers chosen. Availability was not tested with the bare noun, as it can usually not occur in subject position, see section 5.4.

(5.188) Sukuuni   [bi / baako]   bisa-a   sɛ   hwan   na
       student   IND / one   ask-PAST   COMP   who   FOC
       ɔ-fa-a   nwoma   biara.
       3SG.SBJ-take-PAST   book   every
       'A (certain)/One student asked who took every book.'
       ✓∃>∀; ×∀>∃

Temporal adjuncts:

In the case of temporal adjuncts, similar to wh-islands, speakers reject inverse readings over the subject of the matrix clause, but accept them over the object of the matrix clause. An example sentence is given in (5.189) with the existential in subject position and in (5.190) and (5.191) with the existential in object position. (5.189) can only mean that a single worker came before this worker then bought every vehicle.

(5.189) Adwumayɛni   [bi / baako]   ba-a   ha   ansa na   ɔ-tɔ-ɔ
       worker   IND / one   come-PAST   here   before   3SG.SBJ-buy-PAST
       hyɛn   biara.
       vehicle   every
       'A (certain)/One worker came here before buying every vehicle.'
       ✓∃>∀; ×∀>∃

On the other hand, (5.190) allows for the inverse reading, where a different prayer was said before each exam, and (5.191) can mean that a different drink was consumed before each meal. The inverse reading is readily available with the bare noun and *baako*. With *bí*, however, these sentences are preferably interpreted under the surface meaning. In that sense, (5.190) would mean that Kofi had to write multiple exams and that he said a single prayer at the beginning before writing all of them.

(5.190) Kofi   bɔ-ɔ   mpaeɛ   [bi / baako / ø]   ansa na   ɔ-twerɛ
Kofi   *beat-PAST*   *prayer*   *IND / one*   *before*   *3SG.SBJ-write*
nsɔhwɛ   biara.
exam   *every*
'Kofi said a (certain)/one prayer before writing every exam.'
✓∃>∀; ✓∀>∃

(5.191) Kofi   nom-m   nsa   [bi / baako / ø]   ansa na   w'-a-di
Kofi   *drink-PAST*   *drink*   *IND / one*   *before*   *3SG.SBJ-PRF-eat*
aduane   biara.
meal   *every*
'Kofi had a (certain)/one drink before eating every meal.'
✓∃>∀; ✓∀>∃

Note that the embedded clause is actually in a c-commanding relationship relative to the object in (5.190) and (5.191), but not to the subject in (5.189). As a temporal adjunct it will attach to the TP that contains the object of the matrix clause. Nevertheless, there is no c-commanding relationship between the universal and the existential quantifier, as the former is trapped in the embedded clause. This will be discussed again in section 6.2.1.

5.6.7   Discussion

(i)   Basic sentences

Even though in this section, I only presented qualitative data and did not conduct a larger quantitative experiment, this data can still give as a first idea of the extent to which inverse readings are available across sentence constructions in Asante Twi. We have seen that inverse readings are generally difficult to obtain for the four speakers consulted. Nevertheless, inverse readings were not completely absent either. Contrary to the prediction in Owusu (2020), inverse readings were not completely banned when *bí* was structurally higher than the universal quantifier. This is additional evidence that *bí* behaves more like an existential quantifier rather than a skolemized choice function as assumed in Arkoh (2011), Bombi et al. (2019), and Owusu (2020). We saw that the particular choice of item can change the judgments a lot, showing the important role that the plausibility of different readings plays. At the beginning of this section, I predicted, based on Bobaljik & Wurmbrand (2012) that Asante Twi should allow for inverse readings quite readily, considering the fact that it has very strict word order and thus cannot just scramble the quantifiers overtly. However, inverse readings were generally difficult to obtain for the four speakers consulted for this study. Asante Twi is not the only exception in this regard, though. Mandarin Chinese, for example, which is also an SVO language with strict word order, is even less permissive with respect to scope inversion (Aoun & Li 1989, 1993, Tsai et al. 2014/Scontras et al. 2017). In line with multi-factorial accounts (e.g. Ioup 1975, VanLehn 1978, Kuno 1991, Kurtzman & MacDonald 1993, Pafel 2005), we saw that the choice of quantifiers as well as the semantic role played a major role. The universal *nyinaa*, in contrast to *biara*, only rarely allowed for inverse readings. Among the existential expressions, inverse readings were most observed for the bare noun, followed by the

numeral *baako*, with the indefinite *bí* beings most resistant. We also saw that the Goal has a strong inclination to take wide scope, while the Theme tends to take narrow scope.

(ii)   Left-dislocation

As discussed, inverse readings tend to be difficult to obtain in Asante Twi with canonical sentences. However, in certain types of left-dislocated structures, the inverse reading is a lot easier to obtain. We could see that with the *na*-focus construction. This is true across different types of sentence constructions. If the original position of the moved element is below the universal quantifier, then an inverse readings is readily available. If, on the other hand, the original position of the moved element is above the universal quantifier, then an inverse readings is unavailable. Same as Korsah & Murphy (2020), I will take this data as additional evidence in favour of a movement account of the *na*-cleft construction. If the element has been moved, then it can reconstruct into its original position at LF from where it can take narrow scope. Same as in other languages, inverse readings are more accessible when the higher quantifier can reconstruct to a position below the lower quantifier. Inverse readings that arise via reconstruction are generally much more prominent than inverse readings that arise without reconstruction. The same was, for example, observed with non-canonical word order in German (Bott & Schlotterbeck 2012, Radó & Bott 2018; cf. Frey 1993) and Russian sentences (Ionin et al. 2014) and with passive voice in English (Kurtzman & MacDonald 1993). If no reconstruction took place in Asante Twi, it would be unclear why the inverse reading is so much more prominent in structures that involve extraction. The scope data also provided additional evidence that in double-object SVCs, the Theme originates from a position below V2 and moves to V1 to its surface position. Under such an account, the pattern of available inverse readings in SVC versus non-SVC double-object constructions can be explained through reconstruction.

(iii)   Embedding

In section 5.6.5 we saw that left dislocation across an island boundary is acceptable for some but not all speakers of Asante Twi. Acceptability varied with speaker, type of island and type of extraction. The results were consistent with the claim in Saah (1994) that overt extraction out of islands is possible in Asante Twi. At the same time, the results also patterned with Saah's in that this availability was not found to be grammatical for all speakers. Saah, too, obtained mixed results in his experiments. Scope inversion, on the other hand, was available with both subject and object relative clauses and with temporal adjuncts when the existential in the matrix clause was in object position. The inverse reading was unavailable with wh-islands or temporal adjuncts when the existential in the matrix clause was in subject position. While some speakers obtained inverse readings more or less than others, this pattern was consistent across speakers. The direct comparison of extraction acceptability and inverse scope availability across speakers is shown in Table 5.10.

One major piece of evidence in favour of a covert movement operation like QR has always been the fact that it seems to match the behaviour of overt movement in that it cannot apply across clause-boundaries. Table 5.10, however, does not provide a parallel pattern of overt extraction and inverse scope availabilities in Asante Twi. This is a challenge to the QR approach. The data in Table 5.10 suggests that either, inverse readings are not obtained via a covert movement operation like QR in the first place, or covert movement does not behave in the same way as overt movement.

		S1		S2		S3		S4	
		OM	IR	OM	IR	OM	IR	OM	IR
relative clause	focus	×	✓	✓	✓	✓	✓	✓	✓
	wh	×		×		✓		×	
wh-island	focus	×	×	✓	×	✓	×	✓	×
	wh	×		×		✓		✓	
temporal adjunct	focus	×	S: ×	✓	S: ×	×	S: ×	×	S: ×
	wh	✓	O: ✓	✓	O: ✓	✓	O: ✓	×	O: ✓

Table 5.10: Acceptability of overt movement (OM) and availability of inverse readings (IR) across syntactic islands for each speaker S1-S4.

5.7 An experiment proposal[149]

In this section, I will give a suggestion of how an experiment similar to the experiments for English and German in chapter 3 and 4 could be implemented. While the explorative data presented so far can serve as a first hint as to how quantifier scope ambiguities in Asante Twi work, it is important to test these claims in a well-controlled experiment with a larger number of speakers and items. This is important for several reasons. First, three of the four speakers that were consulted for the studies presented in here had had linguistic training. There is evidence that linguistic judgments can vary between trained linguists and linguistically naïve speakers (Culbertson & Gross 2009, Malenica et al. 2019, Cho et al. 2021). Further, in the particular case of quantifier scope ambiguities, we have seen a large amount of variability between speakers, as discussed in the chapters on German and English. Judgments from a single or only a few speakers are therefore limited in their informative value. In the remainder of this section, I will therefore present an experiment proposal similar to the experiments conducted for English and German in previous chapters. I will discuss potential difficulties that arise with cross-linguistic studies that involve unrelated languages, as it is the case with Asante Twi and English/German, and how they can be avoided.

5.7.1 Challenges with stimuli & design

I will provide a short reminder of the way the experiments for English and German were designed and then discuss a number of issues that arise with conducting a comparable experiment in Asante Twi. The English and German experiments were set up in a parallel way, using transitive sentences with an existential subject and a universal object. The choice for the existential was the indefinite article, the choice for the universal was the distributive quantifier. The experiments had two conditions, embedding

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[149] It was not possible to actually conduct this experiment before submission of this thesis, see footnote 48.

and plausibility. Each target sentence was preceded by a context. For easier reference, the English example (3.16/3.33) is repeated in (5.201) below.

(5.201) **Neutral:**

    Context: The police officer hoped that the burglars might be recorded by newly installed surveillance cameras, and then, in fact …

        0-emb   … a newly installed surveillance camera recorded every burglar.

        1-emb   … there was a newly installed surveillance camera [that recorded every burglar].

        2-emb   … there was a newly installed surveillance camera [which hung in such a way [that it recorded every burglar]].

    Experiment E1:

    Question: Can this sentence be understood to mean that, overall, …

        Q-ONE   … **only a single** newly installed surveillance camera recorded the burglars?   *yes/no*

        Q-MORE   … **more than one** newly installed surveillance camera recorded the burglars?   *yes/no*

    Experiment E2:

    Question: Overall, how many newly-installed surveillance cameras recorded the burglars?   *one / more than one*

    (i)   *Choice of quantifier*

In section 5.1 I presented an overview of quantifiers/determiners in Asante Twi and discussed some of them in more detail in section 5.3-5.5. In contrast to English and German, Asante Twi has a three-way article system, with two ways of expressing indefiniteness, namely the bare noun and the indefinite article *bí*. We have seen in section 5.4 that the bare noun is usually rejected in subject position. Thus, the bare noun cannot be used as an existential subject in an experiment on Asante Twi to mirror English *a* and German *'n*. The indefinite *bí*, on the other hand, typically receives a specific interpretation (see section 5.3). It gives rise to pragmatic inferences that are not apparent with English *a* and German *'n*. In that, it is more similar to *some/a certain* in English rather than to the indefinite article. We have also seen in section 5.6 that albeit inverse scope readings are not completely banned with *bí*, they are strongly dispreferred due to its specific interpretation, especially in comparison to other existential expressions. Additionally, *bí* can quite readily be interpreted on a type-level. The type-token ambiguity had also been discussed as a potential confound in the English and German experiments, but there was no evidence that this confound actually played any role. In the elicitation studies on Asante Twi, on the other hand, this indeed turned out to be a confound and had to be controlled for. The reason is that *bí* is more similar to *some* or *a certain* in English rather than to English *a* or German *'n/ein*. In an experiment, this might cause additional problems in how to interpret the results. Therefore, the use of *bí* for an experiment parallel to English and German is also problematic. Finally, there is the possibility of the numeral *baako* (= 'one'). In the German follow-up experiments, we could see that the use of a modified numeral as well as the use of an indefinite, which is morphologically identical to the numeral, reduced the availability of inverse readings. Tsai et al. (2014)/Scontras et al. (2017) also showed that in English, inverse readings receive very low ratings with the numeral *one* compared to the indefinite *a*. However,

the elicitation studies presented in section 5.6 showed that even though the use of *baako* reduces inverse readings compared to the use of the bare noun, it still receives more inverse readings than the use of *bí*. Thus, from the three options bare noun, *bí*, and *baako*, *baako* might in fact be the least problematic option for an experiment, where the existential occurs in subject position.

The choice of universal is less problematic. Similar to English and German, Asante Twi has a distributive and a collective universal quantifier, namely *biara* and *nyinaa*. In section 5.5 I discussed the fact that *biara*, in contrast to English *every* or German *jeder*, is highly underspecified and can receive multiple different interpretations, depending on the context. However, the items used in this experiment series use affirmative episodic sentences, where the interpretation of *biara* is normally fixed to its universal interpretation. *Biara* was also used extensively in the elicitation studies in section 5.6 without any difficulties relating to its interpretational possibilities. Thus, it seems unproblematic to use *biara* for a parallel experiment.

(ii)   Context

Asante Twi, in contrast to English and German, does not have passive voice. Thus, it is not possible to set up the contexts and the information structure therein in the same way in Asante Twi. The contexts were set up in this particular way to control for certain aspects of information structure in the case of German, as information structure was predicted to have an impact by previous theoretical accounts. As no such predictions exist for Asante Twi, this may be of less relevance for an experiment on Asante Twi. However, it reduces comparability between the experiments conducted for English/German and the experiment planned for Asante Twi. The contexts in Asante Twi would either have to be constructed with canonical word order or by using the focus construction, which is in fact often used to express English passive voice, but is less acceptable out of the blue than the passive structure in English.

(iii)   Plausibility

In the case of the English and German experiments, a very close translation was possible due to the fact that these languages are so closely related, thereby allowing for a direct comparison. In the case of Asante Twi, this was not possible to the same extent. Many verbs that were used in the previous experiment did not have a close translation and involved more complex constructions in Asante Twi than a simple transitive verb, such as the use of a PP or SVC. Similarly, many of the modifying adjectives used in previous experiments would be expressed through a relative clause. For these reasons, the translations deviated to a much higher degree from the previous experiments. Further, certain scenarios had to be altered because they did not make sense in the same way in Ghanaian culture. The consequence is that the plausibility pre-test ratings are not applicable to the Asante Twi items. Thus, separate judgments of plausibility specific to the Asante Twi items will be necessary.

(iv)   Task

The experiments in English and German were all presented in a written mode. The task was a written question in all cases except from one follow-up experiment in German, which employed a picture-matching task. A written presentation may be problematic in the case of Asante Twi, though. Even though Akan is widely used in every-day life and also the language of instruction in early school, later

on, most speakers do not or only rarely use it for reading and writing. For this use, English is the dominant language. Because most speakers of Asante Twi are not used to reading it, an experiment with written stimuli and questions may cause additional difficulties compared to English and German, where speakers are used to reading in their native language a lot. These difficulties may lead to increased misunderstanding of the written stimuli, thereby adding additional noise in the data. This difficulty was pointed out by a number of Asante Twi speakers and also caused major issues in a small pilot study. The stimuli should therefore best be presented in an auditory way and the task should employ a picture-matching task comparable to the case of the German Follow-Up 3.

5.7.2 Sketch of experiment

The experiment that sketched below for Asante Twi will be conducted to answer two research questions.

Q1: Is inverse scope of a universal object over an existential subject available in canonical, unembedded sentences?

Q2: To what extent are inverse readings available when the second quantifier is embedded inside a relative clause island?

The experiment will have three conditions, 0-emb/∀, 1-emb/∀, and 0-emb/DEF. An example of each condition is provided in (5.202).

(5.202) *Context:*

Polisini	no	hwɛ-ɛ	anim	sɛ	kameras
Police	*DEF*	*watch-PAST*	*front*	*COMP*	*cameras*
afoforɔ	no	bɛ-twa	akorɔmfoɔ		no.
new.PL	*DEF*	*FUT-record*	*burglars*		*DEF*

'The police officer hoped that the new cameras would record the burglars.'

0-emb/∀

Na	ampa	ara	nso,	kamera	foforɔ	baako
PRT	*indeed*	*EMPH*	*also*	*camera*	*new*	*one*
twa-a			ɔkorɔmfoɔ	biara.		
record-PAST			*burglar*	*every*		

'And then, in fact, one new camera recorded every burglar.'

1-emb/∀

Na	ampa	ara	nso,	kamera	foforɔ	baako	wɔ	hɔ
PRT	*indeed*	*EMPH*	*also*	*camera*	*new*	*one*	*have*	*there*
aa	ɛ-twa-a			ɔkorɔmfoɔ	biara.			
REL	*3SG.SBJ-record-PAST*			*burglar*	*every*			

'And then, in fact, there was one new camera that recorded every burglar.'

0-emb/DEF

Na	ampa	ara	nso,	kamera	foforɔ	baako
PRT	*indeed*	*EMPH*	*also*	*camera*	*new*	*one*
twa-a		akorɔmfoɔ	no.			
record-PAST		*burglars*	*DEF*			

'And then, in fact, one new camera recorded the burglars.'

The two factors are Embedding and Determiner. The factor Embedding has two levels, 0-emb and 1-emb, i.e. no embedding versus a single embedding into a relative clause. The factor Determiner has two levels, the universal quantifier *biara* (∀) and the definite article *no* (DEF). Because in contrast to German and English, no experiment has been conducted on quantifier scope in Asante Twi before, the condition 0-emb/DEF is included to answer the basic question of whether inverse readings are available at all, thereby testing for Q1. When the universal quantifier is replaced with a definite article, we expect inverse readings to be unavailable. If condition 0-emb/∀ is significantly different from 0-emb/DEF, this would be an indication that inverse readings are in fact available in transitive sentences in Asante Twi. The factor Embedding tests for Q2.

Because this experiment will be presented in an auditory manner, which is more time-consuming for the participants, the overall number of stimuli will need to be reduced compared to the previous experiments. In order to gather enough data points per participant and condition, the design is reduced in terms of the number of conditions. That is, there is only a one instead of two levels of embedding, and the factor of plausibility is omitted. These factors may be specifically tested for in a second and/or third experiment. The stimuli are designed to allow for a plausible scenario under both the surface and the inverse interpretation. A second part of the study will collect judgments as to how plausible participants find the respective scenarios. If inverse readings are available in Asante Twi at all, condition 0-emb/∀ is predicted to receive significantly more inverse scope responses than 0-emb/DEF. If inverse readings are also available in a single embedding, 1-emb/∀ is predicted to also receive significantly more inverse scope responses than 0-emb/DEF.

The experiment will remain parallel to the English and the German experiments in that the word order is canonical subject-before-object with a transitive, non-agentive predicate. The subject is an existential QP and the object is a universal QP. While the latter is similar to English/German in that the distributive quantifier *biara* is used, the existential will be expressed by the numeral *baako* rather than the indefinite article. The reasons for this choice were discussed above. While this is different from the main experiments in English/German, it is comparable to the follow-up experiments 1 and 2 for German. Participants will see 24 target items and 24 filler items. Each participant will see a certain target item in only one of the three conditions, resulting in three experimental lists. The task will be identical to the picture-matching task used for the German Follow-Up 3. That is, there are two types of abstract pictures, one representing a fully distributive interpretation and one representing a collective interpretation, see the pictures in Figure 5.1 above. Participants will always only see one of the two pictures and indicate with *aane* (= 'yes') or *daabi* (= 'no') if the respective picture shows a possible interpretation of the sentence heard before. Same as in the English/German experiments, there will be filler/control items, which are designed to unambiguously only allow for one answer. There will be four types of filler conditions, examples of each are given in (5.203)-(5.206).

(5.203) **Filler 1:**
➔ Expected response: distributive - **no**; collective - **yes**
Context:

Kookoo	akuafoɔ	kuo	no	yɛ-ɛ	wɔn	adwen	sɛ
cocoa	*farmers*	*group*	*DEF*	*COP-PAST*	*3SG.POSS*	*decide*	*COMP*

wɔn	de	fertilizers	afoforɔ	bɛ-gu	kookoo	fuo	no	so.
3SG.SBJ	*take*	*fertilizers*	*new.PL*	*FUT-spray*	*cocoa*	*field*	*DEF*	*on.*

'The cocoa farmer association decided that they would spray new fertilizers on the cocoa fields.'

Target:

Na	ampa	ara	nso,	fertilizer	foforɔ	baako	bi	gugu-u
PRT	*indeed*	*EMPH*	*also*	*fertilizer*	*new*	*one*	*IND*	*cover-PAST*

kookoo	fuo	no	nyinaa	so.
cocoa	*field*	*DEF*	*all*	*on*

'And then, in fact, a certain one fertilizer covered all the cocoa fields.'

(5.204) **Filler 2:**

➔ Expected response: distributive - **no**; collective - **yes**

Context:

Nsrahwɛfoɔ	no	bisa-a	sɛ	wɔn	bɛ-pɛ	sɛ
tourists	*DEF*	*ask-PAST*	*COMP*	*3SG.SBJ*	*FUT-like*	*COMP*

ɔkyeame	bɛ-kyerɛ	wɔn	nkanetete	nnwom	no	ase.
translator	*FUT-show*	*3SG.OBJ*	*ancient*	*songs*	*DEF*	*under*

'The tourists demanded that the translator explain the ancient songs.'

Target:

Na	ampa	ara	nso,	ɔkyeame	baako	bi	wɔ	hɔ	aa
PRT	*indeed*	*EMPH*	*also*	*translator*	*one*	*IND*	*at*	*there*	*REL*

ɔ-kyerɛ-ɛ	wɔn	nkanetete	nnwom	no	nyinaa	ase.
3SG.SBJ-show-PAST	*3SG.OBJ*	*ancient*	*songs*	*DEF*	*all*	*under*

'And then, in fact, there was a certain one translator who explained all the ancient songs.'

(5.205) **Filler 3:**

➔ Expected response: distributive - **yes**; collective - **no**

Context:

Ɔfareni	panin	no	daa no adi	sɛ	afarefoɔ	no
fisherman	*old*	*DEF*	*predict-PAST*	*COMP*	*fishermen*	*DEF*

be-tumi	a-kye	amane	biom.
FUT-can	*CONS-catch*	*herring*	*again*

'The old fisherman predicted that the fishermen would be able to catch herring again.'

Target:

Na	ampa	ara	nso,	afareni	biara	kye-e	amane	baako.
PRT	*indeed*	*EMPH*	*also*	*fisherman*	*every*	*catch-PAST*	*herring*	*one.*

'And then, in fact, every fisherman caught a herring.'

(5.206) **Filler 4:**

➔ Expected response: distributive - **yes**; collective - **no**

Context:

Akwantufoɔ	no	wɔ	anidasoɔ	sɛ	wɔn	bɛ-nya
travellers	*DEF*	*have*	*hope*	*COMP*	*3PL.SBJ*	*FUT-procure*

ngo	a-tɔ	wɔ	ahomegyebea	no	hɔ.
oil	*CONS-buy*	*at*	*resting.place*	*DEF*	*there*

'The travellers hoped that they could buy oil at the resting place.'
Target:

Na	ampa	ara	nso,	wɔn	mu	biara	tɔ-ɔ	ngo
PRT	*indeed*	*EMPH*	*also*	*3PL.SBJ*	*in*	*every*	*buy-PAST*	*oil*

toa	baako	baako.
bottle	*one*	*one*

'And then, in fact, each of them bought a bottle of oil.'

5.8 Summary

In this chapter, I have presented novel fieldwork data on both quantifiers and quantifier scope in Asante Twi. I provided judgments on grammaticality and interpretation for the indefinite article *bí*, the bare noun, and the universal quantifier *biara* and offered an analysis for each of these expressions to account for that data. I analysed *bí* as an existential quantifier with obligatory domain restriction, instead of the more common choice function analysis. I showed that this analysis can better capture the possible interpretations of *bí* when it occurs with various other operators, like intensional/modal operators, question operator, or the universal quantifier. The obligatory domain restriction, by default set to a singleton set, accounts for the additional meaning inferences associated with *bí*, such as specificity, epistemicity, identifiability, or noteworthiness, as well as for the (exceptional) wide scope behaviour. I further analysed the bare noun as a plain existential quantifier without such a domain restriction on the D-head. I provided data to show that the bare noun must project a full DP and cannot be taken as some type of incorporation. I also showed that such an analysis can capture the distribution of the two possible interpretations of the bare noun as non-specific indefinite or unique definite, without having to stipulate ambiguity. These interpretations follow naturally, once we take information structure and the semantics of the overt articles *bí* and *no* into account. Finally, I offered data regarding the expression *biara*, which is highly underspecified and can receive an interpretation as universal quantifier, free-choice item, and negative polarity item, depending on the context. After having established the background on quantifiers in Asante Twi, I moved on to discuss quantifier scope ambiguities. I provided data to show that inverse readings are generally difficult to obtain in Asante Twi, unless the higher quantifier can be reconstructed to a position below the lower quantifier. Nevertheless, even without reconstruction, inverse readings are not completely blocked in Asante Twi. I showed that in Asante Twi, inverse readings can be obtained from embedded structures, including syntactic islands. Even though overt movement is also grammatical from syntactic islands for some speakers of Asante Twi, the pattern of acceptability regarding overt extraction and scope inversion was not parallel. This data questions accounts to inverse readings that are based on covert movement. We could also see that – in line with multi-factorial accounts – availability of inverse readings varies with speaker, context, choice of quantifier, and semantic/grammatical role. Finally, the scope data presented in here could provide additional evidence for movement accounts of the *na*-focus construction and double-object SVCs. I ended this chapter by proposing a future experiment that allows to investigate inverse readings in a similar way to the experiments presented on English and German in chapter 3 and 4.

6   General Discussion

In this chapter, I will provide a cross-linguistic perspective on quantifier scope, comparing the three languages investigated in this thesis as well as other languages discussed in the literature. In section 6.1, I will start out with providing an overview of the results found in chapters 3-5 and compare the three languages under investigation to one another. The focus in this section is on the various factors investigated in this thesis that seem to be involved in the availability of inverse readings, involving lexical, structural, and pragmatic factors. The results will also be compared to other data offered in the literature both from the languages at hand as well as other languages. In section 6.2, I will discuss the results in light of the different theoretical frameworks. We will see that the data on inverse readings in the context of embedded clauses poses serious challenges to common theoretical assumptions. Particularly, I will show that the assumption of covert movement is problematic and that semantic approaches are more successful in accommodating the data. In section 6.3, I will discuss methodological aspects and limitations of the studies in this thesis. Section 6.4 concludes this chapter.

6.1   Impact of different factors on inverse scope interpretation

In this section, I will discuss the various factors that play a role in the studies in this thesis. I will compare the different languages to one another and provide a broader, cross-linguistic perspective to these topics. In particular, I will discuss the factor of plausibility in section 6.1.1, the impact of word order freedom in section 6.1.2, the extent to which clause-boundaries block or permit inverse readings in section 6.1.3, and the effect of individual speaker variability in 6.1.4.

6.1.1   Plausibility

The experiments on English in chapter 3 and on German in chapter 4 were designed to particularly control for the impact of plausibility considerations on the availability of inverse readings. The factor plausibility was either neutral, i.e. allowed for both the SR- and IR-scenario to a comparable degree. Or it was biased towards the inverse readings, rendering the surface reading highly implausible. The effect of plausibility was significant in all main experiments as well as the three German follow-up experiments. More than that, the effect of plausibility turned out to be quite strong, increasing the acceptability of inverse readings and at the same time decreasing the acceptability of surface readings by 20-35 percentage points. The German participants in experiment G1, for instance, accepted the inverse reading twice as often compared to the neutral condition. In both E1 and G1, the effect was strong enough to render the otherwise dispreferred inverse reading into the preferred reading in the unembedded condition. Also, in both English and German, the effect of plausibility was smaller in the double-embedded condition compared to the other two embedding conditions, indicating that pragmatic factors are suppressed when they are in competition with structural factors. Despite the overall similar pattern regarding the effect of plausibility, there were also notable differences between the two languages. While the effect of IR-bias was already reduced in the 1-emb condition in the German experiment, this was not the case for English. Here, the effect was only clearly reduced in the 2-emb

condition. This indicates that the structural effect of a single relative clause embedding is stronger in German compared to English, see also section 6.1.4. Further, while a non-ceiling effect of surface readings in the neutral condition was observed for both English and German, the acceptance of the surface reading was overall smaller in English compared to German. This is surprising, given that the preferred surface reading should have been supported by pragmatics in the neutral condition and, by default, always been available. I suggested that participants are usually not aware of any ambiguity and instead the parser commits to one reading at an early stage. Under that assumption, in a certain number of cases, the inverse reading will just happen to come to the participant's mind first and they end up rejecting the surface reading. This relates to general processing aspects and therefore applies to both English and German. However, because inverse readings are generally more available in English, this will happen to English speakers more often than to German speakers, which is why the non-ceiling effect of surface readings is stronger in English than in German. This assumption is supported by the fact that across experiments, we saw a complementary pattern of surface and inverse readings: The surface reading was not just available across the board, but instead decreased when the availability of the inverse reading increased and the other way round. This approach goes (at least partly) against assumptions that give general privilege to the surface reading. For example, under Reinhart's (1995, 1997, 2006) Interface Economy, which only predicts inverse readings if the surface reading is at odds with contextual information.

Further, based on the overall strong impact of plausibility, I argued that variable results between experiments on quantifier scope in the same language can partly be explained by the choice of stimuli and the plausibility of the different readings these stimuli give rise to. The overall large effect of plausibility is in line with what has been suggested by various authors before as well as what other studies have found (Gillen 1991, Kurtzman & MacDonald 1993, Saba & Corriveau 2001, Villalta 2003, Anderson 2004, Reinhart 2006, Srinivasan & Yates 2009, Attali et al. 2021). However, while the majority of previous experiments have targeted the effect of particular context manipulation, for example by providing a singular or plural antecedent (Anderson 2004), the current experiments make reference to general world knowledge. It is important to point out that, as a group, participants do not simply ignore structural or other features of the stimuli when being exposed to a strong pragmatic bias. The inverse reading was still rejected in one third of the cases across embedding conditions in E1 and in half of the cases in G1, even though the surface reading was highly implausible. At the same time, the surface reading was still accepted in almost half of the cases in E1 and two thirds of the cases in G1. However, the extent to which pragmatic and structural factors can override each other varies from speaker to speaker, as will be discussed in section 6.1.4. In the forced-choice experiments E2 and G2, we found that in both languages, being forced to choose between the two readings reduced the choices for inverse readings and not for surface readings when both readings were equally plausible, but it reduced the choices for surface readings and not for inverse readings when there was a bias for the inverse reading. Thus, forcing participants to choose between readings, as is often done (e.g. Gillen 1991, Tunstall 1998, Anderson 2004), will make the inverse reading appear much less available, as long as both readings are pragmatically plausible. Reversely, when the inverse reading is much more plausible, its availability appears exaggerated in forced-choice experiments. It is important to note that plausibility did not have the same effect on all participants (see also section 6.1.4). Some participants rejected inverse readings altogether even in the IR-biased condition, despite the high implausibility of the surface reading. Other participants accept it in some or even all of the cases. If these participants

indeed are able to obtain the inverse reading or if they simply ignore grammar for the sake of pragmatics cannot be concluded from the data available.

Turning to Asante Twi, we can draw less clear conclusions, due to the lack of quantitative data from a large-scale experiment. Nevertheless, the elicitation studies revealed that the particular choice of stimulus had a great impact as to whether speakers accepted inverse readings or not. That is, keeping structure and quantifiers consistent but varying the particular context greatly changed the results. With certain stimuli, inverse readings were rejected across the board, which could easily give the wrong impression that they are unavailable altogether. This is particularly noticeable in Asante Twi, which, similar to German, is rather resistant in allowing inverse readings. Thus, the results of English, German, and Asante Twi suggest that the effect of plausibility on inverse readings is cross-linguistically stable, which is what is typically expected in the realm of pragmatics. Nevertheless, the effect may be additionally inhibited or boosted by language-specific factors, which were partly discussed above and will be looked at closer in subsequent sections.

6.1.2   Word order freedom

In the background chapter 2, I discussed the cross-linguistic approach to quantifier scope provided by Bobaljik & Wurmbrand (2012). Their approach makes a general prediction that inverse readings should be more accessible in languages with strict word order than in languages with free word order, due to their soft Scope Transparency constraint which demands the order of quantifiers at PF to align with the order at LF. Because in free-word-order languages, the desired order of quantifiers can be achieved through overt movement, inverse readings should be completely absent in those languages unless another constraint would be violated by overt reordering. Such a correlation seems intuitively plausible and has been considered by other authors, too (e.g. Szabolcsi 1997/2012). Particularly because inverse readings are associated with higher processing costs across the board (Anderson 2004, Varkanitsa et al. 2016), speakers should avoid them and resign to overt reordering, whenever possible. Sæbø (1997) and Miyagawa (2012) go down a similar path by treating Quantifier Raising as a covert form of scrambling, rather than a covert form of movement in general. From that perspective, too, languages that exhibit scrambling such as German or Russian should not allow inverse readings. This is similar to Bobaljik & Wurmbrand (2012), who also do not consider all types of overt reordering as being subject to ScoT. Passivation in English, for example, is explicitly excluded. The problems with this distinction was discussed in previous chapters.

The studies in this thesis provide evidence against a strict form of the free-word-order/scope-rigidity correlation. Albeit the experiments in chapters 3 and 4 showed that inverse readings are much more readily available in English than in German, they were not banned in German either. This was the case even though the German stimuli were specifically designed in a way to not give rise to potential additional constraints that might block ScoT[205]. The direct comparison between English and German is shown in Figure 6.1.

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[205] Obviously, since the set of possible constraints is left open in Bobaljik & Wurmbrand (2012), it could always be that there is yet another constraint at play in the items used in here. However, because the constraints specifically mentioned by Bobaljik & Wurmbrand, such as information structure and/or prosody were controlled
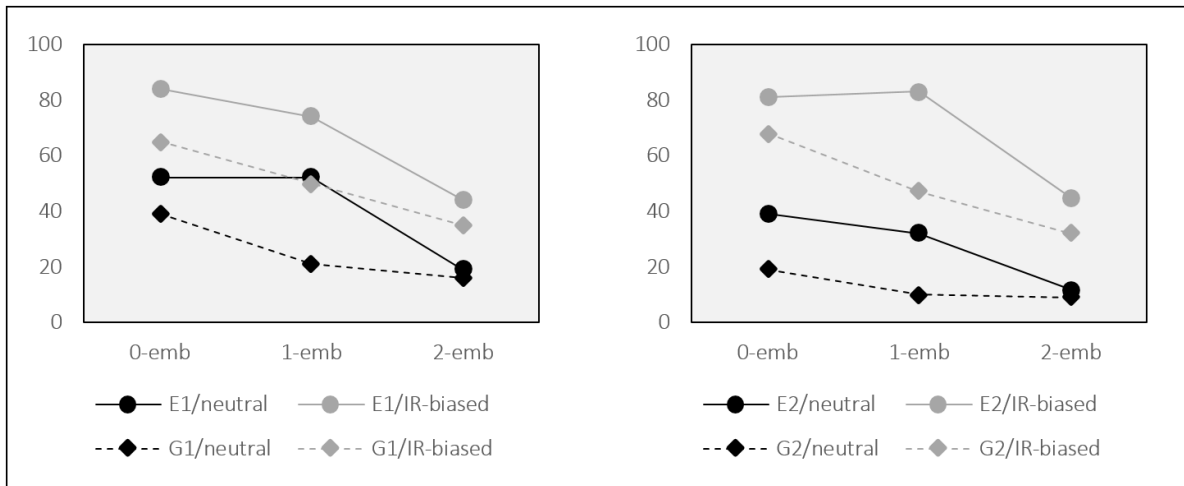
Figure 6.1: Comparison of English experiments (continuous lines) to German experiments (dashed lines) in proportion of IR-responses. E1/G1 are on the left, E2/G2 are on the right.

Asante Twi, on the other hand, shows the exact opposite pattern. As a language that lacks scrambling we would expect inverse readings to be readily available, at least comparable to English. In fact, since Asante Twi does not even have passive voice to potentially reverse the order of quantifiers, it is even more restricted than English. The only way to change word order is by fronting, either through topicalization or through focalization using a cleft-structure. Both options are obviously clearly marked for information structure. Nevertheless, the elicitation data presented in 5.6 suggests that inverse readings are generally difficult to obtain for speakers of Asante Twi, unless reconstruction can be assumed. The languages investigated in here are not the only exceptions. Russian, like German, has free word order and has in fact been claimed to block inverse readings in earlier work (Ionin 2003). Later work, however, showed that similar to German, inverse readings are dispreferred but available (Antonyuk 2015, 2019, Ionin & Luchkina 2018), even though an overt scrambling option could be employed. Greek has been shown to readily permit inverse readings, potentially to an even higher degree than English (Varkanitsa et al. 2016, Oikonomou et al. 2020), despite being a free word order language. Even though Oikonomou et al. (2020) find a correlation between inverse scope availability and information structure associated with different word orders, this variation is only gradual. Japanese, too, had been claimed to only permit surface readings in canonical SOV sentences (Kuroda 1970), but studies by Kitagawa (1990), Hayashishita (2013), and Ueyama & Hayashishita (2020) show that albeit dispreferred, inverse readings can be obtained. Mahajan (2018) points out that despite the general scope rigidity of Hindi, which also is a free constituent language, some speakers do obtain inverse readings in canonical SOV sentences. On the other hand, there are languages more like Asante Twi at the other end of the spectrum, which do not readily allow for inverse readings despite their strict word order. Mandarin Chinese, for example, strictly resists inverse readings despite lacking scrambling[206] (Huang 1982, Lee 1986, Aoun & Li 1989, 2003, Tsai et al. 2014/Scontras et al. 2017).

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for, and an overt reordering would have been grammatical and available without changing the meaning of the sentence, as demonstrated in section 4.3.2, I will leave this possibility aside for now.

[206] Zhou & Gao (2009) provide apparent evidence from an experiment that inverse readings do in fact exists in Mandarin Chinese. However, as pointed out in Tsai et al. (2014)/Scontras et al. (2017), they only used sentences with ∀>∃ order, which cannot actually discern between scope readings, see the entailment problem discussed in section 2.2.2.

While Bobaljik & Wurmbrand (2012) and similar accounts cannot clearly be falsified based on the data presented above and the data of German, English, and Asante Twi presented in this thesis, this data still suggests that the picture is more complex and that binary present/absent predictions of inverse readings for particular structures in the sense of local scope rigidity are too strong. While a general correlation of word order freedom and availability of inverse readings may still hold and seems plausible, the differences will usually only show up as gradual differences. And some languages will not fall into that pattern at all. While there may be yet unknown constraints at play that could align those languages with Bobaljik & Wurmbrand's account, this is mere speculation at the current point.

6.1.3   Embedding

Quantifier scope has commonly been described as being clause-bound and particularly as obeying syntactic islands in not allowing an embedded quantifier to take inverse scope over a quantifier in the matrix clause (May 1977, 1985, Chomsky 1975, Farkas 1981, Fodor & Sag 1982, Abusch 1994, Beghelli 1993, Szabolcsi 1997/2012, Fox 1995, a.o.). For this reason, quantifier scope is commonly described as involving covert movement – Quantifier Raising (May 1977) – thereby being subject to the same constraints that also block overt movement. Relative clauses have been known as syntactic islands for a long time (Chomsky 1977) – as particularly strong islands, in fact – and are therefore considered to block inverse readings. As discussed in section 2.2.3, it has been noted multiple times that it is possible to construct example sentences, where inverse readings do actually seem to be available across relative clause boundaries and that such examples can even be found in natural language corpora (e.g. Sharvit 1999, Szabolcsi 2010, Barker 2012, 2021). Similar observations have been made for other instances of syntactic islands or embedded clauses (e.g. Farkas & Giannakidou 1996, Szabolcsi 2010, Tanaka 2015, Barker 2021). Nevertheless, the general idea pertains that clause boundaries block inverse readings and various proposals have been put forward in order to accommodate apparent counterexamples to still align with this generalization. In the case of relative clauses, for example, it has been proposed that the special relation of the relative clause head to its coindexed gap inside the relative clause is responsible. I will discuss several accounts along those lines in section 6.2.

In chapters 3-5, I presented data from various experiments on English and German as well as fieldwork data from Asante Twi that suggest that inverse readings are available across relative clause island boundaries. The examples involved an existentially quantified relative clause head and a distributive universal quantifier inside the relative clause. These results were unexpected under most approaches to quantifier scope. In the case of German, the acceptance rate of inverse readings was around 20% across experiments when the context was unbiased. While the acceptance rate was clearly lower compared to unembedded sentences (23-39%), it was still higher compared to unambiguous control sentences (~10%). In English, even more surprisingly, the acceptance rate was not even reduced in the embedded condition compared to the unembedded condition (52%), even in the unbiased context.

While in German, no previous experiments have investigated inverse scope in relative clauses, the results from English are supported by the experiment of Tsai et al. (2014)/Scontras et al. (2017). They also found that inverse readings are accepted in relative clauses, even though in their results, acceptance

was still reduced compared to unembedded clauses. The difference may be due to task, as they employed a 7-point-scale, where participants had to indicate how much they liked a certain interpretation. In the experiments in this thesis, participants were not asked how much they liked a certain interpretation, but only, if this interpretation is available at all. Besides that, a number of researchers have provided introspective judgments or naturally occurring examples of relative clauses, which clearly allow for inverse readings (e.g. VanLehn 1978, May 1977, Pafel 2005, Hulsey & Sauerland 2006, Szabolcsi 2010), see (6.1)-(6.6) below. See also Barker (2021) for an extensive list of examples found in literature and corpora. It has been noted, however, that such examples usually involve a definite head noun[207] (6.1-6.2), in contrast to the sentences used for this thesis, which involve an indefinite head noun. Examples with an indefinite head are generally rare to find, but they do exist as well, see examples (6.3)-(6.6) below[208]. The results from the studies in here therefore provide evidence that independent of the determiner, inverse readings are available with relative clauses.

(6.1)   Yet at the time that we devised each plan, we were confident it would succeed.

(Barker 2021, p. 5)

(6.2)   The papers are all laid out by alphabetical order, so you can see the grade that every person got.

(Barker 2021, p. 5)

(6.3)   A timeline poster should list the different ages/periods (Triassic, Jurassic, etc.) and some of the dinosaurs or other animals/bacteria that lived in each.

(Szabolcsi 2010, p. 107)

(6.4)   A book which every prisoner left surprised the warden.

(May 1977, p. 223)

(6.5)   At the conference yesterday, I managed to talk to a guy representing each raw rubber producer from Brazil.

(VanLehn 1978, p. 31)

(6.6)   There is a role that each person is uniquely designed by God to fulfill.

(Barker 2021, p. 5)

I will now move away from relative clauses in particular and turn to embedded clauses in general. In the English follow-up experiment as well as in the elicitation studies on Asante Twi, I tested a number

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[207] Note also that such examples have often received a special treatment as constituting so-called functional relative clauses (Lakoff 1970, Rodmann 1976, Cooper 1978, Jacobson 1994, Sharvit 1999), which will also be discussed in section 6.2.2. Note also that there is a debate as to whether definite expressions should be treated as quantificational (Montague 1973, Barwise & Cooper 1981, Isac 2006, a.o.) or not (Strawson 1950, Hornstein 1984, Krifka 1992, Glanzberg 2007, a.o.). Only if we do, does it even make sense to think of those examples as potential instances of quantifier scope ambiguities.

[208] Note also that many of the examples with a definite determiner would also work with an indefinite determiner, e.g. (i) for (6.1) and (ii) for (6.14) further below. Further, Gibson & Fedorenko (2013) note that "[…] it is a mistake to equate the rarity of a particular construction in a corpus with the syntactic and/or semantic ill-formedness of that construction […]" (Gibson & Fedorenko 2013, p. 90)

(i)   Yet at a time that we devised each plan, we were confident it would succeed.
(ii)   A picture of himself that everybody sent in annoyed the teacher.

of other types of embedding. In English, this concerned finite and non-finite complement clauses, complex noun phrases, and both subject and object relative clauses. In Asante Twi, this concerned complement clauses, temporal adjunct islands as well as wh-islands. In English, no type of embedding lead to a complete rejection of inverse readings. The lowest acceptance rate was observed for complement clauses (23-25%), followed by complex noun phrases (30%), and subject (37%) and object relative clauses (47%). In Asante Twi, speakers accepted inverse readings to a certain degree in both subject and object relative clauses as well as temporal adjuncts when the matrix quantifier was in object position. The speakers rejected inverse readings in temporal adjuncts when the matrix quantifier was in subject position, as well as in wh-islands across the board. However, because only four speakers were consulted, it is not possible to conclude from the latter that these constructions ban inverse readings altogether. Only a large-scale experiment could reliably distinguish between marginal availability and complete absence.

Inverse readings in embedded clauses other than relative clauses have been observed in the literature before. Particularly, in the case of English, Tanaka (2015) ran several experiments, in which she found that inverse readings are marginally available with various types of adjuncts. Barker (2021) lists a whole number of naturally occurring examples, which apparently allow for an inverse interpretation, see (6.7) to (6.9) below. Note, however, that in all examples that Barker cites, except (6.7), the linear order is $\forall > \exists$ (even though the c-command relationship $\forall > \exists$ of course still does not hold). Further, in all other examples, the universal quantifier is also co-indexed with a pronoun in the matrix clause, as in (6.8) and (6.9). Finally, all these examples involve the strong quantifier *each*. These listed factors all seem to facilitate an $\forall > \exists$ reading.

(6.7)   Henceforth you will see a draw method call after each object is created.

(Barker 2021, p. 7)

(6.8)   After each person had eaten, they had a spot of kunkumam (colored powder) placed on their foreheads.

(Barker 2021, p. 7)

(6.9)   When each person had finished his turn at shovelling, he placed the spade back into what remained of the mound.

(Barker 2021, p. 7)

Finite complement clauses have also been argued to marginally allow for inverse readings many times across the literature (Fox & Sauerland 1996, Farkas & Giannakidou 1996, Reinhart 1997, Fox 2000, Szabolcsi 2010). A list of examples is given in (6.10)-(6.12)

(6.10)   A doctor will make sure that we give every new patient a tranquilizer.

(Reinhart 1997, p. 350)

(6.11)   Yesterday, a guide made sure that every tour to the Louvre was fun.

(Farkas & Giannakidou 1996, p. 37)

(6.12) Kapjos kathijitis rithmise etsi ta pragmata oste
some *professor* *arranged* *so* *the* *things* *that*
kathe taksi na ine proetimasmeni ja tis eksetasis.
every *class* *subj* *be* *prepared* *for* *the* *exam*
'Some professor arranged things so that every class be prepared for the exam.'

(Farkas & Giannakidou 1996, p. 38, Greek)

Despite the growing body of counterexamples to the assumption that inverse readings are clause-bounded or trapped in islands, many researchers who have pointed out such counterexamples tried to account for them in a way that maintains the general assumption of clause-boundedness, taking them as exceptions to the rule. Fox & Sauerland (1996) argue that inverse readings out of complement clauses are an illusion, with the argument that a genericity operator causes the distributivity effect. Fox (1995) suggests that QR may not in fact be clause-bounded (but still obeys islands), and that the apparent clause-boundedness effect only arises due to scope economy (see section 2.3.1). Inverse readings out of complement clauses would only be possible when each QR-step is motivated by an effect on interpretation[209]. Tanaka (2015) argues, based on her comparative experiments of overt extraction and quantifier scope out of adjunct islands, that islands are gradient and that the marginal acceptability of inverse readings runs in parallel to marginal acceptability of overt extraction out of the same environment. In that, she maintains the assumption of Quantifier Raising being the underlying operation causing inverse readings and behaving exactly like overt movement. Tsai et al. (2014), who found inverse readings out of relative clauses to be marginally acceptable, adopt the head-raising analysis of relative clauses and argue that the inverse reading is derived by reconstruction of the relative clause head into its original position inside the relative clause with subsequent relative clause internal QR in the case of a subject relative clause, which again allows them to maintain the general framework of QR. That this line of arguing cannot work will be discussed in depth in section 6.2.1.

Sauerland (2005) and Hulsey & Sauerland (2006), who acknowledge that inverse readings out of relative clauses are available, maintain a QR-approach to quantifier scope, but simply assume that relative clauses are not scope islands. They avoid talking about the tension that this creates, as relative clauses are still considered islands for overt extraction. Consequently, this would mean that overt and covert movement simply do not pattern alike, thereby raising the question of whether we should think of inverse scope as involving any type of covert movement at all. In a similar way, Wurmbrand (2018) maintains a QR-account and abandons the idea of clause-boundedness, based on data from complement clauses and adjuncts. She argues that acceptability of inverse readings is merely reduced due to the increased processing costs related to an increasing number of movement steps. Crucially, she only predicts marginal availability of inverse scope across complement clauses and weak islands, not across "absolute islands", such that QR still patterns parallel to overt movement (see section 2.3.1 for details). In section 6.2, I will discuss the extent to which such accounts can cover a wider range of data including the results of this thesis.

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[209] Note, however, that the experiments presented in Anderson (2004) and the replication in E1 and E2 in do not confirm predictions made by Scope Economy.

6.1.4 By-participant variability

Figures 6.2-6.5 are taken from chapter 3 and 4 and show the by-participant response pattern for English and German in direct comparison. The data from E1 and G1 is given in 6.2 for the neutral and in 6.3 for the biased condition. The data from E2 and G2 is given in 6.4 for the neutral and in 6.5 for the biased condition. While pronounced variability between participants could be found across all experiments, the variability was larger in E1/G1, which tested for availability, compared to E2/G2, which tested for preference. This indicates that participants are more similar to each other in their preference for surface scope than in their acceptance of inverse readings in general.
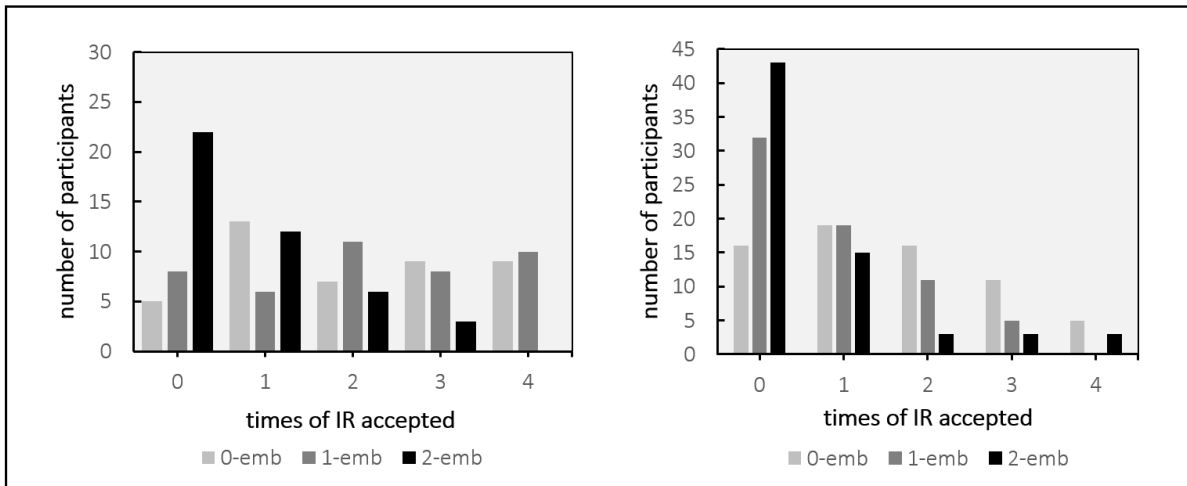
Figure 6.2: Direct comparison of by-participant results of experiment E1 (left) and G1 (right) in the neutral condition only.
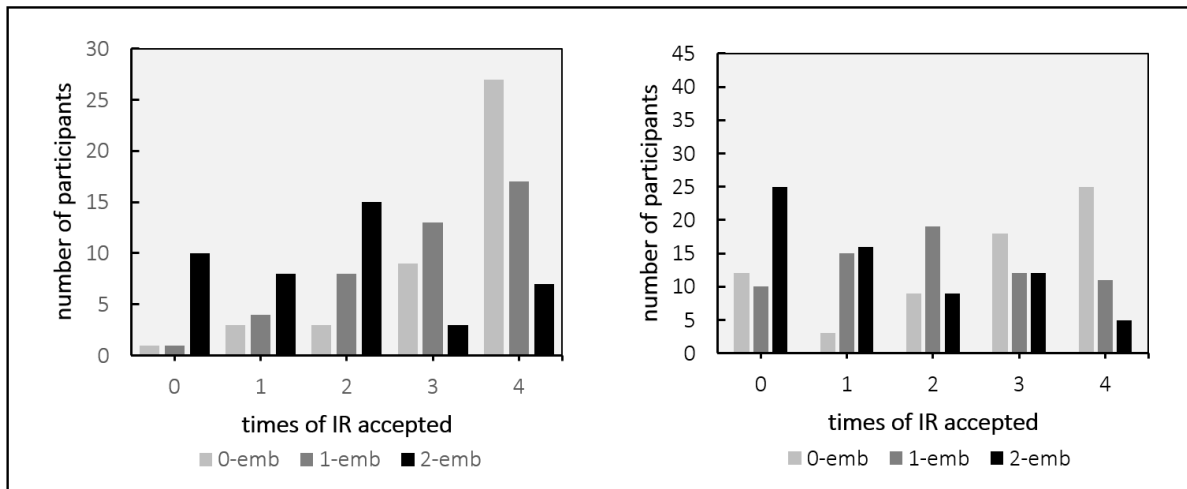
Figure 6.3: Direct comparison of by-participant results of experiment E1 (left) and G1 (right) in the biased condition only.
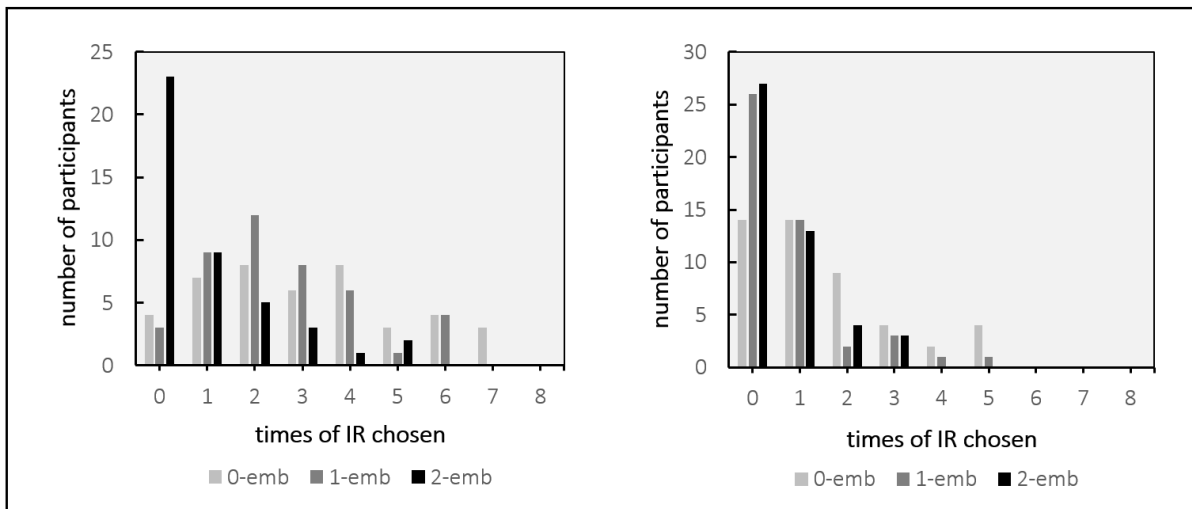
Figure 6.4: Direct comparison of by-participant results of experiment E2 (left) and G2 (right) in the neutral condition only.
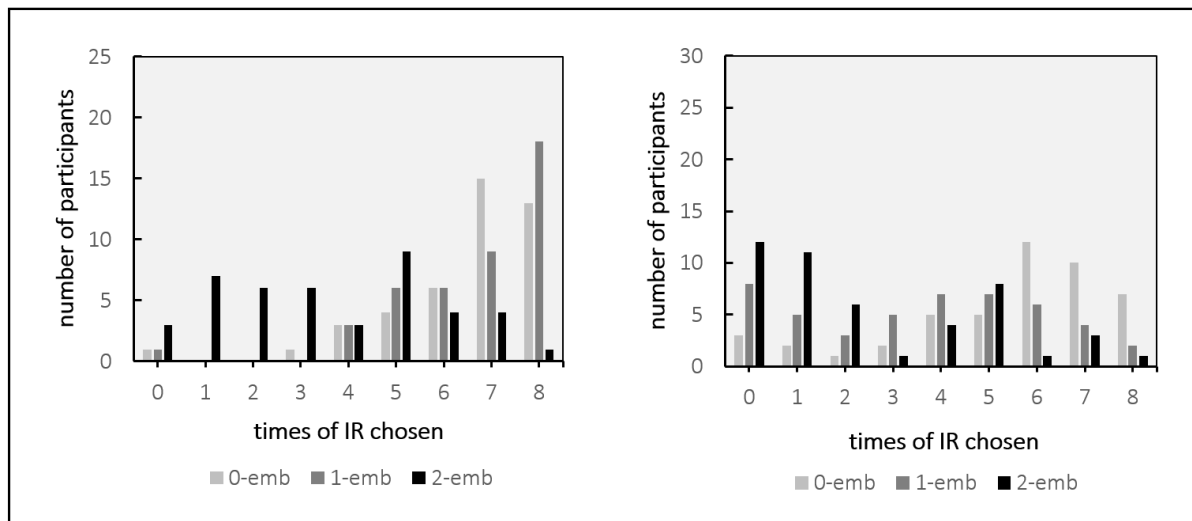
Figure 6.5: Direct comparison of by-participant results of experiment E2 (left) and G2 (right) in the biased condition only.

We can also detect language-specific differences in Figure 6.2-6.5. First, English exhibits larger variability in the neutral condition compared to German, both in E1/G1 and E2/G2, but German exhibits larger variability in the biased condition compared to English, both in E1/G1 and E2/G2. Thus, German speakers show more agreement in their dispreference for inverse scope when the context allows for both readings to an equal extent. Once the pragmatic bias in favour of the dispreferred reading is introduced, participants react in different ways, thereby giving rise to highly variable behaviour. Some speakers resist any pragmatic information and continue to reject inverse readings altogether. Other speakers are greatly influenced by the pragmatic information and are pulled towards the other end of the scale. In English, on the other hand, participants show much less agreement in their acceptance of inverse readings in an unbiased context, but they show much greater agreement in favour of the inverse reading, once the additional pragmatic bias is introduced. There is one further notable difference between English and German. In the averaged results, we could see that there is no significant difference between

no embedding and a single embedding in English. Only the double-embedding reduced the acceptance of inverse readings. In German, already the first embedding reduced acceptance of inverse readings significantly, which was then reinforced with the second embedding. Interestingly enough, we see the same pattern in the between-speaker data. In English, the variability distributions of 0-emb and 1-emb pattern together, and 2-emb shows a distinct pattern. In German, on the other hand, the variability distribution of 1-emb and 2-emb pattern together, and 0-emb shows a distinct pattern. This may indicate that there is a fundamental difference between English and German relative clauses. I will turn to this point again in section 6.2. In both English and German, we can observe a bimodal distribution in certain conditions. In these instances, participants seem to not only differ gradually, but categorically. Participants fall into two distinguishable groups, which may be an indication that they follow different strategies. We find bimodal distributions most pronounced in the case of the biased condition in combination with some level of embedding. Speakers of the same language seem to have different preferences as to whether they give more weight to structural or pragmatic factors. Note that in the biased condition, we cannot clearly distinguish if participants actually obtain the inverse reading or if they simply go by plausibility and ignore grammatical constraints. We may only be able to assume an actual boost of inverse interpretations for those participants who already accept the inverse reading to a certain degree in the parallel neutral condition. The neutral condition does not suffer from this issue, since there are no pragmatic factors that prevent participants from rejecting the inverse and accepting the surface reading. Figure 6.5 shows that the bimodal distribution is pronounced for the 2-emb condition in both English and German, but it is much less pronounced in English compared to German in the case of the 1-emb condition. Thus, this serves as an additional indicator that there is a fundamental difference between English and German relative clauses. Only in the German case do we see a bimodal distribution indicating a conflict between pragmatic and structural factors.

As for the Asante Twi data, again, due to the qualitative exploratory approach, no quantitative statement can be made about by-participant variability. Nevertheless, the variation between the four consultants with respect to their acceptance of inverse readings was still noticeable. Some speakers rejected inverse readings even when a pragmatically implausible scenario arose from the surface reading, while sometimes, a speaker preferred the inverse over the surface reading even when the surface reading was a plausible alternative. At the same time, speakers cannot simply be defined as IR-accepters or -rejecters. This is because their willingness to accept inverse readings was not the same across different constructions. That is, the same speaker may have been resistant to inverse interpretations in one type of construction but much more accepting in another type of construction. Overall, despite the small number of consultants interviewed, differences between them similar to the case of the English and German speakers could already be observed there. A larger-scale experiment as sketched out in section 5.7.2 should explore this with a higher number of participants in the future.

The between-speaker data reported in this thesis is in line with results from other studies on quantifier scope. Unfortunately, many studies on quantifier scope do not report any by-participant data in the first place. However, those that do unequivocally report strong variability between participants in the degree to which they accept inverse readings, thereby patterning with the results found in the current study. No between-speaker data is available for comparison from any of the previous German experiments, but several experiments targeting English quantifier scope have reported such data (Gil 1982, Anderson 2004, Brasoveanu & Dotlačil 2015). Brasoveanu & Dotlačil (2015) mapped their participants to three groups, depending on whether they showed a preference for surface or inverse scope or whether they

showed no clear preference at all. The majority of participants were in the last group. The variability found in one of Anderson's (2004) experiments, who employed a forced-choice paradigm, is less pronounced, with all participants showing either a preference for surface scope or no preference at all. The results are thus similar to the comparable experiment E2 in here. There, too, the majority of participants showed a surface scope preference or no preference. In contrast to Anderson, however, experiment E2 did also have a small group of participants with an inverse scope bias, who chose the inverse over the surface reading in six or seven out of eight times. Seven of the forty-three participants in E2 belong to this group.

Moving away from experiments specifically targeting English or German, variability between participants was also reported for experiments in other languages. A large amount of inter-speaker variability was observed in recent experiments on quantifier scope in Greek (Varkanitsa et al. 2016, Oikonomou et al. 2020). Oikonomou et al. take this variability as indicative "[…] that the accessibility of inverse scope readings depends on a number of competing factors including processing and contextual factors" (Oikonomou et al. 2020, p. 3). Similar to Brasoveanu & Dotlačil (2015), Varkanitsa et al. (2016)[210] identify three different groups. One group with a preference for inverse readings, one group with a preference for surface readings, and one group without clear preference. They also identify two participants who only ever accepted the surface or inverse readings respectively. Again, same as in Brasoveanu & Dotlačil (2015), the group without clear preference was the largest group with 50% of the participants. Following Clark & Kar (2011), they suggest that "[…] individuals exhibit biases towards specific interpretations of ambiguous doubly quantified sentences based on subsequent logical or pragmatic reasoning" (Varkanitsa et al. 2016, p. 20). Achimova et al. (2013) identify varying groups of speakers in the interpretation of wh-questions containing a quantifier. According to the authors, this matches introspective judgments from the literature on the same topic, which also vary to a great degree.

In conclusion, the between-participant data shows that in contrast to certain other phenomena of grammar, scope inversion cannot easily be said to either be present or absent in a given language's grammar. Instead, if inverse interpretations can be found for a certain language and syntactic construction at all, we immediately find a great amount of variability between participants. The reason may be that unless a reading is clearly excluded for grammatical reasons, inverse interpretations are influenced by a large number of factors, as discussed in section 2.2.6. Speakers of the same language may then vary in terms of how much weight they assign to different factors and what previous experience in terms of plausibility considerations they bring along. Additional factors like dialectal background or foreign language influence may play a role. Exposure to a language that is more permissive with regards to inverse readings may have an influence on an individual's general availability of obtaining inverse interpretations. A similar argument was made in Christensen & Nyvad (2019). Additionally, the individual's cognitive capabilities and processing resources may play a role. For example, several experiments have shown differences between participants who have impaired versus unimpaired cognitive abilities, as in the case of aphasia (Saddy 1995, Clark & Kar 2011, Varkanitsa et al. 2016). Differences have also been observed between elder and younger participants (Clark & Kar 2011). Both participants with aphasia as well as elder participants have been reported to

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[210] Varkanitsa et al. (2016) compare quantifier scope resolution between groups of participants with and without aphasia. While their results on this topic are very exciting, this thesis is concerned with quantifier scope in cognitively unimpaired individuals. Therefore, I only report the results of the group without aphasia in the current section. For details, the interested reader is referred to the original article.

show less bias in scope interpretation, thereby allowing for both interpretations to the same degree, i.e. being more permissive towards inverse readings than unimpaired participants. The authors of these studies argue that this effect arises because juggling various factors (lexical, structural, pragmatic, …) which bias towards one reading or the other require unimpaired cognitive abilities[211]. Further, inverse readings are generally known to give rise to higher processing costs. Therefore, differences between speakers may also be related to their general as well as situation-related processing capabilities. Considering the differences discussed for older or language-impaired speakers, it is plausible that there could also be differences between younger and unimpaired language users in their ability to juggle numerous different factors to arrive at one reading or the other. Some speakers may therefore retract to only a few principles while disregarding others. This is purely speculative and could be an interesting line of research to pursue in the future.

I will generally take variable behaviour between participants to indicate that the reading in question is not generally blocked by a hard grammatical constraint, but that it is permitted by the general rules of this language and that gradual differences in interpretation both within and between languages are related to the numerous factors that are involved in quantifier scope ambiguity resolution, discussed both in the current section and section 2.2. In that, I follow the argumentation of Kush et al. (2019) and Bondevik et al. (2021) that variability between speakers of the same language, particularly in combination with a bimodal pattern, should not be treated as mere noise, but as reflecting that a certain phenomenon is not grammatically excluded in that language[212].

In the case of acceptability/grammaticality studies, variable behaviour has sometimes been taken as indicative of different micro-grammars between individuals (e.g. den Dikken et al. 2007). It is unclear, however, if this can be translated to the case of ambiguities and variability in interpretation. Some speakers may consistently reject inverse readings in a particular experiment, even though their individual grammar does not exclude inverse readings per se. These readings may just not be accessible to them in that particular situation or with those particular items. Thus, while it is possible that individuals have underlying different micro-grammars, which allow or ban scope inversion, it is much more difficult to conclude this from an individual's performance in a specific experiment. Particularly, the absence of inverse interpretation in an individual cannot easily be taken as evidence that this speaker never uses or obtains inverse interpretations outside of the experimental setting.

If speakers of the same language vary so much in their interpretations, how do they not frequently have misunderstandings in everyday life? There are several aspects to this. First, many situations do not even require a clear disambiguation towards one reading or the other. Whether a surface or inverse reading is obtained may not be crucial information or even be completely irrelevant. In fact, it has been argued

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[211] Note that this finding may constitute evidence against a theory that derives the general dispreference associated with inverse interpretations to the fundamental way of how inverse readings are derived, as it was argued for in the case of QR (e.g. Anderson 2004, Wurmbrand 2018). The above studies suggest that impaired participants are able to correctly derive inverse and surface readings, but show no preference for either of them, even though both healthy and impaired participants show processing costs in the case of inverse interpretations in the study of Varkanitsa et al. Thus, the SR preference cannot be situated in the derivation of inverse readings itself. This preference may therefore just be one of many factors involved in scope bias (see also section 2.2.6), which impaired participants fail to consider.

[212] Their experiments deal with overt extraction across island boundaries rather than quantifier scope, but similar inconsistent behaviour between participants was detected. See also section 6.2.1.

that unless the situation actually requires it, such ambiguities are not even resolved and participants maintain an underspecified interpretation (e.g. Dwivedi et al. 2010). While some studies on processing of quantifier scope have reported that scope interpretations are computed on-line and not in retrospection (e.g. Filik et al. 2004, Bott & Schlotterbeck 2015), most of these studies involve an additional off-line task, where participants have to answer questions that target these different interpretations in a more or less direct way. Since participants are aware that they have to answer questions with respect to the content of the sentences, they are certainly in a situation, where the situation requires disambiguation from them. Secondly, when participants are in a natural conversation in which the respective interpretation *does* in fact matter, they usually have much more information that allows them to disambiguate towards the intended reading. In experimental settings, sentences are purposefully designed to be ambiguous, in order to find out how participants respond depending on particular manipulations of the stimuli. In a natural conversation, speakers will usually avoid to be vague if the particular interpretation matters in that situation (Grice 1975), and formulate the utterance in a way that they employ more factors which push for the intended meaning. Further, in an experimental setting, participants have very limited information, as they are usually exposed to varying stimuli presented in isolation or with only a short context. In a natural conversation, on the other hand, speaker and addressee tend to have a much larger common ground, both from the current situation as well as from previous shared experience and knowledge. The addressee has much more information about the context with respect to which the doubly-quantified sentence is uttered, and also about the speaker, thereby being able to integrate the utterance into what he would normally expect to hear from that speaker. Thus, while experiments on quantifier scope allow us to understand isolated aspects that impact interpretation, such settings are not representative for communication in normal life. The variability found here, despite being a robust finding, is therefore unlikely to translate to natural communication.

6.2 Implications for theory of quantifier scope

In this section, I will discuss the implications that the findings of the studies in this thesis have for various accounts of quantifier scope. Particularly, the findings regarding embedding environments pose major problems. Quantifier scope ambiguities have received a lot of attention and many proposals have been made over time. It is therefore impossible to cover every single one of them in this section. For that reason, I will restrict myself to only some of the most common accounts, which were also presented in the background chapter. Particular attention will be given to the assumption that scope ambiguities arise through a covert movement operation like Quantifier Raising, which can be considered the most prominent approach to scope ambiguities. This will be discussed in section 6.2.1. In section 6.2.2, I will touch on some accounts that do without covert movement. This section is not intended to make a decision in favour or against certain accounts or to propose yet another account. Instead, it will assess how well existing accounts may accommodate the findings of this thesis.

6.2.1 Evidence for and against covert movement

In this section, I will discuss what the results of the studies on English, German, and Asante Twi in this thesis suggest with respect to the idea of a covert movement operation like QR. As was discussed before,

inverse readings across island boundaries should be blocked if we assume movement. The results may therefore question a movement-based approach. In the first part of this section, I will take a closer look at the ways relative clauses have been analysed structurally and explore if any of them allow us to explain how an inverse interpretation may arise without the embedded quantifier actually crossing the island boundary. In the second part of this section I will take a broader look at similarities and differences between overt movement and scope inversion in embedding environments and discuss if there are enough similarities to justify the stipulation of covert movement.

(i)   *Can reconstruction account for inverse readings out of relative clauses?*

We have seen in chapter 3, 4, and 5 that inverse readings are at least marginally available out of relative clauses in all three languages under investigation, English, German, and Asante Twi. As discussed in those chapters, this is unexpected under a QR approach, since QR is assumed to be subject to general A'-movement constraints, thereby obeying island boundaries. However, as was also discussed before, relative clauses are different from other islands in that there is a filler-gap dependency between the relative clause head and the corresponding position inside the relative clause. It may therefore be possible to explain the occurrence of inverse readings via reconstruction of the head into the relative clause, thereby avoiding movement across the clause boundary. In fact, this has been proposed by multiple authors (e.g. Hulsey & Sauerland 2006, Tsai et al. 2014). In the following, I will take a closer look at the most common analyses of relative clauses and show that none of them can satisfyingly capture the pattern of inverse readings observed in chapters 3-5 under reconstruction alone.

There are three main structures that syntacticians offer for relative clauses: the head external analysis (EA), the matching analysis (MA), and the raising analysis (RA). These three analyses are exemplified in (6.13). Under the EA (6.13a), the RC-head is base generated in its surface position, i.e. external to the relative clause. The relative clause itself is an adjunct to the relative clause head noun. The RC operator originates as a complement to the RC-internal verb and moves to its surface position in the embedded CP. This analysis was suggested by Quine (1960) and can be found in Montague (1973), Chomsky (1977), Jackendoff (1977), a.o. Under the MA (6.13b), the RC-head is also base generated in its surface position, but there is a matching noun inside of the relative clause, which is deleted under identity. The RC operator and the matching noun are generated as complement to the RC-internal verb and move to CP. This analysis was argued for in Lees (1960), Chomsky (1965), Munn (1994), Sauerland (1998, 2000), Hulsey & Sauerland (2006), Salzmann (2006, 2019), a.o. Under the RA (6.13c), RC operator and head are generated inside the relative clause as complement to the verb. They move to the embedded CP, where the operator is left behind while the noun moves further to its surface position. This analysis was adopted by Schachter (1973), Vergnaud (1974), Kayne (1994), Sauerland (1998), Bianchi (1999), Bhatt (2002), Hulsey & Sauerland (2006), a.o.[213] RA and MA have been particularly prominent in the more recent time compared to the EA. A number of researchers argue that relative

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[213] Note that there are slight deviations in the respective implementations of those analyses. For example, the head noun in the RA is sometimes also taken to move to a position above CP (see e.g. Bhatt 2002, also visible in the analysis assumed by Tsai et al. 2014 presented in section 3.2.4). Considering that our goal in this section is to see if any analysis can avoid covert movement across an island boundary, it makes no sense to assume an analysis which in and of itself requires a movement operation across an island boundary. It is obviously not desirable to stipulate an overt movement operation that violates island constraints in order to avoid covert movement from violating island constraints. I therefore only discuss the RA analysis in 6.13c. Beyond that, minor differences in the various relative clause analyses are not relevant for the discussion at hand.

clauses (at least in English) are ambiguous between RA and MA, e.g. Carlson (1977a), Sauerland (1998, 2000), Bhatt (2002), Aoun & Li (2003), or Hulsey & Sauerland (2006).

(6.13) a. EA: [$_{DP}$ a [$_{NP}$ **book** [$_{CP}$ **which**$_i$ [$_{TP}$ every student [$_{VP}$ read _$_i$]]]]]
        b. MA: [$_{DP}$ a [$_{NP}$ **book** [$_{CP}$ **[which ~~book~~]**$_i$ [$_{TP}$ every student [$_{VP}$ read _$_i$]]]]]
        c. RA: [$_{DP}$ a [$_{CP}$ **book**$_j$ **[which** _$_j$ **]**$_i$ [$_{TP}$ every student [$_{VP}$ read _$_i$]]]]

I will not discuss the various arguments that have been put in favour or against each analysis, as it goes beyond the scope of this thesis. The reader is referred to the extensive discussion in the literature. The question we want to answer is whether any of those analyses could in principle capture the inverse reading observed in previous chapters. Previous observations of inverse readings across relative clause boundaries have often been taken as evidence in favour of an RA analysis, with the argument that only if we assume movement of the RC-head, reconstruction can take place and we can avoid QR across the clause boundary. This analysis was also adopted by Tsai et al. (2014) to explain the surprising acceptance of inverse readings in relative clauses that they had observed in their experiment. However, the RA cannot in fact capture the kind of inverse readings that we observed in chapters 3-5 without also assuming QR. The RA can satisfyingly explain other phenomena via reconstruction, such as the apparent Condition A violations in famous examples of binding into the head, like (6.14). Here, we can do without assuming QR of the embedded quantifier, as the pronoun can reconstruct to its original position below the quantifier (see e.g. Bianchi 1999, Bhatt 2002, Aoun & Li 2003). Salzmann (2019) offers a way to solve this binding problem also with the MA.

(6.14) a. The picture of himself that everybody sent in annoyed the teacher.
                                                            (Hulsey & Sauerland 2006, p. 121)
        b. RA: [$_{DP}$ The [$_{NP}$ **[picture of himself**$_k$**]**$_j$ [$_{CP}$ **[which** _$_j$ **]**$_i$ [$_{TP}$ everybody$_k$ [$_{VP}$ sent in **[which [picture of himself**$_k$**]**$_j$**]**$_i$]]]]]] annoyed the teacher.

However, the case is different for inverse scope readings. Since only the RC-head NP is assumed to originate inside the relative clause and subsequently undergo movement, reconstruction can also only apply to this NP. The determiner itself remains outside the relative clause, which means that the clause internal quantifier still cannot take scope over it[214]. This is in fact true not only for the RA, but for all three analysis or relative clauses as represented in (6.15). Here, the elements that are argued to have undergone movement in each analysis are represented in their original position. The indefinite determiner remains in the top position in all three cases.

(6.15) a. EA: [$_{DP}$ a [$_{NP}$ **book** [$_{CP}$ **which**$_i$ [$_{TP}$ every student [$_{VP}$ read **which**$_i$]]]]]
        b. MA: [$_{DP}$ a [$_{NP}$ **book** [$_{CP}$ **[which ~~book~~]**$_i$ [$_{TP}$ every student [$_{VP}$ read **[which ~~book~~]**$_i$]]]]]
        c. RA: [$_{DP}$ a [$_{CP}$ **book**$_j$ **[which** _$_j$ **]**$_i$ [$_{TP}$ every student [$_{VP}$ read **[which book**$_j$**]**$_i$]]]]

In fact, even binding option cannot be satisfyingly explained with reconstruction. In the example in (6.16a), the pronoun *him* occurs outside of the relative clause and is bound by the quantifier inside the relative clause, even though there is no movement relationship and therefore no possibility of reconstruction, as exemplified in (6.16b). This phenomenon is also called *telescoping*. Also, in both

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[214] Thanks to Susi Wurmbrand for a very helpful discussion on these issues.

(6.14) and (6.16), the prominent reading is that the picture/mother co-varies with soldiers, i.e. with the distributive quantifier. That is, (6.14) is understood to mean that everybody sent in a different picture. For such an interpretation, however, the quantifier would need to take scope over the definite determiner *the* – which is not possible through reconstruction, as shown in (6.15)[215].

(6.16) a. The picture of his$_i$ mother [which every soldier$_i$ kept wrapped in a sock] was not
           much use to **him$_i$**.

(adapted from Sternfeld 2019, p. 387)

   b. RA: [$_{DP}$ The [$_{NP}$ **[picture of his$_k$ mother]$_j$** [$_{CP}$ **[which _$_j$]$_i$** [$_{TP}$ every soldier$_k$ [$_{VP}$ kept **[which [picture of his$_k$ mother]$_j$]$_i$** wrapped in a sock]]]]]] was not much use to him$_k$.

Hulsey & Sauerland (2006) are aware of this issue and assume that in order to arrive at the inverse reading, the embedded quantifier undergoes QR outside of the relative clause, following a similar suggestion in Doron (1982/2011). See their analysis in (6.17), where *everybody* is in top most position.

(6.17)   everybody λy. [the λx. y sent in the$_x$ picture of y] annoyed the teacher[216]

(Hulsey & Sauerland 2006, p. 132)

Obviously, with such an assumption, we are running in circles. The main reason to assume reconstruction in the first place is to avoid movement across the relative clause boundary. If in the end, the quantifier undergoes QR anyway, then there is no reason to assume any type of reconstruction, as the raised quantifier can solve both the scope issue and the various binding issues in (6.14) and (6.16) all in one go. Whatever assumptions we make about reconstructions, we have to assume QR either way.

There may be one possibility to assume QR without incurring an island violation. This is because there is a notable difference between overt extraction and Quantifier Raising. In the case of wh-movement, the wh-word has to move all the way up to the matrix-CP. With QR, this is not necessarily the case. Here, in order facilitate an inverse interpretation, the embedded quantifier only has to raise to a point from which it can c-command the indefinite RC-head. That is, in principle, it only has to raise above CP, but not above DP. This is exemplified in (6.18).

(6.18)   a. **[Who]$_i$** was there [$_{DP}$ a surveillance camera [$_{CP}$ that recorded **t$_i$**]]?
         b. There was [$_{DP}$ **[every burglar]$_i$** a surveillance camera [$_{CP}$ that recorded **t$_i$**]].

Traditionally, quantifiers are assumed to raise and attach to an S-node, see May (1977). In more modern accounts, this would be CP. However, several authors have put forward a proposal for inverse linking constructions, where the lower QP only raises to the QP it is embedded in without actually leaving it, e.g. May (1977, 1985) and May & Bale (2006)[217]. A similar thing could be going on in the case of relative clauses with the lower QP only raising to the QP it is embedded in, i.e. the relative clause head (6.18b). Of course, this assumption has the problem that it is CP which is considered to be the island boundary, i.e. an island violation would still be present. One may argue, though, that a raising operation

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[215] There are ways to account for such examples semantically, i.e. without assuming movement or reconstruction, e.g. Sharvit (1999), Sternefeld (2019). I will discuss these analysis and their potential problems in section 6.2.2.

[216] In Hulsey & Sauerland's (2006) notation (p. 112), *the$_x$ picture* is shorthand for 'the λy. (x=y and picture(y))'.

[217] But see Sauerland (2005) for arguments against such an analysis.

to the RC-head might be a smaller violation than movement all the way up to the matrix CP. This could potentially also explain inverse interpretations observed in other island environments like CNPs, observed in the follow-up experiment in chapter 3. It could also explain why inverse readings were accepted to a higher degree in object relative clauses than subject relative clauses in the follow-up experiment in chapter 3. Assuming cyclic covert movement along the lines of Wurmbrand (2018), where each additional step incurs a processing cost, the embedded QP has to undergo more steps in subject RCs compared to object RCs, see (6.19).

(6.19) a. sbjRC: There was $[_{DP}$ [every burglar]$_i$ a surveillance camera $[_{CP}$ that $[_{vP}$ recorded t$_i$]]].
        b. objRC: There was $[_{DP}$ [every surveillance camera]$_i$ a burglar $[_{CP}$ that t$_i$ $[_{vP}$ recorded]]].

Nevertheless, while such an assumption may be applicable in the case of German, where we saw a significant reduction in IR-availability from 0-emb to 1-emb, this is not the case for English, where no such difference was observed. Even if the degree of violation is smaller when movement is shorter, we should still be able to see that *some* violation occurs, reflected in a reduction of IR-availability. After all, the island boundary is CP and is still crossed. Also, this account cannot explain why IR-availability is lower in CNPs. We would expect similar rates as the same "small" island violation occurs in either case. Even if we assume cyclic covert movement as in Wurmbrand (2018), we would expect inverse readings in CNPs to be comparable to object RCs, not to subject RCs, see (6.20). Thus, something else would have to be made responsible for this effect.

(6.20) a. sbjRC: There was $[_{DP}$ [every burglar]$_i$ a surveillance camera $[_{CP}$ that recorded t$_i$]].
        b. objRC: There was $[_{DP}$ [every surveillance camera]$_i$ a burglar $[_{CP}$ that t$_i$ recorded]].
        b. CNP: The fireman received $[_{DP}$ [every fire] a message $[_{CP}$ that t$_i$ was defeated]].

Another possibility to save the covert movement approach and the assumption of clause-boundedness might be to assume that the embedded quantifier moves to the edge of the embedded clause and subsequently, the whole embedded clause undergoes QR[218] (cf. the discussion and criticism in Barker (2021) on similar ideas of "scoping the island"). Each step of QR would be associated with higher processing costs, as in Wurmbrand (2018). This necessarily results in more QR steps with embedded quantifiers and therefore in a reduction of IR-availability. In principle, this would explain why inverse readings can be attested in classical island environments, both strong and weak, such as relative clauses, CNPs, or temporal adjuncts as in Tanaka (2015). It could also explain some variation between this different environments, e.g. why object relative clauses allow for inverse readings more than subject relative clauses, as the former would only require one step and the latter two steps. This is exemplified in Figures 6.6 and 6.7. However, other variation could not be explained in that way. Again, CNPs would require the same amount of steps as object relative clauses, but we saw that acceptability of IR was significantly lower. The complement clauses should also require two steps of QR, according to Wurmbrand (2018), but they also received much lower ratings.

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[218] It is questionable, if this could be implemented technically, but I will not dive into this issue, as we will see that this assumption does not derive the right predictions anyway.
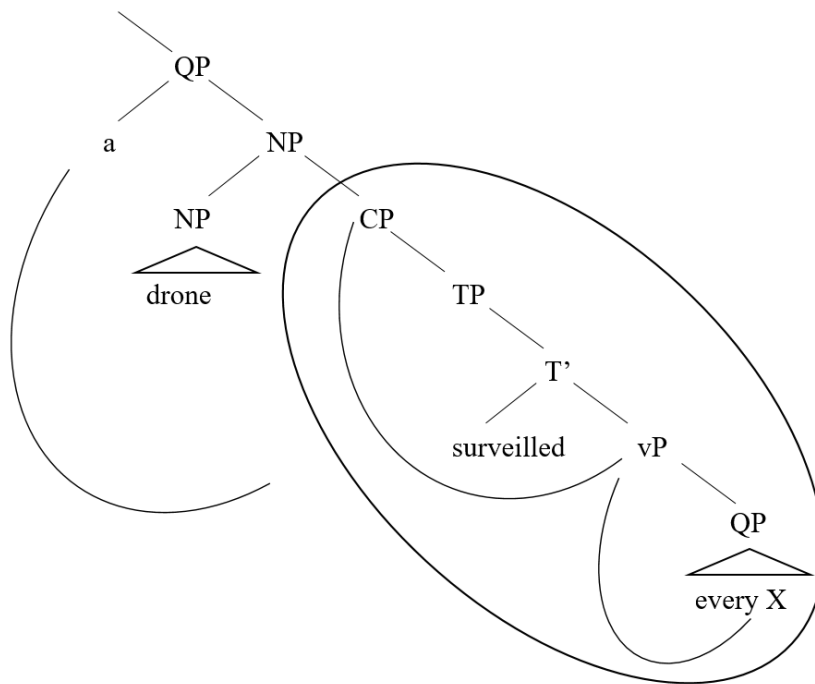
Figure 6.6: QR of the embedded clause – subject relative clause.
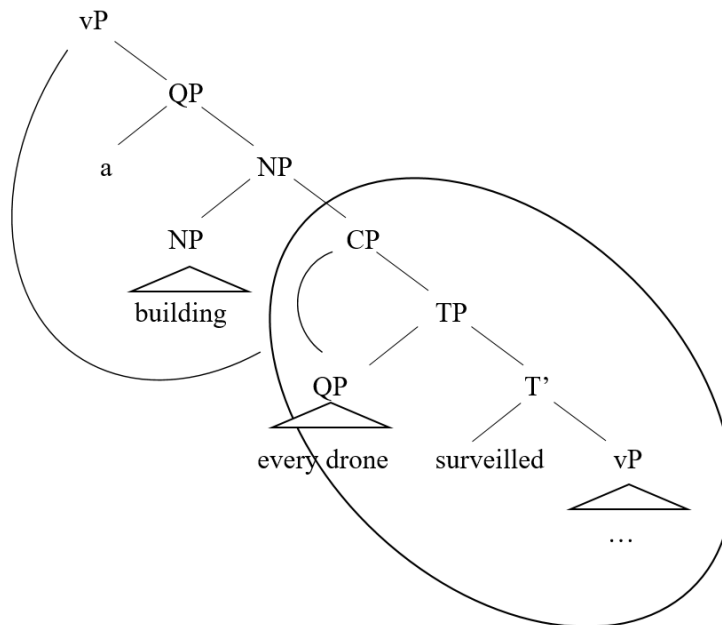

Figure 6.7: QR of the embedded clause – subject relative clause

Finally, Barker (2021) suggests to simply abandon the idea of clause-boundedness of QR altogether. He justifies this radical step by providing an extensive set of examples of inverse readings that arise in various types of embedded clause. He subsumes previous attempts to account for such apparent exceptions under the term "exceptional scope conspiracy", which says that "[n]on-QR scoping mechanisms deliver the same truth conditions that QR would have delivered if we ignored islands." (Barker 2021, p. 9). According to him, there are no scope islands in the sense that QR is simply blocked

by the clause-boundary. Instead, inverse readings across clause-boundaries are limited by the specifications of the "scope-takers" on the one hand and the specifications of the embedding predicate on the other hand. The specifications are located in the semantic type of the respective expressions via mode annotations. Through this, Barker derives a complex pattern of scope options[219]. With this approach, we end up with the same problem as before – why assuming movement, if we do not see any of the expected behaviour of a moved element? If QR does not share any properties with overt movement, then its stipulation seems random and has no explanatory or predictive power. Essentially, QR is now equivalent to just saying "X has scope over Y".

Summing up, we have seen that under a QR-based approach to quantifier scope, there is no way around assuming covert movement across island clause boundaries if we want to explain the embedding results from chapter 3-5. First, all analyses to relative clauses suffer from the problem that the determiner originates outside of the relative clause, which cancels out reconstruction as a possible explanation. Second, even if we could provide a reconstruction-based explanation, we would still be left with the fundamentally different pattern of English versus German. Both languages allow inverse readings across clause-boundaries, but the availability is significantly reduced in the case of German, whereas in English, the availability is identical to unembedded sentences. That is, if we assume that English relative clauses are structurally different from German relative clauses and that this is what explains the difference between the two languages, then we still need to explain why in German, inverse readings are still marginally available. If, on the other hand, we assume that both English and German have a relative clause structure that permits inverse readings without cross-clausal QR, then we cannot explain how the difference between the two languages comes about. Further, we would still be left with the fact that inverse readings also arise at least marginally in other island environments (Tanaka 2015, Barker 2021, see also the follow-up experiment in section 3.4 of this thesis). Therefore, while a fundamentally different structure of relative clauses may explain the unexpectedly high results observed for English, we cannot get around additionally assuming QR across island boundaries. Finally, we have also seen that assuming a different landing site is empirically and theoretically problematic.

(ii)   How strong is the connection between movement and inverse scope after all?

In the previous section, we saw that there is no way to account for the embedding data of chapters 3-5 in a QR-based framework of quantifier scope without actually assuming QR across island-boundaries. This constitutes a major problem, as QR is supposed to parallel overt movement and obey island constraints. In this section, I will reflect on the extent to which inverse scope can still be thought of as a movement process and if there are arguments in favour of such an approach despite the apparent disparities in behaviour between overt movement and scope interpretation. Let us first go back to the original arguments in favour of assuming a movement operation to account for inverse scope. In earlier times, shortly after the introduction of QR, one criticism was that assuming some type of covert movement is problematic because it is not really falsifiable. If the movement is only covert, occurring at some abstract level, then, in principle, anything could be stipulated. Whenever a new data point arises, one might simply adapt the properties of this presumed movement operation to fit that data point. Since

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[219] Note that Barker himself writes that his proposal "[…] is at best a descriptive generalization […] an *invitation* to figure out what is really going on." (Barker 2021, p. 18). In fact, some of the data he observes may be related to more general principles of pragmatics, information structure, processing considerations, etc. and not be related to abstract specifications (see also the subsequent section on syntactic islands and the references therein).

this covert operation has no surface reflection, there would be no limits to what could be stipulated. This criticism vanishes, once it is assumed that QR is an instance of A'-movement that obeys all and only those constraints that overt A'-movement is also subject to. Tying QR to a particular type of overt movement turns it into an falsifiable theory. Evidence for the movement approach was taken from the observation that QR, just like overt movement, cannot apply across syntactic islands, such that inverse readings are blocked in these environments (e.g. Rodman 1976, May 1985, Huang 1995). However, from early on, the parallelism between overt and covert movement faced the problem that overt movement is cross-linguistically attested a grammatical operation across complement clause boundaries, while inverse readings were cross-linguistically found to be either absent or only marginally available in the same environment (Chomsky 1975, Farkas 1981, Fodor & Sag 1982, Abusch 1994, Beghelli 1993, Fox 1995, a.o.). Despite this severe deviation from overt movement, QR continued to be a popular approach to quantifier scope ambiguities and clause-boundedness is usually accepted without questioning the idea of a covert movement operation in and of itself. However, a second problem arose, namely that over time, more and more counterexamples to the island restriction were observed (VanLehn 1978, May 1977, Sharvit 1999, Pafel 2005, Hulsey & Sauerland 2006, Szabolcsi 2010, Barker 2012, 2021, a.o.). I discussed a large set of data points regarding this topic in section 6.1.3. This is in fact a more serious problem than clause-boundedness. If inverse interpretations are more restricted than overt movement, we can always think of additional processing constraints or interpretive aspect which do not play a role when moving overtly. If it is the other way round and inverse interpretations are attested in environments where overt movement is banned, this raises serious doubts as to whether scope inversion can really be thought of as a movement procedure at all. Nevertheless, this did not break the popularity of QR and such data was either largely ignored or various additional assumptions were made to try and accommodate it. At the same time, this data does in fact not necessarily mean that the relationship between overt and covert movement is broken and that QR-theory must be abandoned. This is for two reasons: First, presumed islands are in fact also not completely opaque to overt movement. Second, islands may not be caused by an abstract syntactic constraint but rather by pragmatic, semantic, or processing effects, which might only be relevant in the case of overt movement and not or less so in the case covert movement. These points will be discussed in more detail below and it will be evaluated whether they can save a movement-based approach to quantifier scope.

So far, we have seen increasing evidence that inverse readings are at least marginally available across island boundaries. However, overt extraction has in fact also been shown to be acceptable in certain island environment and in certain languages. Already early on, a distinction was made between weak and strong islands (Chomsky 1977). Weak islands are transparent for wh-movement of arguments, but not of adjuncts. Strong islands block wh-extraction of both arguments and adjuncts. Relative clauses are traditionally considered to be strong islands for movement, an instance of a weak island would be wh-islands (Chomsky 1977). An example for each is provided in (6.21) and (6.22).

(6.21)   a. Peter saw a drone that was surveiling a building secretly.
         b. *What$_i$ did Peter see a drone that surveilled t$_i$ secretly?
         c. *How$_i$ did Peter see a drone that surveilled a building t$_i$?

(6.22)   a. Peter wanted to know whether a drone surveilled the building secretly.
         b. What$_i$ did Peter want to know whether a drone surveilled t$_i$ secretly?
         c. *How$_i$ did Peter want to know whether a drone surveilled the building t$_i$?

In fact, even though complement clauses are usually considered to be transparent to overt extraction, weak island effects occur in certain types of complement clauses depending on the type of embedding verb (Kiparsky & Kiparsky 1970, Cattell 1978, Cinque 1990, Rooryck 1992, Hegarty 1992, Szabolcsi & Zwarts 1993, Oshima 2007, Abrusán 2011, Djärv 2019, a.o.). The difference is shown in (6.23) and (6.24) below[220]. Particularly, factive verbs like *know*, *discover*, *regret*, *forget*, *recall*, *realize*, etc. have long been known to not allow for overt movement of adjuncts either[221]. This is different from non-factive verbs like *think*, *believe*, *say*, *suppose*, *assume*, etc., which freely permit movement across the clause boundary. Factive verbs are usually assumed to presuppose the truth of the verbal complement.

(6.23) a. Why$_i$ do you believe [that John left t$_i$].
        b. *Why$_i$ do you regret [that John left t$_i$].

(6.24) a. How$_i$ do you suppose [that Jon fixed the car t$_i$].
        b. *How$_i$ did you point out [that John stole the file t$_i$].

(adapted from Hegarty 1992, p. 209)

Even though many syntactic accounts of weak island effects are on the market (Kiparsky & Kiparsky 1970, Chomsky 1986, Rizzi 1990, Cinque 1990, Hegarty 1992, Lasnik & Saito 1992, Cuba & Ürögdi 2009, Haegeman & Ürögdi 2010, Kastner 2015, a.o.), they have also often been treated as a purely semantic/pragmatic phenomenon (Szabolcsi & Zwarts 1993, Rullmann 1995, Honcoop 1998, Simons 2001, 2004, Abusch 2002, 2009, Fox & Hackl 2006, Abrusán 2007, Chierchia 2013, Simons et al. 2017, Schwarz & Simonenko 2016, Christensen & Nyvad 2019, Djärv 2019, a.o.). Under the latter accounts, the unavailability of wh-extraction is attributed to e.g. problems with semantic composition, pragmatic blocking effects, the emergence of contradictions, or the presuppositionality/discourse givenness of the predicate complement. The lexical semantics of the embedding verb is of particular relevance across these accounts. Under such accounts, the unacceptability of certain types of extraction would not be related to syntactic locality at all. It is important to point out that even the syntactic accounts mentioned above usually have to make reference to certain semantic concepts such as referentiality. The difference is that they claim a structural correlate for these semantic or pragmatic concepts, such as a difference in structure/size of the embedded clause. It is also worthwhile pointing out that the phenomenon of weak islands is not rigid and uniform, but that languages vary in how permissive they are with extraction out of weak islands (Szabolcsi & Zwarts 1993).

However, there is more than just the difference between strong and weak islands. Even in the case of strong islands, it has been shown that extraction improves in certain sentences or is in fact fully grammatical in certain languages. For example, overt extraction from relative clauses has been observed in a number of languages, such as Swedish (Engdahl 1980, 1997, Allwood 1982, Lindahl 2015), Danish (Erteschik-Shir 1973, Erteschik-Shir & Lappin 1979), Norwegian (Taraldsen 1982) and Hebrew (Doron 1982/2011, Sichel 2018). Cinque (2010) claims that the same is also possible in Romance languages, like Italian, French, and Spanish. In section 5.6, we already saw that overt movement out of relative

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[220] Note that the sentences (6.23b) and (6.24b) are not per se ungrammatical. They are grammatical under the interpretation that the wh-adjunct modifies the matrix verb. However, they are ungrammatical if they are intended to modify the embedded verb, as indicated by the indices.
[221] Beyond the binary categorization factive/non-factive, more fine-grained categories have been suggested, e.g. in Kiparsky & Kiparsky (1970) or Cattell (1978).

clauses is readily available in Asante Twi at least to some speakers (as also claimed in Saah 1994, Saah & Goodluck 1995, Korsah 2017). In Korean (Han & Kim 2004) and Japanese (Sakai 1994), there are so-called double relative clauses, which also seem to violate island constraints. Even for English, some examples can be found in the literature (Kuno 1976, McCawley 1981, Chung & McCloskey 1983, Vincent 2019). While the examples in English are quite exceptional and in fact only considered marginal by some speakers (cf. Cinque 2010), the examples of other languages such as Swedish are representative of a commonly used strategy in colloquial speech (Lindahl 2017). Note also that in contrast to Asante Twi, languages such as Swedish do not employ a resumptive pronoun strategy[222]. A number of examples are given in (6.25)-(6.29).

(6.25) *Swedish:*
Överblivna biljetter   fanns/kom   det en som ville   sälja.
leftover   tickets   existed/came   there one that   wanted sell
(lit.) 'Leftover tickets, there existed/came someone that wanted to sell.'
'There was a guy/A guy came who wanted to sell leftover tickets.'
                    (adapted from Lindahl 2017, p. 30, originally from Teleman et al. 1999, p. 423)

(6.26) *Danish:*
Det er der mange der kan lide.
(lit.) 'That, there are many who like.'
'There are many who like *that*.'
                                        (adapted from Erteschik-Shir & Lappin 1979, p. 55)

(6.27) *Hebrew[223]:*
[al   acmam],   yeš nora me'at talmidim še-muxanim lixtov.
about themselves BE very few   students   that-willing to.write
'About themselves, there are very few students who are willing to write.'
                                        (adapted from Sichel 2018, p. 339)

(6.28) *Italian:*
Giorgio, al quale non conosco nessuno che sarebbe disposto ad affidare I propri risparmi,...
'Giorgio, whom I don't know anybody that would be ready to entrust with their savings,...
                                        (Cinque 2010, p. 83)

(6.29) *English:*
This is the kind of weather that there are many people who like.
                                        (Erteschik-Shir & Lappin 1979, p. 58)
This is a paper that we really need to find someone who understands.
                                        (Chung & McCloskey 1983, p. 708)
Isn't that the song that Paul and Stevie were the only ones who wanted to record?
                                        (Chung & McCloskey 1983, p. 708)

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[222] As discussed in chapter 5, Asante Twi uses resumptive pronouns as a standard strategy in all bi-/multi-clausal constructions and not just to rescue an otherwise ungrammatical derivation. Further, overt resumptive pronouns are only used in some instances (Korsah 2017, Korsah & Murphy 2020), but extraction is still available when no overt resumptive pronoun is present.

[223] Sichel (2018) provides evidence to show that such examples indeed involve movement and not base generation.

These examples pose a serious problem for the view that (strong) islands are a universal phenomenon. Various attempts have been made to make sense of such examples and embed them in the standard framework of syntactic islands. Kush et al. (2013) provide a syntactic explanation by claiming that relative clauses in Mainland Scandinavian languages that allow for overt extraction constitute instances of small clauses. That is, certain verbs take a small clause as argument, which is not a full CP and therefore is transparent to extraction. However, Müller (2015) provides empirical evidence against this hypothesis, including experimental data. Lindahl (2015, 2017) suggests that in Swedish, relative clauses constitute weak islands. Han & Kim (2004) claim that double relative clauses in Korean employ a particular syntactic structure, double nominative constructions, that avoids island violations. Sichel (2018) argues that relative clauses are structurally ambiguous between externally headed and raising relative clauses, in that the former block extraction completely and the latter allow extraction under certain conditions. This is similar to the argument drawn for scope inversion under a QR approach in e.g. Hulsey & Sauerland (2006).

Other authors have taken such examples to question the standard framework of syntactic islands altogether, arguing that extraction is not blocked by an abstract universal locality constraint. Instead, blocking effects of movement should be attributed to general effects of pragmatics, information structure, or processing (Erteschik-Shir 1973, 1982, Engdahl 1982, Pritchett 1991, Kluender & Kutas 1993, Kluender 1998, 2004, Rubowitz-Mann 2000, Ambridge & Goldberg 2008, Hofmeister et al. 2013, Hofmeister & Sag 2010). For example, Erteschik-Shir & Lappin (1979) and Engdahl (1997) assume that overt extraction out of relative clauses in certain Scandinavian languages is more acceptable because topic fronting is a common strategy, in contrast to English, where it is much more degraded.

Certain cross-linguistic similarities between the types of relative clauses that allow extraction have been observed. The most prominent factor is that extraction is available when the existence of the RC-head is asserted, e.g. in existential constructions (e.g. Cinque 2010, Sichel 2018, Vincent 2019), compare also examples (6.25)-(6.29) above. Kush et al. (2013) provide comparative experimental data to show that both in Swedish and English, relative clause extraction is ameliorated when an existential construction, a perception verb, or the verb 'know' is used and Vincent (2019) provides evidence on English that shows that predicate nominals, too, improve overt extraction, similarly to what has been seen in Hebrew (Sichel 2018). Definiteness of the RC referent is also said to play an important role in that indefinite DPs increase acceptability of extraction compared to definite DPs (Kush et al. 2013, Sichel 2018). However, Sichel (2018) and Vincent (2019) argue that definiteness is only an apparent effect that can actually be reduced to presuppositionality of the RC-head. These observations tend to favour approaches that reduce islands to non-structural factors, whereas syntactic accounts usually require additional assumptions to explain these cross-linguistic patterns.

Relative clauses are not the only strong islands that show exceptional behaviour. In chapter 3, I presented in detail the study by Tanaka (2015), which shows that in English, overt movement is at least marginally acceptable out of temporal adjunct islands and that acceptability varies between different types of temporal adjuncts. The same was also shown in Szabolcsi & Lohndal (2017). These experimental results confirm previous claims that adjunct extraction is to a certain degree acceptable in English (e.g. Truswell 2007, Sheehan 2013). In the same way, Dal Farra (2019, 2020) shows that in Italian, adjunct extraction is possible, but transparency varies with the type of adjunct. Similar claims exist for Spanish (Uriagereka 2011, Fábregas & Jiménez-Fernández 2016). Recent experiments on

Swedish (Müller 2017, 2019), Norwegian (Kush et al. 2018, 2019, Bondevik et al. 2021), and Danish (Nyvad et al. 2017) have also confirmed early claims that those languages allow extraction out of adjunct islands (Anward 1982, Maling & Zaenen 1982, a.o.). The same was also shown for Asante Twi in section 5.6 (Saah 1994, Saah & Goodluck 1995). Further, subject extraction was reported to be available in a number of languages such as Russian, English, and French (Stepanov 2007, Abeillé et al. 2020). However, several authors report great between-speaker variability in experiments on adjunct extraction, even to the extent of bimodal distributions (Dal Farra 2019, 2020, Kush et al. 2018, 2019, Bondevik et al. 2021). Variability was also found in the case of Asante Twi in section 5.6. Kush et al. (2019) argue that inconsistent judgments should be taken as indication that the construction under investigation does not constitute an actual island. Some examples of adjunct extraction are provided in (6.30)-(6.32).

(6.30) *English:*
Which topic did you leave without talking about?

(Szabolcsi & Lohndal 2017, p. 4)

(6.31) *Norwegian:*

Bakdøren	blir	han	nervøs	om	de	lar	stå	ulåst.
back.door.DEF	*gets*	*he*	*nervous*	*if*	*they*	*leave*	*stand*	*unlocked*

'The backdoor he gets nervous if they leave unlocked.'

(adapted from Bondevik et al. 2021, p. 225)

(6.32) *Swedish:*

Sportspegeln	somnar	jag	om/när	jag	ser.
sports.program.DEF	*fall.asleep*	*I*	*if/when*	*I*	*see*

'The sports program I fall asleep if/when I see.'

(Anward 1982, p. 74)

Same as in the case of relative clauses, different suggestions have been made to handle such cases. Dal Farra (2019, 2020) argues that adjuncts should not be considered as a uniform class and that acceptability of extraction may vary depending on the point of the tree structure at which the clause is attached to (vP vs. VP). In fact, variation in the point of attachment is the most prominent explanation for extraction differences between adjunct types or languages (Ernst 2002, Truswell 2011, Haegeman 2012, Tanaka 2015, Müller 2019, a.o.). Tanaka (2015) and Müller (2019) hypothesize that at least certain types of adjunct islands might in fact be weak islands. Other authors argue that not only weak islands but all island phenomena including adjunct islands are a consequence of semantic and/or pragmatic properties (Erteschik-Shir 1973, Erteschik-Shir & Lappin 1979, Ambridge & Goldberg 2008, a.o.). This may include presuppositionality, lexical semantics of the complementizer, pragmatic connection between matrix and embedded clause, or information structure like focus-background or topic-comment. Such approaches make it easier to explain the particular circumstances under which extraction can or cannot occur. Note that such accounts can also explain why there is not only variation in acceptability of island extraction depending on the language or the type of island, but also depending on the type of extraction, e.g. topicalization, wh-fronting, or focussing (Kush et al. 2018, 2019 on Norwegian, see also section 5.6.6 on Asante Twi).

Again, similar to relative clauses, various factors were discovered which influence the extent to which extraction out of adjuncts is accepted. The relationship between the event expressed in the matrix clause and the event expressed in the subordinate clause are of particular relevance here. Dal Farra (2019, 2020) proposes that extractability increases if the two events can be perceived as a single macro-event. Similar claims have been made by Truswell (2007, 2011), Tanaka (2015), and Müller (2019). Müller (2019) provides evidence for this from experiments on Swedish and English. Acceptance of extraction increased in both languages "[…] in the presence of a causal, coherent relation between the adjunct and the matrix clause […]". (Müller 2019, p. 157). Generally, extraction out of non-finite clauses is more acceptable than out of finite clauses[224] (Cinque 1990, Truswell 2007, 2011, Szabolcsi & Lohndal 2017, Müller 2019, a.o.). Note, however, that some languages also allow extraction out of tensed adjuncts. For example the Asante Twi adjunct clauses presented in section 5.6 are all tensed. The particular type of adjunct also plays a role, as mentioned before (Tanaka 2015, Dal Farra 2019, 2020, Bondevik et al. 2021).

Summing up, we saw that with regard to overt movement, syntactic islands are not a completely uniform phenomenon. Even though we often talk about islands as one universally observable class, there is a considerable degree of variation, both categorical and gradual[225]. Nevertheless, despite all this variation, there are still limits. For example, we saw that the types of sentences that permit extraction out of relative clauses across languages show a certain similarity. Most importantly, we have seen that purely semantic or pragmatic accounts have been proposed to explain either weak islands specifically or islands in general.

Now, let us go back to the original question asked in this section: Does the fact that inverse readings are available across island boundaries mean that we should dispense with the idea of a covert movement operation? We have seen that overt extraction across islands, too, seems to be a fairly fuzzy phenomenon, where acceptability varies with language, island type, and various additional factors. Considering this, the fact that inverse readings are observed in island environments does not constitute a strong argument against a covert movement approach. In fact, there might even be certain similarities in the type of factors that improve acceptability of extraction and inverse readings. For example, we saw that extraction out of relative clauses improves cross-linguistically when an existential construction is used (Cinque 2010, Kush et al. 2013, Sichel 2018, Vincent 2019). The experiments on English presented in chapter 3 also gave some indication that inverse readings are easier to obtain when an existential construction is used. Both in the case of overt movement (Truswell 2007, 2011, Tanaka 2015, Müller 2019, Dal Farra 2019) and scope availability (Farkas & Giannakidou 1996), the connection of the events expressed in the matrix and the embedded clause have been claimed to play a role. Further, the experiments presented in Tanaka (2015) show that the acceptability patterns of overt extraction parallel those of inverse scope availability across different types of adjunct islands. Finally, both phenomena exhibit great variability across participants[226] (overt extraction: Dal Farra 2019, 2020,

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[224] Finiteness was also considered an important factor by Wurmbrand (2018) in the case of complement clauses. But see the follow-up experiment on English in chapter 3, where no significant difference was found. However, due to certain shortcomings of this experiment discussed in the same chapter, further experiments should be done regarding this question.

[225] Remember also that in Asante Twi, there were notable differences between speakers regarding the extent to which they accepted overt extraction out of islands, see section 5.6.6.

[226] An interesting future experiment could be to investigate if the same participants which are more permissive with inverse readings across island boundaries also give higher ratings to overt extraction without at the same

Kush et al. 2018, 2019, Bondevik et al. 2021; inverse scope: Gil 1982, Brasoveanu & Dotlačil 2015, Anderson 2004, Varkanitsa et al. 2016, Oikonomou et al. 2020). At the same time, there are also clear differences which factors improve acceptability of extraction versus inverse readings. For instance, inverse readings in relative clauses have mainly been observed with definite RC-heads in the literature (cf. Barker 2021). This is opposite from overt extraction, where acceptability improves with the use of an indefinite RC-head (Kush et al. 2013, Sichel 2018). Also, overt argument extraction is cross-linguistically acceptable across both finite and non-finite complement clauses, while extraction across relative clauses is only observed in some languages and under restricted circumstances. In the case of inverse scope, the data found in chapters 3-5 seem to indicate that inverse readings are easier to obtain with relative clauses than with complement clauses. This was the case in all three languages investigated. However, under approaches that take islands to be a multi-faceted phenomenon that arises due to pragmatic, semantic, and processing aspects, rather than a general abstract syntactic constraint, these differences are not necessarily a problem. The pragmatic and information structural factors that are at work in the case of wh-fronting or topicalization may be different from those that are at work in the case of scope inversion. They may therefore impact acceptability/availability in different ways. The same is true for processing constraints. Nevertheless, if we reduce island phenomena to such factors and thereby loosen the ties between overt extraction and scope inversion in island environments, then we lose the evidence that was put forward in favour of a movement account in the first place. That is, even though the fact that inverse readings are observed in island environments does not constitute an argument *against* a covert movement account, it does not constitute an argument in *favour* of it either. That is, we are back to the original problem of Quantifier Raising, which is that we have to take it qua stipulation and that we have no independent evidence for assuming a movement operation. If we let go of islands as evidence for the connection of inverse scope and overt extraction, no evidence is left in favour of such a connection, since inverse scope does not exhibit any other signs of overt movement either (e.g. reflexes of movement).

The stipulation of covert movement is in the end dependent on the degree to which we can show parallel acceptability of overt movement and inverse scope readings. Of course, we can still stipulate a covert movement operation that is simply subject to other structural constraints than overt movement. However, such a theory would be weak in that it is not falsifiable. After all, it should be questioned if a covert movement operation is the best model we can think of if we cannot observe any movement-like behaviour in the first place. A similar point was made in Ruys & Winter (2011): "[…] evidence for QR exists to the extent that generalizations on quantifier scope can be stated in terms of syntactic properties of the relevant constructions, and to the extent that these generalizations apply to other purported movement operations as well. Ultimately, on the QR approach, a unified theory explaining properties of both overt and covert movement should be possible." (Ruys & Winter 2011, p. 184).

6.2.2   Alternatives to covert movement

In section 6.2.1 we have established that the data provided in this thesis together with previous data from the literature pose serious problems to the assumption that inverse readings arise due to a covert movement operation. In this section, I will take a brief look at a number of accounts that employ various

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time being more permissive with ungrammatical structures overall. Even though Tanaka (2015) compares the two phenomena directly, she does not provide individual participant data along these lines but only compares averages.

semantic tools and assess whether they can offer a satisfying alternative. In particular, the question is whether they can accommodate inverse readings in relative clauses in particular and in embedded clauses in general. Some of these accounts are compatible with generative linguistics, others require a different framework altogether.

For certain types of relative clauses, it has been known for a long time that they do give rise to (apparent) inverse readings. These are so-called functional relative clauses of the kind exemplified in (6.33), see Geach (1964), Rodmann (1976), von Stechow (1990), Jacobson (1994, 2019), Sharvit (1999), Heim (2019), a.o. These sentences have a definite relative clause head and have a meaning where the relative clause head is defined as a particular function – in the case of (6.33) the function of being a mother. While in previous work it was argued that such readings only arise in identity sentences of the kind in (6.33a) (Lakoff 1970, Rodmann 1976, Cooper 1978, Jacobson 1994), Sharvit (1999) shows that this restriction does not hold and sentences like (6.33b) from Hebrew also allow for such readings.

(6.33) a. The woman every man loves is his mother.
       b. ha-iSa   Se   kol   gever   xibek   cavta   oto.
         the-woman *that* *every* *man* *hugged* *pinched* *him*
         'The woman that every man hugged pinched him.'

(adapted from Sharvit 1999, p. 448 & 449)

These functional relative clauses have received a special treatment throughout the literature and various proposals have come about that explain those readings without the need of covert movement (e.g. von Stechow 1990, Sharvit 1999, Heim 2019; see also Jacobson 1994, 2019, Barker 2019 for an analysis of function relative clauses in a direct-compositionality framework). These accounts tend to be fairly complex, involving accommodation of the semantic machinery, several type shifts, layered traces, etc. and cannot simply be extended to the sentences discussed in this thesis. This is because the items used in chapter 3-5 do not have a functional interpretation[227]. Sharvit (1999) further shows that functional readings show a fundamentally distinct behaviour from non-functional readings overall and therefore motivates a separate analysis. This distinct behaviour includes the type of quantifiers that license the reading, certain logical implications, Matrix Leftness effects, and across-the-board extraction.

Sharvit (1999), however, argues that relative clauses, parallel to questions, not only have a functional but also a pair-list interpretation, mainly using data from Hebrew. Sharvit nevertheless rejects QR as an explanation for any of the possible interpretations, mainly due to the island-status of relative clauses. Instead, she assumes that both readings arise from a functional dependency. In her analysis, the RC-operator and the quantifier are "absorbed" into one constituent and the RC-head "inherits" the syntactic properties of the absorbed quantifier. The DP containing the relative clause is then combined with the rest of the sentence by a special semantic rule, which guarantees distributivity. However, the data observed in the studies in this thesis cannot be explained along these lines. In contrast to the sentences considered in Sharvit (1999), the sentences in here contain an indefinite, not a definite, RC-head. While this may be accommodated, Sharvit's account predicts that pair-list readings only arise with object RCs,

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[227] The functional interpretation of these sentences may be considered the type-reading discussed in section 3.2.4. There, it was argued that the results obtained cannot simply be reduced to a type interpretation.

not subject RCs[228]. Sharvit attributes this to a weak crossover effect in the case of subject relative clauses. In chapter 3-5, however, we have seen that inverse readings with an indefinite RC-head arise in subject RCs. Even though the follow-up experiment in chapter 3 indicates that inverse readings are easier to obtain in English object RCs than subject RCs, they were still clearly present even in the latter case[229]. Also in German and Asante Twi, albeit more degraded compared to subject RCs in English, we found inverse readings in subject RCs. The same was also observed in Barker (2021).

Von Stechow (1991), Cresti (1995), Rullman (1995), Ruys (2015) offer an analysis based on flexible types for traces for sentences like (6.34). These are cases where an existential quantifier has overtly raised to a position above an intensional predicate. The basic idea is that the trace can be interpreted under different types. The surface reading arises when the trace is interpreted of type ‹e› and the inverse reading arises when the trace is interpreted of type ‹‹e,t›,t›.

(6.34)   Someone$_i$ is likely t$_i$ to arrive.

(Schenner 2019, p. 24)

Such an approach may in principle be extended to inverse readings with relative clauses under a raising analysis. However, they fail to account for cases of binding in the case of telescoping and they also cannot account for inverse readings in island contexts without a filler-gap dependency. Particularly, the follow-up experiment in chapter 3 indicates that inverse readings may arise in CNPs as well, see example (6.35) below. Further, examples of adjunct islands as tested for Asante Twi in chapter 5 also have no such dependency, see (6.36). Finally, the naturally occurring examples provided in Barker (2021) do neither, see (6.7)-(6.9) above. As discussed in section 6.2.1, we would like to assume something particular about relative clauses in the case of English, which is not available in German, to account for the difference between the two languages in the degree to which inverse readings are degraded in relative clauses compared to unembedded sentences. At the same time, we would like to additionally assume something more general with inverse readings out of embedded clauses to be able to put the broad range of embedding data discussed further above under the same umbrella. Otherwise we are forced to create ever more and more exceptions for each case of inverse readings in embedded clauses (relative clauses, CNP, complement clause, adjunct island). This effect was similarly criticised under the term "exceptional scope conspiracy" in Barker (2021).

(6.35)   The fireman received [a message [that every fire was defeated]].

(6.36)   Kofi   bɔ-ɔ   mpaeɛ   [bi / baako / ø] ansa na   ɔ-twerɛ
         Kofi   *beat-PAST*   *prayer*   *IND / one*   *before*   *3SG.SBJ-write*
         nsɔhwɛ   biara
         exam   *every*
         'Kofi said a (certain)/one prayer before writing every exam.'

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[228] Sharvit's account further predicts only a restricted set of quantifiers to license such readings. Because the sentences used in chapter 3-5 all contained a distributive universal quantifier, we do not have information about the extent to which this prediction holds.

[229] See also Hulsey & Sauerland (2006) for arguments against Sharvit's analysis and in favour of QR across of relative clause boundaries.

In Steedman's (2012) CCG account to quantifier scope, clause-boundedness or island sensitivity are not a fundamental part of the system itself, as is the case with a covert movement approach. Nevertheless, Steedman still added this property into the system to account for the presumed clause-boundedness of inverse scope[230]. For example, the relative pronoun has a categorial type that takes the relative clause itself and the bare head noun as arguments. Thus, Skolem specification cannot occur at a point in the derivation where the Skolem term is bound by the universal quantifier (for the mechanism of Skolem specification see also the general introduction to Steedman in section 2.3.2). This is represented in (6.37). Here the operator is of type (N\N)/(S\NP), thereby taking an argument of type (S\NP) to its right, i.e. the relative clause. The resulting (N\N) combines with the head noun to simply a complex N, which can only be taken as an argument by the determiner but not take anything as an argument itself. In principle, however, it would be possible to change the categorial type of the relative operator to accommodate for the data of relative clauses observed in chapter 3-5.

(6.37)   The police installed [a camera that recorded every burglar].

a	camera	that	recorded	every burglar
(S\NP)\((S\NP)/NP)/N	N	**(N\N)/(S\NP)**	(S\NP)/NP	(S\NP)\((S\NP)/NP)
				(S\NP)
			(N\N)	
		N		
(S\NP)\((S\NP)/NP)				

Similar to Steedman (2012), under Hendriks' (1988, 1993) type-shifting account, there is no inherent property of the system that predicts island sensitivity, but Hendriks stipulates that the type-shifting operator is lexically restricted to predicates and cannot act on a relative clause operator. Therefore, similarly to Steedman (2012), the puzzle could be solved relatively easily by simply removing the restriction on type-shifting of relative pronouns discussed in section 2.3.2. However, we have evidence that inverse readings are available in other embedding environments, so simply changing the type of the relative operator can only solve part of the problem. Obviously, a type-shifting approach can always be altered in changing the type shifting options to account for the data. However, doing so still leaves open the question open why we find differences in availability of inverse readings between different constructions. As discussed in section 6.2.1, it may be possible to account for those differences based on pragmatic, semantic, or processing reasons. It may also be possible to associate (certain) type-shifting procedures with higher processing costs, for example with increasing complexity of the semantic type. Thus, while Steedman's (2012) or Hendrik's (1988, 1993) accounts could potentially accommodate the data, the current implementations would have to be seriously altered to do so.

In the background section 2.3.2, I provided a brief summary of continuation-based accounts to quantifier scope (Barker 2002, 2009, Shan & Barker 2006, Barker & Shan 2014, Kiselyov & Shan 2014, Sternefeld 2019). Same as in the case of Steedman and Hendriks, there is no inherent property of a continuation-based system that predicts island sensitivity. In contrast, additional assumptions had to be made to account for this property. Barker (2002) specifically writes that "[i]n general, scope

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[230] Steedman admits that these restrictions are soft and can be overcome by a biasing context. However, we observed availability of IR even in cases where the surface reading is plausible and thus should be readily available. Context bias thus cannot be the whole answer.

displacement can cross an unbounded number of syntactic levels." (Barker 2002, p. 223). He offers certain adjustments to his composition rules that can prevent inverse readings across clause-boundaries for "[…] people [who] believe that QNPs cannot take scope outside of their minimal tensed S." (Barker 2002, p. 223). Considering that the clause-boundedness rule is artificially added to the system and that Barker himself does not seem convinced that this alleged property is even real (which becomes explicit in his later work, e.g. Barker 2021), we could simply remove it from the system. The apparent clause-boundedness effects could then be explained by e.g. softer pragmatic or processing constraints rather than by a cognitively unmotivated abstract rule. In fact, Barker & Shan (2014) explicitly discuss cases of relative clauses such as (6.38). In their account, object relative clauses can receive an inverse reading through reconstruction. Reconstruction is here taken as *delayed evaluation* (see also Barker 2009), which is a more general strategy that does not require movement, copies, or an additional level like LF[231].

(6.38)   the relative of his$_i$ that everyone$_i$ loves _

(Barker & Shan 2014, p. 48)

They further discuss subject relative clauses like (6.39) on a par with inverse linking. They suggest that a quantifier in such a relative clause can take the whole relative clause – including the relative clause head – as a semantic complement. This is achieved via categorical type shifting. An obvious problem with this idea is that *The man who builds* does not pass as a constituent by standard constituency tests. This is a more general problem of CCG and continuation-based grammars.

(6.39)   [[The man who builds] each clock] also repairs it.

(Barker & Shan 2014, p. 111)

This account thus in principle allows for both inverse readings in subject and object relative clauses. Also, since the strategies for the two types of relative clauses vary, the difference in availability of inverse readings could be explained. Such a difference was found in the follow-up experiment in chapter 3. However, neither strategy can easily be extended to other cases of embedded clauses, where inverse readings seem to also occur, e.g. complement clauses, adjunct islands, or CNP. If we omit the stipulation of any kind of clause-boundedness rule, this is not a problem. To the contrary – since we have special strategies at hand in the case of relative clauses, and particularly in the case of object relative clauses, differences in availability between object relative clauses, subject relative clauses, and other island environments are already accounted for.

Finally, as discussed in section 2.3.2, Kiselyov & Shan (2014) suggest that scope ambiguities are essentially a phenomenon of lexical semantics and follow from the particular denotations of the quantifiers. The exceptional wide scope property of existentials and the clause-boundedness of universal quantifiers follows from the fact that the former are stronger in their lexical semantics (the number of levels). Under this approach, no inverse readings of a universal out of an embedded clause should arise. However, the exceptional wide scope of existentials could also be treated in a different way (see the summary of this phenomenon in section 2.2.4). In that case, we could assume polysemy for universal quantifiers with a higher number of levels, but higher levels and the subsequent derivations

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[231] cf. semantic reconstruction in Cresti (1995), Rullmann (1995), Sternefeld (2001)

could be associated with higher processing costs, accounting for a reduction of IR-availability and variation between speakers. In fact, if inverse readings in different constructions arise due to polysemy, then we might expect some speakers who have simply not acquired the lexical entry for a higher level and therefore reject inverse readings in this context across the board.

To sum up, we have seen that the majority of approaches that do without covert movement also cannot easily account for the full set of data. Particularly, previous explanations for cases illusory inverse scope cannot be extended to the data presented in this thesis. Semantic frameworks like CCG, particularly the continuation-based approaches, may provide a more useful tool to identify how scope readings are derived. Nevertheless, in order to account for the embedding data, artificial island or clausal restrictions would need to be removed or modified. After all, the fact that inverse readings are harder to obtain or even excluded across embedded clauses could be related to more general principles of processing, pragmatic or logical reasoning, or semantic concepts like presuppositionality. Just to give a few examples for illustration: Farkas & Giannakidou (1996) argue that inverse readings across complement clause boundaries can arise when there is a causative relationship between the matrix and the embedded clause such that they can be perceived as the same event (see also Barker 2021, who discussed the importance of the embedding predicate). If this condition is not met, it may simply be conceptually difficult to derive the inverse reading. As mentioned further above, in most cases of embedded sentences, the intended inverse reading is simply not a plausible scenario in everyday life. As for the case of relative clauses, it is a well-known fact that more modifying material makes a noun more specific. That is, a relative clause tends to increase specificity of the noun it modifies. That in turn can reduce the availability of inverse readings. In section 5.6 about scope in Asante Twi with the existential *bí*, we could observe how difficult it is for speakers to obtain an inverse reading when the existential is interpreted as specific. From a processing point of view, the single reference principle proposed by Kurtzman & MacDonald (1993) – and similarly in Fodor (1982), Crain & Steedman (1985) and Altmann & Steedman (1988)[232] – may play an important role. When participants first encounter an existential DP, they build a representation of a single referent, which would need to be revised once the universal quantifier is encountered. This principle may be particularly strong in the context of multiple clauses, if the parser prefers to "close off" a derivation as soon as one clause is complete. This again may be promoted by the fact that the two distinct clauses often describe two separate events or concepts and occupy different levels of semantic information (e.g. at-issue vs. presuppositional information). This processing principle interacts with the semantic/information structure principle that cross-linguistically, elements that occur earlier in the sentence, particularly in subject position, tend to be more specific/referential[233] (e.g. Kuno 1972, Dahl 1974, Fodor & Sag 1982, Lambrecht 1994, Portner & Yabushita 1998, 2001, Endriss 2009). If there is no general ban, then such factors which strongly disfavour an inverse interpretation may be overcome if enough factors are added to outweigh their effect (in spirit of multi-factorial accounts discussed in section 2.3.2 and 4.1.2). This is what we observed, for example, in the case of Barker's adjunct island examples (6.7)-(6.9) further above. Future experiments could investigate this further. The main idea would be that inverse scope in embedded environments is never completely blocked by virtue of an abstract principle. Instead, there are a number of factors

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[232] cf. Shan & Barker (2006) and Barker & Shan (2014) on evaluation order.

[233] In scope experiment on Greek, Oikonomou et al. (2020) find that inverse readings are readily available in transitive clauses, but are reduced dramatically when the indefinite is interpreted as a contrastive topic. Compare also the great body of evidence that linear order, grammatical role, and semantic role play a major role in scope interpretation, see section 2.2.6 and the references therein.

associated with different types of embedded clauses, which inhibit an inverse interpretation. This inhibition may be overcome or at least ameliorated if enough other factors balance out this effect. Scope inversion is a tool available to all languages, but languages may differ in the extent to which they make use of this tool.

6.3   Methodological considerations

In chapter 3 and 4, I already discussed several potential confounds regarding the experiments presented in this thesis and provided arguments why they do not impact the overall outcome and implications of those studies. This included the possibility that (i) participants obtained a non-exhaustive surface-scope reading by accommodating the existence of more referents, not specifically mentioned in the context, (ii) participants obtained a type-referential surface reading, (iii) participants solely followed pragmatic considerations ignoring structural constraints. However, the different experimental conditions, the control items used in those studies as well as several follow-up experiments did not give any indication that the unexpected availability of inverse readings were due to such confounding factors. Note that these confounds are not specific to the design used in the experiments presented in this thesis, but could in the same way apply to many other experiments on quantifier scope. The fact that these confounds were controlled for in the previous chapters is therefore not only reassuring with respect to the experiments presented herein, but also with respect to other experiments with similar focus and design.

In this final section, I will set aside those confounds, which were extensively discussed in previous chapters. Instead, I will discuss some more general methodological considerations, which relate to all studies presented in chapters 3-5. I will discuss the reliability of different sources of judgments, such as introspection, fieldwork, and experiments. This is particularly relevant as in the case of quantifier scope, introspective judgments have often provided different outcomes than subsequent experiments, which is also what we found in the course of this thesis. I will provide a background discussion on introspective versus experimental judgments from the literature in section 6.3.1 and then relate this discussion to the experiments and fieldwork studies in chapter 3-5 as well as work on quantifier scope in general in section 6.3.2. In 6.3.3, I will end the methodological discussion with various factors that have to do with cross-linguistic comparisons of the same phenomenon and problems with setting up cross-linguistic experiments.

6.3.1   Introspective versus experimental judgments

In the past decades, theoretical linguistics underwent a noticeable shift in methodology: While in earlier times, conclusions were mostly drawn based on introspective judgments of trained linguists, the use of quantitative experimental data gathered from a larger group of naïve speakers has become a lot more prominent. While experimental results often confirm previous introspective judgments, they also sometimes provide contradicting results. This is also what we saw in previous chapters, where we found that, contrary to most claims in the literature, (i) inverse readings are a dispreferred option in German, (ii) inverse readings are available even across relative clause boundaries in both English (readily) and German (marginally).

However, the studies presented in this thesis are not alone in contradicting common previous claims based on introspective expert judgments. Similar effects have been observed both in other studies on quantifier scope (see the discussion in section 6.1.3) as well as various other phenomena (e.g. Schütze 1996, Gordon & Hendrick 1997, Wasow & Arnold 2005, Bresnan & Nikitina 2009, Scontras & Gibson, 2011, Gibson & Fedorenko 2013). The opinions on how to handle such deviations vary. One point of view is that quantitative experiments on naïve speakers are superior over introspective expert judgments and that the latter are in fact inherently problematic (Schütze 1996, Keller 2001, Featherston 2007, Bresnan & Nikitina 2009, Gibson & Fedorenko 2010, Gibson & Fedorenko 2013, Dąbrowska 2016, Branigan & Pickering 2017, a.o.). Other researchers argue that expert judgments provide reliable data, more reliable than large-scale experiments with non-linguists (e.g. Phillips 2009, Devitt 2010, Sprouse & Almeida 2012, 2013, Christensen & Nyvad 2019, Cho et al. 2021, Francis 2021, a.o.). Proponents of the latter point of view argue that naïve speakers are often distracted by various other aspects of a sentence and their judgments may be partly based on those other aspects, which the linguist actually wishes to isolate and ignore (e.g. Devitt 2010, Cho et al. 2021). A trained linguist, on the other hand, is capable of teasing those different factors apart and provide and isolated judgment on the one aspect they are interested in. This is said to be particularly relevant with sentences that contain additional difficulties, for example if they are hard to process or if they contain an unusual structure[234]. It is further argued that most experiments only confirm expert judgments anyway, so they rarely offer new insights, which is also supported by some experimental data directly comparing the two sources (Culbertson & Gross 2009, Devitt 2010, Sprouse & Almeida 2012). Sprouse & Almeida (2012) explain these highly similar outcomes with the fact that most phenomena in theoretical linguistics give rise to large effect sizes. Further, it is argued that through repeated exposure and discussion with colleagues, e.g. via conferences, the data essentially turns from a single introspective judgment into quantitative and therefore more robust data[235] (Marantz 2005, Phillips 2009, Sprouse & Almeida 2012, 2013).

These arguments in favour of using introspective data have received a lot of criticism. Most importantly, introspective judgments violate various standards of the scientific approach (Gibson & Fedorenko 2013). In contrast to experiments, presentation and setting are not properly controlled, and judgments are dependent on idiosyncrasies of both the individual items and the individual researcher (Schütze 1996, Featherston 2007, Gibson & Fedorenko 2010, a.o.). This introduces various undesirable confounds. The researcher may be biased in having a desired outcome or influenced by her theoretical knowledge, by judgments from colleagues, as well as by previous exposure to the phenomenon and other sentences considered. There is in fact evidence that such biases exist (see e.g. Schütze 1996, Wasow & Arnold 2005, Dąbrowska 2010, Bader & Häussler 2010). Further, when trained linguists and naïve participants are directly compared in the same experimental setting, it can be shown that they sometimes differ in their judgments (Culbertson & Gross 2009, Malenica et al. 2019, Cho et al. 2021).

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[234] Note that this argument seems to imply that naïve participants may tend to downgrade sentences which are actually grammatical due to certain factors irrelevant to the research question. However, studies that directly compared linguist versus non-linguist judgments found that linguists are in fact more strict in their judgments, while naïve speakers are more permissive (Malenica et al. 2019).

[235] Sprouse & Almeida argue that the true number of subjects with the introspective method is therefore actually 5-15. However, their own study raises doubts whether this number is high enough to provide reliable judgments. In their study, using only the lower half of the phenomena in terms of effect size, "[…] a mere 10 judgments (one per subject) was sufficient to detect 70% of the phenomena in Linguistic Inquiry (2001-2010) with 80% power […]" (Sprouse & Almeida 2013, p. 225). This in turn means that when using only 10 subject, 30% of the phenomena would not be detected. This seems like a large number of phenomena to simply dismiss.

Some linguists argue that judgments from naïve participants are to be preferred over judgments from linguists, because they are not subject to the same biases as linguists (e.g. Gibson & Fedorenko 2013, Gibson et al. 2013). Another criticism is that effect size can only be measured in experiments, which means that gradient phenomena or phenomena involving various interacting factors may remain undetected or the degree of their impact may be poorly understood (Keller 2001, Scontras & Gibson 2011, Gibson et al. 2013). Gibson & Fedorenko (2013) argue that such confounds may lead to incorrect generalizations and theories, which can be exemplified with various cases from the literature[236] (e.g. Schütze 1996, Gordon & Hendrick 1997, Wasow & Arnold 2005, Bresnan & Nikitina 2009, Gibson & Fedorenko 2013). Gibson et al. (2013) further argue that even though the convergence rate between experimental outcomes and introspective judgments obtained in Sprouse & Almeida (2013) is relatively high (95%), this still leaves a large number of phenomena where judgments based on introspection turn out incorrect, particularly if one takes into account that Gibson et al. assume that these convergence rates may be inflated (see also Mahowald et al. 2016). Considering the discussion in the field, it is not clear to what extent expert judgments or naïve judgments are more reliable in a situation in which they clearly deviate.

6.3.2   Relating the debate to studies on quantifier scope

The discussion about introspective versus experimental data presented in the previous section often circles around syntactic phenomena and acceptability studies. Even though many authors specifically talk about theoretical linguistics, including semantics, or the field of linguistics as a whole, the discussion eventually gravitates towards acceptability judgments of syntactic phenomena. Direct comparisons between naïve and trained speakers (Culbertson & Gross 2009, Malenica et al. 2019, Cho et al. 2021) or between introspective judgments and experimental outcomes (Sprouse & Almeida 2012, Sprouse & Almeida 2013) also provide this particular subtype of examples. This makes it difficult to relate those results to semantic phenomena in general and quantifier scope ambiguities in particular for a number of reasons. First, testing what interpretation speaker obtains is generally more difficult than testing whether a speaker considers a sentence acceptable. Particularly when a presumed ambiguity is involved, testing availability of (dispreferred) interpretations is more blurry than testing for grammaticality. In the case of quantifier scope, we consistently see a great degree of variability between speakers (Gil 1982, Brasoveanu & Dotlačil 2015, Anderson 2004, Varkanitsa et al. 2016, Oikonomou et al. 2020, chapter 3-5 in here). Introspective judgments are therefore expected to be much more prone to failure. Considering the variability between speakers observed in here and in other experiments, the judgment of a single person with respect to ambiguity has extremely limited informative value. Even if we ask a handful of speakers, dispreferred readings can easily be overlooked. For example in the case of German, where we observed that inverse readings were accepted in about one out of four times, this can easily be taken as German lacking inverse readings, if we only ask three speakers who happen to fall into the group who find it particularly difficult to obtain inverse readings or reject them across the board. This is exacerbated by findings that trained linguists tend to be stricter in their judgments[237]

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[236] See Sprouse & Almeida (2013) for arguments why these examples do not convincingly show that there is a problem with introspective judgments.

[237] It is of course possible that the stricter results from the group of linguists simply show the 'real' judgments and the results from the non-linguist group are more permissive because participants fail to ignore other aspect of

(Malenica et al. 2019). It is therefore questionable if the relatively high convergence rate of 95-98% between introspective judgments and experimental results observed in Sprouse & Almeida (2012, 2013) would replicate in the case of ambiguities. In the literature on quantifier scope, there are numerous examples of languages or constructions which were claimed to lack inverse readings and later on, experiments contradicted those claims (e.g. Antonyuk 2015, 2019, Ionin & Luchkina 2018 for Russian; Kitagawa 1990, Hayashishita 2013 for Japanese). Considering this fact, it questionable whether introspection is a reliable source in the case of semantic phenomena or (quantifier) ambiguities in particular[238]. In chapter 2, I discussed the large number of factors which seem to have an influence on scope interpretation and in the experiments in this thesis I also showed how great the influence of a particular choice of context can be. Making judgments based on only a small number of items is therefore also problematic.

In section 3.4.4 on English, I discussed various reasons why the data from the literature deviates from the data obtained in the experiments presented in this thesis. A further concern is the pattern uncovered in section 6.1.1 comparing the five experiments on German. This comparison indicates that factors that potentially disfavour the dispreferred readings, independent of whether they are of syntactic, semantic, pragmatic or extra-linguistic nature, act in a disproportionally strong way and can easily mask the existence of an available but dispreferred reading. Large-scale experiments, with many speakers and items, with thoroughly designed items and a well-controlled procedure have better chances at avoiding such inhibiting factors or discovering their impact in the first place. The fact that semantic phenomena and ambiguities in particular are often ignored in the debate on introspective versus experimental results summarized in section 6.3.1 is a problem. The arguments in favour of trusting introspective judgments are mainly based on phenomena that are much easier to judge in the first place and show much more consistent behaviour (see also the discussion in Gibson et al. 2013). While these arguments may be at least partly valid in those cases, they cannot be extended to the whole area of theoretical linguistics. One counter-argument may be the idea that trained linguists provide better judgments because they are able to judge the particular phenomenon in question in an isolated manner without other factors confounding the judgment. Under that assumption, the data obtained in chapter 3 and 4 might be confounded and the previous introspective judgments from the literature might be on the right track[239]. However, this argument would only be valid if such confounding factors could be found. Considering that various potentially confounding factors were tested and no evidence for their influence was found, it is unclear, which further aspects of the items or the task could have caused participants to judge something else but the point of interest, at least not to a degree that would completely change the overall pattern. The discussion above also means that the results with regards to Twi presented in section 5.6, which are based on the judgments of four speakers and 3-10 items per speaker and phenomenon, can only give a first hint and would need to be verified through quantitative experiments with naïve participants as suggested in section 5.7.

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the sentence or are driven by extra-linguistic factors. Currently, there is no way to know which group provides the 'real' data and which group provides biased data, see also the discussion in Achimova et al. (2013).

[238] In fact, as the author of this thesis, the results in chapter 4 were completely unexpected to me. As a native speaker of German myself, I seem to fall into the group of people who cannot obtain those inverse interpretations whatsoever. Trusting my own intuition would therefore have resulted in very different judgments.

[239] Note, however, that there are also several introspective judgments in the literature, which claim inverse readings in various embedding environment.

6.3.3   Cross-linguistic studies

The studies on English, German, and Asante Twi presented in chapters 3-5 were not only intended to provide information about the phenomenon of quantifier scope in each of these languages individually, but also to provide cross-linguistically comparable information. While Asante Twi stands out in this respect, because no actual experiment comparable to the ones for English and German could be conducted, experiments E1 and G1 and E2 and G2 were purposefully designed in a maximally parallel way to allow for direct comparison. There are a number of problems with designed such cross-linguistic studies, which may limit the informative value to a certain extent and which I will discuss in this section. The first difficulty is translatability. This affects the items on multiple levels. The first level is the choice of the quantifying expressions, which play an important role in quantifier scope resolution. While one can try to find expressions that are as similar as possible in their lexical semantics, there will never be an exact equivalent. For example in the case of English and German, I opted for the indefinite articles *a* and *'n(e)*. One reason why the main experiments G1 and G2 did not contain the full indefinite *ein(e)* is its highly underspecified semantics. Not only can it be interpreted in both a specific and non-specific way, it can also receive a numeral interpretation, which English *a* does not have. The German follow-up experiments showed that the choice *'n(e)* of versus *ein(e)* has indeed an impact. English, on the other hand, has another existential expression, some, which German lacks. The lexical competition of *a* versus *some* may have an effect that is absent in German[240]. This is effect is even stronger in the case of Asante Twi, as discussed in the experiment proposal in section 5.7, where a lexical distinction between specific and non-specific interpretation is made through the use of the bare noun versus the article *bí*. See also the discussion in Tsai et al. (2014)/Scontras et al. (2017), who faced the same problem with respect to the choice of indefinite in their cross-linguistic study on English and Mandarin Chinese quantifier scope. Of course, the same problem arises with the choice of the universal quantifier. While English has two distributive universals, *every* and *each*, which differ in their strength of distributivity, German has only one, *jede(r)*. The choice of *every* over *each* may therefore result in fewer inverse interpretations in English compared to German. The same may apply in the case of Asante Twi, which, like German, also only has a single distributive quantifier (*biara*). At the same time, this quantifier is highly underspecified, see section 5.5, which means that its interpretation as a free-choice item may interfere.

A second level of translatability issues concerns the rest of the target sentence and the preceding context. While the choice of wording may have a smaller impact on scope interpretation compared to the quantifiers themselves, it may still play a role. In addition to the linguistic aspect, there is also a cultural one. Experiments E1/E2 and G1/G2 contained the factor plausibility, which was controlled for in a pre-test. However, there may be cultural differences as to what is considered plausible. Thus, there is a trade-off as to whether the string of words and the content should remain exactly parallel or whether the scenarios should be culturally matched to the best extent. A further issue arises with the task and the style of presentation. In Asante Twi, written language is unusual and native speakers mostly use their language in spoken speech. This makes it impossible to run an experiment in Asante Twi parallel to the design used in E1/E2 and G1/G2. As discussed in section 5.7, auditory stimuli must be presented and the question must be replaced by pictures. While there are more general arguments in favour of

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[240] See e.g. Gillen (1991) on experiments in English which directly compare the scope interpretation when using *a* versus *some*.

auditory over written stimuli[241], showing pictures does not allow for underspecification in the way questions allow for. Particularly, when opting for pictures, one necessarily can show only one specific scenario. For example the left side of Figure 6.8, repeated from chapter 4, only shows one out of various scenarios that are compatible with an inverse scope reading, as exemplified on the right side. The questions used in E1/E2 and G1/G2 were purposefully stated in a way that they only distinguish between surface and inverse reading and are vague with respect to the possible scenarios compatible with each reading. Overall, any cross-linguistic study on a phenomenon like quantifier scope will always be flawed in some way or other and can never provide the 'true' difference between the languages considered. However, an experimental paradigm as presented here for English and German can still provide a general pattern.
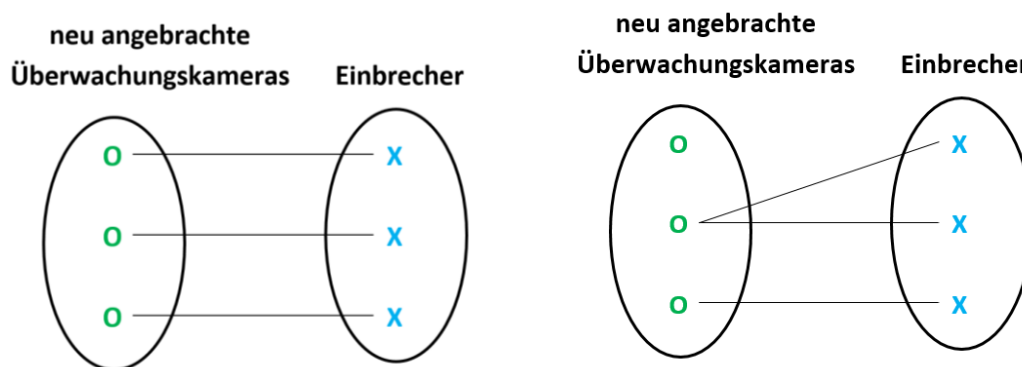
Figure 6.8: picture materials for inverse reading from German follow-up 3 (left) and alternative inverse interpretation (right).

6.4 Summary

In this chapter, I have provided a summary of the findings in chapter 3-5 and a cross-linguistic comparison between the languages considered in this thesis, English, German, and Asante Twi. I also discussed the consequences these results have for theories on quantifier scope. This final section briefly summarizes the most important empirical findings of this thesis and the most important theoretical implications.

Word order freedom:
- *Main finding:* Inverse readings in unembedded transitive clauses are available in all three languages investigated: English, German, and Asante Twi. In English, inverse readings are more readily available than in German. However, contrary to the literature, inverse readings are not banned in German, even when factors like prosody are controlled for.

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[241] For example, Dąbrowska (2016) argues that participants' ideas about what is correct in written language greatly influences the judgments they give. "[…] linguistic intuitions are not direct reflections of mental representations of linguistic knowledge, but of speakers' sensitivity to socially constituted norms." (Dąbrowska 2016, p. 55). Vogel (2019) shows how so-called grammatical taboos, i.e. naturally occurring phenomena which are deemed 'bad language' in prescriptive grammar, lead to judgment patterns that differ qualitatively from the patterns found for phenomena that are both naturally and prescriptively accepted as well as from the patterns found for phenomena that are neither naturally and prescriptively accepted.

- *Local scope rigidity:* Together with data from other languages, this suggests that there is no local scope rigidity: Even though more word-order freedom may reduce the availability of inverse readings in a given language/construction, they are not completely blocked. At the same time, languages with strict word order do not necessarily allow for inverse readings readily, such as Asante Twi.

Embedding:
- *Main finding:* Contrary to expectation, a relative clause embedding does not fully suppress inverse readings in any of the three languages considered. While in German, the availability was clearly reduced compared to unembedded sentences, no significant reduction was observed in English. In English, inverse readings were also attested in other embedding environments in a follow-up experiment, albeit to a lesser degree than in relative clauses. In the fieldwork data in Asante Twi, similar effects were observed. These data, while unpredicted by scope theory, are in line with a number of previous results and claims in the literature.
- *Reconstruction:* I showed that inverse readings in relative clauses cannot be explained in a QR-framework without actually assuming that the clause boundary is crossed. No syntactic analysis of relative clauses can provide a reconstruction-based explanation for inverse readings in relative clauses. They also cannot be reduced to some kind of illusory inverse scope. Further, inverse readings also seem to be available in environments without filler-gap dependency.
- *Covert movement:* Considering the findings, we lack sufficient evidence to assume that inverse scope is related to a covert movement operation. We saw that island phenomena are fairly variable in both overt extraction and scope inversion and may in both cases better be explained by other means than an abstract constraint. The behaviour of overt extraction and inverse scope does not show enough parallelism to assume movement as an explanation for scope phenomena.
- *Semantic accounts:* Approaches to quantifier scope which do without covert movement may be preferable over QR. At the same time, as they currently stand, they also cannot derive the observed patterns without modifications. A continuation-based approach seems to accommodate the results of chapters 3-5 most easily.

Further findings:
- *Plausibility:* We saw that plausibility considerations play a major role in quantifier scope resolution cross-linguistically. The influence of pragmatic IR-bias decreases the more other factors bias towards a surface interpretation. However, it cannot be clearly stated if some participants ignore structural constraints and provide purely pragmatic judgments.
- *Variability:* There is a large degree of variability between speakers of the same language with respect to inverse scope availability. Some conditions even showed a bimodal distribution, indicating that speakers entertain varying strategies in scope resolution and assign different weight to the different scope-biasing factors.
- *Task:* The type of task changed the results to a great extent, up to the point of making a dispreferred but available reading disappear.

While the findings presented in this thesis provide a relevant contribution to the topic of inverse readings in the particular languages investigated as well as to the cross-linguistic perspective, they cannot provide conclusive evidence. As discussed earlier, even though care was taken to ensure that participants' judgments reflect the underlying scope interpretation and are not shaped by possible

confounds, the possibility that an undiscovered confounding factor had an unwanted influence cannot be excluded. Considering how unexpected some of the results were, future work should (i) test if the results obtained in here can be replicated, (ii) investigate in more depth the availability of inverse readings in various kinds of embedded sentences across languages, (iii) provide more data to identify if inverse scope can be said to involve a movement operation. Further topics for future research are the underlying reasons for the highly variable behaviour between participants. This includes the questions (i) whether more exposure leads to higher acceptance of inverse readings, (ii) whether L2 exposure to a language with high IR-availability increases availability in a speaker's L1, (iii) whether some speakers have more processing difficulties with inverse readings and if that reduces the degree to which they obtain inverse readings, (iv) if a plausibility bias only boosts an available but dispreferred reading or if at least some speakers ignore grammar for the sake of a sensible interpretation of the sentence.

Bibliography

Abeillé, A., Hemforth, B., Winckel, E., & Gisbon, E. (2020). Extraction from subjects: Differences in acceptability depend on the discourse function of the construction. *Cognition*, 204, 104293. https://doi.org/10.1016/j.cognition.2020.104293

Abels, K. (2015). Word order. In A. Alexiadou, & T. Kiss (Eds.), *Syntax: Theory and Analysis* (Vol. 2, pp. 1400-1448). Berlin: de Gruyter. https://doi.org/10.1515/9783110363708-017

Aboh, E. O. (2009). Clause structure and verb series. *Linguistic Inquiry*, 40(1), 1-33. https://doi.org/10.1162/ling.2009.40.1.1

Abrusán, M. (2007). *Contradiction and grammar: The case of weak islands*. Doctoral dissertation, MIT.

Abrusán, M. (2011). Presuppositional and negative islands: A semantic account. *Natural Language Semantics*, 19, 257-321.

Abusch, D. (1994). The scope of indefinites. *Natural Language Semantics,* 2, 83–134. https://doi.org/10.1007/BF01250400

Abusch, D. (2002). Lexical alternatives as a source of pragmatic presuppositions. In B. Jackson (Ed.), *Proceedings of Semantics and Linguistic Theory 22* (pp. 1-19). Ithaca, NY: Cornell University Press.

Abusch, D. (2009). Presupposition triggering from alternatives. *Journal of Semantics*, 27, 37-80.

Achimova, A., Deprez, V., Musolino, J. (2013). What makes pair-list answers available: An experimental approach. In Y. Fainleib, N. LaCara, & Y. Park (Eds.), *Proceedings of the 41st Annual Meeting of the North East Linguistic Society* (pp. 1-14). Amherst, MA: GLSA.

Aldrige, E. (2007). Wh-indefinites and their relation to wh-in-situ. In M. Elliott, J. Kirby, O. Sawada, E. Staraki, & S. Yoon (Eds.), *Proceedings from the Annual Meeting of the 43rd Chicago Linguistic Society* (pp. 139-153). Chicago, IL: Chicago University Press.

Allwood, J. (1982). The complex NP constraint in Swedish. In E. Engdahl, & E. Ejerhed (Eds.), *Readings on unbounded dependencies in Scandinavian languages* (pp. 15-32). Stockholm: Almqvist & Wiksell International.

Aloni, M. (2001). *Quantification under conceptual covers*. Doctoral dissertation, University of Amsterdam.

Aloni, M. (2007). Free choice and exhaustification: An account of subtrigging effects. In L. McNally, & E. Puig-Waldmüller (Eds.), *Proceedings of Sinn und Bedeutung 11* (pp. 16-30). Universitat Pompeu Fabra.

Aloni, M. (2008). Concealed questions under cover. *Grazer Philosophische Studien*, 77(1), 191-216.

Aloni, M., & Port, A. (2013). Epistemic indefinites crosslinguistically. In Y. Fainleib, N. LaCara, & Y. Park (Eds.), *Proceedings of the 41st Annual Meeting of the North East Linguistic Society* (pp. 29-43). Amherst, MA: GLSA.

Aloni, M., & Port, A. (2015). Epistemic indefinites and methods of identification. In L. Alonso-Ovalle, & P. Menéndez-Benito (Eds.), *Epistemic indefinites: Exploring modality beyond the verbal domain* (pp. 117-140). Oxford: Oxford University Press.

BIBLIOGRAPHY

Altman, A., Peterzil, Y., & Winter, Y. (2005). Scope dominance with upward monotone quantifiers. *Journal of Logic, Language and Information*, 14, 445-455. https://doi.org/10.1007/s10849-005-4960-6

Altmann, G., & Steedman, M. (1988). Interaction with context during human sentence processing. *Cognition,* 30(3), 191-238.

Ambridge, B. & Goldberg, A. E. (2008). The island status of clausal complements: Evidence in favour of an information structure explanation. *Cognitive Linguistics,* 19(3), 357-389. https://doi.org/10.1515/COGL.2008.014

Amfo, N. A. A. (2007). Akan demonstratives. In D. L. Payne, & J. Peña (Eds.), *Selected Proceedings of the 37th Annual Conference on African Linguistics*. Somerville, MA: Cascadilla Proceedings Project.

Amfo, N. A. A. (2010a). Indefiniteness marking and Akan bi. *Journal of Pragmatics*, 42, 1786-1798. https://doi.org/10.1016/j.pragma.2009.02.002

Amfo, N. A. A. (2010b). Lexical signalling of information structure in Akan. *Linguistics*, 48(1), 195-225. https://doi.org/10.1515/ling.2010.006

Amfo, N. A. A. (2010c). Negation in Akan: Linguistic convention versus pragmatic inference. *Journal of Asian and African Studies*, 80, 97-112.

Ampofo, J. S. (2015). *Syntax and semantics of negation in Akan*. Master's thesis, University of Ghana.

AnderBois, S., Brasoveanu, A., & Henderson, R. (2012). The pragmatics of quantifier scope: A corpus study. In A. Aguilar-Guevara, A. Chernilovskaya, & R. Nouwen (Eds.), *Proceedings of Sinn und Bedeutung 16* (pp. 15-28). Cambridge, MA: MIT.

Anderson, C. (2004). *The structure and real-time comprehension of quantifier scope Ambiguity*. Doctoral dissertation, Northwestern University.

Ansre, G. (1966). The verbid – a caveat to 'serial verbs'. *Journal of West African Languages*, 3(1), 29-32.

Antonyuk, S. (2015). *Quantifier scope and scope freezing in Russian*. Doctoral dissertation, State University of New York.

Antonyuk, S. (2019). Quantifier scope in Russian. *Glossa: a journal of general linguistics*, 4(1), 54. https://doi.org/10.5334/gjgl.562

Anward, J. (1982). Basic Swedish. In E. Engdahl, & E. Ejerhed (Eds.), *Readings on unbounded dependencies in Scandinavian languages* (pp. 47-75). Stockholm: Almqvist & Wiksell.

Aoun, J., & Li, Y.-H. (1989). Scope and constituency. *Linguistic Inquiry*, 20(2), 141-172. https://www.jstor.org/stable/4178623

Aoun, J., & Li, Y.-H. (1993). *Syntax of scope*. Cambridge, MA: Cambridge University Press.

Aoun, J., & Li, Y.-H. (2003). *Essays on the representational and derivational nature of grammar*. Cambridge, MA: MIT Press.

Arkoh, R. (2011). *Semantics of Akan bi and nʊ*. Master's thesis, University of British Columbia.

Arkoh, R., & Matthewson, L. (2013). A familiar definite article in Akan. *Lingua,* 123, 1-30. https://doi.org/10.1016/j.lingua.2012.09.012

BIBLIOGRAPHY

Attali, N., Scontras, G., & Pearl, L. S. (2021). Pragmatic factors can explain variation in interpretation preferences for quantifier-negation utterances: A computational approach. In *Proceedings of the 43rd Annual Meeting of the Cognitive Science Society* (pp. 917-923). Vienna: Cognitive Science Society.

Bach, E., Jelinek, E., Kratzer, A., & Partee, B. (1995). *Quantification in natural languages*. Dordrecht: Kluwer

Bader, M., & Häussler, J. (2010). Toward a model of grammaticality judgments. *Journal of Linguistics*, 46(2), 273-330.

Baker, C. L. (1968). *Indirect questions in English*. Doctoral dissertation, University of Illinois.

Baker, M. C. (1989). Object sharing and projection in serial verb constructions. *Linguistic Inquiry*, 20(4), 513-553. https://www.jstor.org/stable/4178644

Baltazani, M. (2002). *Quantifier scope and the role of intonation in Greek*. Doctoral dissertation, UCLA.

Barker, C. (2002). Continuations and the nature of quantification. *Natural Language Semantics*, 10, 211-242. https://doi.org/10.1023/A:1022183511876

Barker, C. (2009). Reconstruction as delayed evaluation. In E. Hinrichs, & J. Nerbonne (Eds.), *Theory and evidence in semantics* (pp. 1-28). Stanford, CA: CSLI Publications.

Barker, C. (2012). Quantificational binding does not require c-command. *Linguistic Inquiry*, 43(4), 614-633. https://doi.org/10.1162/ling_a_00108

Barker, C. (2019). Evaluation order, crossover, and reconstruction. In M. Krifka, & M. Schenner (Eds.), *Reconstruction effects in relative clauses* (pp. 357-386). Berlin: de Gruyter. https://doi.org/10.1515/9783050095158

Barker, C. (2021). Rethinking scope islands. *Linguistic Inquiry*. Early access version. https://doi.org/10.1162/ling_a_00419

Barker, C., & Shan, C. (2014). *Continuations and natural language*. Oxford: Oxford University Press.

Barwise, J., & Cooper, R. (1981). Generalized quantifiers and natural language. *Linguistics & Philosophy*, 4, 159-219.

Bates, D., Maechler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, 67, 1–48. https://doi.org/10.48550/arXiv.1406.5823

Beck, S., & Kim, S.-S. (1997). On wh- and operator scope in Korean. *Journal of East Asian Linguistics*, 6, 339-384. https://doi.org/10.1023/A:1008280026102

Beck, S., & Sauerland, U. (2000). Cumulation is needed: A reply to Winter (2000). Natural Language Semantics, 8, 349-371. https://doi.org/10.1023/A:1011240827230

Beghelli, F. (1993). A minimalist approach to quantifier scope. In *Proceedings of the 23rd Annual Meeting of the North East Linguistic Society* (pp. 65-80). Amherst: GLSA.

Beghelli, F. (1995). *The phrase structure of quantifier scope*. Doctoral dissertation, UCLA.

Beghelli, F., & Stowell, T. (1997). Distributivity and negation: The syntax of each and every. In A. Szabolcsi (Ed.), *Ways of scope taking* (pp. 71-107). Dordrecht: Kluwer.

Bhatt, R. (2002). The raising analysis of relative clauses: Evidence from adjectival modification. *Natural Language Semantics,* 10, 43-90. https://doi.org/10.1023/A:1015536226396

Bianchi, V. (1999). *Consequences of antisymmetry: Headed relative clauses*. Berlin: Mouton de Gruyter.

Blok, D. (2019). *Scope oddity: On the semantic and pragmatic interactions of modified numerals, negative indefinites, focus operators, and modals*. Doctoral dissertation, Utrecht University.

Boadi, L. A. (1974). Focus-marking in Akan. *Linguistics,* 140, 5-57. https://doi.org/10.1515/ling.1974.12.140.5

Boadi, L. K. A. (2005). *Three major syntactic structures in Akan: Interrogatives, complementation, and relativization*. Accra: Black Mask.

Bobaljik, J., & Wurmbrand, S. (2012). Word order and scope: transparent interfaces and the ¾ signature. *Linguistic Inquiry*, 43(3), 371–421. http://doi.org/10.1162/LING_a_00094

Bombi, C. (2017). *Definiteness in Akan*. Master's thesis, University of Potsdam.

Bombi, C., Grubic, M., Renans, A., & Duah, R. A. (2019). The semantics of the (so-called) clausal determiner nó in Akan (Kwa). In M. T. Espical, E. Castroviejo, M. Leonetti, L. McNally, & C. Real-Puigdollers (Eds.), *Proceedings of Sinn und Bedeutung 23* (pp. 181-200). Universitat Autònoma de Barcelona. https://doi.org/10.18148/sub/2019.v23i1.510

Bondevik, I., Kush, D., & Lohndal, T. (2021). Variation in adjunct islands: The case of Norwegian. *Nordic Journal of Linguistics*, 44(3), 223-254. https://doi.org/10.1017/S0332586520000207

Bott, O., & Radó, J. (2007). Quantifying quantifier scope: a cross-methodological comparison. In S. Featherston, & W. Sternefeld (Eds.), *Roots – linguistics in search of its evidential base* (pp. 53-74). Berlin: de Gruyter.

Bott, O., & Radó, J. (2009). How to provide exactly one interpretation for every sentence, or what eye movements reveal about quantifier scope. In S. Featherston, & S. Winkler(Eds.), *The Fruits of Empirical Linguistics* (Vol. 1, pp. 25-46). Berlin: de Gruyter.

Bott, O., & Schlotterbeck, F. (2012). Incremental truth value judgments. In B. Stolterfoht, & S. Featherston (Eds.), *Empirical approaches to linguistic theory* (pp. 3-28). Berlin: de Gruyter.

Bott, O., & Schlotterbeck, F. (2015). The processing domain of scope interaction. *Journal of Semantics,* 32(1), 39–92. https://doi.org/10.1093/jos/fft015

Branigan, H. P., & Pickering, M. J. (2017). An experimental approach to linguistic representation. *Behavioral and Brain Sciences*, 40, E282. https://doi.org/10.1017/S0140525X16002028

Brasoveanu, A., & Dotlačil, J. (2015). Strategies for scope taking. *Natural Language Semantics,* 23, 1–19. https://doi.org/10.1007/s11050-014-9109-1

Breheny, R. (2003). Exceptional-scope indefinites and domain restriction. In M. Weisgerber (Ed.), *Proceedings of Sinn und Bedeutung 7* (pp. 38-52). University of Konstanz.

Bresnan, J., & Nikitina, T. (2009). The gradience of the dative alternation. In L. Uyechi, & L. H. Wee (Eds.), *Reality exploration and discovery: Pattern interaction in language and life* (pp. 161-184). Stanford, CA: CSLI.

Brody, M., & Szabolcsi, A. (2003). Overt scope in Hungarian. *Syntax* 6(1), 19-51. https://doi.org/10.1111/1467-9612.00055

Brooks, P. J., & Sekerina, I. A. (2005). Shortcuts to quantifier interpretation in children and adults. *Language Acquisition*, 13, 177-206.

BIBLIOGRAPHY

Brooks, P. J., & Sekerina, I. A. (2006). Shallow processing of universal quantification: A comparison of monolingual and bilingual adults. In R. Sun & N. Miyake (Eds.), *Proceedings of the 28ᵗʰ Annual Conference of the Cognitive Science Society* (pp. 2450). Mahwah, NJ: Erlbaum.

Büring, D. (1994). Topic. In P. Bosch, & R. van der Sandt (Eds.). *Focus and natural language processing* (Vol. 2, pp. 271-280). Heidelberg: IBM Germany.

Büring, D. (1997). The great scope inversion conspiracy. *Linguistics and Philosophy*, 20(2), 175-194. https://www.jstor.org/stable/25001661

Büring, D. (2004). Crossover situations. *Natural Language Semantics,* 12(1), 23-62. https://doi.org/10.1023/B:NALS.0000011144.81075.a8

Campbell, R. (1989). *The grammatical structure of verbal predicates*. Doctoral dissertation, UCLA.

Campbell, R. (1992). Serial verbs and unaccusativity. In C. Collins, & V. Manfredi (Eds.), *Proceedings of the Kwa Comparative Syntax Workshop* (pp. 41-51). Cambridge, MA: MIT.

Campbell, R. (1996). Serial verbs and shared arguments. *The Linguistic Review*, 13(2), 83-118. https://doi.org/10.1515/tlir.1996.13.2.83

Carlson, G. N. (1977a). Amount relatives. *Language*, 53(3), 520-542. https://doi.org/10.2307/413175

Carlson. G. N. (1977b). *Reference to kinds in English*. Doctoral dissertation, University of Massachusetts, Amherst.

Carlson, G. N. (1981) Distribution of free-choice any. In R. Hendrick, C. Masek, & M. Miller (Eds.), *Papers from the 17ᵗʰ Regional Meeting of the Chicago Linguistic Society* (pp. 8-23). Chicago, IL: Chicago University Press.

Catlin, J., & Micham D. L. (1975). Semantic representations as procedures for verification. *Journal of Psycholinguistic Research,* 4, 209-225. https://doi.org/10.1007/BF01066927

Cattell, R. (1978). On the source of interrogative adverbs. *Language*, 54(1), 61-77. https://doi.org/10.2307/412999

Cecchetto, C. (2004). Explaining the locality conditions of QR: Consequences for the theory of phases. *Natural Language Semantics*, 12, 345-397. https://doi.org/10.1007/s11050-004-1189-x

Charlow, S. (2010). Can DP be a scope island? In T. Icard, & R. Muskens (Eds.), *Interfaces: Explorations in Logic, Language and Computation. ESSLLI 2008/2009* (Vol. 6211, pp. 1–12). Berlin: Springer. http://doi.org/10.1007/978-3-642-14729-6_1

Charlow, S. (2020). The scope of alternatives: Indefiniteness and islands. *Linguistics and Philosophy,* 43(4), 427–472. https://doi.org/10.1007/s10988-019-09278-3

Chierchia, G. (1998). Reference to kinds across languages. *Natural Language Semantics*, 6, 339-405. https://doi.org/10.1023/A:1008324218506

Chierchia, G. (2001). A puzzle about indefinites. In C. Cecchetto, G. Chierchia, & M-T. Guasti (Eds.), *Semantic interfaces: Reference, anaphora and aspect* (pp. 51-89). Stanford: CSLI.

Chierchia, G. (2013). Free choice nominals and free choice disjunction: The identity thesis. In A. Fălăuş (Ed.), *Alternatives in semantics* (pp. 50-87). London: Palgrave Macmillan.

Cho, J., Li, Y., & Shields, R. (2021). Gradient acceptability between naïve and expert linguistic intuitions. In A. Botinis (Ed.), *Proceedings of 12ᵗʰ International Conference of Experimental Linguistics* (pp. 49-52). Athens: ExLing Society.

Chomsky, N. (1965). *Aspects of the theory of syntax*. Cambridge, MA: MIT Press.

Chomsky, N. (1975). *Reflections on language*. New York: Pantheon.

Chomsky, N. (1977). On wh-movement. In P. Culicover, T. Wasow, & A. Akmajian (Eds.), *Formal syntax* (pp. 71-132). New York: Academic Press.

Chomsky, N. (1986). *Barriers*. Cambridge, MA: MIT Press.

Chomsky, N. (1993). A minimalist program for linguistic theory. In K. Hale, & S. J. Keyer (Eds.), *The view from Building 20: Essays in linguistics in honor of Sylvain Bromberger* (pp. 1-52). Cambridge, MA: Cambridge University Press.

Chomsky, N. (1995). *The minimalist program*. Cambridge, MA: Cambridge University Press.

Christensen, K. R., & Nyvad, A. M. (2019). No escape from the island: On extraction from complement wh-clauses in English. In K. R. Christensen, H. Jørgensen, & J. L. Wood (Eds.), *The sign of the V – papers in honour of Sten Vikner* (pp. 95-112). Aarhus: AU Library Scholarly Publishing Services. https://doi.org/10.7146/aul.348.91

Chung, S. (2012). Sources of difficulty in L2 scope judgments. *Second Language Research*, 29(3), 285-310. https://doi.org/10.1177/0267658312464969

Chung, S., & McCloskey, J. (1983). On the interpretation of certain island facts in GPSG. *Linguistic Inquiry*, 14(4), 704-713. https://www.jstor.org/stable/4178357

Cinque, G. (1990). *Types of A'-Dependencies*. Cambridge, MA: Cambridge University Press.

Cinque, G. (2010). On a selective "violation" of the Complex NP Constraint. In J.-W. Zwart, & M. de Vries (Eds.), *Structure preserved: Studies in syntax for Jan Koster* (pp. 81-89). Amsterdam: John Benjamins.

Clark, D. G., & Kar J. (2011). Bias of quantifier scope interpretation is attenuated in normal aging and semantic dementia. *Journal of Neurolinguistics*, 24, 401-419. https://doi.org/10.1016/j.jneuroling.2011.01.002

Cooper, R. (1975). *Montague's semantic theory and transformational syntax*. Doctoral dissertation, University of Massachusetts, Amherst.

Cooper, R. (1978). Variable binding and relative clauses. In F. Guenthner, & S. J. Schmidt (Eds.), *Formal semantics and pragmatics for natural language* (pp. 131-169). Dordrecht: Reidel.

Cooper, R. (1983). *Quantification and syntactic theory*. Dordrecht: Reidel.

Cooper, R. (1993).Generalized quantifiers and resource situations. In P. Aczel, D. Israel, Y. Katagiri, & S. Peters (Eds.), *Situation theory and its applications* (pp. 191-211). Stanford: Stanford University Press.

Cooper, R. (1996). The role of situations in generalized quantifiers. In S. Lappin (Ed.), *The handbook of contemporary semantic theory* (pp. 65-86). Oxford: Blackwell.

Corbett, G. (2000). *Number*. Cambridge, MA: Cambridge University Press.

Crain, S., & Steedman, M. (1985). On not being led up the garden path: the use of context by the psychological syntax processor. In D. R. Dowty, L. Karttunen, & A. M. Zwicky (Eds.), *Natural language parsing: Psychological, computational and theoretical perspectives* (pp. 320-358). Cambridge: Cambridge University Press.

Cresti, D. (1995). Extraction and reconstruction. *Natural Language Semantics*, 3(1), 79-122.

Culbertson, J., & Gross, S. (2009). Are linguists better subjects? *The British Journal for the Philosophy of Science*, 60, 721-736.

Dąbrowska, E. (2010). Naïve v. expert competence: An empirical study of speaker intuitions. *The Linguistic Review*, 27, 1-23.

Dąbrowska, E. (2012). Different speakers, different grammars: Individual differences in native language attainment. *Linguistic Approaches to Bilingualism* 2(3), 219-253. https://doi.org/10.1075/lab.2.3.01dab

Dąbrowska, E. (2015). Individual differences in grammatical knowledge. In E. Dąbrowska, & D. Divjak (Eds.), *Handbook of cognitive linguistics* (pp. 649-667). Berlin: de Gruyter.

Dąbrowska, E. (2016). Looking into introspection. In G. Drożdż (Ed.), *Studies in Lexicogrammar: Theory and applications* (pp. 55-74). Amsterdam: John Benjamins.

Dahl, Ö. (1974). Topic-comment structure revisited. In Ö. Dahl (Ed.), *Topic and comment, contextual boundedness and focus* (Vol. 6, pp. 1-24). Hamburg: Buske.

Dal Farra, C. (2019). Variability in adjunct islands: An experimental study in Italian. In R. Stockwell, M. O'Leary, Z. Xu, & Z. L. Zhou (Eds.), *Proceedings of the 36th West Coast Conference on Formal Linguistics* (pp. 115-120). Somerville, MA: Cascadilla Proceedings Project.

Dal Farra, C. (2020). *To be or not to be an island: The status of adjuncts*. Doctoral dissertation, Ca'Foscari University of Venice.

Davidson, D. (1984). Inquiries into truth and interpretation. Oxford: Clarendon Press. https://doi.org/10.1093/0199246297.001.0001

Dayal, V. (1998). Any as inherently modal. *Linguistics and Philosophy*, 21, 433-476. https://doi.org/10.1023/A:1005494000753

Dayal, V. (2004). Number marking and (in)definiteness in kind terms. *Linguistics and Philosophy*, 27, 393-450.

Dayal, V. (2011). Hindi pseudo-incorporation. *Natural Language & Linguistic Theory*, 29, 123-167. https://doi.org/10.1007/s11049-011-9118-4

Dayal, V. (2013). A viability constraint on alternatives for free choice. In A. Fălăuş (Ed.), *Alternatives in semantics* (pp. 88-122). London: Palgrave Macmillan. https://doi.org/10.1057/9781137317247_4

De Cuba, C., & Ürögdi, B. (2009). Eliminating factivity from syntax: Sentential complements in Hungarian. In M. den Dikken, & R. M. Vago (Eds.), *Approaches to Hungarian: Papers from the 2007 New York Conference* (Vol. 11, pp. 29-64). Amsterdam: John Benjamins.

De Hoop, H. (1995). On the characterization of the weak-strong distinction. In E. Bach, E. Jelinek, A. Kratzer, & B. Partee (Eds.), *Quantification in natural languages* (pp. 421-450). Dordrecht: Kluwer.

DelliCarpini, M. (2003). Developmental stages in the semantics acquisition of quantification by adult L2 learners of English: A pilot study. In J. M. Liceras, H. Zobl, & H. Goodluck (Eds.), *Proceedings of the 6th Generative Approaches to Second Language Acquisition Conference* (GASLA 2002), (pp. 55-63). Somerville, MA: Cascadilla Proceedings Project.

Den Dikken, M., Bernstein, J. B., Tortora, C., & Zanuttini, R. (2007). Data and grammar: Means and individuals. *Theoretical Linguistics*, 33(3), 335-352. https://doi.org/10.1515/TL.2007.022

Devitt, M. (2010). Linguistic intuition revisited. *The British Journal for the Philosophy of Science*, 61(4), 833-865.

Diesing, M. (1992). *Indefinites*. Cambridge, MA: Cambridge University Press.

Diesing, M., & Jelinek, E. (1995). Distributing arguments. *Natural Language Semantics*, 3(2), 123-176. https://doi.org/10.1007/BF01249836

Djärv, K. (2019). *Factive and assertive attitude reports*. Doctoral dissertation, University of Pennsylvania.

Dong, H. (2009). *Issues in the semantics of Mandarin questions*. Doctoral dissertation, Cornell University.

Doron, E. (2011). On the syntax and semantics of resumptive pronouns. In A. Rouveret (Ed.), *Resumptive pronouns at the interfaces* (pp. 289–318). Amsterdam: John Benjamins. (Reprinted from *Texas Linguistics Forum* 19, 1–48, 1982)

Driemel, I. (2020a). Pseudo-incorporation and its movement patterns. *Glossa: a journal of general linguistics,* 5(1), 1-40. https://doi.org/10.5334/gjgl.1120

Driemel, I. (2020b). Pseudo-noun incorporation: A DP/VP approach. In M. Asatryan, Y. Song, & A. Whitmal (Eds.), *Proceedings of the 50th Annual Meeting of the North East Linguistic Society* (pp. 173-182). Amherst: GLSA.

Duah, R. A. (2013). *Force dynamics and causation in Akan*. Doctoral dissertation, University of Ghana.

Duah, R. A. (2015). Exhaustive focus marking in Akan. In F. Bildhauer, & M. Grubic (Eds.), *Mood, exhaustivity and focus marking in non-European languages* (pp. 1-28). Potsdam: Universitätsverlag Potsdam.

Duah, R. A., Grubic, M., & Renans, A. (2021). The combination of the indefinite and definite 'determiners' – a cross-linguistic study. In P. G. Grosz, L. Martí, H. Pearson, Y. Sudo, & S. Zobel (Eds.), *Proceedings of Sinn und Bedeutung 25* (pp. 238-255). University College London and Queen Mary University of London.

Dwivedi, V. D., Phillips, N. A., Einagel, S., &, Baum, S. R. (2010). The neural underpinnings of semantic ambiguity and anaphora. *Brain Research,* 1311, 93-109. https://doi.org/10.1016/j.brainres.2009.09.102

Ebert, C., & Hinterwimmer, S. (2010). Quantificational variability effects with plural definites: Quantification over individuals or situations? *Journal of Semantics*, 27(2), 139-176. https://doi.org/10.1093/jos/ffq003

Eisner, J. (1994). '∀'-less in wonderland? Revisiting any. In J. Fuller, H. Han, & D. Parkinson (Eds.), *Proceedings of the Eastern States Conference on Linguistics 11* (pp. 92-103). Ithaca: DMLL Publications.

Enç, M. (1991). The semantics of specificity. *Linguistic Inquiry*, 22(1), 1-25. https://www.jstor.org/stable/4178706

Endriss, C. (2009). *Quantificational topics. A scopal treatment of exceptional wide scope phenomena*. Studies in Linguistics and Philosophy (SLAP, Vol. 86). Dordrecht: Springer.

Engdahl, E. (1980). Wh-constructions in Swedish and the relevance of Subjacency. In J. T. Jensen (Ed.), *Proceedings of the 10th Annual Meeting of the North East Linguistic Society* (pp. 89-108). Ottawa: University of Ottawa.

Engdahl, E. (1982). Restrictions on unbounded dependencies in Swedish. In E. Engdahl, & E. Ejerhed (Eds.), *Readings on unbounded dependencies in Scandinavian languages* (pp. 151-174). Stockholm: Almqvist & Wiksell.

Engdahl, E. (1997). Relative clause extractions in context. *Working Papers in Scandinavian Syntax*, 60, 51-79.

Ernst, T. (2002). *The syntax of adjuncts*. Cambridge: Cambridge University Press.

Erteschik-Shir, N. (1973). *On the nature of island constraints*. Doctoral dissertation, MIT.

Erteschik-Shir, N. (1982). Extractability in Danish and the pragmatic principle of dominance. In E. Engdahl, & E. Ejerhed (Eds.), *Readings on unbounded dependencies in Scandinavian languages* (pp. 175-191). Stockholm: Almqvist & Wiksell International.

Erteschik-Shir, N., & Lappin, S. (1979). Dominance and the functional explanation of island phenomena. *Theoretical linguistics* 6(1-3), 41-86. https://doi.org/10.1515/thli.1979.6.1-3.41

Fábregas, A., & A. L. Jiménez-Fernández. (2016). Extraction from gerunds and the internal syntax of verbs. *Linguistics*, 54(6), 1307-1354. https://doi.org/10.1515/ling-2016-0029

Farkas, D. (1981). Quantifier scope and syntactic islands. In R. A. Hendrick, C. S. Masek, & M. F. Miller (Eds.), *Papers from the 17th regional meeting, Chicago Linguistic Society* (pp. 59–66). Chicago, IL: Chicago University Press.

Farkas, D., & Giannakidou, A. (1996). How clause-bounded is the scope of universals? In T. Galloway, & J. Spence (Eds.), *Proceedings of Semantics and Linguistic Theory 6* (pp. 35–52). Ithaca, NY: Cornell University Press.

Fauconnier, G. (1975). Pragmatic scales and logical structure. *Linguistic Inquiry*, 6(3), 353-375.

Featherston, S. (2007). Data in generative grammar: The stick and the carrot. Theoretical *Linguistics*, 33, 269-318.

Feiman, R., & Snedeker, J. (2016). The logic in language: How all quantifiers are alike, but each quantifier is different. *Cognitive Psychology,* 87, 29–52. https://doi.org/10.1016/j.cogpsych.2016.04.002

Fiengo, R., & Higginbotham, J. (1981). Opacity in NP. *Linguistic Analysis*, 7, 395-421.

Filik, R., Paterson, K. B., & Liversedge, S. P. (2004). Processing doubly quantified sentences: Evidence from eye movements. *Psychonomic Bulletin and Review,* 11, 953-959. https://doi.org/10.3758/BF03196727

Fodor, J. D. (1982). The mental representation of quantifiers. In S. Peters, & E. Saarinen (Eds.), *Processes, beliefs, and questions* (pp. 129-164). Dordrecht: Springer.

Fodor, J. D., & Sag, I. A. (1982). Referential and quantificational indefinites. *Linguistics and Philosophy*, 5(3), 355-398. https://doi.org/10.1007/BF00351459

Fox, D. (1995). Economy and scope. *Natural Language Semantics*, 3, 283-341. http://doi.org/10.1007/BF01248820

Fox, D. (1999). Reconstruction, binding theory, and the interpretation of chains. *Linguistic Inquiry*, 30(2), 157-196. https://doi.org/10.1162/002438999554020

Fox, D. (2000). *Economy and semantic interpretation*. Cambridge, MA: Cambridge University Press.

Fox, D. (2003). On Logical Form. In R. Hendrick (Ed.), *Minimalist syntax* (pp. 82-123). Oxford: Blackwell

Fox, D., & Hackl, M. (2006). The universal density of measurement. *Linguistics and Philosophy*, 29(5), 537-586. https://doi.org/10.1007/s10988-006-9004-4

Fox, D., & Sauerland, U. (1996). Illusive scope of universal quantifiers. In K. Kusumoto (Ed.), *Proceedings of the 26th Annual Meeting of the North East Linguistic Society* (pp. 71-85). Amherst: University of Massachusetts.

Francis, E. (2021). *Gradient acceptability and linguistic theory*. Oxford: Oxford University Press.

Freunberger, D., & Nieuwland, M. S. (2016). Incremental comprehension of spoken quantifier sentences: Evidence from brain potentials. *Brain Research,* 1646, 475-481. https://doi.org/10.1016/j.brainres.2016.06.035

Frey, W. (1993). *Syntaktische Bedingungen für die semantische Repräsentation: Über Bindung, implizite Argumente und Skopus*. Berlin: Akademie Verlag.

Gabbay, D., & Moravscik, J. (1974). Branching quantifiers, English and Montague grammar. *Theoretical Linguistics*, 1(1-3), 139-157. https://doi.org/10.1515/thli.1974.1.1-3.139

Geach, P. (1964). Referring expressions again. *Analysis,* 24(5), 172-175.

Geurts, B. (2000). Indefinites and choice functions. *Linguistic Inquiry*, 31(4), 731-738.

Giannakidou, A. (1998*). Polarity sensitivity as (non)veridical dependency*. Amsterdam: John Benjamins.

Giannakidou, A. (2001). The meaning of free choice. *Linguistics and Philosophy*, 24, 659-735. https://doi.org/10.1023/A:1012758115458

Giannakidou, A. (2008). Negative and positive polarity items: Variation, licensing, and compositionality. In C. Maienborn, K. von Heusinger, & P. Portner (Eds.), *Semantics: An international handbook of natural language meaning* (pp. 69-134). Berlin: de Gruyter.

Giannakidou, A., & Cheng, L. L. (2006). (In)definiteness, polarity, and the role of wh-morphology in free-choice. *Journal of Semantics*, 23(2), 135-183. https://doi.org/10.1093/jos/ffl001

Gibson, E. & Fedorenko, E. (2010). Weak quantitative standards in linguistics research. *Trends in Cognitive Sciences*, 14(6), 233-234.

Gibson, E. & Fedorenko, E. (2013). The need for quantitative methods in syntax and semantics research. *Language and Cognitive Processes*, 28(1-2), 88-124. https://doi.org/10.1080/01690965.2010.515080

Gibson, E., Piantadosi, S. T., & Fedorenko, E. (2013). Quantitative methods in syntax/semantics research: A response to Sprouse and Almeida (2013). Language and Cognitive Processes, 28(3), 229-240. https://doi.org/10.1080/01690965.2012.704385

Gil, D. (1982). Quantifier scope, linguistic variation, and natural language semantics. *Linguistics and Philosophy,* 5(4), 421-472. https://www.jstor.org/stable/25001107

Gillen, K. (1991). *The comprehension of doubly quantified sentences*. Doctoral dissertation, University of Durham.

Givón, T. (1983). *Topic continuity in discourse: A quantitative cross-language study*. Amsterdam: John Benjamins.

Glanzberg, M. (2007). Definite descriptions and quantifier scope: Some mates cases reconsidered. *European Journal of Analytic Philosophy*, 3(2), 133-158.

Gordon, P. C., & Hendrick, R. (1997). Intuitive knowledge of linguistic co-reference. *Cognition*, 62(3), 325-370.

Goro, T. (2007). *Language-specific constraints on scope interpretation in first language acquisition*. Doctoral dissertation, University of Maryland.

Grice, H. P. (1975). Logic and conversation. In P. Cole, & J. Morgan (Eds.), *Syntax and semantics: Speech acts* (pp. 41-58). New York: Academic Press.

Grimshaw. J. (1990). *Argument structure*. Cambridge, MA: Cambridge University Press.

Grubic, M., Renans, A., & Duah, R. A. (2019). Focus, exhaustivity and existence in Akan, Ga and Ngamo. *Linguistics*, 57(1), 221-268. https://doi.org/10.1515/ling-2018-0035

Gualmini, A., Hulsey, S., Hacquard, V., & Fox, D. (2008). The question-answer requirement for scope assignment. *Natural Language Semantics*, 16, 205-237. https://doi.org/10.1007/s11050-008-9029-z

Gundel, J. (1985). 'Shared knowledge' and topicality. *Journal of Pragmatics*, 9(1), 83-107. https://doi.org/10.1016/0378-2166(85)90049-9

Gundel, J., Hedberg, N., & Zacharski, R. (1993). Cognitive status and the form of referring expressions in discourse. *Language*, 69, 274-307.

Hackl, M., Koster-Hale, J., & Varvoutis, J. (2012). Quantification and ACD: Evidence from real-time sentence processing. *Journal of Semantics* 29(2), 145-206. https://doi.org/10.1093/jos/ffr009

Haegeman, L. (2012). *Adverbial clauses, main clause phenomena, and the composition of the left periphery*. Oxford: Oxford University Press

Haegeman, L. & Ürögdi, B. (2010). Referential CPs and DPs: An operator movement account. *Theoretical Linguistics*, 36(2-3), 111-152. https://doi.org/10.1515/thli.2010.008

Haider, H., & Rosengren, I. (2003). Scrambling: Nontriggered chain formation in OV languages. *Journal of Germanic Linguistics* 15(3), 203-267. https://doi.org/10.1017/S1470542703000291

Hajicová, E., Partee, B., & Sgall, P. (1998). *Topic-focus articulation, tripartite structures, and semantic content*. Dordrecht: Kluwer.

Halliday, M. A. (1967). Notes on transitivity and theme in English: Part 2. *Journal of Linguistics*, 3, 37-81.

Hamblin, C. L. (1973). Questions in Montague English. *Foundations of Language*, 10, 41-53.

Han, C. & Kim, J. (2004). Are There "Double Relative Clauses" in Korean? *Linguistic Inquiry*, 35(2), 315-337.

Haspelmath, M. (1997). *Indefinite pronouns*. Oxford: Oxford University Press.

Hawkins, J. (1978). *Definiteness and indefiniteness: A study of reference and grammaticality prediction*. London: Croom Helm.

Hayashishita, J.-R. (2013). On the nature of inverse scope readings. *Gengo Kenkyu,* 143, 29-68. https://doi.org/10.11435/gengo.143.0_29

Hegarty, M. (1992). Adjunct extraction without traces. In D. Bates (Ed.), *Proceedings of the 10th West Coast Conference on Formal Linguistics* (pp. 209-223). Stanford: CSLI.

Heim, I. (1982). *On the semantics of definite and indefinite noun phrases*. Doctoral dissertation, University of Massachusetts, Amherst.

Heim, I. (1991). Artikel und Definitheit. In A. von Stechow and D. Wunderlich (Eds.). *Semantik: Ein internationales Handbuch zur zeitgenössischen Forschung* (pp. 487-535). Berlin: de Gruyter.

Heim, I. (2011). Definiteness and indefiniteness. In K. von Heusinger, & C. Maienborn (Eds.), *Semantics. An international handbook of natural language meaning* (pp. 1025-1058). Berlin: de Gruyter.

Heim, I. (2019). Functional readings without type-shifted noun phrases. In M. Krifka, & M. Schenner (Eds.), *Reconstruction effects in relative clauses* (pp. 283-301). Berlin: de Gruyter. https://doi.org/10.1515/9783050095158

Heim, I., & Kratzer, A. (1998). *Semantics in Generative Grammar*. Oxford: Blackwell.

Hein, J. & Georgi, D. (2020, December 3). Asymmetries in Asante Twi A-bar-movement: On the role of noun type in resumption. [Paper presentation]. Syntax Semantics Lab, University of Delaware.

Hellan, L. (1981). *Towards an integrated analysis of comparatives*. Tübingen: Narr.

Hendriks, H. (1988). Type change in semantics: The scope of quantification and coordination. In E. Klein, & J. van Benthem (Eds.), *Categories, polymorphism and unification (*pp. 96-119). Amsterdam: ITLI.

Hendriks, H. (1993). *Studies flexibility. Categories and types in syntax and semantics*. Doctoral dissertation, University of Amsterdam.

Hofmeister, P., Cassasanto, L. S., & Sag, I. A. (2013). Islands in the grammar? Standards of evidence. In J. Sprouse, & N. Hornstein (Eds.), *Experimental syntax and island effects* (pp. 42-63). Cambridge: Cambridge University Press.

Hofmeister, P., & Sag, I. A. (2010). Cognitive constraints and island effects. Language, 86(2), 366-415. https://doi.org/10.1353/lan.0.0223

Höhle, T. N. (1982). Explikationen für „normale Betonung" und „normale Wortstellung". In W. Abraham (Ed.), *Satzglieder im Deutschen* (pp. 75-153). Tübingen: Narr.

Höhle, T. N. (1991). On reconstruction and coordination. In H. Haider, & K. Netter (Eds.), *Representation and derivation in the theory of grammar* (pp. 138–197). Dordrecht: Kluwer.

Höhle, T. N. (1992). Über Verum-Fokus. In J. Joachim (Ed.), *Informationsstruktur und Grammatik* (pp. 112–141). Opladen: Westdeutscher Verlag.

Honcoop, M. (1998). *Dynamic excursions on weak islands*. Doctoral dissertation, University of Leiden.

Horn., L. (1972). *On the semantic properties of logical operators in English*. Doctoral dissertation, UCLA.

Horn, L. (1989). *A natural history of negation*. Chicago, IL: Chicago University Press.

Horn, L. (2000). Pick a theory: Not just any theory. In L. Horn, & Y. Kato (Eds.), *Negation and polarity: Syntactic and semantic perspectives* (pp. 147-192). Oxford: Oxford University Press.

Hornstein, N. (1984). *Logic as grammar: An approach to meaning in natural language*. Cambridge, MA: MIT Press.

Hornstein, N. (1995). *Logical Form: From GB to Minimalism*. Oxford: Blackwell.

Huang, C.-T. J. (1982). *Logical relations in Chinese and the theory of grammar*. Doctoral dissertation, MIT.

Huang, C.-T. J. (1995). Logical Form. In G. Webelhuth (Ed.), *Government and Binding Theory and the Minimalist Program* (pp. 125–175). Oxford: Blackwell.

Hulsey, S. & Sauerland, U. (2006). Sorting out relative clauses. *Natural Language Semantics,* 14, 111-137. https://doi.org/10.1007/s11050-005-3799-3

Ionin, T. (2001). The one girl who was kissed by every boy: Scope, scrambling and discourse function in Russian. In M. van Koppen, J Sio, & M. de Vos (Eds.), *Proceedings of ConSole X* (pp. 79-94). Leiden: Leiden University.

Ionin, T. (2003). *Article semantics in second language acquisition*. Doctoral dissertation, MIT.

Ionin, T. (2006). This is definitely specific: specificity and definiteness in article systems. *Natural Language Semantics*, 14(2), 175-234. https://doi.org/10.1007/s11050-005-5255-9

Ionin, T. (2013). Pragmatic variation among specificity markers. In C. Ebert, & S. Hinterwimmer (Eds.), *Different kinds of specificity across languages* (pp. 75-103). Dordrecht: Springer.

Ionin, T., & Luchkina, T. (2015). One reading for every word order: Revisiting Russian scope. In U. Steindl, T. Borer, H. Fang, A. García Pardo, P. Guekguezian, B. Hsu, C. O'Hara, & I. Chuoying (Eds.), *Proceedings of the 32ⁿᵈ West Coast Conference on Formal Linguistics* (pp. 21-30). Somerville, MA: Cascadilla Proceedings Project.

Ionin, T. & Luchkina, T. (2018). Focus in Russian scope: An experimental investigation of the relationship between quantifier scope, prosody, and information structure. *Linguistic Inquiry*, 49(4), 741-779. https://doi.org/10.1162/ling_a_00288

Ionin, T., Luchkina, T., & Stoops, A. (2014). Quantifier scope and scrambling in the second language acquisition of Russian. In C.-Y. Chu, C. E. Coughlin, B. L. Prego, U. Minai, & A. Tremblay (Eds.), *Selected Proceedings of the 5ᵗʰ Conference on Generative Approaches to Language Acquisition North America* (pp. 169-180). Somerville, MA: Cascadilla Proceedings Project.

Ionin, T., & Matushansky, O. (2006). The composition of complex cardinals. *Journal of Semantics*, 23, 315-360.

Ioup, G. (1975). Some universals for quantifier scope. In J. Kimball (Ed.), *Syntax and semantics* (pp. 37–58). New York: Academic Press.

Isac, D. (2006). In defense of a quantificational account of definite DPs. *Linguistic Inquiry*, 37(2), 275-288. https://doi.org/10.1162/ling.2006.37.2.275

Jackendoff, R. S. (1972). *Semantic interpretation in Generative Grammar*. Cambridge, MA: Cambridge University Press.

Jackendoff, R. S. (1977). *X' syntax. A study of phrase structure*. Cambridge, MA: MIT Press.

Jacobs, J. (1997). I-Topikalisierung. *Linguistische Berichte*, 168, 91-133.

Jacobson, P. (1992). Raising without movement. In R. K. Larson, S. Iatridou, U. Lahiri, & J. Higginbotham (Eds.), *Control and grammar* (pp. 149-194). Dordrecht: Springer.

Jacobson, P. (1994). Binding connectivity in copular sentences. In M. Harvey, & L. Santelmann (Eds.), *Proceedings of Semantics and Linguistic Theory 4* (pp. 161-178). Ithaca, NY: Cornell University Press.

Jacobson, P. (1996). The locality of interpretation: the case of binding and coordination. In T. Galloway, & J. Spence (Eds.), *Proceedings of Semantics and Linguistic Theory 6* (pp. 111-135). Ithaca, NY: Cornell University Press.

Jacobson, P. (2019). Deconstructing reconstruction. In M. Krifka, & M. Schenner (Eds.), *Reconstruction effects in relative clauses* (pp. 303-355). Berlin: de Gruyter. https://doi.org/10.1515/9783050095158

Johnson-Laird. (1969). On understanding logically complex sentences. *Quarterly Journal of Experimental Psychology*, 21(1), 1-13. https://doi.org/10.1080/14640746908400187

Kadmon, N., & Landman, F. (1993). Any. *Linguistics and Philosophy*, 16(4), 353-422. https://www.jstor.org/stable/25001516

Kamp, H., & Reyle, U. (1993). Tense and aspect. In H. Kamp, & U. Reyle (Eds.), *From discourse to logic: Introduction to modeltheoretic semantics of natural language, formal logic and Discourse Representation Theory* (pp. 483-689). Dordrecht: Springer.

Karttunen, L. (1968). *What do referential indices refer to?* Santa Monica: RAND Corporation.

Karttunen, L. (1977). Syntax and semantics of questions. *Linguistics and Philosophy*, 1, 3-44. https://doi.org/10.1007/BF00351935

Kastner, I. (2015). Factivity mirrors interpretation: The selectional requirements of presuppositional verbs. *Lingua*, 164, 156-188. https://doi.org/10.1016/j.lingua.2015.06.004

Kayne, R. S. (1994). *The antisymmetry of syntax*. Cambridge, MA: Cambridge University Press.

Keenan, E. L. (1992). Beyond the Frege boundary. *Linguistics and Philosophy*, 15(2), 199-221. https://doi.org/10.1007/BF00635807

Keenan, E. L., & Stavi, J. (1986). A semantic characterization of natural language determiners. *Linguistics and Philosophy*, 9(3), 253-326. https://www.jstor.org/stable/25001246

Keller, F. (2001). *Gradience in grammar: Experimental and computational aspects of degrees of grammaticality*. Doctoral Dissertation, University of Edinburgh.

Kempson, R. M., & Cormack, A. (1981). Ambiguity and quantification. *Linguistics and Philosophy*, 4, 259-309.

Kennelly, S. D. (2004). Pragmatics and quantificational dependencies. *Lingua*, 114(3), 367-388.

Kiefer, F. (1990). Noun incorporation in Hungarian. *Acta Linguistica Hungarica*, 40(1-2), 149-177.

Kiparsky, P., & Kiparsky, C. (1970). Fact. In M. Bierwisch, & K. E. Heidolph (Eds.), *Progress in linguistics* (pp. 143-173). The Hague: Mouton.

Kiselyov, O., & Shan, C. (2014). Continuation hierarchy and quantifier scope. In E. McCready, K. Yabushita, & K. Yoshimoto, *Formal approaches to semantics and pragmatics* (pp. 105-134). Dordrecht: Springer. https://doi.org/10.1007/978-94-017-8813-7_6.

Kitagawa, Y. (1990). Anti-scrambling. [Unpublished manuscript]. University of Rochester.

Kitagawa, Y. (1994). Shells, yolks and scrambled eggs. In M. González (Ed.), *Proceedings of the 24th Annual Meeting of the North East Linguistic Society* (pp. 221-239). Amherst: GLSA.

Kluender, R. (1998). On the distinction between strong and weak islands: A processing perspective. In P. Culicover, & L. McNally (Eds.), *Syntax & semantics 29: The limits of syntax* (pp. 241-279). San Diego, CA: Academic Press.

Kluender, R. (2004). Are subject islands subject to a processing account? In V. Chand, A. Kelleher, A. J. Rodriguez, & B. Schmeiser (Eds.), *Proceedings of the 23rd West Coast Conference on Linguistics* (pp. 101-125). Somerville, MA: Cascadilla Press.

Kluender, R. & Kutas, M. (1993). Subjacency as a processing phenomenon. *Language and Cognitive Processes*, 8, 573-633.

Korsah, S. (2017). *Issues in Kwa syntax. Pronouns and clausal determiners*. Doctoral dissertation, Universität Leipzig.

Korsah, S., & Murphy, A. (2020). Tonal reflexes of movement in Asante Twi. *Natural Language & Linguistic Theory*, 38(3), 827-885. https://doi.org/10.1007/s11049-019-09456-9

Kratzer, A. (1998). Scope or pseudoscope? Are there wide-scope indefinites? In S. Rothstein (Ed.), *Events and grammar* (pp. 163-196). Dordrecht: Kluwer.

Kratzer, A., & Shimoyama, J. (2002). Indeterminate pronouns: The view from Japanese. In Y. Otsu (Ed.), *The proceedings of the third Tokyo conference on psycholinguistics* (pp. 1-25). Tokyo: Hituzi Syobo. https://doi.org/10.1007/978-3-319-10106-4_7

Krifka, M. (1989). Nominal reference, temporal constitution and quantification in event semantics. In R. Bartsch, J. van Benthem, & P. van Emde Boas (Eds.), *Semantics and contextual expressions* (pp. 75-115). Dordrecht: Foris.

Krifka, M. (1992). Definite NPs aren't quantifiers. *Linguistic Inquiry*, 23(1), 156-163. https://www.jstor.org/stable/4178762

Krifka, M. (1998). Scope inversion under the rise-fall pattern in German. *Linguistic Inquiry,* 29(1), 75–112. http://doi.org/10.1162/002438998553662

Krifka, M. (2008). Basic notions of information structure. *Acta Linguistica Hungarica,* 55(3-4), 243–276. https://doi.org/10.1556/aling.55.2008.3-4.2

Kroch, A. S. (1974). *The semantics of scope in English*. Doctoral dissertation, MIT.

Kuno, S. (1972). Functional sentence perspective: A case study from Japanese and English. *Linguistic Inquiry*, 3(3), 269-336. https://www.jstor.org/stable/4177715

Kuno, S. (1976). Subject, theme, and the speaker's empathy: A reexamination of relativization phenomena. In C. Li (Ed.), *Subject and topic* (pp. 417–444). New York: Academic Press.

Kuno, S. (1991). Remark on quantifier scope. In H. Nakajima (Ed.), *Current English linguistics in Japan* (pp. 261-287). Berlin: de Gruyter.

Kuroda, S.-Y. (1970). Remarks on the notion of subject with reference to words like also, even or only. *Annual Bulletin,* 4, 127-152.

Kurtzman, H. S., & MacDonald, M. C. (1993). Resolution of quantifier scope ambiguities. *Cognition*, 48(3), 243–279. https://doi.org/10.1016/0010-0277(93)90042-T

Kush, D., Omaki, A., & Hornstein, N. (2013). Microvariation in islands? In J. Sprouse, & N. Hornstein (Eds.), *Experimental syntax and island effects* (pp. 239-264). Cambridge: Cambridge University Press.

Kush, D., Lohndal, T., & Sprouse, J. (2018). Investigating variation in island effects. *Natural Language & Linguistic Theory*, 36, 743-779. https://doi.org/10.1007/s11049-017-9390-z

Kush, D., Lohndal, T., & Sprouse, J. (2019). On the island sensitivity of topicalization in Norwegian: An experimental investigation. *Language,* 95(3), 393-420.

Ladd, D. R. (1980). *The structure of intonational meaning*. Bloomington: Indiana University Press.

Ladusaw, W. A. (1979). *Polarity sensitivity as inherent scope relations*. Doctoral dissertation, University of Texas, Austin.

Lahiri, U. (1995). Negative polarity in Hindi. In M. Simons, & T. Galloway (Eds.), *Proceedings of Semantics and Linguistic Theory 5* (pp. 168-185). Ithaca, NY: Cornell University Press.

Lahiri, U. (1998). Focus and negative polarity in Hindi. *Natural Language Semantics*, 6, 57-123.

Lakoff, G. (1970). Repartee. *Foundations of Language*, 6, 389-422.

Lakoff, G. (1971). On generative semantics. In D. D. Steinberg, & L. A. Jakobovits (Eds.), *Semantics: An interdisciplinary reader in philosophy, linguistics, and psychology*. Cambridge, MA: Cambridge University Press.

Lambrecht, K. (1994). *Information structure and sentence form*. Cambridge, MA: Cambridge University Press.

Landman, F. (2000). *Events and plurality: The Jerusalem lectures*. Dordrecht: Kluwer.

Larson, R. K. (1990). Double objects revisited: Reply to Jackendoff. *Linguistic Inquiry*, 21, 589-391.

Lasnik, H. & Saito, M. (1992). *Move alpha: Conditions on its application and output*. Cambridge, MA: MIT Press.

Lechner, W. (1996). On semantic and syntactic reconstruction. *Wiener Linguistische Gazette*, 57-59, 63-100.

Lee, C. (1996). Negative polarity items in English and Korean. *Language Sciences*, 18, 503-523.

Lee, T. (1986). *Studies on quantification in Chinese*. Doctoral dissertation, UCLA.

Lee, T., Yip, V., & Wang, C. (1999). Inverse scope in Chinese-English Interlanguage. *Lingua Posnaniensis*, 41, 39-56.

Lee, Y.-S. & Horn, L. (1994). Any as indefinite plus even [Unpublished manuscript]. Yale University.

Lees, R. B. (1960). *The grammar of English nominalizations*. The Hague: Mouton.

Lenerz, J. (1977). *Zur Abfolge nominaler Satzglieder im Deutschen*. Tübingen: Narr.

Liberman, M., & Sag, I. (1974). Prosodic form and discourse function. In M. W. La Galy, R. A. Fox, & A. Bruck (Eds.), *Papers from the 10th Regional Meeting of the Chicago Linguistics Society*, 416-427. Chicago, IL: Chicago University Press.

Lidz, J., & Musolino, J. (2002). Children's command of quantification. *Cognition*, 84(2), 113-154. https://doi.org/10.1016/S0010-0277(02)00013-6

Lindahl, F. (2015). Swedish relative clauses as weak islands. In *LSA Annual Meeting Extended Abstracts*. https://doi.org/10.3765/exabs.v0i0.3000

BIBLIOGRAPHY

Lindahl, F. (2017). *Extraction from relative clauses in Swedish*. Doctoral dissertation, University of Gothenburg.

Link, G. (1983). The logical analysis of plurals and mass terms: A lattice-theoretic approach. In R. Bäuerle, C. Schwarze, & A. von Stechow (Eds.), *Meaning, use, and interpretation of language* (pp. 302-323). Berlin: de Gruyter.

Liu, F. H. (1990). *Scope dependency in English and Chinese*. Doctoral dissertation, UCLA.

Liu, M., & Yang, Y. (2021). Modal wh-indefinites in Mandarin. In P. G. Grosz, L. Martí, H. Pearson, Y. Sudo, & S. Zobel (Eds.), *Proceedings of Sinn und Bedeutung 25* (pp. 581-599). University College London and Queen Mary University of London.

Löbner, S. (1990). *Wahr neben falsch*. Tübingen: Niemeyer.

Longobardi, G. (1994). Reference and proper names: A theory of N-movement in syntax and logical form. *Linguistic Inquiry*, 2584), 609-665.

Lyons, C. (1999). *Definiteness*. Cambridge, MA: Cambridge University Press.

Mahajan, A. (2018). Quantification in Hindi. In E. L. Keenan, & D. Paperno (Eds.). *Handbook of quantifiers in natural language* (Vol. 2, pp. 383-430). Dordrecht: Springer. https://doi.org/10.1007/978-3-319-44330-0_7

Mahowald, K., Hartman, J., Graff, P., & Gibson, E. (2016). SNAP judgments: A small N acceptability paradigm (SNAP) for linguistic acceptability judgments. *Language*, 92(3), 619-635. https://www.jstor.org/stable/44164109

Malenica, F., Vukosav, M. K., & D. Lečić. (2019). Disagreement over agreement – a comparison of naïve and expert intuitions. *Suvremena lingvistika*, 45(87), 59-81. https://doi.org/10.22210/suvlin.2019.087.07

Maling, J., & Zaenen, A. (1982). A phase structure account of Scandinavian extraction phenomena. In P. Jacobson, & G. K. Pullum (Eds.), *The nature of syntactic representation* (pp. 229-282). Dordrecht: Springer.

Marantz, A. (2005). Generative linguistics within the cognitive neuroscience of language. *The Linguistic Review*, 22, 429-445.

Marfo, C., & Bodomo, A. (2005). Information structure in Akan question-word fronting and focus constructions. *Studies in African Linguistics*, 34(2), 179-208. https://doi.org/10.32473/sal.v34i2.107330

Marsden, H. L. (2004). *Quantifier scope ambiguities in non-native Japanese: A comparative interlanguage study of Chinese-, English-, and Korean-speaking learners*. Doctoral dissertation, Durham University.

Marsden, H. (2009). Distributive quantifier scope in English-Japanese and Korean-Japanese interlanguage. *Language Acquisition*, 16(3), 135-177. https://doi.org/10.1080/ 10489220902967135

Martí, L. (2003). *Contextual variables*. Doctoral dissertation, University of Connecticut.

Martin, C. (2010). *On the structure and derivation of Twi multi-verb constructions: Serialization despite multiple clauses*. Bachelor's thesis, University of Kansas.

Massam, D. (2009). Noun incorporation: Essentials and extensions. *Language and Linguistic Compass*, 3(4), 1076-1096.

Matthewson, L. (1999). On the interpretation of wide-scope indefinites. *Natural Language Semantics*, 9(2), 145-189.

Matthewson, L. (2004). On the methodology of semantic fieldwork. *International Journal of American Linguistics*, 70(1), 369-415.

May, R. (1977). *The grammar of quantification*. Doctoral dissertation, MIT.

May, R. (1985). *Logical Form*. Cambridge, MA: Cambridge University Press.

May, R., & Bale, A. (2006). Inverse linking. In M. Everaert, & H. van Riemsdijk (Eds.), *Blackwell companion to syntax* (pp. 639-667). Oxford: Blackwell. http://doi.org/10.1002/9780470996591.ch36

Mayr, C., & Spector, B. (2012). Generalized scope economy – Not too strong. In M. Prinzhorn, V. Schmitt, & S. Zobel, *Proceedings of Sinn und Bedeutung 14* (pp. 305-321). Vienna.

McCawley, J. D. (1981). The syntax and semantics of English relative clauses. *Lingua,* 53(2-3), 99–149. https://doi.org/10.1016/0024-3841(81)90014-0

Menéndez-Benito, P. (2005). *The grammar of choice*. Doctoral dissertation, University of Massachusetts, Amherst.

Menéndez-Benito, P. (2010). On universal free choice items. *Natural Language Semantics*, 18, 33-64.

Micham, D. L., Catlin, J., van Derveer, N. J., & Loveland, K. A. (1980). Lexical and structural cues to quantifier scope relations. *Journal of Psycholinguistic Research,* 9, 367–377. https://doi.org/10.1007/BF01067449.

Milsark, G. (1974). *Existential sentences in English*. Doctoral dissertation, MIT.

Milsark, G. (1977). Toward an explanation of certain peculiarities of the existential construction in English. *Linguistic Analysis*, 3, 1-29.

Miyagawa, S. (2012). Optionality. In C. Boeckx (Ed.), *The Oxford handbook of linguistic minimalism* (pp. 354-376). Oxford: Oxford University Press.

Miyamoto, Y., & Yamane, M. (1996). L2 rigidity: the scope principle in adult L2 grammar. In A. Stringfellow, D. Cahana-Amitay, E. Hughes, & Andrea Zukowski (Eds.), *Proceedings of the 22nd annual Boston University conference on language development* (Vol. 2, pp. 494-505). Somerville, MA: Cascadilla Press.

Modarresi, F. (2014). *Bare nouns in Persian: Interpretation, grammar, and prosody*. Doctoral dissertation, University of Ottawa.

Mojapelo, M. L. (2007). *Definiteness in Northern Sotho*. Doctoral dissertation, University of Stellenbosch.

Molnár, V. (1993). Zur Pragmatik und Grammatik des TOPIK-Begriffes. In M. Reis (Ed.), *Wortstellung und Informationsstruktur* (pp. 155-202). Tübingen: Niemeyer.

Moltmann, F. (1992). Reciprocals and "same/different": Towards a semantic analysis. *Linguistics and Philosophy*, 15(4), 411-462. https://www.jstor.org/stable/25001480

Montague, R. (1973). The proper treatment of quantification in ordinary English. In K. J. J. Hintikka, J. M. E. Moravcsik, & P. Suppes (Eds.), *Approaches to Natural Language: Proceedings of the 1970 Stanford Workshop* (pp. 221–242). Dordrecht: Reidel. https://doi.org/10.1007/978-94-010-2506-5_10

Müller, C. (2015). Against the small clause hypothesis: Evidence from Swedish relative clause extractions. *Nordic Journal of Linguistics*, 38(1), 67-92.

Müller, C. (2017). Extraction from adjunct islands in Swedish. *Norsk Lingvistisk Tidsskrift*, 35, 67-85.

Müller, C. (2019). *Permeable islands*. Doctoral dissertation, Lund University.

Munn, A. (1994). A minimalist account of reconstruction asymmetries. In M. Gonzàlez (Ed.), *Proceedings of the 24th Annual Meeting of the North East Linguistic Society* (pp. 397-410). Amherst, MA: GLSA.

Musolino, J. (1998). *Universal grammar and the acquisition of semantic knowledge: An experimental investigation into the acquisition of quantifier negation interaction in English*. Doctoral dissertation, University of Maryland.

Musolino, J., & Lidz, J. (2006). Why children aren't universally successful with quantification. *Linguistics*, 44(4), 817-852. https://doi.org/10.1515/LING.2006.026

Nasta, A. (2015). *Varieties of linguistic economy. Essays on scope and binding*. Doctoral dissertation, University of East Anglia.

Neeleman, A., & Titov, E. (2009). Focus, contrast, and stress in Russian. *Linguistic Inquiry*, 40(3), 514-524. https://www.jstor.org/stable/40284328

Newman, P. (2000). *The Hausa language*. New Haven & London: Yale University Press.

Nyvad, A. M., Christensen, K. R., & Vikner, S. (2017). CP-recursion in Danish: A cP/CP-analysis. *The Linguistic Review*, 34(3), 449-477.

Ofori, S. A. (2011). On the basic focus marker, and the basic focus sentence, in Akan (Twi). *Nordic Journal of African Studies*, 20(3), 241-262. https://doi.org/10.53228/njas.v20i3.184

Oikonomou, D., Golcher, F., & Alexiadou, A. (2020). Quantifier scope and information structure in Greek. *Glossa: a journal of general linguistics*, 5(1), 1-36.

Osam, E. K. (1994). *Aspects of Akan grammar: A functionalist perspective*. Doctoral dissertation, University of Oregon.

Osam, E. K. (2008). Akan as an aspectual language. In F. K. Ameka, & M. E. Kropp Dakubu (Eds.), *Aspect and modality in Kwa languages* (pp.69-90). Amsterdam: John Benjamins.

Oshima, D. Y. (2007). On factive islands: Pragmatic anomaly vs. pragmatic infelicity. In T. Washio, K. Satoh, H. Takeda, & A. Inokuchi (Eds.), *Proceedings of JSAI 2006* (pp. 147-161). Berlin: Springer. https://doi.org/10.1007/978-3-540-69902-6

Owusu, A. P. (2015). *Linguistic strategies in the expression of modality in Akan*. Master's thesis, University of Ghana.

Owusu, A. P. (2019). A closer look at the Akan determiner bi: An epistemic indefinite analysis. In S. Lotven, S. Bongiovanni, P. Weirich, R. Botne, & S. G. Obeng (Eds.), *African linguistics across the disciplines: Selected papers from the 48th Annual Conference on African Linguistics* (pp. 257-280). Berlin: Language Science Press.

Owusu, A. P. (2020). Cross-categorial definiteness/familiarity. [Unpublished manuscript]. Rutgers University.

Özçelik, Ö. (2009). L2 acquisition of scope: Testing the full transfer full access hypothesis. In M. Bowles, T. Ionin, S. Montrul, & A. Tremblay (Eds.), *Proceedings of the 10th Generative Approaches*

to Second Language Acquisition Conference (pp. 168-179). Somerville, MA: Cascadilla Proceedings Project.

Pafel, J. (2005). *Quantifier scope in German*. Amsterdam: John Benjamins.

Partee, B. (1986). Noun phrase interpretation and type-shifting principles. In J. Groenendijk, D. de Jongh, & M. Stokhof (Eds.), *Studies in Discourse Representation Theory and the theory of generalized quantifiers* (pp. 115-144). Dordrecht: Foris.

Partee, B. (1991). Topic, focus and quantification. In S. Moore, & A. Z. Wyner (Eds.), *Proceedings of Semantics and Linguistic Theory 11* (pp. 159-188). Ithaca, NY: Cornell University Press.

Partee, B., & Rooth, M. (1983). Generalized conjunction and type ambiguity. In R. Bäuerle, C. Schwarze, & A. von Stechow (Eds.), *Meaning, use, and interpretation of language* (pp. 361-383). Berlin: de Gruyter.

Partee, B., Bach, E., & Kratzer, A. (1987). Quantification: A cross-linguistic investigation. [Unpublished manuscript]. University of Massachusetts, Amherst.

Phillips, C. (2009). Should we impeach armchair linguists? In S. Iwasaki, H. Hoji, P. Clancy, & S.-O. Sohn (Eds.), *Japanese-Korean Linguistics* (Vol. 17, pp. 49-64). Stanford, CA: CSLI Publications.

Portner, P., & Yabushita, K. (1998). The semantics and pragmatics of topic phrases. *Linguistics and Philosophy*, 21(2), 117-157. https://www.jstor.org/stable/25001699

Portner, P., & Yabushita, K. (2001). Specific indefinites and the information structure theory of topics. *Journal of Semantics*, 18(3), 221-297. https://doi.org/10.1093/jos/18.3.271

Postma, G. (1994). The indefinite reading of WH. In R. Bok-Bennema, & C. Cremers (Eds.), *Linguistics in the Netherlands* (pp. 187-198). Amsterdam: John Benjamins.

Pritchett, B. L. (1991). Subjacency in a principle-based parser. In R.C. Berwick, S. P. Abney, & C. Tenny (Eds.), *Principle-based parsing: Computation and psycholinguistics* (pp. 301-345). Dordrecht: Kluwer.

Pylkkänen, L., & McElree, B. (2006). The syntax-semantics interface: Online composition of sentence meaning. In M. Traxler, & M. A. Gernsbacher (Eds.), *Handbook of psycholinguistics* (pp. 539-579). New York: Elsevier.

Quine, W. V. O. (1960). *Word and object*. Cambridge, MA: MIT Press.

R Core Team (2019). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. Vienna, Austria. https://www.R-project.org/.

Radó, J., & Bott O. (2012). Underspecified representations of scope ambiguity? In M. Aloni, V. Kimmelmann, F. Roelofsen, G. W. Sassoon, K. Schulz, & M. Westera (Eds.), *Logic, Language and Meaning: 18th Amsterdam Colloquium* (pp. 180–189). Amsterdam: Springer.

Radó, J., & Bott, O. (2018). What do speaker judgments tell us about theories of quantifier scope in German? *Glossa: a journal of general linguistics,* 3(1), 1-29. https://doi.org/10.5334/gjgl.309

Reinhart, T. (1976). *The syntactic domain of anaphora*. Doctoral dissertation, MIT.

Reinhart, T. (1983). *Anaphora and semantic interpretation*. London: Croom Helm.

Reinhart, T. (1995). Interface strategies (OTS working papers in linguistics). [Unpublished manuscript]. Utrecht University.

Reinhart, T. (1997). Quantifier scope: How labour is divided between QR and choice Functions. *Linguistics and Philosophy*, 20, 335-397. http://doi.org/10.1023/ A:1005349801431

Reinhart, T. (2006). *Interface strategies*. Cambridge, MA: Cambridge University Press.

Renans, A., Sağ, Y., Ketrez, F. N., Tieu, L. Tsoulas, G., Folli, R., de Vries, H., & Romoli, J. (2020). Plurality and crosslinguistic variation: an experimental investigation of the Turkish plural. *Natural Language Semantics*, 28, 307-342. https://doi.org/10.1007/s11050-020-09165-9

Rizzi, L. (1990). *Relativized minimality*. Cambridge, MA: MIT Press.

Rodman, R. (1976). Scope phenomena, movement transformations, and relative clauses. In B. Partee (Ed.) *Montague grammar* (pp. 165-176). New York: Academic Press. https://doi.org/10.1016/B978-0-12-545850-4.50011-X

Rooryck, J. (1992). Negative and factive islands revisited. *Journal of Linguistics*, 28, 343-374.

Ross, J. R. (1967). *Constraints on variables in syntax*. Doctoral dissertation, MIT.

Rubowitz-Mann, T. (2000). *Extraction from relative clauses: An information structure account*. Doctoral dissertation, The Hebrew University of Jersualem.

Rullmann, H. (1995). *Maximality in the same semantics of wh-constructions*. Doctoral dissertation, University of Massachusetts, Amherst.

Ruys. E. G. (1992). *The scope of indefinites*. Doctoral dissertation, Utrecht University.

Ruys, E. G. (2015). A minimalist condition on semantic reconstruction. *Linguistic Inquiry*, 46(3), 453-488.

Ruys, E. G., & Winter, Y. (2011). Quantifier scope in formal linguistics. In D. Gabbay, & F. Guenthner (Eds.), *Handbook of philosophical logic* (pp. 159-225). Dordrecht: Springer. https://doi.org/10.1007/978-94-007-0479-4_3

Saah, K. K. (1988). Wh-questions in Akan. *Journal of West African Languages*, 18(1), 17-28.

Saah, K. K. (1994). *Studies in Akan syntax, acquisition, and sentence processing*. Doctoral dissertation, University of Ottawa.

Saah, K. K. (2010). Relative clauses in Akan. In E. Aboh, & J. Essegbey (Eds.), *Topics in Kwa syntax* (pp. 91-107). London: Springer.

Saah, K. K., & Goodluck, H. (1995). Island effects in parsing and grammar: Evidence from Akan. *Linguistic Review*, 12, 381-409. https://doi.org/10.1515/tlir.1995.12.4.381

Saba, W. S., & Corriveau, J. P. (1997). A pragmatic treatment of quantification in natural language. In M. Kaufmann (Ed.), *Proceedings of the 14th National Conference on Artificial Intelligence and 9th Innovative Applications of Artificial Intelligence Conference (AAAI/IAAI)* (pp. 610-615).

Saba, W. S., & Corriveau, J. P. (2001). Plausible reasoning and the resolution of quantifier scope ambiguities. *Studia Logica*, 67(1), 271-289. https://doi.org/10.1023/ A:1010503321412

Sabel, J. (2005). String-vacuous scrambling and the effect on output condition. In J. Sabel, & M. Saito (Eds.), *The free word order phenomenon* (pp. 281-334). Berlin: de Gruyter.

Saddy, J. D. (1995). Variables and events in the syntax of agrammatic speech. *Brain and Language*, 50(2), 135-150.

Sæbø, K. J. (1997). Topic, focus and quantifier raising. In P. Dekker, M. Stokhof, & Y. Venema (Eds.), *Proceedings of the 11th Amsterdam Colloquium* (pp. 67-72). ILLC/University of Amsterdam.

Sæbø, K. J. (2001). The semantics of Scandinavian free choice items. *Linguistics and philosophy*, 24, 737-788.

Sakai, H. (1994). Complex NP constraint and case conversions in Japanese. In M. Nakamura (Ed.), *Current topics in English and Japanese* (pp. 179-203). Tokyo: Hituzi Syobo.

Sakyi, J. P. (2019). *Modality and evidentiality in Akan: A corpus-based study*. Doctoral dissertation, University of Antwerp.

Salzmann, M. (2006). Reconstruction in German restrictive relative clauses. *Linguistics in the Netherlands*, 23(1), 186-198.

Salzmann, M. (2019). A new version of the matching analysis of relative clauses. In M. Krifka, & M. Schenner (Eds.), *Reconstruction effects in relative clauses* (pp. 187-224). Berlin: de Gruyter. https://doi.org/10.1515/9783050095158

Sanford, A. J., & Garrod, S. C. (1998) The role of scenario mapping in text comprehension, *Discourse Processes*, 26(2-3), 159-190. https://doi.org/10.1080/01638539809545043

Sato, Y., & Maeda, M. (2018). Spelling-out inverse scope in Japanese: Intonation and scope-prosody correspondence. *Phonological Externalization*, 3, 25-53.

Sauerland, U. (1998). *The meaning of chains*. Doctoral dissertation, MIT.

Sauerland, U. (2000). Two structures for English restrictive relative clauses. In M. Saito, Y. Abe, H. Aoyagi, J. Arimoto, K. Murasugi, & T. Suzuki (Eds.), *Proceedings of the Nanzan GLOW* (pp. 351-366). Nagoya: Nanzan University Press.

Sauerland, U. (2005). DP is not a scope island. *Linguistic Inquiry*, 36, 303–314. http://doi.org/10.1162/0024389053710657

Sauerland, U., & Bott, O. (2002). Prosody and scope in German inverse linking constructions. In B. Bel, & I. Marlien (Eds.), *Proceedings of the 1st International Conference on Speech Prosody* (pp. 623-628). Aix-en-Provence.

Sauerland, U., Andersen, J., & Yatsushiro, K. (2005). The plural is semantically unmarked. In S. Kepser, & M. Reis (Eds.), *Linguistic evidence: Empirical, theoretical, and computational perspectives* (pp. 413–434). Berlin: de Gruyter.

Scha, R. (1981). Distributive, collective, and cumulative quantification. In J. Groenendijk, T. Janssen, & M. Stokhof (Eds.), *Formal methods in the study of language* (pp. 483-512). Amsterdam: Mathematical Centre.

Schachter, P. (1973). Focus and relativization. *Language*, 49(1), 19-46. https://doi.org/10.2307/412101

Schenner, M. (2019). An introduction to reconstruction effects in relative clauses. In M. Krifka, & M. Schenner (Eds.), *Reconstruction effects in relative clauses* (pp. 1-33). Berlin: de Gruyter. https://doi.org/10.1515/9783050095158

Schütze, C. T. (1996). *The empirical base of linguistics: Grammaticality judgments and linguistic methodology*. Chicago, IL: Chicago University Press.

Schwarz, F. (2009). *Two types of definites in natural language*. Doctoral dissertation, University of Massachusetts, Amherst.

Schwarz, F. (2012). Situation pronouns in determiner phrases. *Natural Language Semantics*, 20, 431-475. https://doi.org/10.1007/s11050-012-9086-1

Schwarz, B., & Simonenko, A. (2016). Two pragmatic accounts of factive islands. In B. Prickett, & C. Hammerly (Eds.), *Proceedings of the 46th Annual Meeting of the North East Linguistic Society* (Vol. 3, pp. 169-179). Amherst: GLSA.

Schwarzschild, R. (2002). Singleton indefinites. *Journal of Semantics*, 19, 289-314. https://doi.org/10.1093/jos/19.3.289

Scontras, G., & Gibson, E. (2011). A quantitative investigation of the imperative-and-declarative construction in English. *Language*, 87(4), 817-829.

Scontras, G., Polinsky, M., Tsai C.-Y. E., & Mai, K. (2017). Cross-linguistic scope ambiguity: When two systems meet. *Glossa: a journal of general linguistics* 2(1), 1–28. https://doi.org/10.5334/gjgl.198

Shan, C., & Barker, C. (2006). Explaining crossover and superiority as left-to-right evaluation. *Linguistics and Philosophy,* 29(1), 91-134. https://doi.org/10.1007/s10988-005-6580-7

Sharvit, Y. (1999). Functional relative clauses. *Linguistics and Philosophy*, 22(5), 447-478. https://www.jstor.org/stable/25001753

Sheehan, M. (2013). The resuscitation of the CED. In S. Kan, C. Moore-Cantwell, & R. Staubs (Eds.), *Proceedings of the 40th Annual Meeting of the North East Linguistic Society* (pp. 135-150). Amherst: GLSA.

Sichel. I. (2018). Anatomy of a counterexample: Extraction from relative clauses. *Linguistic Inquiry*, 49(2), 335-378. https://doi.org/10.1162/LING_a_00275

Šimík, R. (2021). Inherent vs. accidental uniqueness in bare and demonstrative nominal. In A. Blümel, J. Gajić, L. Geist, U. Junghanns, & H. Pitsch (Eds.), *Advances in formal Slavic linguistics 2018* (pp. 365-391). Berlin: Language Science Press.

Simons, M. (2001). On the conversational basis of some presuppositions. In R. Hastings, B. Jackson, & Z. Zvolensky (Eds.), *Proceedings of Semantics and Linguistic Theory 11* (pp. 431-448). Ithaca, NY: CLC Publications.

Simons, M. (2004). Presuppositions and relevance. In Z. Szabó (Ed.), *Semantics vs. pragmatics* (pp. 329-355). Oxford: Oxford University Press.

Simons, M., Beaver, D., Roberts, C., & Tonhauser, J. (2017). The best questions: Explaining the projection behaviour of factives. *Discourse Processes*, 54(3), 187-206. https://doi.org/10.1080/0163853X.2016.1150660

Sportiche, D. (2006). Reconstruction, binding and scope. In M. Everaert, & H. van Riemsdijk (Eds.), *The Blackwell companion to syntax* (pp. 35-93). Oxford: Blackwell.

Sprouse, J., & D. Almeida. (2012). Assessing the reliability of textbook data in syntax: Adgers Core Syntax 1. *Journal of Linguistics*, 48(3), 609-652. https://doi.org/10.1017/S0022226712000011

Sprouse, J., & D. Almeida. (2013). The empirical status of data in syntax: A reply to Gibson & Fedorenko. *Language and Cognitive Processes*, 28(3), 222-228.

Sprouse, J., Schütze, C. T., & D. Almeida. (2013). A comparison of informal and formal acceptability judgments using a random sample from Linguistic Inquiry 2001-2010. *Lingua*, 134, 219-248. https://doi.org/10.1016/j.lingua.2013.07.002

Srinivasan, P., & Yates, A. (2009). Quantifier scope disambiguation using extracted pragmatic knowledge: Preliminary results. In P. Koehn, & R. Mihalcea (Eds.), *Proceedings of the 2009*

Conference on Empirical Methods in Natural Language Processing (pp. 1465-1474). Singapore: Association for Computational Linguistics.

Stanley, J. (2000). Context and logical form. *Linguistics and Philosophy*, 23(4), 391-434. https://doi.org/10.1023/A:1005599312747

Stanley, J., & Gendler-Szabó, Z. (2000). On quantifier domain restriction. *Mind and Language*, 15(2-3), 219-261. https://doi.org/10.1111/1468-0017.00130

Steedman, M. (2000). Information structure and the syntax-phonology interface. *Linguistic Inquiry,* 34, 649–689. https://doi.org/10.1162/002438900554505

Steedman, M. (2012). *Taking scope. The natural semantics of quantifiers*. Cambridge, MA: Cambridge University Press.

Stepanov, A. (2007). The end of CED? Minimalism and extraction domains. *Syntax*, 10(1), 80-126. https://doi.org/10.1111/j.1467-9612.2007.00094.x

Sternefeld, W. (1998). Reciprocity and cumulative predication. *Natural Language Semantics* 6, 303–337. https://doi.org/10.1023/A:1008352502939

Sternefeld, W. (2001). Semantic vs. syntactic reconstruction. In H. Kamp, A. Rossdeutscher, & C. Rohrer (Eds.), *Linguistic form and its computation* (pp. 145-182). Stanford, CA: CSLI Publications.

Sternefeld, W. (2019). Telescoping by continuations. In M. Krifka, & M. Schenner (Eds.), *Reconstruction effects in relative clauses* (pp. 387-404). Berlin: de Gruyter. https://doi.org/10.1515/9783050095158

Stoops, A., & Ionin, T. (2013). Quantifier scope and scrambling in Russian: An experimental study. In S. Franks, M. Dickinson, G. Fowler, M. Whitcombe, & K. Zanon (Eds.), *Formal Approaches to Slavic Linguistics: The 3rd Indiana Meeting* (pp. 344-358). Ann Arbor, MI: Michigan Slavic Publications.

Strawson, P. (1950). On referring. *Mind*, 59, 320-344.

Strawson, P. (1974). *Subject and predicate in logic and grammar*. London: Methuen.

Street, J. A. & Dąbrowska, E. (2010). More individual differences in language attainment: How much do adult native speakers of English know about passives and quantifiers? *Lingua*, 120(8), 2080-2094.

Sugawara, A., Haeckl, M., Onoprienko, I., & Wexler, K. (2018). Children know the prosody-semantic/pragmatic link: Experimental evidence from rise-fall-rise and scope. In K. É. Kiss, & T. Zétényi (Eds.), *Linguistic and cognitive aspects of quantification. Studies in theoretical psycholinguistics* (pp. 31-55). Cham: Springer. https://doi.org/10.1007/978-3-319-91566-1_3

Surányi, B. & Turi, G. (2018). Quantifier scope in sentence prosody? A view from production. *Acta Linguistica Academica*, 65(2-3), 385-416. https://doi.org/10.1556/2062.2018.65.2-3.6

Syrett, K. (2015). Experimental support for inverse scope readings of finite-clause-embedded antecedent-contained-deletion sentences. *Linguistic Inquiry,* 46(3), 579–592.

Syrett, K., & Lidz, J. (2011). Competence, performance, and the locality of Quantifier Raising: Evidence from 4-year-old children. *Linguistic Inquiry*, 42(2), 305-337. https://doi.org/10.1162/LING_a_00194

Szabolcsi, A. (2012). Strategies for scope taking. In A. Szabolcsi (Ed.), *Ways of Scope Taking*. Dordrecht: Springer. (Original work published 1997).

Szabolcsi, A. (2010). *Quantification*. Cambridge, MA: Cambridge University Press.

Szabolcsi, A., & Lohndal, T. (2017). Strong vs. weak islands. In M. Everaert, & H. van Riemsdijk (Eds.), *The Wiley Blackwell companion to syntax* (pp. 1-51). Hoboken, NJ: Wiley.

Szabolcsi, A., & Zwarts, F. (1993). Weak islands and an algebraic semantics for scope taking. *Natural Language Semantics*, 1, 235-284. https://doi.org/10.1007/BF00263545

Szendrői, K. (2012, March 30). Blocking quantifier raising by passives. [Paper presentation]. GLOW 35, University of Potsdam, Germany.

Szendrői, K., Schumacher, R., Fritzsche, T., & Höhle, B. (2017). Acquisition of quantifier raising of a universal across an existential: Evidence from German. *Glossa: a journal of general linguistics*, 2(1), 1-16. https://doi.org/10.5334/gjgl.261

Tanaka, M. (2015). *Scoping out of adjuncts: Evidence for the parallelism between QR and wh-movement*. Doctoral dissertation, University College London.

Taraldsen. K. (1982). Extraction from relative clauses in Norwegian. In E. Engdahl, & E. Ejerhed (Eds.), *Readings on unbounded dependencies in Scandinavian languages* (pp. 205-221). Stockholm: Almqvist & Wiksell International.

Teleman, U., Hellberg, S., & Andersson, E. (1999). *Svenska Akademiens grammatik* [*Swedish Academy grammar*]. Stockholm: Norstedts.

Titov, E. (2019). Morphosyntactic encoding of information structure in Akan. *Glossa: a journal of general linguistics*, 4(1), 1-36. http://doi.org/10.5334/gjgl.576

Truswell, R. (2007). Extraction from adjuncts and the structure of events. *Lingua*, 117, 1355-1377. https://doi.org/10.1016/j.lingua.2006.06.003

Truswell, R. (2011). *Events, phrases and questions*. Oxford: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199577774.001.0001.

Tsai, E., Scontras, G., Mai, K., & Polinsky M. (2014). Prohibiting inverse scope: An experimental study of Chinese vs. English. *Empirical Issues in Syntax and Semantics,* 10, 1–18.

Tunstall, S. L. (1998). *The interpretation of quantifiers*. Doctoral dissertation, University of Massachusetts, Amherst.

Ueyama, A., & J.-R. Hayashishita. (2020). Sentence structure and quantifier scope in Japanese: A retrospective and reanalysis. In W. M. Jacobsen, & Y. Takubo (Eds.), *Handbook of Japanese semantics and pragmatics* (pp. 267-308). Berlin: de Gruyter.

Urbach, T. P., & Kutas, M. (2010). Quantifiers more or less quantify on-line: ERP evidence for partial incremental interpretation. *Journal of Memory and Language*, 63, 158-179.

Urbach, T. P., DeLong, K. A., & Kutas, M. (2015). Quantifiers are incrementally interpreted in context, more than less. *Journal of Memory and Language*, 83, 79-96. https://doi.org/10.1016/j.jml.2010.03.008

Uriagereka, J. (2011). *Spell-out and the Minimalist Program*. Oxford: Oxford University Press.

Van Benthem, J. (1989). Polyadic quantifiers. *Linguistics and Philosophy*, 12(4), 437-464. https://www.jstor.org/stable/25001353

VanLehn, K. A. (1978). Determining the scope of English quantifiers. *Technical Report AI-TR 483*. Cambridge MA: Artificial Intelligence Laboratory, MIT.

Varkanitsa, M, Kasselimis, D., Fugard, A. J. B., Evdokimidis, I., Druks, J., Potagas, C., & van de Koot, H. (2016). Syntactic predictions and asyntactic comprehension in aphasia: Evidence from scope relations. *Journal of Neurolinguistics*, 40, 15-36. https://doi.org/10.1016/ j.jneuroling.2016.04.001

Vendler, Z. (1967). *Linguistics in philosophy*. Ithaca, NY: Cornell University Press.

Vergnaud, J.-R. (1974). *French relative clauses*. Doctoral dissertation, MIT.

Villalta, E. (2003). The role of context in the resolution of quantifier scope ambiguities. *Journal of Semantics*, 20(2), 115–162. https://doi.org/10.1093/jos/20.2.115

Vincent, J. W. (2019). *Relative clause subextraction in English*. Doctoral dissertation, UCSC.

Vogel, R. (2019). Grammatical taboos. *Zeitschrift für Sprachwissenschaft*, 38(1), 37-79. https://doi.org/10.1515/zfs-2019-0002

Von Fintel, K. (1994). *Restrictions on quantifier domains*. Doctoral dissertation, University of Massachusetts, Amherst.

Von Fintel, K. (2000). Whatever. In B. Jackson, & T. Matthews (Eds.), *Proceedings of Semantics and Linguistic Theory 10* (pp. 27-39). Ithaca, NY: Cornell University Press.

Von Stechow, A. (1990). Layered traces. [Paper presentation]. Confernce on Logic and Lnaguage, Revfülöp, Hungary.

Von Stechow, A. (1991). Syntax und Semantik. In A. von Stechow, & D. Wunderlich (Eds.), *Semantics: An international handbook of contemporary research* (HSK 6) (pp. 90-148). Berlin: de Gruyter.

Von Stechow, A. (2000). Some remarks on choice functions and LF-movement. In K. von Heusinger, & U. Egli (Eds.), *Reference and anaphoric relations* (pp. 193-228). Dordrecht: Kluwer.

Von Stechow, A., & Sternefeld, W. (1988). *Bausteine syntaktischen Wissens: ein Lehrbuch der generativen Grammatik*. Opladen: Westdeutscher Verlag.

Ward, G., & Hirschberg, J. (1985). Implicating uncertainty: The pragmatics of fall-rise intonation. *Language*, 61(4), 747-776. https://doi.org/10.2307/414489

Wasow, T., & Arnold, J. (2005). Intuitions in linguistic argumentation. *Lingua*, 115, 1481-1496.

Watanabe, A. (2000). Absorption: Interpretability and feature strength. [Unpublished manuscript]. University of Tokyo.

Wilson, N. (1959). Substances without substrata. *The Review of Metaphysics*, 12(4), 521-539.

Winter, Y. (1997). Choice functions and the scopal semantics of indefinites. *Linguistics and Philosophy*, 20(4), 399-467. https://www.jstor.org/stable/25001672

Winter, Y. (2004). Functional quantification. *Research on Language and Computation*, 2, 331-363. https://doi.org/10.1007/s11168-004-0909-1

Wu, M.-J., & Ionin, T. (2019). L1-Mandarin L2-English speakers' acquisition of English universal quantifier-negation scope. In M. M. Brown, & B. Daily (Eds.), *Proceedings of the 43rd Boston University Conference on Language Development* (pp. 716-729). Somerville, MA: Cascadilla Press.

Wurmbrand, S. (2018). The cost of raising quantifiers. *Glossa: a journal of general linguistics,* 3(1), 1–40. https://doi.org/10.5334/gjgl.329

Yun, J. (2013). *Wh-indefinites: Meaning and prosody*. Doctoral dissertation, Cornell University.

Zhou, P., & Crain, S. (2009). Scope assignment in child language: Evidence from the acquisition of Chinese. *Lingua*, 119(7), 973-988. https://doi.org/10.1016/ j.lingua.2009.01.001

Zhou, P., & Gao. L. (2009). Scope processing in Chinese. *Journal of Psycholinguistic Research*, 38, 11-24. https://doi.org/10.1007/s10936-008-9079-x

Zimmermann, M. (2008). Quantification in Hausa. In L. Matthewson (Ed.), *Quantification: Universals and variation* (pp. 415-475). Bingley: Emerald.

Zimmermann, M. (2009). Variation in the expression of universal quantification and free choice: The case of Hausa *koo*-wh expressions. In J. van Craenenbroeck (Ed.), *Linguistic Variation Yearbook* (Vol. 8, pp. 179–232). Amsterdam: John Benjamins. https://doi.org/10.1075/livy.8.06zim

Zimmermann, M. (2020). Inverse linking constructions: An apple in every basket. In D. Gutzmann, L. Matthewson, C. Meier, H. Rullmann, & T. E. Zimmermann (Eds.), *The Wiley Blackwell companion to semantics* (pp. 1-31). Hoboken, NJ: Wiley. https://doi.org/ 10.1002/9781118788516.sem137