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6

Contents

List of Figures

List of Tables

1 Introduction

Sentence production and comprehension involves the integration of different sources of information. Thus to acquire their mother language, children have to figure out how these different types of information interact. Given the remarkable speed in which children acquire language, research in language acquisition deals with the question of what sources of information children may use to acquire the grammar of their ambient language. Obviously, children acquire the language that they are exposed to in their environment, thus experience-related factors clearly influence language acquisition. Yet, theoretical approaches differ in their assumptions about the characteristics (e.g., abstractness) of adult grammars and (accordingly) in the question whether children can acquire language solely on the basis of the input provided to the child, as usage-based and functional approaches suggest (e.g., E. Bates & MacWhinney, 1987; MacWhinney, 1987; Tomasello, 2000, 2003; see Behrens, 2009 for a review), or whether innate principles are required that restrict the hypothesis space in language acquisition (e.g., Chomsky, 1965, 1995; Valian, 2009a, 2009b; Yang, 2014; see Eisenbeiß, 2009 for a review).

Relevant to both approaches is the question of which sources of information or cues children may use to acquire the regularities or grammar of their language.

This dissertation investigates the impact of contextual cues, i.e., information structure categories like givenness and topic sta-

tus, and sentence-levels cues, i.e., the type of referring expression, on the production and comprehension of word order variation in children.[1] Children usually acquire obligatory word order variation quite rapidly. For instance, 2- to 2.5-year-old German-speaking children already produce utterances in the canonical word order and usually get the verb placement (finite verbs in second position) right (e.g., Clahsen, 1990; Poeppel & Wexler, 1993; Weissenborn, 1990). In these cases, children may rely on sentence level cues, e.g., morphological and morphosyntactic cues that can be used to distinguish different word classes, finiteness and case marking.

The acquisition of word order variation appears to be more difficult with respect to "optional" word order variation which depends on discourse and contextual factors. Optional word order concerns settings in which roughly the same (semantic) meaning can be expressed in different ways. Usually one word order is preferred, usually the more frequent one (1.1a); but the same meaning may also be expressed using a less frequent word order (1.1b).

(1.1)   a. Peter hat Maria das Buch gegeben.
             "Peter gave Mary the book."
         b. Peter hat das Buch Maria gegeben.
             "Peter gave the book to Mary."

While both word orders are grammatical, the choice between them often depends on factors related to information structure. Information structure (IS) concerns the way information is organized in discourse and aims to ease communication between interlocutors (e.g., Chafe, 1976; Clark & Haviland, 1977; Krifka, 2008; Lambrecht, 1994). IS categories like givenness, topic or focus are marked at the sentence level by means of prosody or

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1   As will be explained below the information and topic status of a referent is often determined by the context (though not always), yet information structure categories are marked at the sentence-level in terms of prosody, word order, and referring expressions.

word order. Nevertheless, they are usually linked to contextual or discourse factors that determine which referents (or constituents in a sentence) are given, topical or focused. In this way, context may be seen as a way to license word order variation.

For instance, the less frequent word order in sentence (1.1b) is licensed when the order of the indirect and direct object follows the given-new order, as illustrated in (1.2). In this case, the given-new order marks the direct object *das Buch* as given and the indirect object *Maria* as new.

(1.2) Wo ist denn unser Märchenbuch? ("Where is our book of fairy tails?")
  a. Peter hat das Buch Maria gegeben.
    "Peter gave the book to Mary."
  b. ?Peter hat Maria das Buch gegeben.
    "Peter gave Mary the book."

The marking of information structure could be seen as involving two steps that require the child determining the information structure status of referents (givenness, topicality, focus) and using the appropriate means (prosody, word order) to mark information structure that are allowed in their language (e.g., Chafe, 1976; Krifka, 2008, see also De Cat, 2011; Gundel & Johnson, 2013; Hickmann, Hendriks, Roland, & James, 1996; MacWhinney & Bates, 1978). Determining the IS status of referents and choosing the appropriate means to mark IS may be difficult for children because it often requires taking the perspective of the hearer into account (e.g., De Cat, 2011; Campbell, Brooks, & Tomasello, 2000; Gundel & Johnson, 2013; Hendriks, 2014; Wittek & Tomasello, 2005). Applying the appropriate means to mark information structure may also impose difficulties because different syntactic IS marking strategies may be used in different constructions in a given language.

One strategy to mark IS structure is the given-before-new (or topic-first) strategy[2] that influences word order in a variety of languages, for instance in Germanic languages like English and German (e.g., Bresnan, Cueni, Nikitina, & Baayen, 2007; Røreng, 2011), in Slavic languages like Russian and Ukraine (e.g., Mykhaylyk, Rodina, & Anderssen, 2013), and in Japanese (Ferreira & Yoshita, 2003) (see also Skopeteas & Fanselow, 2010). However, in contrast to adults, children do not always show a preference for the given-new order. Some studies provided evidence for the given-before-new preference (e.g., Anderssen, Rodina, Mykhaylyk, & Fikkert, 2014; de Marneffe, Grimm, Arnon, Kirby, & Bresnan, 2012; Mykhaylyk et al., 2013; Stephens, 2010) while others did not (e.g., Narasimhan & Dimroth, 2008; MacWhinney & Bates, 1978).

This incoherent pattern may result from the impact of the referring expression, which was not always controlled for. Crucially, different types of referring expressions may be seen as a cue to IS categories like givenness and topic (e.g., E. Bates, 1976; Hickmann et al., 1996; MacWhinney & Bates, 1978) but may also influence word order, e.g., in terms of a short-before-long preference (e.g., Bresnan et al., 2007; Lenerz, 1977). In addition, it was suggested that children may acquire the "local" marking of IS, e.g., referential choice or marking of definiteness on the noun phrase (NP), earlier than the "global" marking of IS which affects the entire utterance, e.g. word order (e.g., Hickmann et al., 1996; MacWhinney & Bates, 1978, but see Bittner & Kuehnast, 2011; Hendriks, Koster, & Hoeks, 2014). Both factors may contribute to the incoherent results.

The second issue concerning the acquisition of word order variation with respect to IS is the production-comprehension-asymmetry (e.g., Hendriks & Koster, 2010). Children usually produce sentences in the non-canonical word order, e.g., the

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2   Note that these strategies are difficult to disentangle from the final focus strategy, as discussed in chapter 2.

OVS word order in (1.3b), around age 2.5 to 3 (e.g., Fleischhauer, 2009). However, even school-age children have problems understanding sentences in the non-canonical word order when factors like animacy and plausibility are controlled for (e.g., Dittmar, Abbot-Smith, Lieven, & Tomasello, 2008a). This asymmetry is surprising because it is usually assumed that children should be able to comprehend a sentence structure when they are able to produce it (e.g., Hendriks & Koster, 2010).

(1.3)   a.   Der Tiger fängt den Hund. (SVO)
             "The tiger chases the dog."
        b.   Den Tiger fängt der Hund. (OVS)
             "The tiger, the dog chases."

The discrepancy between production and comprehension studies may result from the fact that in comprehension experiments the test sentences tended to be presented without an appropriate context and the agent and the patient tended to be realized as lexical NPs (*der Tiger*, *den Hund*). In spoken discourse, however, sentences are always produced and comprehended in a context and referents are usually realized as pronouns when they refer to given or old information.

Presenting an OVS sentence in an appropriate context, e.g. a topic-first context, may ease the comprehension of the non-canonical word order (1.4a) because the context licenses the non-canonical word order and may be related to processing advantages (e.g., Burmester, Spalek, & Wartenburger, 2014; Schumacher & Hung, 2012).

(1.4)   Ich erzähle dir etwas über den Tiger. (I will tell you something about the tiger?)
        a.   Ich wette, den Tiger fängt gleich der Hund. (OVS)
             "I bet, the dog will chase the tiger."
        b.   Ich wette, ihn fängt gleich der Hund. (OVS)
             "I bet, the dog will chase him (the tiger)."

In addition, realizing the topic ("the tiger") as pronoun *ihn* ("him") (1.4b) may ease the comprehension of OVS sentences because research from relative clause processing suggests that pronouns reduce memory costs (e.g., Warren & Gibson, 2002) as well as intervention effects (e.g., Rizzi, 2013) and establish discourse coherence (e.g., Gordon, Grosz, & Gilliom, 1993; Grosz, Joshi, & Weinstein, 1995). However, pronouns may also be seen as a frequency-related cue to thematic roles, e.g., the subject status (e.g., Brandt, Kidd, Lieven, & Tomasello, 2009; Kaan, 2001; Kidd, Brandt, Lieven, & Tomasello, 2007), because pronouns are usually subjects. This correlation may influence processing, i.e., pronouns may ease sentence processing when the pronoun is the subject but may induce processing difficulties when the pronoun is not the subject but the object, as in (1.4b).

To summarise, the results from the production and comprehension studies suggest that the type of referring expression may be a crucial factor that influences the comprehension and production of word order variation, especially because referring expressions are related to the IS of their referents.

The impact of referring expressions as cue to IS and thematic roles assignment has mainly been investigated from a usage-based and functional perspective so far (e.g., E. Bates, 1976; E. Bates & MacWhinney, 1987; Tomasello, 2003). These approaches usually emphasize the relationship between comprehension and production and the impact of frequency-related factors on language acquisition, grammar and sentence comprehension (e.g., Behrens, 2009; MacWhinney, 1987; Tomasello, 2003). The grammar and processing system (which are the same system in these accounts) develops on the basis of the input. Children usually start producing item-based constructions because they lack the abstract adult grammar and only later generalize from item-based constructions to more general and abstract constructions (e.g., Dittmar, Abbot-Smith, Lieven, & Tomasello, 2008b; Tomasello, 2000, 2003). Children's compre-

hension is also influenced by the relationship between the input and grammar. Initially, children may not consider the same sources as adults during sentence comprehension or weight them differently, and only later use them in an adult-like way (e.g., Chan, Lieven, & Tomasello, 2009; Dittmar et al., 2008a).

In the present study, the nativist perspective on grammar, language acquisition and sentence procession is adopted (see also chapter 3). Following the basic assumptions of the Minimalist Program (Chomsky, 1965, 1995), the linguistic/grammatical knowledge *competence* is distinguished from processing factors performance, and a modular language architecture is assumed (see in chapter 3).[3]

The grammar of languages consists of a set of universal *principles*, that are innate and shared by all languages, and a set of *parameters*, that differ between languages. Language acquisition basically means setting the parameters to the values of the language that the child is learning (e.g., Eisenbeiß, 2009; Yang, 2014) on the basis of the input. Nevertheless, it is usually assumed that even young children have abstract linguistic knowledge.

Crucially, within the Minimalist Program the syntactic structure is the main factor determining meaning. This differs from usage-based or constraint-based approaches who consider the syntactic structure as one of many factors. Thus, sentence comprehension and thematic role assignment are determined by the syntactic structure. Factors like plausibility or animacy also play a role but influence the syntactic structure. Referring expressions may influence the production and comprehension of word order variation because they (or their prosodic correlates) interact with derivation of the syntactic structure (grammar factors), e.g., movement constraints (e.g., Rizzi, 2013), with the process-

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3 Note that other nativist approaches may not distinguish between competence and performance or may consider a non-modular language architecture.

ing of the syntactic structure (performance factors), e.g., memory costs resulting from structural factors (e.g., Gibson, 1998; Gordon, Hendrick, & Johnson, 2001; Warren & Gibson, 2005), or with developmental factors, e.g., the acquisition of morphological knowledge (e.g., Clahsen, 1996; Eisenbeiß, 1994).

The studies reported in this dissertation were conducted to investigate the effect of the type of referring expression on the production and comprehension on word order variation in German-speaking children and adults. Three corpus analyses were conducted to investigate the impact of givenness, topicality and the type of referring expression on word order in double object constructions in spontaneous child language and child-directed speech. The general research questions of the corpus studies were:

1. Are children sensitive to the information structure constraints on word order variation involving the prefield and middlefield?

2. Is word order variation predictable from different types of referring expression in the prefield and middlefield?

3. Do children and adults show similar ordering patterns?

As will be shown in greater detail in Chapter 2, different factors influence word order variation in the middlefield (sentence-medial positions) and determine which constituent occurs in the prefield (sentence-initial position). Bornkessel-Schlesewsky, Grewe, and Schlesewsky (2012) demonstrated that *discourse prominence*, e.g., givenness and animacy, influences word order variation in the middlefield, whereas *aboutness*, i.e., the aboutness topic status, influences which constituent occurs in the prefield. While prominence and aboutness are different theoretical concepts they often overlap which may make it more difficult to acquire their impact on word order.

The corpus results will indicate whether children may use referring expressions to acquire word order regularities and whether referring expressions are associated with different word orders in child-directed speech (so that children can acquire these associations). In this way, referring expressions may not only be a factor contributing to the incoherent patterns concerning the given-before-new ordering in child language but may also be means to acquire the different IS factors influencing word order in the prefield and middlefield.

Furthermore, two experiments were conducted to investigate the impact of topicality and the type of referring expression on German children's comprehension of SVO and OVS sentences. In particular, the experiments addressed the following research questions:

1. Does the topic status of the initial object ease the processing of OVS sentences when both referents are realized as lexical NP?

2. Does the realisation of a the topic as personal pronoun ease the processing of OVS sentences?

The experiments aimed to investigate the effects of contextual and sentence-level cues on sentence comprehension on the one hand, and the impact of frequency-related, structural and discourse factors on the other. Experiment 1 will show whether contextual licensing, i.e., the topic-first context, eases sentence comprehension in children as has been demonstrated in adults (Burmester et al., 2014).

Experiment 2 will clarify the impact of pronouns on sentence processing, in particular whether their impact is influenced by their grammatical role. If personal pronouns ease processing regardless of their grammatical role, this may indicate that pronouns ease processing because they establish discourse coher-

ence or reduce memory costs that arise from structural factors. If the impact of personal pronouns is influenced by the grammatical role, this may suggest that the frequency-based link between subjects and pronouns influence comprehension.

In this way, both results do not only contribute to possible explanations of the production-comprehension asymmetry but also clarify the role of structural, discourse and frequency factors in sentence comprehension.

The dissertation is organised as follows. Chapter 2 introduces the core concepts of IS and describes previous studies that investigated the marking of IS in terms of word order and the type of referring expression. Chapter 3 provides the background on the factors influencing word order in German and on the acquisition of word order variation. Chapter 4 reports the corpus analyses conducted to investigate the impact of givenness, topicality and the type of referring expression on word order in child language and child-directed speech. Chapter 5 introduces previous research on the impact of IS and pronominalisation on the comprehension of non-canonical word orders in adults and children. Chapter 6 reports the experiments conducted to investigate the impact of topicality and personal pronouns on the comprehension of SVO and OVS sentences in children and adults. Chapter 7 links the results to the acquisition of IS marking and the production-comprehension asymmetry.

2 Information structure

2.1 Introduction

2.1.1 Marking of information structure

As mentioned in the introduction information structure (IS) is related to the notion of *common ground*, i.e., the information or knowledge that is shared between speaker and hearer (e.g., Clark & Haviland, 1977; Krifka, 2008; Stalnaker, 2002).

Krifka (2008) distinguishes between two ways how IS and common ground are related. On the one hand, IS concerns the content of the common ground, in that it influences the denotation (i.e., truth condition) of utterances. This is illustrated in example (2.1). In (2.1a) the focus particle *only* is associated with *Mary*, meaning that *Tom only gave Mary the book (but nobody else)*, in (2.1b) it is associated with *a book*, meaning that *Tom gave Mary the book but nothing else*.

(2.1)   a. Tom only gave [MARY]$_F$ a book.
   b. Tom only gave Mary [a BOOK]$_F$.

On the other hand, IS concerns the "common ground management", i.e., the way of how information is presented in discourse, which corresponds to the concept of *information packaging* introduced by Chafe (1976). Common ground management is a pragmatic notion and does not influence the denotation of a sentence.

Example (2.2) illustrates that IS, e.g., the givenness status of the referents, influences the prosodic, syntactic and lexical realization of utterances (e.g., Lambrecht, 1994; Vallduví & Engdahl, 1996; Ward, Birner, & Huddleston, 2005). In (2.2a) and (2.2b) *he* and *the machine* refer to "given" information that is part of the common ground, i.e., *Tom* and *the motorbike*, because they were introduced in the context sentence. The expression *Lisa* is "new" because it was not mentioned before.

(2.2)   Tom bought a new motorbike yesterday.
  a. Proudly, he showed the machine to Lisa.
  b. #Proudly, he showed Lisa the machine.

At the syntactic level, givenness may be marked by the given-before-new ordering. This is reflected by the preference of the given-new order in (2.2a) in comparison to the new-given order in (2.2b). At the prosodic level, given referents (*he*) are usually deaccented while new referents (*Lisa*) are accented. IS is also reflected at the lexical level, i.e., by the type of referring expressions. Usually, given referents are realized as pronouns and new referents as indefinite noun phrases.[1]

Prosody and syntax provide two common means that may be used to mark IS, although languages differ in the extent to which they use each means (e.g., Lambrecht, 1994; Vallduví & Engdahl, 1996). Thus, with respect to language acquisition, children have to determine the IS categories which requires the consideration of the common ground and to acquire (and use) the appropriate means possible in their ambient language to

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1   Yet referring expressions may be distinguished from prosodic and syntactic means to mark IS. Vallduví and Engdahl (1996) consider referring expressions as "signals" for the identification of a referent in the common ground whereas the prosodic and syntactic marking of IS may be seen as way of common ground management (i.e., instructions how to update the discourse). Other researchers, however, link referring expressions to the marking of IS (e.g., Hickmann et al., 1996; MacWhinney & Bates, 1978).

mark these IS categories (e.g., De Cat, 2011; Gundel & Johnson, 2013; Hickmann et al., 1996; MacWhinney & Bates, 1978).

2.1.2 Terminological issues

Unfortunately, there is no uniform agreement concerning the definitions of IS categories such as givenness, focus, and topic (e.g., Chafe, 1976; Krifka, 2008; Lambrecht, 2008; Vallduví & Engdahl, 1996). I will follow the terminology by Krifka (2008) who proposes three basic distinctions of IS categories: given vs. new, background vs. focus, and topic vs. comment. These dimensions of IS overlap, in that topics are usually given and background information and focus is usually new information that belongs to the comment. However, these overlaps are often not perfectly correlated and capture different aspects of IS: givenness concerns the information status of referents, focus indicates a contrast and the topic-comment distinction indicates how the information has to be "stored" in the common ground.

2.1.2.1 Givenness

Givenness is usually defined in terms of whether information is given or new (e.g., Halliday, 1967; E. F. Prince, 1981, 1992). E. F. Prince (1981) notes that givenness may be defined at three levels, i.e., with respect of the *predictability/recoverability* of information, with respect to its *saliency*, or whether it is *shared knowledge*, i.e., is part of the common ground. The definition at the first two levels indicate that information (or referents) may differ in their saliency or predictability that is they may differ in their "degree" of givenness. The third aspects of "shared knowledge" may be related to the notion of the common ground, so that it may comprises information that was already introduced in the discourse (*discourse-givenness*) or information (e.g., world knowledge) that the speaker assumes to be shared with the hearer but that may not necessarily have been explicitly introduced in the discourse (*hearer-givenness*) (Chafe, 1976; E. F. Prince, 1992).

Krifka's (2008) definition of "givenness" is defined in terms of hearer-givenness and considers the gradual notion of givenness (see 2.3).

(2.3) "A feature X of an expression α is a Givenness feature iff X indicates whether the denotation of α is present in the CG or not, and/or indicates the degree to which it is present in the immediate CG." (Krifka, 2008, p. 262)

2.1.2.2   Focus

Focus may be defined as information focus or contrastive focus (Katz & Selkirk, 2011; Selkirk, 2007; see also É. Kiss, 1998). *Information focus* is often defined in terms of the focus-background or focus-presupposition distinction (e.g., Halliday, 1967; Jackendoff, 1972) and refers to new information. This notion of focus largely overlaps with the notion of *givenness*. In (2.4) the question context in a) defines *Tom* as focus and *Mary met* as background in the answer in b). Correspondingly, *Tom* is new information while *Mary met* is given information.

(2.4) a. Who did Mary meet?
       b. Mary met [Tom]$_F$.

Contrastive focus may be indicated by focus particles such as *only* or an explicit contrast in a discourse and indicates a contrast between the focused element and a set of alternatives (e.g., Rooth, 1992, 1996). This is illustrated in example (2.5) where *Tom* is in contrast to a set of alternatives (*Tom*, *Peter*) introduced by the question. This example also illustrates that focused constituents may also be given.

(2.5) a. Did Mary meet Tom or Peter?
       b. Mary met [Tom]$_F$.

Krifka's (2008, cf. Rooth, 1992) definition of "focus" does not distinguish between information and contrastive focus but rather assumes that focus always indicates a set of alternatives (see 2.6).

(2.6) "Focus indicates the presence of alternatives that are relevant for the interpretation of linguistic expressions." (Krifka, 2008, p. 247)

2.1.2.3 Topic

Several definitions and terms have been used to for the concept of "topic" or "theme" (e.g., Chafe, 1976; Firbas, 1964; Halliday, 1967; Reinhart, 1981). *Sentence* or *aboutness topics* are usually defined in terms of the topic-comment structure (e.g., Krifka, 2008; Reinhart, 1981). An *aboutness topic* is what the sentence is about (the expression *Tom* in 2.7) and the *comment* is the information given about the topic (*bought a new motorbike* in 2.7).

(2.7) a. Let me tell you something about Tom.
       b. $[Tom]_{topic}$ [bought a new motorbike]$_{comment}$.

Topics may also be defined in terms of familiarity, in that, they refer to given information (cf., Frey, 2004b; Krifka, 2008). However, although topics tend to be be discourse-given, they may also be discourse-new (Krifka, 2008).

Thus, Krifka considers only the aboutness characteristic in his definition of "topic" (Krifka, 2008, see also Frey, 2004b). He adopts Reinhart's filecard metaphor for (sentence) topics in his definition of topics (see 2.8). In this way, the information (comment) that *(Tom) bought a new car* should be added to the filecard of the expression *Tom*.

(2.8) "The topic constituent identifies the entity or set of entities under which the information expressed in the com-

ment constituent should be stored in the CG content."
(Krifka, 2008, p. 265)

Contrastive topics are a special type of aboutness topics that indicate a set of alternatives and thus is also a subtype of focus (e.g., Krifka, 2008; Repp & Cook, 2010). In (2.9) *Peter* and *Mary* are contrastive topics because they are topics in the sentences and indicate a set of alternatives.

(2.9)   [Peter]$_{topic}$ [bought a motorbike]$_{comment}$ and [Mary]$_{topic}$ [(bought) a car]$_{comment}$.

2.2   Syntactic marking and the given-before-new preference

2.2.1   Syntactic marking in adults

As mentioned above, syntactic means may be used to mark IS. In this way, IS categories like givenness, focus and topic may influence word order variation (Ward et al., 2005). In this thesis, I am particularly interested in the impact of the given-before-new preference, however, other IS categories may interact with this preference.

On the one hand, the given-before-new preference (e.g., Haviland & Clark, 1974) may be difficult to disentangle from the topic-before-comment preference (e.g., Chafe, 1976; Halliday, 1967; Hornby, 1974) and the focus-final preference (e.g., Chomsky & Halle, 1968). On the other hand, there may be a competition between different preferences, e.g., focus may be marked by it-clefts or by placing the focus in the initial or final position in languages like German (Ward et al., 2005). This indicates that the given-before-new preference may be construction-dependent and may sometimes be in conflict with a new-before-given order that is used to highlight important or new information (e.g., Lambrecht, 1994; Ward et al., 2005).

Clark and Haviland (1977) argue that speakers follow the so-called given-new contract in that they mark given and new information prosodically and syntactically. Haviland and Clark (1974) propose that the given-before-new ordering has advantages for the hearer because it allows the hearer to integrate given information, which usually is easier to retrieve than new information (Almor & Eimas, 2008), early into the discourse model (Benatar & Clifton, 2013; Schumacher & Hung, 2012). If speakers consider the given-new contract they should be cooperative and produce the sentences in the given-new order because it eases comprehension for the listener. Moreover, the given-before-new ordering may also have advantages for the speaker. Given information is usually activated and easier to retrieve during the production process which may give the speaker more resources for the planning of the rest of the utterance (e.g., Bock & Irwin, 1980; Jaeger & Tily, 2011).

Psycholinguistic research has confirmed that the given-before-new ordering has processing advantages in both production and comprehension in adults (see Jaeger & Tily, 2011 for a review). Most of this research investigated the dative alternation which involves the alternation between the prepositional (2.10a) and double object construction (2.10b).

(2.10)   a. The man gave the book to Mary.
          b. The man gave Mary the book.

The choice between the constructions is influenced by several factors, among them verb factors as well as the givenness, length, pronominality and animacy of the objects (e.g., Arnold, Wasow, Losongco, & Ginstrom, 2000; Bresnan et al., 2007). With respect to givenness, speakers tend to produce utterances which follow the given-before-new order, for instance, they produce the prepositional dative construction when the direct object (*the book*) is given but the double object construction when it is new (Arnold et al., 2000; Bock, 1977; Bock & Irwin, 1980).

With respect to other constructions, production studies have shown that the salience of the referents involved in an action influences production in picture/scene description tasks. Participants were more likely to produce passives or sentences in the non-canonical word order in conditions when the patient rather than the subject was made salient by a preceding context or its animacy status (e.g., Prat-Sala & Branigan, 2000) or by visual cues (e.g., Tomlin, 1995; Gleitman, January, Nappa, & Trueswell, 2007). However, although salience may be related to information that is given or in the focus of attention (Tomlin, 1995) it may also comprise new information (E. Bates, 1976; Baker & Greenfield, 1988).

2.2.2   Syntactic marking in children

Children seem to be sensitive to IS categories such as givenness and newness from quite early on, although they may determine the information status, e.g., givenness status, only from their own perspective (i.e., the speaker perspective) but may not fully consider the perspective of the hearer as well. The consideration of the hearer perspective will be discussed in section 2.4.

With respect to the marking of IS, children tend to realize the most informative information in their first-word utterances but omit given or topic information (e.g., E. Bates, 1976 for Italian; Baker & Greenfield, 1988; Greenfield, 1978 for English). The most informative information may be a salient (novel or given) object that is present in the environment (E. Bates, 1976; Greenfield, 1978).

At the two-word stage, children tend to express new and old information but often they only express the most informative (new or salient) information, usually in terms of the new-old and new-new order (e.g., E. Bates, 1976; Baker & Greenfield, 1988; Matthews, Lieven, Theakston, & Tomasello, 2006; Salomo, Lieven, & Tomasello, 2010).

The ordering preferences for older children are less clear because studies revealed a preference for the given-new order, for the new-given order or no preference. Research showing a preference for the given-before-new order mainly concern the dative alternation in English and Norwegian and the ordering of double objects in German.

Elicited production studies in which children were asked to describe pictures in a linguistic context showed that 4- to 5-year-old children were sensitive to the impact of givenness and the type of the referring expression on the dative alternation in English and Norwegian (e.g., Anderssen et al., 2014; Stephens, 2010). In both languages, children tended to use the prepositional construction when the direct object was given or pronominal (*Peter gave [the book/it] to her.*, given-new order). The givenness of the indirect object had a weaker effect on word order variation, that is, when the recipient was given the preference for the double object construction (*Peter gave the woman the book.*, given-new order) was weaker. In English, this difference may be due to the restriction on the ordering of pronominal arguments (*/?*Peter gave her it.* vs. *Peter gave it to her.*) (Stephens, 2010). In Norwegian, the difference went together with the children's tendency to drop the indirect objects when they were given and may have resulted from an interaction between the basic word order and the salience of the semantic roles (Anderssen et al., 2014).[2]

These studies indicate that dative alternation was influenced not only by givenness but also by the type of referring expression. De Marneffe et al. (2012) investigated the English dative alternation in the spontaneous speech of 2- to 5-year-old children and

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2 A similar asymmetry, i.e., a stronger impact of the givenness of the direct object compared to the givenness of the indirect object has been found in Russian and Ukrainian 3- to 6-year-olds (Mykhaylyk et al., 2013). The results also indicate that the impact of the givenness of the indirect object increases with age. However, while the study shows that givenness influences word order variation, it is not clear whether the type of referring expression also plays a role.

their mothers, but they employed a statistical method to disentangle the effects of givenness and the type of the referring expression. They found that the type of referring expression influenced word order in children and adults in the same way. That is, pronouns were placed before lexical NPs. Givenness did not influence on word order in adults but did influence the ordering of pronominal objects in children. In the child data pronominal direct objects tended to follow the indirect object when they were new (*Peter gave her it.*) but preceded the indirect object when they were given (*Peter gave it to her.*). Adults may not show a similar effect of givenness because – in contrast to children – they rarely overgeneralized pronominal objects to new referents and because the double object constructions involving pronominal objects (**Peter gave her it.*) may be marked in adult language but not necessarily in child language (but see Stephens, 2010).

More recently, B. Höhle, Hörnig, Weskott, Knauf, and Krüger (2014) conducted an elicited repetition task to investigate the impact of focus on the ordering of double objects in German-speaking 5-year-olds. The test sentences were presented with a preceding question context that marked one object as focus whereas the other object (and constituents in the sentence) was given. Focus was marked prosodically and contextually so that background information was always given and the focused object always new. Children repeated the sentences more correctly when they followed the background-before-focus order. Crucially, in this study the impact of the type of referring expression was controlled for, indicating that 5-year-olds may follow the given-before-new preference, at least if it is accompanied with the corresponding focus structure.

While the studies on the ditransitive sentences showed that givenness and the referring expression influence word order variation, two cross-linguistic studies looking at different constructions did not find a robust given-before-new preference. MacWhinney and Bates (1978) investigated the syntactic,

prosodic and lexical marking of givenness in 3- to 5-year-olds acquiring German, Hungarian and Italian. Hickmann et al. (1996) looked at the acquisition of IS marking in 4- to 10-year-olds learning Mandarin Chinese, French, German and English. Both studies show that the local marking of information structure (in terms of prosody and referential choice) may be easier to acquire than the global marking (in terms of word order). That is, new referents were usually stressed and realized as lexical NP whereas given referents were usually deaccented and realized as pronouns or omitted.

The results for the global syntactic marking of given and new information was less clear and indicate cross-linguistic differences. In German, there was a preference for local marking of givenness (in both studies) and a developmental change in the use of word order: 4-year-olds and 7-year-olds placed given and new referents in the post-verbal position whereas 10-year-olds were more likely to introduce new referents post-verbally and given referents pre-verbally (Hickmann et al., 1996). In contrast, French-speaking children performed almost adult-like already at age 4 (Hickmann et al., 1996).

This agrees with findings by De Cat (2009) who showed that even 2;11-year-old French-speaking children use syntactic and lexical means to mark topic and focus. De Cat (2009) used a picture description task in which the agent of the target picture was defined as contrastive topic or focus. Children in all age groups (2-, 4- and 5-year-olds) tended to realize topics as dislocated NPs, subject clitics or null subjects and focus as heavy pronouns or parts of cleft constructions, indicating that they were sensitive to the differences between topic and focus (see also De Cat, 2011 for similar results using a story elicitation task).

The cross-linguistic studies underline cross-linguistic differences in the acquisition of the marking of IS. While preschoolers may prefer local means (prosody and referring expressions) to global means (e.g., syntactic means) to mark IS in languages like

English or German (see also Hornby, 1971 for the topic marking in English and Sauermann, Höhle, Chen, & Järvikivi, 2011 for focus marking in German), 3- to 4-year-olds may already use syntactic means to mark information structure in languages like French (e.g., De Cat, 2009, 2011; Hupet & Tilmant, 1989), where syntactic marking may be more common. Additionally, the results indicate that the impact of the local cues (like the referring expression) on word order variation needs to be considered.

Narasimhan and Dimroth (2008) conducted a study wherein they controlled the impact of the type of referring expression and the effects of the grammatical role. They investigated the ordering of full NPs in conjoined constructions (e.g., an egg and a bed) in German-speaking children and adults. In each trial two object were visible to the child but invisible to the hearer. First, one object (the "given" object) was placed in a container and labeled by the children, and then the second object (the "new" object) was added. Thus, at the second step, the first object was already mentioned and given to the hearer whereas the second object was new. When asked to mention what is in the container, 3-year-olds and 5-year-olds preferred to produce the new-given order (65 %) while 9-year-olds and adults preferred the given-new order (70 %). In a second study, Dimroth and Narasimhan (2012) introduced the "given" object as discourse topic (i.e., the experimenter made two comments about it). However, 3-year-olds and 5-year-olds still preferred the new-given order to given-new order. This supports proposals that argue that children start with a new-given preference and may develop the given-before-new (or topic-comment) preference quite late (e.g., E. Bates, 1976; Narasimhan & Dimroth, 2008).

The results by Narasimhan and Dimroth contrast with the results of the study by B. Höhle et al. (2014), which also controlled for the impact of the referring expression. These differences may result from differences in the factors influencing word order at the phrasal level and sentence level (cf., Bock & Levelt, 1994); but this does not explain the differences between children

and adults at the phrasal level, i.e., in the study by Narasimhan and Dimroth. Alternatively, the children in the study may not have consider the perspective of the hearer, who did not see the objects (Narasimhan & Dimroth, 2008), and may prefer to place salient information (the last object added to the scene) before the less salient information (E. Bates, 1976; Prat-Sala & Branigan, 2000). In the study by B. Höhle et al. (2014) the linguistic context defines what is given and new for both the speaker and hearer and givenness and newness was accompanied by prosodic marking. Accordingly, children may have relied on the contextual and/or the prosodic cues (e.g., final focus accent) to word order.

While the impact of prosody and context cannot be separated in the study by Höhle and colleagues (2014), the impact of sentence-level cues (prosody and the referring expression) may be a factor contributing to the incoherent results for the given-new preference in children. As will be shown in the next section, referential choice is correlated with the information status of the referents but children may not always be adult-like in their choice of referring expression so that the referring expression and context may "cue" different word orders.

2.3 Factors influencing referential choice

2.3.1 Referential choice in adults

Referring expressions are used to introduce referents to the common ground or to refer to referents already in the common ground (e.g., Gundel, Hedberg, & Zacharski, 1993; Krifka, 2008; Vallduví & Engdahl, 1996). Therefore, the speaker has to provide enough information for the hearer to identify the referent (e.g., Arnold, 2008; Gundel et al., 1993), which requires the speaker to take the perspective of the hearer into account.

Experimental research has demonstrated that referent salience and discourse coherence influence the production of referring expressions (see Arnold, 2008 for a review). Speakers usually use personal pronouns to refer to the most salient referent unless the use of a pronoun creates ambiguities. The salience of referents and thus the use of pronouns may be influenced by factors like animacy (Fukumura & van Gompel, 2011), the sentence position or distance between antecendent and anaphor (Stevenson, Crawley, & Kleinman, 1994), the presence of other referents (Arnold & Griffin, 2007; Fukumura & van Gompel, 2011), the grammatical role, e.g., subject status (Brennan, 1995; Fukumura & van Gompel, 2011; Stevenson et al., 1994), and by the information and discourse status (Brennan, 1995; Hendriks et al., 2014).

Crucially, adults usually do not use a pronoun for a referent that may be less salient due to it discourse status (e.g., Brennan, 1995) or the presence of other referents in the context (e.g., Arnold & Griffin, 2007; Fukumura & van Gompel, 2011), even if a pronoun is sufficient for referent identification (e.g., in terms of gender information). This clearly indicates that information status of the intended referent – in addition to the avoidance of ambiguities – influences referential choice.

2.3.1.1   Information status of a referent

Several theoretical accounts have linked the type of referring expression to the referent salience (e.g., Ariel, 2001; Givón, 1983; Gundel et al., 1993). While the accounts differ in the exact implementation of this relationship and used different concepts to define salience, it is usually proposed that the more salient a referent in the discourse model, the less complex or informative the referring expression needs to be that is used to refer to the referent (Ariel, 2001; Gundel et al., 1993). Accordingly, I will restrict the theoretical discussion to the introduction of one approach, i.e., the Givenness Hierarchy.

Following the Givenness Hierarchy referring expressions encode the information about the (proposed) cognitive status of the antecedent in the discourse model of the hearer (Gundel et al., 1993; Gundel, Hedberg, & Zacharski, 2012). Table 2.1 illustrates the linking between referring expressions and the cognitive status for English examples.

Table 2.1: Givenness hierachy (taken from Gundel et al., 1993, p. 275)

			uniquely		type
in focus >	activated >	familiar >	identifiable >	referential >	identifiable
{it}	{that	{that N}	{the N}	{ indefinite	{a N}
	this			this N }	
	this N}				

The hierarchy describes seven cognitive statuses which are arranged as an ordered set. The status "in focus" (of attention) indicates the highest status of a referent while the status "type identifiable" indicates the lowest status. A status higher in the scale, e.g., "in focus" entails the lower statuses, e.g., "activated". The type of referring expression below each status indicates the referring expression that is minimally required and, as Gundel's corpus data suggest, usually produced to refer to a referent with this cognitive status.

Thus, as illustrated in (2.11), a personal pronoun like *she* or *him* indicates that the intended referent is "in focus". Therefore, a pronoun can refer to a referent that is "in focus" (as *she* in 2.1a) but not to a referent that are merely identifiable (as *he* in 2.1b) because it would not provide enough information for referent identification.

(2.11)   Mary went shopping yesterday.

    a. She met Tom.

    b. # She met him.

    c. ? Mary met Tom.

Yet, a referring expression indicating a lower cognitive status may be used for referents with higher cognitive status (e.g., in focus) because the higher cognitive status entails the lower status. Thus, a proper name, indicating that a referent is identifiable, may refer to referents "in focus" (2.11c). However, in this case a pronoun (*she*) may be preferred to a proper name (*Mary*) because the proper name is overinformative (2.11c) and often leads to processing difficulties, i.e., the *repeated-name* or *repeated NP penalty* (Almor, 1999; Almor & Eimas, 2008; Cowles, Walenski, & Kluender, 2007; Gordon et al., 1993; Gordon & Chan, 1995). These findings can be explained in terms of the Centering Theory which proposes that pronominal referents establish local coherence between utterances.

2.3.1.2   Discourse context

The Centering Theory (Grosz et al., 1995; Grosz & Sidner, 1986) models the attentional structure of texts, with referring expressions (especially pronouns) being one device to establish local coherence between utterances. The link between the current and the subsequent utterance is provided by the *forward looking center* (Cf(n)) which contains all referents of the current utterance which are ranked according to their prominence, i.e., grammatical role and surface position (cf. Gordon et al., 1993; Gordon & Chan, 1995). The link to the preceding utterance is provided by the *backward looking center* (Cb(n)) of a sentence which is realized by an entity of the current utterance that is the most prominent entity of the previous utterance, i.e., the highest ranked element in the forward looking center of the previous utterance (Cf(n-1)), usually the subject of the previous sentence.

In example (2.12), the most prominent element in the Cf in sentence a) is *Susan* which is also the highest ranked element in Cf and the element in Cb of the subsequent sentence (2.12b).

(2.12) (Example adapted from examples (6)–(10) in Grosz et al., 1995)

    a. Susan gave Betsy a pet hamster.
       Cf={Susan, Betsy, hamster}

    b. She reminded her that such hamsters were quite shy.
       Cb={she=Susan},   Cf={she=Susan,   her=Betsy, hamster}

    c. She suggested to keep the hamster in the cage for a few days.
       Cb={she=Susan}, Cf={she=Susan, hamster, cage}

    c'. Betsy promised to keep the hamster in the cage for a few days.
       Cb={Betsy}, Cf={Betsy, hamster, cage}

Usually the backward looking center (Cb) is realized as pronoun and thus establishes local coherence between utterances (cf., Gordon et al., 1993). When the center of attention is continued, the use of a pronoun rather than a proper name is preferred to refer to the Cb (Susan) in example (2.12c). This is reflected by the repeated name penalty, i.e., processing difficulties that arise when the proper name *Susan* rather than the pronoun *she* is used. However, when (2.12c') follows (2.12b), the use of the proper name *Betsy* (in 2.12c') is required because the center of attention is not continued but shifted (cf., Brennan, 1995; Gordon et al., 1993).

This indicates that the repeated name penalty and referential choice are not only depended on givenness but also on the discourse status and the transition of centers of attention (Gordon et al., 1993). The center of attention often corresponds to the aboutness topic (Grosz & Sidner, 1986). Accordingly, pronouns can be used to refer to topics that are continued but proper names or lexical NPs are required when the topic is shifted, i.e., the referent was not the topic of the previous utterance.

2.3.2   Referential choice in children

2.3.2.1   Referent salience

It is usually assumed that children start to use referring expressions deictically, that is they use them to refer to referents in the visual context, and only later use them anaphorically, i.e., in terms of the anaphor-antecedent relationship in linguistic discourse (e.g., Karmiloff-Smith, 1981; Tomasello, 2003). In both cases the referring expression needs to provide enough information for the identification of the referent. Thus, speakers need to consider the information status of the referent.

As mentioned above, children tend to omit given information and only realize new information in their earliest utterances (E. Bates, 1976; Greenfield, 1978; Matthews et al., 2006; Salomo et al., 2010). In this case, new information is usually realized as (bare) nouns (Matthews et al., 2006; Salomo et al., 2010).

Starting around age 2;6 to 3, children successively become more sensitive to the relation between referring expressions and the information status of referents. Especially when a linguistic question context is provided, they tend to use more pronouns (and less elliptic responses) to refer to given information and more lexical NPs to refer to new information (e.g., Campbell et al., 2000; Matthews et al., 2006; Serratrice, 2008 for English; Wittek & Tomasello, 2005 for German). This agrees with the cross-linguistic studies by Hickmann et al. (1996) and MacWhinney and Bates (1978) mentioned above, that showed that children were sensitive to the impact of the information status on the type of referring expression.

Spontaneous speech data by Gundel and Johnson (2013) indicate that 2.5- to 3-year-olds are sensitive to the relationship between the cognitive status of referents and different types of referring expression as proposed by the Givenness Hierarchy. The children produced personal pronouns for referents that were

"in focus", demonstrative pronouns for referents that were "activated" and "in focus", demonstrative determiners for "familiar" or "activated" referents, and definite NPs for referents that were at least "uniquely identifiable".

Other studies, however, demonstrated that 2- to 3-year-olds also tend to overgeneralize pronouns to new referents and referents that are not uniquely identifiable and tend to use definite NPs or pronouns for new referents (e.g., Campbell et al., 2000; De Cat, 2011; Emslie & Stevenson, 1980; Gundel & Johnson, 2013; Hickmann et al., 1996; Maratsos, 1976; Matthews et al., 2006; Serratrice, 2008; Wittek & Tomasello, 2005).

This may suggest that children have fewer problems with the linguistic marking of the information status of the referent (but see Gundel & Johnson, 2013) than with determining the information status of a referent which requires taking the perspective of the hearer into account (see section 2.4 below). Moreover, results from narrative studies indicate that discourse skills like the development of introducing and maintaining topics and referents may develop later.

2.3.2.2   Topic continuity and narrative discourse

Studies that investigated the production of referring expressions in narrative contexts do not only require the child to distinguish between given and new information but also to maintain or shift discourse topics. Thus, children need to know what the topic is and how it may be introduced and maintained.

Foster (1986) argues that even children below one year of age show some sensitivity to "rudimentary" topic management in preverbal communication. They use gestures to introduce topics and attract the attention of caretakers. Initially the child herself is the topic but around 6 months of age objects in the immediate environment also serve as topics. However, children that young are restricted in their abilities to maintain topics. Topic

maintenance is usually done by adults and/or in terms of routines such as language games. By age 2 to 2.5, children start to introduce topics that are not present in the environment and start to organize their utterances around a discourse topic.

Studies on narrative discourse showed that preschoolers and school-age children are sensitive to the differences between main and secondary characters in a story but only gradually develop sensitivity to the discourse structure. In particular, they seem to have fewer problems with the introduction of new referents, even though they may be less likely to use (indefinite) NPs to introduce main characters in comparison to secondary characters (e.g., Kail & Hickmann, 1992; Karmiloff-Smith, 1981). It is rather the case that they have more problems with the maintenance and the re-introduction of given referents. They may use pronouns to reintroduce referents that are given but not in the center of attention and involve a topic shift (e.g., Hendriks et al., 2014) or apply strategies for reference management, i.e., they may use pronouns for main characters and lexical NPs for secondary characters, regardless of their information status (e.g., Bamberg, 1986; Hickmann & Hendriks, 1999; Karmiloff-Smith, 1981; Wigglesworth, 1990).

This suggests that children may have problems maintaining the discourse structure of narratives. On the basis of data from English and French-speaking 4- to 9-year-olds, Karmiloff-Smith (1981) argues that the development of children's discourse-skills proceeds through three stages. Pre-schoolers use pronouns *deictically* and use them for all characters in a story, regardless of their discourse status. Older children employ the *thematic subject strategy*, that is, main characters are usually realized as pronouns and secondary characters as noun phrases. In the final phase, children's referential choice is not influenced by the global structure anymore but by the local structure of the story, and similar to adults they use pronouns *anaphorically*.

Data by Bamberg (1986) and Wigglesworth (1990) confirm this general pattern but German-speaking children seem to pass through these stages earlier. 3.5- to 4-year-olds tended to apply the thematic subject strategy; 5- to 6-year-olds relied on the thematic subject and the anaphoric strategy, and 9- to 10-year-olds mostly used the anaphoric strategy.

Crucially, the production studies also show a correlation between syntactic position and referential choice, in that pronouns which refer to main characters were usually introduced in subject position and refered to main characters (Karmiloff-Smith, 1981; Wigglesworth, 1990; Hickmann & Hendriks, 1999). This relationship between the grammatical role (subject status) and the referring expression (pronoun) agrees with the predictions of the centering theory (Grosz et al., 1995), i.e., the subject pronoun is usually the current discourse topic and continued through a narrative.

However, Theakston (2012) argues that children's preference to realize subjects as pronouns may be influenced by the *preferred argument structure* (Du Bois, 1987), i.e., the tendency that subjects are usually discourse-given and realized as pronouns whereas objects may be given or new and tend to be realized as noun phrase. In Theakston's study, English-speaking 5-year-olds realized subjects as pronouns and objects as lexical NPs, regardless of the information status of the referents. Thus, children may have merely relied on the correlation between subject status and pronominality, but still have to learn how the information status of a referent influences the type of referring expression.

However, more recent research showed that discourse factors (salience, contrast) influence the argument realization of subjects and objects even in English-speaking 2- to 3-year-olds (Hughes & Allen, 2013; Graf, Theakston, Lieven, & Tomasello, 2015). This contrast to the study by Theakston (2012) and may result from differences in the IS category investigated, i.e.,

givenness vs. contrast (Graf et al., 2015) or from the hypothesis that children consider a combination of saliency features in their referential choice, i.e., not just discourse givenness (prior mention) but also joint attention and physical presence (Hughes & Allen, 2013).

In general, children's problems with maintaining and reintroducing discourse referents may also be influenced by cognitive factors, i.e., problems with keeping track of what is given and new information (De Cat, 2011) or with problems considering the hearer perspective. Both explanations can account for the overgeneralization of pronouns and will be discussed in the next section.

2.4 Impact of the hearer perspective

So far, the results have shown that children are not always adult-like with respect to the type of referring expression and the given-new preference. One explanation of the differences between children and adults may be that children do not consider the perspective of the hearer.

With respect to word order, children may not produce given-new orders because they do not follow the given-new contract (e.g., Clark & Haviland, 1977; Haviland & Clark, 1974) and/or they do not consider the needs of the speaker. However, if the given-new order is also linked to processing advantages for the speaker (e.g., Bock & Irwin, 1980; Jaeger & Tily, 2011), the lack of this preference is unexpected.

However, children's earliest utterances indicate that children show a preference to place new information first and it has been argued that the new-given order may be easier to produce (e.g., E. Bates, 1976; Narasimhan, Dimroth, Duffield, & Kim, 2010, November). Accordingly, there may be two preferences

(given-before-new and new-before-given) that influence word order.

Alternatively, children may not follow the given-new preference if they determine the givenness or information status of referents solely on the basis of their perspective and have problems integrating the hearer perspective. Support for this hypothesis is provided by research on referential choice.

Several studies demonstrated that 3-year-olds already show some sensitivity to the differences between shared and non-shared knowledge (common ground) in that they produced more lexical NPs when the hearer did not share the scene (e.g., Campbell et al., 2000; Matthews et al., 2006; Serratrice, 2008).

In addition, Nadig and Sedivy (2002) showed that English-speaking children are sensitive to the speaker perspective in production and comprehension. In a referential communication task, 5- to 6-year-olds were more likely to produce adjective modifiers that were required to distinguish a target (e.g., a glass) from a competitor (e.g., a small glass) in conditions when the competitor was visible to the children and the hearer, compared to conditions when the competitor was only visible to the children or absent for both the children and the hearer. In comprehension, children were more likely to look at the correct target (glass) in trials in which the competitor (small glass) was only visible to them but not to the speaker than in trials in which both the target and the competitor were also visible to the speaker and the referring expression (the glass) was ambiguous (because it could refer to both glasses).

However, even 5- to-6-year-old children may not always choose the appropriate referring expression when the hearer does not share the scene (Kail & Hickmann, 1992; De Cat, 2011, 2013) because they may use pronouns to introduce referents that are new to the hearer but given for the speaker. Moreover, the results of the previous section indicate that children overgeneral-

ize pronouns to new referents or referents that are not uniquely
identifiable, even if the hearer shares the scene.

Yet, children may not be "non-pragmatic" per se. They may
have problems estimating how much information is required by
the hearer for target interpretation (Gundel & Johnson, 2013) or
may not have the processing resources to adapt to the perspec-
tive of the hearer (Epley, Morewedge, & Keysar, 2004). Indeed,
Deutsch and Pechmann (1982) showed that children produce
more informative referring expressions when the hearer asked
clarification questions, indicating that they were able to adapt
to the hearer-perspective in certain experimental settings (see
also Matthews, Lieven, & Tomasello, 2007). Moreover, DeCat
(2011, 2013) showed that errors in referential choice in 2- to
5-year-olds were not strongly correlated with performance on
Theory-of-Mind tasks, even though egocentric errors could be
related to pragmatic development in some children (De Cat,
2013). These findings indicate that the errors children make
in referential choice may not solely result from a failure to
consider the perspective of the hearer but also from cognitive
demands, e.g., keeping track of the referents or monitoring the
hearer perspective (De Cat, 2013).

The hypothesis that processing or cognitive demands may
account for the errors children make is supported by studies
showing that adults may also produce referring expressions that
do not provide enough information for the referent identifica-
tion when experimental settings require the explicit distinction
between the listener and speaker perspective and when the task
required the inhibition of irrelevant information or enhanced
memory demands (Fukumura & van Gompel, 2012; Keysar,
Barr, Balin, & Peak, 1998).

Horton and Keysar (1996) suggest that referential choice in-
volves two steps: first, the selection of a referent on the basis of
the speaker's discourse model and second, the monitoring of
the referring expression with respect to the hearer perspective.

Thus, memory factors or interference effects in adults may target the monitoring process.

Similar factors may play a role in children. Epley et al. (2004) used the referential communication task in which English-speaking 5-year-olds (range 4–12 years) and adults saw a target object (a car) in three sizes (big, medium-size, small car) but shared only two of them with the speaker (big, medium-size car). Participants were asked to move the "small car", i.e., the medium-size object (based on the shared common ground) but not the competitor, i.e., the smallest car only visible to the participants. The eye-movements indicate that both children and adults were looking at the competitor item, i.e., the "egocentric" object, but adults were faster to look at the correct medium-size object and were less likely to reach for the "egocentric" object in comparison to children.

Taken together the results indicate that children can adjust to the hearer perspective to some extent but that they may not apply the monitoring process because they are not aware that their utterances lead to misunderstandings (cf., Deutsch & Pechmann, 1982) or because it taxes their processing resources (cf., De Cat, 2013).

However, a recent study by Hendriks et al. (2014) indicates that children's errors in referential choice may result from both language experience and cognitive factors. They investigated the comprehension and production of referring expressions in narratives with two (masculine) characters in Dutch-speaking 4- to 7-year-olds, "young" adults (18–35 years) and "elderly" adults (69–87 years). In production, participants told a picture story to a hearer who could not see the pictures. All groups performed similar with respect to the introduction and maintenance of the first character and the introduction of the second character. They differed in the maintenance of the second character (topic continue) and reintroduction of the first character (topic shift). In both cases, younger adults produced more lexical NPs (73 %,

91 %) than children (44 %, 38 %) and elderly adults (19 %, 53 %). Yet, elderly (and young) adults produced more noun phrases in topic shift than topic continue utterances whereas children did not differ between both conditions.

The comprehension task assessed the resolution of an ambiguous pronoun in a topic continue vs. topic shift task. The elderly adults patterned like the younger adults. They resolved the anaphora to the continued topic referent (first character) in the continue condition and to the shifted referent (second character) in shift conditions whereas children always preferred to resolve anaphora to the first character regardless of the topic context.

Hendriks et al. (2014) propose that problems keeping track of the prominence of referents may be a reason why the elderly people produced more pronouns (than younger adults) in the topic continue and topic shift condition. But crucially, they used more lexical NPs in the topic shift condition where the use of a pronoun leads to ambiguity, indicating that they considered the perspective of the hearer. Children also used more pronouns in the topic continue and topic shift condition, but they showed no difference between the conditions, indicating that they did not consider the speaker perspective in the topic-shift condition. Moreover, the comprehension task does not seem to be affected by cognitive factors because in this task elderly adults pattern like young adults. Accordingly, the interpretative errors that children made may not be reduced to cognitive problems.

2.5   Summary

In this chapter, I introduced the main concepts of information structure. Information structure categories like givenness, focus and topic are related to the common ground, the mutually shared knowledge between interlocutors, and influence the syntactic, prosodic and lexical realization of utterances. Thus, the

marking of information structure requires the child to acquire the means of marking information structure and to consider the perspective of the hearer when assessing the information status of referents.

Givenness may be marked syntactically by the given-before-new order. This order is usually produced by adults but appears to be construction specific. In children, there are incoherent results with respect to the given-before-new order, and one factor influencing the pattern of results may be the impact of the referring expression on word order.

The type of referring expression used for a referent is influenced by its givenness and discourse properties. While children are sensitive to the relationship between givenness and referential choice, they tend to overgeneralize pronouns to new references and have problems when referential choice depends on the discourse-context which requires them to maintain the information status of several referents and to shift attention between the referents. Thus, children may have fewer problems with the general link between the information status of a referent and referential choice but rather with determining the information status of the referent from the perspective of the hearer. However, children are not "ignorant" towards the hearer perspective but may have problems adapting to it, either due to processing difficulties, i.e., keeping track of referents and monitoring the hearer perspective, or due to their discourse skills which are still developing.

With respect to the given-before-new preference, this may suggest that children may not be "ignorant" towards the hearer perspective but rather may be faced with a competition of different ordering strategies (given-new and new-given) and more likely to consider the impact of sentence-level information like pronominality.

This issue, i.e., the impact of information structure and referring expressions on word order variation in German, will be discussed in the next chapter.

3 Word order variation

3.1 Characteristics of the syntax model

As mentioned in the introduction, the syntactic approach that I adopt in this thesis is the Minimalist Program (Chomsky, 1995). Two main basic assumptions of this framework were defined in the Principle and Parameters Theory (PP-theory; Chomsky, 1995). First, competence, i.e., the grammatical knowledge of a speaker, is distinguished from performance, i.e., the factors influencing language use. Second, languages have universal principles and a set of parameters, i.e., restrictions of how these principles apply. Languages differ in the value of the parameters and language acquisition basically involves setting the parameter to the value in the language that the child is learning.

Within the PP-theory, the syntactic structure was derived by the (universal) X-bar schema illustrated in Figure 3.1 (e.g., Chomsky, 1995; Grewendorf, 2002). This schema illustrates that a head ($X°$) projects a phrase (XPs), i.e., a constituent. Other constituents or words may be integrated as complement or specifier (or adjunct). Languages differ in their settings of the head parameter, i.e., whether a head follows or precedes the complement. Thus, on the basis of the input data, the child as to figure out whether their ambient language is a head-final or head-initial language to set this parameter.

The basic language architecture assumed in the Minimalist Program is illustrated in Figure 3.2 (adapted from Grewendorf,
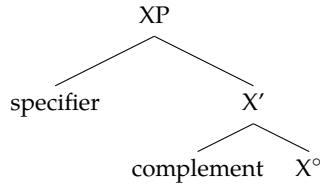
Figure 3.1: Illustration of the X-bar schema

2002, p. 109). The derivation starts with a numeration, i.e, a set of lexical items and functional items (e.g., C°, T°). Syntactic operations are applied to create syntactic derivations that can be interpreted by the conceptual-intentional (LF) and articulatory-perceptual level (PF) and lead to the semantic and phonological representation of a sentence.
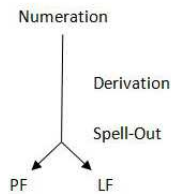
Figure 3.2: Illustration of the Minimalist language architecture

Syntactic structures are created by two operations, merge and move, which are used to combine syntactic objects, i.e., phrases and heads (e.g., Chomsky, 1995; Grewendorf, 2002). Movement operations, which may account for word order phenomena, are influenced by features and economy restrictions (e.g., Chomsky, 1995; Grewendorf, 2002). Functional heads (T°, C°) have uninterpretable (formal) features while lexical items have uninterpretable (formal) features and interpretable (phonological and semantic) features. Uninterpretable features need to be checked and eliminated in certain checking relations, which may involve the movement of constituents into a checking domain of a functional head. Movement may either be *overt* or *covert*, depending on whether the feature to be checked is

strong or weak, with overt movement taking place before spell out and thus being "visible" in the word order of the sentence and covert movement taking place after spell out and being "invisible". Crucially, economy principles restrict the movement of constituents to the sake of feature checking, that is movement is triggered by the requirement of feature checking (*Last resort*, Chomsky, 1995, p. 280).

Figure 3.3 illustrates a simplified syntactic structure of a German main clause *Peter hat ein Buch gelesen.*"Peter read a book." (adapted from Grewendorf, 2002, p. 151).[1] Verb movement of the auxiliary *hat* ("has") (T° to C°) is triggered by the formal features of the head C° and the auxiliary. Subject movement (*Peter*) from the specifier of the VP ([Spec,VP]-position) to the specifier of the TP ([Spec,TP]-position) is triggered by the formal features of T° and the subject (EPP, congruency, case). Subject movement to the [Spec,CP]-position may be triggered by the formal features of C° requiring the sentence-initial position to be filled, but also by the features (e.g., prosodic or information structure features) of the subject. This question of what actually triggers movement to the [Spec,CP]-position is related to the issue of how information structure (IS) may influence word order variation.

Two main questions concern the relation between IS and word order (Fanselow, 2008; Szendrői, 2004). The first concerns the question whether IS influences syntax directly or indirectly. Rizzi (1997) proposed that IS may influence word order directly, for instance in terms of IS features that are checked in the focus phrase (FocP) or topic phrase (TopP). Alternatively, word order variation is triggered by formal features and IS phenomena arise from the interpretation of the sentence in a felicitous context (e.g., Fanselow & Lenertová, 2011).

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1   For the sake of convenience, the base position of moved lexical items are indicated by traces (*t*) rather than deleted copies and the vP is omitted.
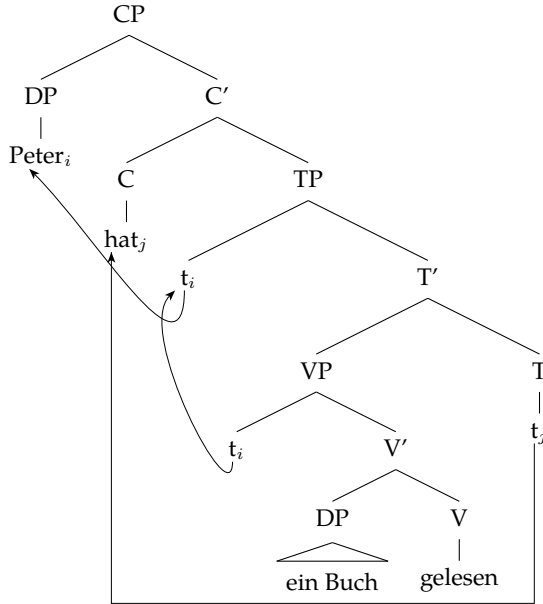
Figure 3.3: Syntactic structure for the sentence *Peter hat ein Buch gelesen*

The second question concerns the optionality of movement which often occurs with IS marking. This may be problematic because optional movement violates economy restrictions, i.e., movement is always more costly than non-movement. In a feature-based approach, the presence of focus and topic heads in the numeration may be optional and depend on discourse conditions (Cinque & Rizzi, 2008). The prosodic approach suggests that phonological factors (e.g., the preference to place focus sentence-finally) may "trigger" word order variation but do not ban the generation of the canonical word order. In this way, the (discourse) factors that may favour one word order over the other are not part of core syntax (e.g., Fanselow, 2008; Fanselow & Lenertová, 2011).

3.2 German word order variation

3.2.1 Distinction between prefield and middlefield

Word order variation in German usually involves to two areas of a sentence, the prefield and the middlefield (cf., Grewendorf, 2002). As Table 3.1 illustrates, the prefield is the position preceding the auxiliary or finite verb in main clauses, i.e., the [Spec,CP]-position in a sentence structure like Figure 3.3.

The middlefield can be defined for main clauses and subordinate clauses. In main clauses (example a) in Table 3.1), it comprises the area between the finite verb (verb-second (V2) position) and the infinitival verb (verb-final (V-final) position), and in subordinate clauses (example b) the area between the complementizer *dass* ("that") and the finite verb.

Table 3.1: Illustration of the prefield and middlefield

	Prefield	V2	Middlefield	V-final
a)	Der Mann	hat	dem Jungen das Buch	gegeben
	the.nom man	has	the.dat boy the.acc book	given
	"The man has given the boy the book."			
b) "Ich glaube (I believe)..."				
		dass	der Mann dem Jungen das Buch	gab
		that	the.nom man the.dat boy the.acc book	gave
	"I believe that the man gave the boy the book."			

3.2.2 Word order variation in the middlefield

3.2.2.1 Factors influencing word order in the middlefield

Word order variation may results from scrambling or pronoun movement (e.g., Müller, 1999; Haider & Rosengren, 1998). Scrambling refers to the positioning of an argument with respect to an adjunct (e.g., the positioning of the direct object *das Buch* "the book" before or after the adverb *heute* "today"

in 3.1) or with respect to another argument (e.g., the order of
the indirect (dative) object *dem Schüler* "the student" and of the
direct (accusative) object *das Buch* "the book" in 3.2). Pronoun
movement involves the ordering of weak pronominal referents
as indicated in (3.3). Crucially, the order of two lexical NP ob-
jects shows some variability in that both orderings of the objects
are grammatical, whereas the order of pronominal objects may
be more restricted.

(3.1) a. Peter   liest heute das   Buch. (Adv-DO)
          Peter.nom reads today the.acc book

          "Peter read the book today."

       b. Peter   liest das   Buch heute. (DO-Adv)
          Peter.nom reads the.acc book today

          "Peter read the book today."

(3.2) a. Peter gibt dem   Schüler das   Buch. (IO-DO)
          Peter gives the.dat student the.acc book

          "Peter gives the student the books."

       b. Peter gibt das   Buch dem   Schüler. (DO-IO)
          Peter gives the.acc book the.dat student

          "Peter gives the book to the student."

(3.3) a. Heute gibt Peter   es   ihm.   (DO-IO)
          today gives Peter.nom it.acc him.dat

          "Peter gives it to him today."

       b. ? Heute gibt Peter   ihm   es.   (IO-DO)
            today gives Peter.nom him.dat it.acc

          "Peter gives it to him today."

When the indirect and direct object are realized as lexical noun
phrase, sentences in which the indirect object precedes the di-
rect object (IO-DO) are more frequent, more acceptable and eas-
ier to process compared to sentences in which the direct object
precedes the indirect object (DO-IO), at least in all-new contexts

(e.g., Kempen & Harbusch, 2005; Pappert, Schließer, Janssen, & Pechmann, 2007; Pechmann, Uszkoreit, Engelkamp, & Zerbst, 1996; Rösler, Pechmann, Streb, Röder, & Hennighausen, 1998). Nevertheless, it is debated whether the IO-DO order is the underlying word order (e.g., Lenerz, 1977), but possibly influenced by verb factors (e.g., Haider & Rosengren, 1998; Lenerz, 2001; Meinunger, 2000), or whether factors like prosody, case or animacy favour the IO-DO order (e.g., Fanselow, 2012; Müller, 1999; Røreng, 2011).

Factors (see 3.4) proposed to influence the order of the objects include animacy (e.g., Müller, 1999; Lenerz, 1977), definiteness (e.g., Lenerz, 1977; Müller, 1999), pronominality (e.g., Haftka, 2004; Lenerz, 1977), and IS factors like focus (e.g., T. N. Höhle, 1982; Lenerz, 2001; Müller, 1999), theme (e.g., Lenerz, 1977) and topic status (e.g., Haftka, 2004; Meinunger, 2000). Thus, the IO-DO word order may be preferred to the DO-IO word order in (3.2) above because this word order follows the animate>inanimate word order.

(3.4)   a. Animacy: animate>inanimate
        b. Definiteness: definite>indefinite
        c. Pronominality: pronoun>noun phrase
        d. Focus: non-focus>focus
        e. Topic: topic>comment

When both objects are realized as pronominal referents the preferred word order is usually DO-IO (Kempen & Harbusch, 2005; Lenerz, 1977; Müller, 1999). However, there is disagreement whether pronoun movement should be distinguished from scrambling (e.g., Meinunger, 2000; Müller, 1999, 2001) or whether scrambling and pronoun movement are influenced by the similar factors (cf., Chocano, 2007; Gärtner & Steinbach, 2000; Haider & Rosengren, 1998).

3.2.2.2   Theoretical accounts

Approaches to word order in the middlefield differ a) in the question whether there is an underlying word order from which the other word order is derived, b) in the factors proposed to influence word order, and c) whether the different syntactic processes are involved in the ordering of nominal and pronominal referents.

Müller (1999, 2001) accounts for word order variation within the framework of *Optimality Theory* (Prince & Smolensky, 2002) and distinguishes between two components of the grammar: the *GEN(erator)*, a set of inviolable constraints, that generates a set of candidate structures, and the *H(armony)-Eval(uation)*, the OT grammar which consists of violable and ranked constraints and evaluates the candidate set (Müller, 1999).

Müller considers the DO-IO order as the underlying word order and proposes that word order variation involving weak (deaccented) pronouns results from pronoun movement and word order variation involving lexical NPs and strong (accented) pronouns results from scrambling. Pronoun movement depends on phonological factors and targets a special position, i.e., the so-called Wackernagel position, which is located between the TP and the VP. Scrambling adjoins constituents to the VP and is influenced by factors like definiteness, animacy and focus.

The ranking of the constraints that are relevant for the word order of objects is given in (3.5).

(3.5)   PRON-CRIT >>SCR-CRIT (DEF >>AN >>FOC) >>EPP, STAY >>PAR-MOVE

The constraint for pronoun movement (PRON-CRIT) is ranked higher than the scrambling constraints (SCR-CRIT), as indicated by >>. This indicates that pronoun movement is less optional than scrambling. Following the scrambling constraints, there

are three further constraints that are relevant here: EPP requires the subject to be in the [Spec,TP]-position, Stay, an economy constraint, bans movement, and Par-Move, a faithfulness constraint, requires the order of the moved constituents to resemble the order of the underlying word order and ensures that weak pronouns are ordered according to the preferred DO-IO order.

This ranking explains the word order preference in examples (3.2) and (3.3) above. The IO-DO word order is the preferred word order of nominal objects (3.6a) because it satisfied the animacy constraint. When the direct object is realized as a (weak) pronoun (3.6b), the DO-IO word order is preferred because the pronoun *es* (it) is subject to Pron-Crit and has to precede the indirect object, even though this order violates the lower ranked animacy constraint.

(3.6) a. Peter   gibt dem   Jungen heute das   Buch.
           Peter.nom gives the.dat boy   today the.acc book

           "Peter will give the boy the book today."

       b. Peter gibt es   heute dem   Jungen.
           Peter gives it.acc today the.dat boy

           "Peter will give it to the boy today."

Müller (1999) proposed several factors influencing the selection of the optimal candidate and thus captures several functions of scrambling. Other approaches mainly considered IS (topic, focus) as a crucial factor influencing word order variation (Frey, 2004a; Lenerz, 2001; Meinunger, 2000).[2]

Lenerz (2001), for instance, assumes that the background-focus distinction influences word order variation and argues that all scrambled elements are interpreted as background information. Thus, as illustrated in (3.7), the indirect object *ihm* "him" has

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2   The issue whether IS influences word order directly (Frey, 2004a; Lenerz, 2001; Meinunger, 2000) or indirectly (e.g., Chocano, 2007; Fanselow, 2012) will not be discussed here.

to be interpreted as background (or given) information while the direct object is interpreted as focus. Note that in contrast to Müller (1999), Lenerz considers the IO-DO word order as underlying for verbs like *geben* "give" and does not distinguish between pronoun movement and scrambling.

(3.7) $[_{CP}$ Peter$_j$ gibt $[_{TP}$ t$_j$ $[_{VP}$ ihm$_i$ $[_{VP}$ heute $[_{VP}$ t$_i$ das
$[_{CP}$ Peter$_j$ gives $[_{TP}$ t$_j$ $[_{VP}$ ihm$_i$ $[_{VP}$ today $[_{VP}$ t$_i$ the
Buch $]]]]]$
book $]]]]]$
[Background-domain$[_{VP}$ (adverb) $[_{VP}$ **Focus-domain**$]]]$
"Today Peter gives ihm the book."

3.2.2.3 Empirical studies investigating the word order constraints in adults

Crucially, there is an ongoing debate concerning the underlying word order of the objects in ditransitive sentences and the factors influencing word order variation on the theoretical side (e.g., Grewendorf, 2002) as well as on the empirical sides, basically due to difficulties to disentangle the effects of animacy and verb factors (see Bader & Häussler, 2010 for an attempt to disentangle both effects).

Studies investigating the factors influencing the ordering of the double objects showed that focus, animacy and case influence word order, while definiteness did not lead to clear results (Røreng, 2011; Pappert et al., 2007).

A corpus analyses by Røreng (2011) revealed that focus, animacy and case but not definiteness influenced word order, with the constraint ranking focus>>animacy>>case. In agreement with Müller (1999), Røreng argues for the DO-IO word order as underlying word order but she considered a variety of verbs, i.e., also verbs for which the DO-IO word order may be proposed (Haider & Rosengren, 1998; Lenerz, 2001).

Pappert et al. (2007) conducted a variety of studies (corpus analyses, completion tasks, reading tasks) to test the impact of case, animacy and definiteness on the ordering of lexical noun phrases. Their results show that animacy and case influenced word order (but both effects were difficult to disentangle) whereas definiteness had no clear effects. Pappert et al. propose that *prominence*, i.e., the preference to place prominent before less prominent referents, may be the "underlying" factor influencing word order.

3.2.3 Word order variation involving the prefield

3.2.3.1 Factors influencing movement to the prefield

Word order variation in the prefield also involves optionality. Usually the subject (3.8a) or an adverb (3.8b) is placed in the prefield, but also another constituent, e.g., an object (3.8c), may occur there.

(3.8)   a. Peter liest   heute ein Buch.
             Peter reads today a   book
             "Peter read a book today."

        b. Heute liest   Peter ein Buch.
             today reads Peter a   book
             "Today, Peter reads a book."

        c. Ein Buch liest   Peter heute.
             a   book reads Peter today
             "A book, Peter reads today."

There is general agreement that movement to the prefield is influenced by IS, in particular topic and focus. The preference to place the subject or adverbs to the prefield may be linked to topicality because the subject is often the topic of a sentence and adverbials may be seen as frame-setting topics (e.g., Jacobs, 2001; Speyer, 2004, 2007). Other arguments like the object may also be placed to the prefield when they are topic (3.9a), focus (3.9b),

or are part of a poset-relation (e.g., superset-subelement relation (family-brother)) with an element in the preceding context (3.9c) (e.g., Frey, 2006, 2010; Speyer, 2007; Weskott, Hörnig, Fanselow, & Kliegl, 2011).

(3.9)   a. Let me tell you something about my brother.

   Ihn   wird Peter   morgen   auf dem Fest
   he.acc   will Peter.nom tomorrow at   the   festival
   treffen.
   meet

   "Him, Peter will meet tomorrow at the festival."

   b. Who will Peter meet at the festival?

   Meinen Bruder wird er   auf dem Fest
   my.acc brother will he.nom at   the   festival
   treffen.
   meet

   "My brother, Peter will meet at the festival."

   c. Did Peter met your family?

   Nein, meinen Bruder wird er   auf dem
   no,   my.acc brother will he.nom at   the
   Fest   treffen.
   festival meet

   "No. My brother, he will meet at the festival."

3.2.3.2   Theoretical approaches

Theoretical accounts usually agree that topical and focus constituents are moved to the prefield but differ in the question whether IS, prosodic or formal features trigger this movement.

One account in terms of the feature-based was proposed by Frey (2006, 2010). Frey distinguishes two movement operations to place constituent in the prefield.

With respect to the prefield, Frey (2006) suggests that a constituent may be moved to the prefield by *formal movement* or *(true) Ā-movement*.[3] Formal movement moves the highest constituent in the middlefield to the prefield while keeping the function that this constituent had. Crucially, Frey (2004a) proposes a position for topical elements in the middlefield, i.e., a medial topic position, which is located at the left edge of the middlefield. This can explain why an object may be interpreted as the topic of a sentence, as indicated in (3.10a). Here, the pronoun *ihn* ("him") was first scrambled to the topic position (in TopicP) where it received the topic interpretation. Then, it is placed to the prefield via formal movement and is interpreted as topic (because it received this pragmatic function in the medial topic position).

(3.10) a. Formal Movement: (Context: Let me tell you something about my brother.)

$[_{CP}$ Ihn$_i$ wird $[_{TopicP}$ t$_i$ $[_{TP}$ Peter t$_i$ auf dem
$[_{CP}$ Him$_i$ will $[_{TopicP}$ t$_i$ $[_{TP}$ Peter t$_i$ at   the
Fest   treffen]]]
festival meet   ]]]

"Him, Peter will meet at the festival."

b. Ā-movement: (Context: Who will Peter met at the festival?)

$[_{CP}$ Meinen Bruder$_i$ wird $[_{TopicP}$ Peter$_k$ $[_{TP}$ t$_k$ t$_i$
$[_{CP}$ My   brother$_i$ will $[_{TopicP}$ Peter$_k$ $[_{TP}$ t$_k$ t$_i$
treffen]]]
meet   ]]]

"My brother, Peter will meet at the festival."

---

3   Frey (2006) also considers formal movement as a kind of Ā-movement because the [Spec, CP] is a Ā-position. Ā-movement may be distinguished from A-movement in that it is related to the checking of features of the "peripherial" system (information structure, speech acts) rather than to features of the case-congruency system that are linked to A-movement (cf., Grewendorf, 2002).

While formal movement itself is not related to any pragmatic effect, regular Ā-movement leads to a contrastive interpretation and requires the moved constituent to be stressed (Frey, 2010). This operation moves the constituent directly from its base position to the prefield (3.10b).

In contrast, Fanselow and Lenertová (2011) argue that IS does not directly influence word order. Rather the interpretation of the constituents as topic or focus results from contextual factors that require the deaccentuation of given material and the accentuation of new/focused material. Crucially, these contextual factors are not part of the core syntax, so that the syntactic system basically only has to ensure that possible movements are allowed by the grammar.

Fanselow and Lenertová assume that a formal feature requires a constituent to be placed in the prefield but leaves it open which constituent may be moved. Deaccented and accented constituents may be placed in the prefield but a locality restriction prevents a structurally accented constituent from crossing another accented constituent. Structurally accented constituents may be contextually new but not contrastively focused or given.

Thus, in an all-new context (3.11a), the object *meinen Bruder* ("my brother") cannot be placed in the prefield when both the subject and the object bear structural accents. Nevertheless, it can be placed in prefield if it is contrastively focused (and thus does not bear a structural accent) or given, regardless of whether the subject is given (3.11b) or new.

(3.11)   a. Context: What happened?

$?[_{CP}$ Meinen Bruder$_i$ wird $[_{TP}$ Peter t$_i$ auf dem
$?[_{CP}$ My   brother$_i$ will $[_{TP}$ Peter t$_i$ at   the
Fest   treffen]]
festival meet]]

"My brother, Peter will meet at the festival."

b. Context: Who will Peter met at the festival?

[$_{CP}$ Meinen Bruder$_i$ wird [$_{TP}$ Peter t$_i$ treffen]]
[$_{CP}$ My   brother$_i$ will [$_{TP}$ Peter t$_i$ meet   ]]

"My brother, Peter will meet at the festival."

3.2.3.3 Empirical studies investigating movement to the prefield in adults

Studies investigating movement to the prefield mainly investigated transitive sentences in the SVO and OVS word order. Corpus analyses and production studies revealed higher frequencies of the canonical SVO word order compared to the noncanonical OVS word order (e.g., Skopeteas & Fanselow, 2010; Weber & Müller, 2004). In addition, the results suggest that topic status, inferrability and focus, but not givenness, are crucial factors that determine the use of the non-canonical word order.

Weber and Müeller (2004) investigated the impact of givenness, definiteness and pronominality in SVO and OVS sentences. Their corpus data show that the constraints tended to be satisfied in the SVO word order. SVO sentences usually had given-new, definite-indefinite and pronoun-NP orderings. In the OVS word order, the constraint satisfying orders were not preferred. A reason for this might be the correlation between the constraint characteristics and grammatical role. Subjects tend to be given, definite and pronominal but objects were given or new, definite or indefinte, and pronominal or nominal (e.g., Chafe, 1976; Du Bois, 1987; E. F. Prince, 1992).

Moreover, a cross-linguistic production elicitation study by Skopeteas and Fanselow (2010) showed that contexts in which the object was given and the subject new did not trigger the OVS word order; rather participants tended to stick to the SVO word order (76.6 %) or used passives (21.3 %).

This suggests that ther factors besides givenness may influence which constituent is placed in the prefield. For instance, a corpus analysis by Bader and Häussler (2010) showed that the topic status of the object may play a role in the use of the OVS word order.

With respect to focus, Fanselow, Lenertová, and Weskott (2008) showed that focused objects may license the OVS word order but did not lead to a preference of the OVS word order. They used question contexts (3.12) to cue focus on the object in the subsequent target sentence and showed that sentences in the OVS (3.12b) and SVO word order (3.12b) were rated as equally acceptable.

(3.12)   Who did the nurse want to leave?

   a. Die   Krankenschwester wollte   den
      the.nom/acc nurse   wanted the.acc
      Medizinstudenten verlassen.
      medicine.student   leave

      "The nurse wanted to leave the student of medicine."

   b. Den   Medizinstudenten wollte   die
      the.acc medicine.student   wanted the.nom/acc
      Krankenschwester verlassen.
      nurse   leave

      "The student of medicine, the nurse wanted to leave."

3.2.4   Impact of the referring expression on word order

The relationship between referring expressions and word order may be considered from two perspectives. On the one hand, referring expressions may influence grammar in terms of locality constraints. That is, the movement of objects across subjects may lead to intervention effects when the subject and the object share certain features, e.g., the type of referring expression (e.g., Rizzi, 1990, 2013; see Fanselow & Lenertová, 2011 who

consider structural accents as intervening). These intervention effects may not necessarily lead to ungrammaticality but may still influence the production and comprehension of the non-canonical word order (e.g., Rizzi, 2013; see Chapter 5).

On the other hand, referring expressions (or their prosodic correlates) may influence word order because they may occur in special positions or are banned from certain positions. With respect to the middlefield, theoretical proposals differ in how the type of referring expression may influence word order. That is, either the referring expression or its phonological correlate (e.g., Müller, 1999, 2001) or the IS status of its referent (Lenerz, 2001; Rizzi, 1997) influences word order. Notably, from the IS feature-based approach, there should not be any difference in whether a given or topic constituent is realized as a pronoun or a lexical noun phrase. However, if phonological properties influence word order, as Müller (2001) suggested, referring expressions may have a impact on word order because (given) weak pronouns are placed in the Wackernagel position whereas (given) lexical NPs are not.

The type of referring expression is less related to word order variation in the prefield. While it may be argued that weak pronouns may not occur in the prefield unless they are subjects (e.g., Rambow, 1993), Frey's proposal suggests they may also be placed in the prefield provided that they are topics (Frey, 2006, 2010).

Nevertheless, it appears that discourse factors may influence referential choice in the prefield. It has been argued that personal pronouns may refer to topical referents whereas demonstrative pronouns, like *der*, *die* and *das* ("that"), refer to less topical referents (Bosch, Rozzario, & Thao, 2003; Hinterwimmer, 2014). Rambow (1993) links the relation between referential choice and word order to Centering Theory (Grosz et al., 1995, see Chapter 2). He suggests that the backward looking center, which contains the most prominent entity

of the previous utterance and is usually realized as a personal pronoun, may only occur in the prefield if it is the subject. Moreover, he links the prefield to the forward looking center, i.e., to the subsequent discourse. Thus, a subject personal pronoun usually indicates topic continuity whereas an object indicates a topic shift (because subjects are usually continued in a discourse). This corresponds to proposals that personal pronouns in the prefield may indicate topic continuity and demonstrative pronouns a topic shift (Hörnig, Weskott, Kliegl, & Fanselow, 2013).

3.3 Word order variation in children

3.3.1 Acquisition of word order variation

Given that generative grammar is the theoretical background in this thesis, also the language acquisition background will be discussed within this framework. As mentioned in the introduction, nativist approaches assume that language cannot be acquired solely on the basis of the input (e.g., see Eisenbeiß, 2009; Valian, 2009a, 2009b; Yang, 2014).

While the input clearly plays a role, it is usually assumed that there may be certain learning biases (Yang, 2014) or aspects of language, i.e., the universal grammar (UG), that are innate. As mentioned above, the Principles and Parameters theory (Chomsky, 1995) distinguishes between universal principles, which apply to all languages and parameters, which exist in all languages but differ in their setting among languages. Language acquisition basically involves the setting of the parameter to the value of a given language on the basis of the input. In this way, the Universal Grammar (UG) restricts the learning hypothesis space for the children acquiring their language (cf., Eisenbeiß, 2009; Yang, 2014).

Thus, generative approaches have to explain how children set the parameters. Notably, accounts vary in the proposed number and nature of the parameters and in the kind of information (cues) children may use from the input to set the parameters (e.g., Eisenbeiß, 2009; Yang, 2014).

In addition, theories differ in whether all parameters and constraints of UG are available to the child from early on or not and in how non-adult-like utterances are accounted for (Eisenbeiß, 2009). With respect to the acquisition of word order variation, the issues concern the syntactic representation of sentences in child language (e.g., Clahsen, 1990; Poeppel & Wexler, 1993; Rizzi, 1993/1994; Weissenborn, 1990, 1994) and the factors influencing word order variation (e.g., Barbier, 2000; Penner, Tracy, & Weissenborn, 2000; Schaeffer, 2000).

In the minimalist framework, overt (visible) movement is triggered by strong features whereas weak features lead to covert movement which takes place after spell-out. The child has to acquire the functional heads of a given language, e.g. C°, that provide checking domains, and whether features are strong or weak (and thus trigger overt or covert movement).

With respect to non-obligatory movement, the child has to acquire that certain features – depending on the account prosodic, semantic, or IS features – trigger word order variation, but also the discourse or IS conditions when movement is possible.[4]

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4   I won't distinguish between feature-based and stress-based accounts to IS here. In the feature based account, children need to acquire the discourse conditions when IS phrases (FocP, TopP) are available so that topic and focus constituents can be moved to these domains. In the stress-based account, children may need to acquire that prosodic characteristics trigger word order variation, and the OT constraint ranking, which may include discourse factors, that determines the choice between different linearizations. That is, in both accounts the child needs to acquire the discourse factors influencing word order variation but they are implemented at different stages in the grammatical model.

Proposals on the acquisition of word order variation propose that children may initially produce the underlying (base-generated) word order because this may be the less complex and more economic structure (Snyder, 2007; Westergaard, 2008; Zuckermann & Hulk, 2001; see Weissenborn, 1994 on verb movement), or because of a lack of morphological (Clahsen, Eisenbeiß, & Penke, 1996; Eisenbeiß, 1994), pragmatic or semantic knowledge (e.g., Barbier, 2000; Schaeffer, 2000). Subsequently, on the basis of the input data (e.g., Snyder, 2007; Westergaard, 2008) and/or the development of morphological, pragmatic and semantic knowledge, children acquire the non-canonical word orders and the factors triggering word order variation. With respect to the impact of the input data, this suggests that word order variation that is obligatory and frequent in the input will be acquired earlier than word order variation that is optional and occurs less often.[5] However, if development of word order variation depends more on the development of morphological, pragmatic or semantic knowledge, it should be less dependent on input frequency.

3.3.2 Acquisition of the factors influencing word order

German-speaking children acquire obligatory word order variation relatively early, i.e., between age 2 to 2.5. At this age, children are almost adult-like in their placement of verbs, i.e., they tend to place finite verbs in the verb-second position or sentence initial position (see 3.13a) and tend to place verbs in the infinite form in the clause-final position (e.g., Clahsen, 1990, 1996; Poeppel & Wexler, 1993; Weissenborn, 1990). While subjects may often be omitted (Clahsen, 1990), they may also be realized in the pre-verbal (pre-V2) position or in the middlefield (Poeppel & Wexler, 1993; Weissenborn, 1990). Yet it is

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5 Crucially, in contrast to usage-based approaches, it is assumed that the acquisition of a movement operation in one constructions (which may involve the setting of a parameter) is not restricted to this construction but also affects other constructions involving the movement operation (e.g., Snyder, 2007).

not clear whether children at this age have already acquired the adult-like sentence structure (e.g., Clahsen, 1990; Poeppel & Wexler, 1993; Weissenborn, 1990, 1994). Indications that the adult-like sentence structure is constructed are instances when a non-subject occurs in the prefield. Children produce these utterances already at age 2 (see 3.13b) (Poeppel & Wexler, 1993; Weissenborn, 1990) or around 2.5 (Clahsen, 1990).

(3.13) a. mag er   nicht (H; 2;01.04)
            want he.nom not
            "He doesn't want." (Weissenborn, 1990, p. 201)

       b. das   macht der   maxe nicht (S; 2;01.01)
            that.acc makes the.nom Max not
            "Max didn't do that." (Weissenborn, 1990, p. 204)

3.3.2.1 Word order variation in the middlefield

Word order variation in the middlefield starts around the age of 2 and usually involves pronoun movement or local scrambling, i.e., the positioning of an argument with respect to the negation or a focus particle (e.g., Penner et al., 2000 on German; Schaeffer, 2000 and Barbier, 2000 on Dutch). Penner et al. (2000) show that 2-year-olds already place subjects and objects in front of focus particles (see 3.14) and somewhat later in front of the negation, indicating that they are sensitive to the impact of focus and negation on word order variation. Nevertheless, they do not always scramble objects in contexts where adults would do (Clahsen et al., 1996; see also Barbier, 2000; Schaeffer, 2000).

(3.14) a. mone   auch laffe habe (Simone, 2;01.21)
            Simone also bottle have
            "Simone also wants to have a bottle." (Penner, 2000, p. 158)

       b. des auch mone   hol(en) (Simone, 2;01.21)
            this also Simone gets
            "Simone also gets this." (Penner, 2000, p. 158)

As mentioned in Chapter 2 givenness, i.e., the preference for the given-before-new order, may influence the dative alternation in English, Norwegian, Russian and Ukrainian speaking 3- to 5-year-olds (Anderssen et al., 2014; de Marneffe et al., 2012; Mykhaylyk, 2012; Stephens, 2010). However, these results might be confounded by the type of the referring expression, which is often correlated with givenness, so that it is not completely clear whether givenness or the type of referring expression influenced word order variation.

With respect to the ordering of double objects in German, studies suggest a preference of the IO-DO word order to the DO-IO word order, at least with transfer verbs like *geben* "give", which belong to the verbs produced by young children. Repetition studies showed that children were more likely to change sentences presented in the DO-IO word order (e.g., 3.15a) to the IO-DO word order (Roeper, 1973; Drenhaus, 2004; Eisenbeiß, 1994) even when factors like animacy are controlled for. This may indicate that the IO-DO word order is the underlying, canonical word order for these verbs (Drenhaus, 2004; Eisenbeiß, 1994).

(3.15) a. Der   Mann will   die   Katze dem   Kind
          the.nom man wants the.acc cat   the.dat child
          zeigen.
          show
          "The man wants to show the cat to the child."

      b. Der   Mann will   ihn   (Stuhl) der
          the.nom man wants him.acc (chair) the.dat
          Frau   geben.
          woman give
          "The man wants to show it (chair) to the woman."

Crucially, Drenhaus (2004) also found that the repetition of the DO-IO word order was improved when the direct object was realized as a pronoun. That is, 3- to 6-year-old German-speaking children repeated the sentences correctly about 44 % of the time

when the direct object was realized as a lexical NP (3.15a) but around 76 % when it was realized as a pronoun (3.15b).

This difference may be related to the licensing of the DO-IO word order. Even though the sentences were presented without a context (but with a picture), it might be that the use of the pronoun made the use of the DO-IO sentence (more) felicitous, i.e., either in terms of givenness (pronouns indicate givenness) or in terms of prosody (pronouns are usually deaccented).

Alternatively, it might be that word order variation involving pronouns, i.e., pronoun movement, may be easier to acquire than word order variation involving lexical NPs, i.e., scrambling. This might be due to three reasons: a) the case marking of the pronouns may be acquired earlier, b) different factors may influence pronoun movement and scrambling (e.g., prosody vs. information structure), or c) pronoun movement is more frequent and predictable in the input.

The claim that the case marking of pronouns may influence the production of the DO-IO word order is supported by a corpus study by Eisenbeiß (1994). She found that German-speaking children aged between 1;10 and 3;5 initially omitted indirect objects or realized them as pronominal referents and only later realized them as lexical NPs with the correct case marking. Eisenbeiß (see also Clahsen et al., 1996) proposes that scrambling of lexical NPs depends on the acquisition of case marking. That is, scrambling of indirect and direct objects only occurs when the child has already acquired the dative and accusative case morphology, whereas word order variation involving pronouns does not depend on case marking.

Pronoun movement may also be easier to acquire than scrambling because it depends on prosodic factors rather than on IS or semantic factors like definiteness. Corpus data by Schaeffer (2000) suggest that children may be less adult-like in scrambling when word order variation depends on specificity because this

feature is underspecified in child grammar. Moreover, a repetition task by Barbier (2000) showed that Dutch-speaking children aged 2;8 to 6;3 repeated the non-canonical structures more correctly when word order variation depended on syntactic factors like case than when it depended on factors like focus.

However, spontaneous speech data on Swiss and Standard German (Penner et al., 2000) and cross-linguistic evidence from Norwegian- and French-speaking children (Anderssen, Bentzen, & Westergaard, 2010, but see Anderssen, Bentzen, & Rodina, 2012; De Cat, 2009, 2011) indicate that 2- to 3-year-olds were sensitive to IS factors like focus and topic status on word order variation.

In addition, the study by B. Höhle et al. (2014), introduced in Chapter 2, indicates that German-speaking 5-year-olds may be more adult-like when word order variation depends on focus rather than definiteness. Children were asked to repeat sentences in the IO-DO and DO-IO word order which either satisfied or violated the focus constraint (background>focus) or definiteness constraint (definite>indefinite). They repeated the sentences more correctly when they were given in the IO-DO word order (3.16a, 3.17a) than in the DO-IO word order, especially when the constraints were satisfied. Focus influenced the results in that children repeated the structures more correctly when the sentence followed the DO-IO word order and satisfied the focus constraint (background>focus, 3.16b) than when the sentence followed the IO-DO word order and violated the constraint (focus>background). Satisfaction of the definiteness constraint (definite>indefinite, 3.17b), however, did not increase the correct repetitions of sentences in the DO-IO word order.

(3.16)   a. Der   Mann gab dem   Jungen den   BALL.
            the.nom man gave the.dat boy   the.acc ball
            "The man gave the boy the ball."

b. Der   Mann gab den   Ball dem   JUNGEN.
the.nom man   gave the.acc ball the.dat boy
"The man gave the ball to the boy."

(3.17)   a. Der   Mann gab dem   Jungen einen Ball.
the.nom man   gave the.dat boy   a.acc   ball
"The man gave the boy a ball."

b. Der   Mann gab den   Ball einem Jungen.
the.nom man   gave the.acc ball a.dat   boy
"The man gave the ball to a boy."

This indicates that children may have less problems with the impact of focus on word order and have more problems with definiteness. However, the correlation between prosodic focus and contextual modification of information structure in the study by Höhle et al makes it difficult to distinguish between the impact of sentence-level and contextual cues that license word order variation. That is, sentences in which focus was modified were presented in a corresponding question context whereas sentences in which definiteness was modified were always presented in an all new context.

Nevertheless, the results fit to the study by Drenhaus (2004) and indicate that the DO-IO word order may not be licensed without an appropriate context and that sentence-level cues like pronouns and focus prosody (but not definiteness) make the DO-IO word order more felicitous.

Finally, word order variation involving pronoun movement may be easier to acquire because it is obligatory and thus possibly more frequent in the input. Given that children may initially produce sentences in the underlying or canonical word order due to economy restrictions, they may only produce derived structures when there is enough evidence for these structures in the input (e.g., Snyder, 2007; Westergaard, 2008; Zuckermann & Hulk, 2001). Support for this relationship between input fre-

quency, economy and word order variation comes from studies
investigating the Norwegian subject and object shift (Anderssen
et al., 2010; Anderssen, Bentzen, & Rodina, 2012) and optional
wh-questions in French (Zuckermann & Hulk, 2001).

Anderssen and colleagues (2010; 2012) propose that differences
in the frequency of the subject and object shift may explain
why children consider the same IS factor (topical pronouns are
shifted) influencing word order variation much earlier for the
subject shift, i.e, around age 2.5 to 3, than for the object shift,
around age 5.

The study by Zuckermann and Hulk (2001) on the production
of optional wh-questions in French showed that 4- to 5-year-
olds tended to produce the less complex structure (producing
the wh-word in situ) even though this structure may be less fre-
quent in the input than the more complex structure in which
the wh-element was fronted. In this way structural economy
was more important than frequency.

With respect to the differences between obligatory pronoun
movement and (possibly) optional scrambling in German, we
might expect that children acquire pronoun movement earlier
because it is obligatory and possibly more frequent in the input
whereas scrambling may be acquired later or used less often if
it is optional and less frequent.

3.3.2.2   Word order variation in the prefield

Theoretical proposals suggest that topic and focus constituents
may appear in the prefield and that movement to the prefield
may be less influenced by the type of referring expression.
Accordingly, the prefield is a good test case to see whether
children place given or new constituents in the prefield.

Unfortunately, the acquisition of the factors influencing move-
ment to the prefield has received less attention. To the best of

my knowledge, the only systematic analysis on the factors influencing word order variation in the prefield in spontaneous speech was conducted by Fleischhauer (2009). Fleischhauer analyzed the impact of givenness, definiteness and pronominality on the SVO and OVS word order in the utterances produced by one child, Simone, in the age range of 2;0 to 4;0. Overall, OVS sentences were less frequent than SVO sentences (17.4 %) and their frequency increased with age, but in general they occurred equally often as in child-directed speech (24.5 %).

In both child language and child-directed speech, the orderings in the SVO word order either satisfied the constraints (especially, definiteness and pronominality) or were neutral with respect to the constraints (givenness) while constraint violations were rare. In contrast, the orderings in the OVS word order rarely satisfied the constraints but rather tended to be neutral with respect to the constraints most of the time. In addition, there was also a considerable amount of constraint violations, with constraint violations being most frequent for the pronominality constraint (CL: 45 %, CDS: 63 %), intermediate for the definiteness constraint (CL: 21 %, CDS: 37 %) and least frequent for the givenness constraint (CL: 14 %, CDS: 11 %).

Fleischhauer also analyzed the information status of the object in OVS sentences in child language. In general, objects were given (70 %) rather than inferrable or focused (around 25–30 %). This suggests that children may prefer the given-new order for SVO sentences and the given-given or given-new order for OVS sentence, and may do not support a general preference to place new-before-given information (cf., Narasimhan & Dimroth, 2008).

Nevertheless, givenness and inferability did not influence word order variation because given and inferable objects occurred in both the SVO and OVS word order.[6] In contrast, focused objects

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6 Fleischhauer annotated all pronouns as given, except for the indefinite pronoun *man*, "one". In this way, hearer-givenness and discourse-givenness

that were the answer to a focus question occurred slightly more often in the OVS word order than in the SVO word order.

The observation that focused objects may be placed in the prefield are supported by results of an elicited production task on the prosodic and syntactic marking of focus in 5-year-old German-speaking children (Sauermann et al., 2011). Children and adults were asked to "correct" sentences that were presented with flat intonation in the SVO and OVS word order. Focus was modulated by question contexts. Adults showed a strong preference for the SVO word order and used prosodic means to mark focus on the subject and the object. Children also predominantly used prosodic means to mark focus, however, their results may also indicate some sensitivity to the factors that license the OVS word order. They were slightly more likely to produce the OVS word order when the object was focused (by a wh-question and contrastive context) and when the subject was focused by a wh-question that may also mark the object as the topic. This may indicate that children accept focused and to some extent topical objects in OVS sentences. However, children only produced the OVS word order when they were asked to repeat sentences in the OVS word order but rarely changed from the SVO word order to the OVS word order. This agrees with the results of the studies mentioned in Chapter 2 that children seem to prefer to use prosodic rather than syntactic cues to mark information structure.

Fleischhauer's (2009) results may also be related to the findings of the cross-linguistic study by Hickmann et al. (1996), which could not show that word order variation in children and adults was influenced by givenness. This may indicate that givenness is not a sufficient factor licensing the OVS word order (Skopeteas & Fanselow, 2010), even though direct objects in the prefield

were not distinguished. However, in an interactive context in which possibly almost all referents are given, discourse-givenness, which draws the attention to a referent by mentioning it, may be a better measure of givenness.

tend to be given as Fleischhauer shows. Accordingly, other factors, e.g., topic status, may trigger movement to the prefield. Moreover, givenness may not play a role in word order variation because children and adults may follow a passivation strategy as suggested by Skopeteas and Fanselow (2010). Nevertheless, givenness may influence word order in constructions which are less likely to be passivized, e.g., ditransitive sentences.

While pronominality was not a factor influencing word order in the corpus analysis by Fleischhauer (2009), the type of referring expression may be seen as a cue to word order in non-canonical sentences if demonstrative pronouns rather than personal pronouns occur in the prefield when they refer to objects. Fleischhauer (2009) did not distinguish between different pronoun types so that it is possible that a finer distinction of different pronoun types may clarify this issue.[7]

3.4   Summary

This chapter provided the background for the impact of information structure in adult and child language. Theoretical proposals suggest that the given-new order (or the corresponding background-focus order) may have a stronger impact on word order variation in the middlefield than on movement to the prefield. Thus, differences between the middlefield and prefield may be a reason for the incoherent results concerning the given-before-new preference in children, as suggested in Chapter 2.

The type of referring expression may be a crucial factor influencing word order variation in the middlefield. Previous research suggests that word order variation involving pronoun movement may be easier to acquire than scrambling because it may be less optional than scrambling and depended on phono-

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7   Notably, Fleischhauer's data, which she provided to me, show that objects in OVS sentences tend to be realized as demonstrative pronouns.

logical factors. This issue will be investigated in the first corpus analysis, reported in the next chapter, that investigated the factor influencing word order variation in double object constructions.

With respect to word order variation in the prefield, several factors, in particular topic and focus, may influence word order. These factors may be related to givenness because topics tend to be given and focus constituents new. Theoretical proposals suggest that movement to the prefield may be less influenced by the type of referring expression so that word order involving the prefield may reflect whether children may follow a given-before-new or new-before-given strategy. Nevertheless, different pronoun types may be related to differences in the discourse-givenness of the referents, so that children may also use the type of referring expression as cue to word order. This question will be addressed in the second corpus analysis.

Finally, topicality may be a means of distinguishing between given referents, i.e., it distinguishes topical referents, which are highly prominent and in the focus of attention, from referent that are "just" given. The question whether topic status may be a better predictor for movement to the prefield and word order variation in the middlefield will be investigated in the third corpus analysis.

4 Production: Corpus analyses

The production part of the thesis investigated the factors influencing word order variation in spontaneous child language and child-directed speech. In particular, word order variation involving the prefield and middlefield of ditransitive sentences was investigated. Ditransitive sentences were selected because the order of double objects in the middlefield resembles most closely the dative alternation in English and Norwegian. Investigating the movement to the prefield extends previous research that usually investigated transitive sentences, but the factors that influence movement to the prefield should be the same for both transitive and ditransitive sentences.

Three corpus analyses were conducted to investigate the following research questions:

- Corpus analysis 1 (including corpus analysis 1a and 1b) investigated the impact of givenness, definiteness, animacy and the type of referring expressions on word order in the middlefield to determine whether children may acquire pronoun movement earlier than scrambling.

- Corpus analysis 2 investigated the impact of givenness and the type of referring expressions on word order in the prefield to determine whether children follow a given-before-new or new-before-given strategy in constructions that allow both orders.

- Corpus analysis 3 investigated the impact of topic status and the type of referring expressions on word order variation in the middlefield and prefield to determine whether topic status may be a better predictor of word order variation than givenness or the type of referring expression.

Notably as discussed in Chapter 3, theoretical accounts on word order in German usually consider focus rather than givenness as a factor influencing word order variation. However, given that the corpus data available do not provide prosodic information, which may be reliable cue for focus annotations in spontaneous speech, (discourse-)givenness rather than focus was annotated. Nevertheless, givenness is usually correlated with focus, in particular information focus, although this does not extend to contrastive focus.

4.1   The data set for the corpus analyses

The data were taken from four corpora of typically-developing German-speaking children (Miller, 1979; Rigol, 2007; Szagun, 2001; Wagner, 1985) provided by the CHILDES database (MacWhinney, 2000). Utterances of 12 children aged between 2;0 and 4;11 and their mothers (child-directed speech) were analyzed, but transcripts were not available for all children across the entire age range. Data extraction was done manually using the CLAN system (MacWhinney, 2000). The search of the relevant utterances was based on 20 ditransitive verbs that were selected in advance on the basis of the verbs uttered by all children and later narrowed down due to the exclusion criteria mentioned below. Utterances that included the verbs were extracted from the corpus.

The data were restricted to utterances in which the indirect and direct object were realized as non-clausal continuous constituents. Word order was annotated with respect to the relative

positioning of the indirect and direct object, regardless of the position of the subject. Sentences in which the indirect and direct object could not be identified were excluded.

Three word orders were distinguished: IO-DO, DO-IO and pre-DO. The IO-DO (indirect object before direct object) and DO-IO (direct object before indirect object) word order referred to word order variation in the middlefield and comprised main and subordinate clauses. In main clauses the middlefield was defined as the domain following the finite verb (*gab* "gave" in 4.1a) or between the auxiliary (*hat* "has") and the infinite or participle verb (*gegeben* "given" in 4.1b), and in subordinate clauses as the domain preceding the finite verb (*gab* "gave" in 4.1c). The pre-DO word order indicated that the direct object was placed in the prefield (4.1d), i.e., the position preceding the infinite verb or auxiliary in main clauses. Indirect objects were rarely placed in the prefield and therefore these cases were not considered in the subsequent analyses.

(4.1)   a. Der   Mann gab   dem   Jungen das
           the.nom man   gave.finV the.dat boy   the.acc
           Buch.
           book.
           "The man gave the boy the book."

        b. Der   Mann hat dem   Jungen das   Buch
           the.nom man   has the.dat boy   the.acc book
           gegeben.
           given.partV
           "The man gave the boy the book."

        c. (Hans glaubt,   dass) der   Mann dem
           (Hans believes, that) the.nom man   the.dat
           Jungen das   Buch gab.
           boy   the.acc book gave.finV
           "Hans believes that the man gave the boy the book."

> d. Das   Buch gab   der   Mann dem
>   the.acc book gave.finV the.nom man   the.dat
>   Jungen.
>   boy
>   "The book, the man gave to the boy."

The data were restricted to utterances with verbs that occurred in all three word orders and occurred more than five times in both the child data and the adult data. This was the case for nine verbs: *bringen* "bring", *erzählen* "tell", *geben* "give", *holen* "bring", *nehmen* "take", *sagen* "say", *schenken* "give as present", *vorlesen* "read" and *zeigen* "show".

Overall, the data consisted of 1272 utterances (334 child and 938 adult utterances) produced by 12 children and 12 adults (their mothers). Table 4.1 gives the absolute frequency of each word order for children and adults. As can be seen in the table, the IO-DO word order was produced most often, whereas the DO-IO and pre-DO word order were produced less frequently.

In addition, there seems to be a relationship between child language and child-directed speech concerning the production of the DO-IO and pre-DO word order, in that children tended to produce these word orders more often when they were provided more frequently in the input (DO-IO: $r = 0.64$, $t(10) = 2.65$, $p < .05$; pre-DO: $r = 0.80$, $t(10) = 4.16$, $p < .01$)

Table 4.1: Frequency of each word order for each child and mother

Transcript	Children			Adults		
	IO-DO	DO-IO	pre-DO	IO-DO	DO-IO	pre-DO
Anna (2–3 yrs)	31	0	0	25	0	0
Caroline (2–3 yrs)	14	0	2	77	21	16
Carsten (3 yrs)	9	0	1	3	0	0
Cosima (2–4 yrs)	19	10	2	38	19	6
Emely (2–3 yrs)	14	2	0	14	0	0
Falko (2–3 yrs)	18	1	8	7	1	2
Kerstin (2–4 yrs)	11	2	0	61	4	5
Lisa (2-3 yrs)	34	0	0	23	1	3
Pauline (2–4 yrs)	42	12	5	97	23	15
Rahel (2–3 yrs)	11	0	9	8	1	3
Sebastian (3–4 yrs)	21	5	4	98	49	30
Simone (2–4 yrs)	41	3	3	216	49	23
Total	265	35	34	667	168	103

4.2 CA 1: Givenness and referring expression (middlefield)

4.2.1 Introduction

The set of analyses investigated the impact of givenness, definiteness, animacy and the type of referring expressions on word order in the middlefield to determine whether children acquire pronoun movement earlier than scrambling.

The first set of analyses investigated the impact of givenness (given vs. new), animacy (animate vs. inanimate), definiteness (definite vs. indefinite) and pronominality (pronoun vs. NP) on word order variation. These analyses allow comparisons with the studies on the Norwegian and English dative alternation and indicate which factors or constraints (e.g., given-new, animate-inanimate, pronoun-NP or definite-indefinite) influence word variation in the middlefield.

The second set of analyses considered the impact of different types of pronouns on word order variation and will indicate whether children are indeed more adult-like when word order variation involves (weak) pronouns (and depends on pronoun movement) than when it involves lexical noun phrases (and depends on scrambling).

4.2.2 Method

4.2.2.1 Data basis

The analyses considered the utterances in the IO-DO and DO-IO word order by speakers (7 children and 9 adults) who produced both word orders. Table 4.2 presents the relative frequency (with actual numbers) of each word order in child language, separated by age, and in child-directed speech. As can be seen in the table, all age groups produced the IO-DO word order more frequently than the DO-IO word order (80 % vs. 20 %). A chi-square test assessing age differences in the distribution of the word orders in the three child groups and in adults did not show a significant effect ($\chi^2(3) = 3.91$, $p = .2715$), indicating that the difference in the frequency of both word orders was not influenced by group or age. For this reason, and due to the low amount of data when the children were two and four years, age (i.e., age differences between the children) was not included as a separate factor in the subsequent analyses.

Table 4.2: Frequency of the IO-DO and DO-IO word order in each age group

	IO-DO	DO-IO
Adults	9 % (625)	21 % (168)
Children (2-years)	90 % (35)	10 % (4)
Children (3-years)	83 % (104)	17 % (22)
Children (4-years)	75 % (27)	25 % (9)
Children (total)	81 % (166)	17 % (35)

4.2.2.2 Annotations

I annotated the indirect and direct object of each sentence for animacy, definiteness, givenness, and pronominality, based on a adapted version of the annotation guidelines in Dipper, Götze, and Skopeteas (2007). The annotations were checked by at least one out of three independent annotators, and discrepancies between the annotations were discussed.

Animacy. Animacy annotations distinguished "animate" and "inanimate" referents. All referents referring to humans were annotated as "animate" whereas all other referents, including dolls that may be considered as "agent" in a playing situation, were annotated as "inanimate". Based on the animacy of the objects four orderings were distinguished: "animate>inanimate", "inanimate>animate", "animate>animate", "inanimate>inanimate".

Definiteness. Definiteness distinguished "definite" from "indefinite" referents. Definiteness was defined by the form of the referring expression. Expressions that included a definite article, that were realized as a proper name (e.g., *Frau Rigol* "Mrs Rigol" in 4.2a) or as a noun phrase (NP) that included a universal quantifier (e.g., *alle Sachen* "all things" in 4.2b) were annotated as "definite" (cf., Prince, 1992). Pronouns were annotated as "definite" (e.g., *dir* "you" in 4.2b), unless they were indefinite pronouns (e.g., *ein(e)s* "one" in 4.2b). All remaining referents were "inanimate". Definiteness annotations distinguished "definite>indefinite", "indefinite>definite", "definite>definite" and "indefinite>indefinite" orderings.

(4.2) a. ich   will mal [Frau Rigol]$_{def}$ hier [alle
           I.nom want PRT Mrs   Rigol.dat here all.acc
           Sachen]$_{def}$ zeigen
           things   show

        "I want to show Mrs Rigol all things here." (Cosima, 3;04.22)

   b. Mutti, jetzt geb   ich   [ein(e)s]$_{indef}$ [dir]$_{def}$
      Mom now give.finV I.nom one.acc   you.dat
      "Mom, now I give one to you." (Pauline, 3;11.09)

Givenness. (Discourse-)Givenness was defined in terms of co-reference and distinguished between "given" and "new" referring expressions. Expressions were "given" when they co-referred to a referent or a proposition that was already introduced by one of the speakers in the previous 30 utterances (usually a "given" referring expression occurred in the previous ten utterances). Expressions that did not co-refer to an expression in the preceding context were "new", except for personal pronouns referring to the speaker or hearer (i.e., forms of *ich* "I" and *du* "you"), which were always annotated as "given" (see 4.3). Note that not all pronouns were "given" as illustrated by the demonstrative pronoun *der* "her" in (4.3a) and the indefinite pronoun *eines* "one" in (4.3b). Although the referents of these pronouns may be available in the visual context or inferable from the previous discourse (Götze et al., 2007; Prince, 1992), they were treated as "(discourse-)new".[1]

(4.3) a. nee, ich   will [(e)s]$_{giv}$ [der]$_{new}$ nicht erzähle(n)
        no   I.nom want it.acc her.dat not   tell
        "No, I don't want to tell it to her." (Sebastian, 3;11.03)

     b. Mutti, jetzt geb ich   [ein(e)s]$_{new}$ [dir]$_{giv}$
        Mom now give I.nom one.acc   you.dat
        "Mom, now I give one to you." (Pauline, 3;11.09)

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1   The pattern of results did not change when "inferable" or "accessible" referents were treated as a separate category, i.e. when the givenness annotations distinguished between "given", "accessible" and "new" referents. Therefore, the distinction between "given" and "new" was used in the analyses for the middlefield.

Pronominality. The annotation of the pronominality distinguished between "pronouns" and "lexical noun phrases (NPs)" (including proper names and bare noun phrases), resulting in pronoun>NP (4.4a), NP>pronoun (4.4b), pronoun>pronoun and NP>NP orderings.[2]

(4.4)   a. ich   schenk [dir]$_{pron}$ [ein   eis]$_{NP}$
I.nom give   you.dat an.acc ice-cream
"I give you ice-cream." (Emely, 2;05.07)

b. aber ich   will [dem   Maxe]$_{NP}$ [die]$_{pron}$
but   I.nom want the.dat Max   them.acc
bringen
bring
"But I want to give them to Max." (Simone, 3;04.07)

4.2.3   Analysis 1a: Impact of the word order constraints

4.2.3.1   Ordering patterns for the constraints

Table 4.3 gives the frequency (with numbers) of the ordering patterns for animacy, definiteness, pronominality and givenness in the IO-DO and DO-IO word order in child language (CL, left panel) and child-directed speech (CDS, right panel).

The first row of each constraint presents the orderings when the constraints were satisfied (e.g., "animate>inanimate"), the second row when the constraints were violated (e.g., "inanimate>animate") and the next two rows the orderings when the constraints were not violated but the characteristics of the objects did not differ (e.g., "animate>animate", "inanimate>inanimate"). In general, similar ordering patterns occurred in CL and CDS.

2   While NPs and DPs differ syntactically (e.g., Abney, 1987), the term "NP" is used here to comprise NPs and DPs and to distinguish them from pronouns. Length differences of NPs are not considered because NPs usually consisted of just one or two words.

Table 4.3: Frequency of the constraint orders in each word order

	CL		CDS	
	IO-DO	**DO-IO**	**IO-DO**	**DO-IO**
	(N=166)	**(N=35)**	**(N=625)**	**(N=168)**
Animacy				
Animate>inanimate	95 % (158)	0	94 % (587)	0
Inanimate>animate	0	100 % (35)	0	97 % (163)
Animate>animate	0	0	1 % (4)	0
Inanimate>inanimate	5 % (8)	0	5 % (34)	3 % (5)
Definiteness				
Definite>indefinite	52 % (87)	0	57 % (358)	0
Indefinite>definite	0	9 % (3)	0 % (1)	1 % (2)
Definite>definite	46 % (77)	91 % (32)	42 % (265)	99 % (166)
Indefinite>indefinite	1 % (2)	0	0 % (1)	0
Givenness				
Given>new	76 % (126)	3 % (1)	73 % (455)	15 % (26)
New>given	1 % (1)	26 % (9)	1 % (6)	22 % (37)
Given>given	19 % (32)	71 % (25)	21 % (129)	58 % (98)
New>new	4 % (7)	0	6 % (35)	4 % (7)
Pronominality				
Pronoun>NP	57 % (95)	9 % (3)	57 % (356)	39 % (66)
NP>pronoun	4 % (7)	6 % (2)	4 % (23)	1 % (2)
Pronoun>pronoun	34 % (56)	86 % (30)	28 % (178)	58 % (98)
NP>NP	5 % (8)	0	11 % (68)	1 % (2)

Animacy. In both CL and CDS, the animacy constraint was almost always satisfied (animate>inanimate) in the IO-DO word order but almost always violated (inanimate>animate) in the DO-IO word order.

Definiteness. In both CL and CDS, the definiteness constraint tended to be satisfied (definite>indefinite) or did not apply (def-

inite>definite) in the IO-DO word order. In the DO-IO word order, few violations of the constraint (indefinite>definite) occurred but the most frequent ordering was the definite>definite ordering (91–99 %).

Givenness. The given>new order was the dominant order in the IO-DO word order in CL and CDS (76 %, 73 %). Constraint violations (new>given) were rare in the IO-DO word order but occurred more often in the DO-IO word order (26 %, 22 %). Yet, the dominant pattern in the DO-IO word order was given>given (71 %, 58 %).

Pronominality. In CL and CDS, the constraint was satisfied (pronoun >NP) 57 % of the time in the IO-DO word order. Constraint violations were rare in both word orders. In the DO-IO word order, the constraint satisfying pronoun>NP ordering occurred to some extent in CDS (39 %) but less often in CL (9 %). The dominant ordering pattern in the DO-IO word order was pronoun>pronoun, especially in CL (86 %).

Figure 4.1 illustrates the frequency of the constraint orderings for each constraint, word order and group, and illustrates the main results of the constraint orderings. First, all constraints tend to be satisfied in the IO-DO word order (green bars), reflecting that this word order was produced when the indirect object was animate, definite, given and pronominal and the direct object inanimate, indefinite, new and realized as a lexical NP. Second, more constraint violations (red bars) and fewer constraint satisfying orderings (green bars) occurred in the DO-IO word order (except for the pronominality in CDS), indicating that the DO-IO word order was not produced to satisfy the constraints. Nevertheless, the DO-IO word order was usually produced when both objects were definite, given and pronominal, that is, when there was no contrast between the objects on these dimensions (blue bars).
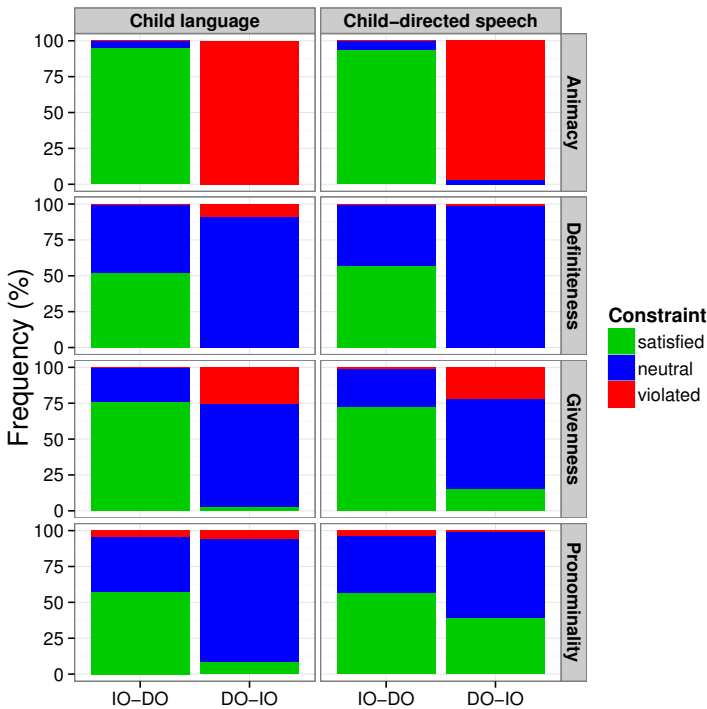
Figure 4.1: Frequency of the constraint satisfying, neutral and violating orders in each word order in CL (left panel) and CDS (right panel)

4.2.3.2   Model predicting word order variation in the middlefield

To assess the impact of definiteness, givenness and pronominality on word order variation, logit linear-mixed effects (LME) models (e.g., Baayen, 2008) were calculated using the lmer function of the lme4 package (D. M. Bates, Maechler, & Bolker, 2013) in the R environment (R Core Team, 2013). The models were calculated to predict the probability of the DO-IO word order based on the definiteness, givenness and pronominality of the indirect and direct object. Animacy was not included in the models because it did not vary within indirect and direct ob-

jects, i.e., indirect objects were almost always animate and direct objects inanimate. The models resemble multiple logistic regression analyses which take the variation due to the speaker into account and indicate whether a difference in the level of a predictor (e.g., given vs. new direct object) changes the probability of the DO-IO word order. The DO-IO word order was chosen as predicted variable because it occurred less frequently in the data.

The parameters of the fixed effects of the logit LME models are presented in Table 4.4. The models included Pronominality of the indirect object (Pron_IO), Pronominality of the direct object (Pron_DO), Definiteness of the direct object (Def_DO) and Givenness of the direct object (Giv_DO) as fixed effects and Speaker as random effect. The fixed effects (or predictors) distinguished the levels "definite" vs. "indefinite" (Definiteness), "given" vs. "new" (Givenness) and "pronoun" vs. "NP" (Pronominality). The predictor names (e.g., Pron_DO_pronoun) indicate the name of the predictor ("Pron_DO" for Pronominality of the direct object) and the level of the predictor ("pronoun" for pronominal direct object vs. full NP direct object). Positive values of the estimates of the predictors (b) indicate an increase in the probability of the DO-IO word order. Note that the Givenness and Definiteness of the indirect object were not considered in the models because these characteristics did not influence word order in child language (CL) and child-directed speech (CDS). Moreover, the models reported did not include interactions because they were not significant or could not be calculated due to lack of data.

Child language (CL). The parameters of the LME model for CL are given in the left panel of Table 4.4. The Pronominality, Givenness and Definiteness of the direct object were significant predictors whereas the Pronominality of the indirect object was not significant. The probability of the DO-IO word order was increased when the direct object was realized as a pronoun rather than as an NP (Pron_DO), when it was given rather than

Table 4.4: Fixed effects of the LME models assessing the impact of Pronominality, Givenness and Definiteness on the probability of the DO-IO order. Left panel – CL, middle panel – CDS, and right panel – comparison between CL and CDS.

	CL			CDS			CL vs. CDS		
	b	SE	z	b	SE	z	b	SE	z
(Intercept)	−6.06	1.20	−5.051***	−8.63	1.07	−8.095***	−8.47	1.03	−8.255***
Pron.DO_pronoun	3.11	0.77	4.035***	5.70	0.71	8.978***	5.64	0.71	7.984***
Giv.DO_given	1.62	0.54	2.983**	0.64	0.32	2.030*	0.64	0.31	2.057*
Def.DO_definite	1.70	0.73	2.339*	5.67	0.91	6.229***	5.58	0.90	6.216***
Pron.IO_pronoun	0.33	0.81	0.413	−3.09	0.56	−5.501***	−3.05	0.55	−5.401***
Group							2.52	1.61	1.566
Group x DO_pronoun							−2.54	1.09	−2.352*
Group x DO_given							0.93	0.65	1.444
Group x DO_definite							−3.76	1.17	−3.203**
Group x IO_pronoun							3.11	0.99	3.148**

b: estimate, SE: standard error, z: z-score
$^{+}p < .1, *p < .05, **p < .01, ***p < .001$

new (Giv_DO) and when it was definite rather than indefinite (Def_DO).

Child-directed speech (CDS). The middle panel of Table 4.4 presents the parameters of the LME model for CDS. All four predictors were significant. The probability of the DO-IO word order was increased when the direct object was realized as a pronoun rather than as an NP (Pron_DO), when it was given rather than new (Giv_DO) and when it was definite rather than indefinite (Def_DO). In addition, the probability of the DO-IO word order was decreased when the indirect object was a pronoun rather than an NP (Pron_IO, negative estimate).

Child language (CL) vs. child-directed speech (CDS). The right panel of Table 4.4 presents the results of the model testing for differences between both groups. CDS was taken as baseline so that the effects of Pron_DO Giv_DO, Def_DO and Pron_IO resemble those of the model for the CDS. Crucial are the interactions between Group and the other predictors. The interaction between Group and Giv_DO was not significant, indicating the impact of the Givenness of the direct object did not differ between the groups. However, the interactions between Group and Pron_DO between Group and Def_DO and between Group and Pron_IO were significant. The first two interactions indicate that the effects of the Pronominality and Definiteness of the direct object, which occurred in CDS and CL, were weaker in CL than in CDS. These may results from the higher number of violations of the definiteness and pronominality constraint that children produced in the DO-IO word order. The third interaction mirrors the fact that the Pronominality of the indirect object influenced word order only in CDS.

4.2.4   Intermediate discussion

The results of the first set of analyses revealed similar results for child language and child-directed speech. In both groups, the word order constraints tended to be satisfied more often in

the IO-DO word order than in the DO-IO word order. In the
DO-IO word order, the animacy constraint was almost always
violated while the dominant pattern for the other constraints
included constraint neutral orderings, i.e., orders that were not
influenced by the constraints. Yet the results indicate that given,
pronominal and definite objects tended to be placed towards the
beginning of the middlefield.

Children and adults differed mainly in the impact of the
pronominality of the indirect object, an effect that was only
present in child-directed speech. They also differed in the "fine
tuning" of the impact of the givenness and pronominality of
the direct object, with children revealing slightly weaker effects.

Animacy was not a strong factor influencing word order, as re-
flected by the high proportion of constraint violations in the DO-
IO word order, possibly because animacy was highly correlated
with the grammatical role. Direct objects were almost always
inanimate whereas indirect objects were almost always animate.

In contrast definiteness, givenness and pronominality influ-
enced word order variation, but these effects were mainly
restricted to the properties of the direct object. This pattern
also results from correlations between these properties and the
grammatical role. While direct objects varied with respect to
definiteness, givenness and pronominality (and this variability
influenced word order), indirect object tended to be definite,
given and pronominal. Only in adults the pronominality of
the indirect object varied and this property influenced the
production of the DO-IO word order.

Crucially, the discourse investigated, i.e., spontaneous speech
usually produced in a play situation, may be a reason why
both objects were often given, definite and pronominalized and
thus may have contributed to the relatively high amount of
definite>definite, given>given and pronoun>pronoun orders
in both word orders. For these orders, the characteristics of

both objects did not differ with respect to a particular constraint but they may be affected by the other constraint or by different types of pronouns.

Recall that Müller (1999) argued that the differences between weak and strong pronouns (realizing both the indirect and direct object) influences word order variation. Accordingly, the high proportion of pronoun>pronoun orderings may have been influenced by the pronoun types realizing the indirect and in particular the direct object.

4.2.5   Analysis 1b: Impact of the referring expression

The second part of the corpus analysis considered a finer distinction of the types of pronouns for direct objects. First, the relationship between different pronoun types and word order was investigated and the finer distinction of pronominality was included in the models predicting word order variation. Finally, the correlation between givenness and different pronoun types was investigated.

4.2.5.1   Annotations

The finer distinction of pronominality differentiated between demonstrative pronouns (4.5a), indefinite pronouns (4.5b), personal pronouns (4.5c), clitics (4.5d), reflexive pronouns (4.5e) and lexical NPs. Clitics were determined on the basis of the written transcripts (as indicated by brackets or apostrophes) because the auditory data for the transcripts were not available.

(4.5)   a.   du (s)oll mir **das** vorlesen (IO-DO)
              "You ought to read that to me." (Pauline, 2;04.28)
         b.   ich kauf dir **einen** (IO-DO)
              "I buy one for you." (Rahel, 2;09.07)

c. ja, du sollst **sie** mir holen (DO-IO)
"Yes, you should to bring them to me." (Pauline, 3;07.14)

d. ich zeig **(e)s** dir ma(l) (DO-IO)
"I just show it to you." (Cosima, 2;10.14)

e. un dann holn die **sich** die baumstämme (IO-DO)
"And then they take the trunks for themeselves." (Falko, 3;06.14)

4.2.5.2   Impact of the referring expression realizing the indirect object

Figure 4.2 illustrates the frequency of the types of referring expression realizing the indirect object in the IO-DO and DO-IO word order for child language (CL, left figure) and child-directed speech (CDS, right figure). The actual numbers and the statistical models assessing the impact of the type of referring are given in Table A.1 and Table A.2 in Appendix A.
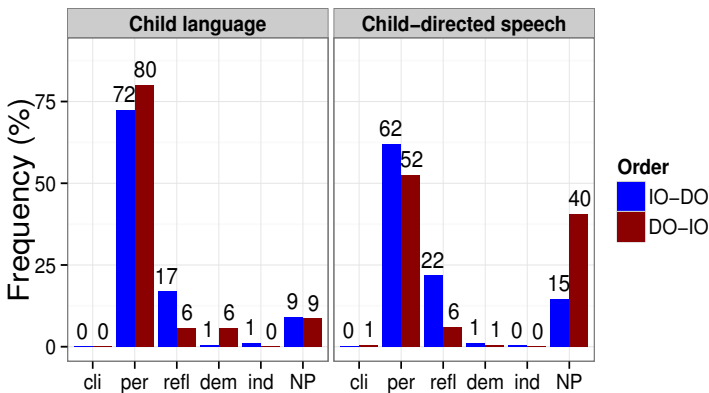
Figure 4.2: Frequency of the types of referring expression realizing the indirect object in each word order and group

The results for CL indicate that children mostly realized the indirect object as personal pronouns in both word orders. Reflexive pronouns (refl) or full NPs occurred less often, with reflexive pronouns occurring more often in the IO-DO than DO-IO word order. Clitics (cli), demonstrative pronouns (dem) and indefinite pronouns (ind) were rare.

The results for CDS are quite similar. Most indirect objects were realized as personal pronouns and to some extend as reflexive pronouns and full NPs, whereas clitics, demonstrative pronouns and indefinite pronouns were rare. Reflexive pronouns and personal pronouns occurred more often in the IO-DO (blue bars) than DO-IO word order whereas lexical NPs occurred more often in the DO-IO (red bars) than in the IO-DO word order. This was reflected by the impact of the pronominality of the indirect object on word order in the first corpus analysis.

4.2.5.3 Impact of the referring expression realizing the direct object

Figure 4.3 illustrates the frequency of the type of referring expression of the direct object in each word order in CL (left figure) and CDS (right figure). Logit LME models were calculated to compare the probability of the different types of referring expressions between the word orders (see Appendix A, Table A.3 and Table A.4 for actual numbers and the statistical tests). Similar patterns occurred in both groups: direct objects realized as clitics (cli) and personal pronouns (per) were more likely to occur in the DO-IO word order (red bars). In contrast, direct objects realized as indefinite pronouns (ind) and lexical NPs tended to occur in the IO-DO word order (blue bars). Demonstrative pronouns (dem) had no preference for either word order.

These results indicate that the referring expression may be seen as a predictor of word order: clitics and personal pronouns may be seen as predictor of the DO-IO word order and indefinite pro-
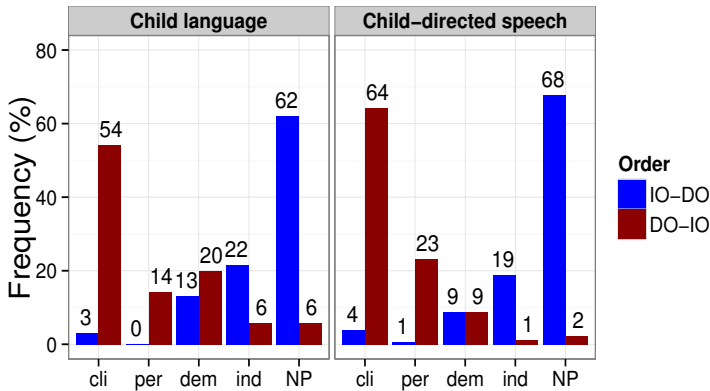
Figure 4.3: Frequency of the types of referring expression realizing the direct object in each word order and group

nouns and NPs for the IO-DO word order. Only demonstrative pronouns had no preference for either word order so that their position may be influenced by their givenness or by the pronominality of the indirect object.

Logit LME models were calculated to investigate the factors influencing the positioning of direct objects realized as demonstrative pronouns. In CDS, their positioning was influenced by the Pronominality of the indirect object (b = -5.85, SE = 1.30, z = -4.520, $p < .001$) but not by the Givenness of the direct object, that is, demonstrative pronouns tended to occur before the indirect object (DO-IO order) when the indirect object was realized as full NP but to follow the indirect object (IO-DO order) when it was realized as pronoun. In CL, neither Giveness the direct object nor the Pronominality of the indirect object influenced the positioning of the direct objects realized as demonstrative pronouns.

4.2.5.4   Revised model predicting word order variation

The impact of givenness and type of referring expression on word order variation was assessed in logit LME models predicting word order variation. These models differ from those of the first analysis in that the Pronominality of the direct object (Pron_DO) was extended to distinguish between the different pronoun types. As the Pron_DO predictor consisted of more than two levels, one level had to be chosen as baseline for the comparisons with the other levels represented by three sub-predictors. Demonstrative pronouns were chosen as baseline because they did not have a preference for any word order. Accordingly, the four sub-predictors Pron_DO_np, Pron_DO_indPr, Pron_DO_perPr and Pron_DO_cliPr captured the differences between demonstrative pronouns on the one hand, and lexical noun phrases (NP), indefinite pronouns (indPr), personal pronouns (perPr) and clitic pronouns (cliPr) on the other hand. The data set of the CL did not include direct objects realized as personal pronouns because children did not produce them in the IO-DO word order.

The Pronominality of the indirect object (Pron_IO) did not distinguish between different pronoun types because including different pronoun types as sub-levels did not improve the models compared to the distinction between "pronoun" vs. "NP".

The other predictors considered were the Givenness of the direct object (Giv_DO) and the Pronominality of the indirect object (Pron_IO). The Definiteness of the direct object was excluded because it was highly correlated with the impact of the direct objects realized as indefinite pronouns.

As in the previous analysis, positive values of the estimate of the predictors indicate an increase in the probability of DO-IO order.

Table 4.5: Fixed effects of the LME models assessing the impact of Pronominality and Givenness on the probability of the DO-IO word order. Left panel – CL, middle panel – CDS, and right panel – comparison between CL and CDS.

	CL			CDS			CL vs. CDS		
	b	SE	z	b	SE	z	b	SE	z
(Intercept)	−1.17	0.81	−1.451	0.89	0.76	1.176	1.04	0.70	1.485
Pron_DO_cli	**2.38**	**0.73**	**3.263****	**3.88**	**0.58**	**6.738*****	**3.78**	**0.58**	**6.537****
Pron_DO_perPr				**4.57**	**0.76**	**6.007*****			
Pron_DO_indPr	−1.12	0.93	−1.202	**−3.48**	**1.00**	**−3.471*****	**−3.50**	**0.99**	**−3.542*****
Pron_DO_np	**−2.46**	**0.86**	**−2.866****	**−4.19**	**0.80**	**−5.238*****	**−4.10**	**0.81**	**−5.074****
Giv_DO_given	1.07	0.63	1.695+	0.72	0.40	1.808+	0.72	0.40	1.793+
Pron_IO_pronoun	−0.73	0.81	−0.896	**−4.08**	**0.71**	**−5.745*****	**−4.26**	**0.75**	**−5.695*****
Group							**−2.21**	**1.07**	**−2.070***
Group x DO_cli							−1.40	0.93	−1.504
Group x DO_indPr							2.39	1.36	1.760+
Group x DO_np							1.64	1.18	1.391
Group x DO_given							0.35	0.75	0.467
Group x IO_pronoun							**3.54**	**1.10**	**3.207****

b: estimate, SE: standard error, z: z-score
+p < .1, *p < .05, **p < .01, ***p < .001

Child language (CL). Table 4.5 (left panel) presents the parameters of the fixed effects of the model for the CL. The Pronominality of the direct object was the only significant predictor. The probability of the DO-IO word order was decreased when the direct object was realized as an NP rather than as a demonstrative pronoun (Pron_DO_np) and increased when it was realized as a clitic pronoun rather than as a demonstrative pronoun (Pron_DO_cliPr). In contrast to the previous model, the Givenness of the direct object did not influence word order ($p = .0901$), indicating that givenness did not influence word order variation within a given type of referring expressions.

Child-directed speech (CDS). The parameters of the model for the CDS are given in Table 4.5 (middle panel). Significant predictors were the Pronominality of the direct object and the Pronominality of the indirect object. The probability of the DO-IO word order was reduced when the direct object was realized as an NP or indefinite pronoun rather than as a demonstrative pronoun (Pron_DO_np, Pron_DO_indPr) and increased when it was a clitic or personal pronoun rather than a demonstrative pronoun (DO_Pron_cliPr, DO_Pron_perPr). In addition, the probability of the DO-IO word order was decreased when the indirect object was realized as a pronoun rather than as an NP (IO_Pron_pronoun). The Givenness of the direct object (Giv_DO), however, did not or at best only marginally influence word order ($p = .0701$).

Child language (CL) vs. child-directed speech (CDS). The parameters of the models testing the differences between CL and CDS are presented in Table 4.5 (right panel). Given that children did not produce personal pronouns in the IO-DO word order, personal pronouns were excluded from the data set considered in the conjoined model. CDS was taken as baseline so that the results for the predictors Pron_DO, Giv_DO and Pron_IO reflect the effects of the model for the CDS. The models revealed a significant main effect of group (Group_CDS). This effect reflects the differences in the baseline between the groups and indicates

a higher probability of the DO-IO order in CDS than in CL when the direct object was a demonstrative pronoun and the indirect object was an NP. The results of the model did not reveal significant interactions between Group and the Pronominality of the direct object, indicating that the type of the referring expression realizing the direct object had a similar impact on word order in CL and CDS. However, the interaction between Group and Pron_IO was significant, reflecting that the Pronominality of the indirect object only influenced word order in CDS but not in CL.

4.2.5.5 Correlation between givenness and type of the referring expression

The results of the models indicate that the givenness of the direct object did not influence word order variation. A reason for this may be the strong correlation between givenness and the type of the referring expression. The relationship between word order, givenness and type of referring expression realizing the direct object is presented in Table 4.6.

Table 4.6: Frequency of given and new direct objects separated by type of referring expression, word order and group

	IO-DO			DO-IO		
	given	**new**	**total**	**given**	**new**	**total**
Child language						
Clitic pronoun	80 % (4)	20 % (1)	5	84 % (16)	16 % (3)	19
Personal pronoun	0	0	0	80 % (4)	20 % (1)	5
Demonstrative pronoun	41 % (9)	59 % (13)	22	57 % (4)	43 % (3)	7
Indefinite pronoun	3 % (1)	97 % (35)	36	0	100 % (2)	2
Noun phrase	18 % (19)	82 % (84)	103	100 % (2)	0	2
Child-directed speech						
Clitic pronoun	54 % (13)	46 % (11)	24	73 % (79)	27 % (29)	108
Personal pronoun	75 % (3)	25 % (1)	4	79 % (31)	21 % (8)	39
Demonstrative pronoun	58 % (32)	42 % (23)	55	80 % (12)	20 % (3)	15
Indefinite pronoun	3 % (3)	97 % (115)	118	0	100 % (2)	2
Noun phrase	20 % (84)	80 % (340)	424	50 % (2)	50 % (2)	4

Similar patterns occurred in CL and CDS. Direct objects realized as clitics and personal pronouns tended to be given and to occur in the DO-IO word order. Direct objects realized as indefinite pronouns and (to some extend) NPs tended to be new and to occur in the IO-DO word order.[3] Direct objects realized as demonstrative pronouns did not have any clear tendency concerning givenness in both word orders as revealed by the LME models mentioned above.

With respect to clitics, personal pronouns and NPs, it seems that givenness may also influence word order in CDS. For instance, clitics and demonstrative pronouns in the DO-IO word order tended to be given rather than new. However, given the total frequency of each type of referring expression in each word order, it appears that the type of referring expression itself was a better cue to word order than givenness. This may explain why givenness only had a marginal effect on word order.

4.2.6   Discussion

The results of corpus analysis 1a demonstrated that givenness, definiteness and pronominality influence word order variation when pronominality distinguished between pronouns and lexical NPs: children and adults tended to place given, definite and pronominal referents towards the beginning of the middlefield. These findings largely agree with the previous work on the dative alternation in English and Norwegian (e.g., Anderssen et al., 2014; de Marneffe et al., 2012; Stephens, 2010).

However, corpus analysis 1b revealed that the type of referring expression was a better predictor of word order than givenness and definiteness when pronominality considered different pronoun types. In this way, word order variation was predictable from the referring expressions itself, indicating that the given-

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3   Indefinite pronouns were annotated as given, e.g., when they were repetitions and referred to a referent already introduced.

new order may be influenced by the type or referring expression.

The corpus data suggest that word order variation in both child language and child-directed speech emerged from pronoun movement rather than scrambling. On the one hand, the pronominality of the indirect object influenced word order: indirect object tended to be realized as personal pronouns in the IO-DO word order (around 90 %) but less often in the DO-IO word order, at least in child-directed speech (56 %).[4]

On the other hand, the relative order of the indirect and direct object was modulated by the referring expression of the direct object in both child language and child-directed speech. When the direct object was realized as clitic and personal pronoun, it preceded the indirect object, regardless of the pronominality of the indirect object. When the direct object was realized as an NP or indefinite pronoun, it followed the indirect object. In this case, the word order constraints may apply. Indirect objects were usually definite, animate and pronominal so that placing a direct object that is an NP or indefinite pronoun before an indirect object may violate the definiteness, pronominality or animacy constraint. This may indicate that children are sensitive to the factors influencing scrambling. But crucially, even in these cases, the positioning of direct objects realized as indefinite pronouns or NPs was solely predictable from the referring expres-

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4   Note that pronoun movement may be involved regardless of whether the IO-DO or DO-IO word order is the underlying word order. A test case for pronoun movement are sentences with adverbs or particles. Particles and verbs are usually adjuncts of the VP (Bayer & Obenauer, 2011) so that a pronoun that precedes a particle like *mal* (see b) indicates that it has left its base position (a). In the present data 73 % of the IO-DO sentences produced by children involved a particle or adverb and in all cases the indirect object was placed before the particle.

    a. Ich gebe $[_{VP}$ mal $[_{VP}$ (dir) das Buch]].
        I give PRTyou the book.

    b. Ich gebe dir$_i$ $[_{VP}$ mal $[_{VP}$ (t$_i$) das Buch]].
        'I give you PRT the book'

sion. Only when the direct object was realized as a demonstrative pronoun, word order was not predictable from the referring expression itself. In this case, children appeared to be less adult-like.

Müller (1999, 2001) proposes that phonological characteristics distinguish weak pronouns from strong pronouns, which distinguish deaccented personal pronouns (and clitics) from accented pronouns and noun phrases. However, especially the status of demonstrative pronouns is less clear. They may be taken as strong pronouns but may also be pattern like personal pronouns (Chocano, 2007; Gärtner & Steinbach, 2000).

The corpus data indicate that adults considered demonstrative pronouns as strong pronouns because demonstrative pronouns followed weak pronominal (indirect) objects but preceded nominal (indirect) objects. Children, however, did not show a similar pattern. One reason may be that they rarely realize indirect objects as noun phrases (also demonstrated by Eisenbeiß, 1994; see also Anderssen et al., 2014; Stephens, 2010), another that children may consider demonstrative pronouns both as weak or strong pronouns and may consider them as "default" pronoun for reference (e.g., Bittner & Kuehnast, 2011).

Overall the data indicate that the referring expression was a better predictor of word order than givenness. Nevertheless, as discussed in Chapter 2, different pronoun types have been linked to the givenness status of referents (e.g. Gundel et al., 1993). In our study, (discourse-)givenness was correlated with different pronoun types but the pronoun types themselves were better predictors of word order. Thus, the correlation between givenness and the referring expression may be a factor why givenness did not influence word order in the models. In addition, the restriction to (discourse-)givenness and more importantly the restriction to the two-level distinction of givenness may be another reason why givenness was not a strong predictor. Possibly, if all referents are given in a discourse, a gradual definition of

givenness may be required and the notion of a given-before-new preference (or constraint) may be oversimplified.

The two subsequent corpus analyses aimed to clarify both issues. Corpus analysis 2 investigated the impact of givenness on movement to the prefield which may be less less influenced by the type of referring expression. The question whether topicality may be a better predictor of word order in the middlefield and prefield was investigated in corpus analysis 3.

4.3   CA 2: Givenness and referring expression (prefield)

4.3.1   Introduction

This corpus analysis investigated the factors influencing the movement of the direct object to the prefield. Although theoretical approaches usually proposed that topic and focus influence movement to the prefield, it is conceivable that givenness may also play a role in CL and CDS speech because the givenness status of a referent may overlap with topicality and focus.

Fleischhauer's study (2009) revealed that children and adults tend to place given referents to the prefield (66–70 % in both word orders). However, it could not identify hearer-givenness as a factor influencing word order because direct objects tended to be given regardless of whether they occurred in the SVO or OVS word order.

The results of the analysis on the middlefield (Section 4.2), that considered discourse-givenness, revealed that direct objects varied in their givennesss status in that they were "given" in the DO-IO and "new" in the IO-DO word order. Accordingly, it is possible that the discourse-givenness of the direct object may influence its movement to the prefield when this case is com-

pared to the IO-DO word order. In this way, the distinction on the basis of discourse-givenness may indicate whether children follow a given-before-new or new-before-given preference with respect to word order in the prefield.

Nevertheless, the type of referring expression may indirectly be related to word order variation. Rambow (1993) found that personal pronouns are usually placed in prefield when they were subjects, while non-subjects may be more likely to occur in the prefield when they are realized as demonstrative pronouns. Thus, we might expect that direct objects realized as demonstrative pronouns may occur in the prefield rather than direct object that are personal pronouns or weak pronouns (because they are placed towards the beginning of the middlefield as corpus analyses 1a and 1b demonstrated). In this way, the impact of givenness on movement to the prefield may interact with the type of referring expression realizing the direct object.

4.3.2 Method

4.3.2.1 Data extraction and data basis

The analyses only considered utterances in main clauses that were produced in the IO-DO and pre-DO word order. In the pre-Do word order, the prefield was filled by the direct object, and in the IO-DO word order by the subject, an adjunct (e.g., adverb) or no constituent.

The data analysed comprised 907 utterances produced by 8 children and 9 adults who produced both the IO-DO and pre-DO word order.[5] Table 4.7 presents the frequency (with actual numbers) of the word orders in children and adults. As can be seen, the frequency of the word orders did not differ between children

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5   Note that the number of utterances in the IO-DO word order differed from that of corpus analyses 1a and 1b because data from subordinate clauses was excluded and different children were considered (because some children did not produce all three word orders) (see Table 4.1 in section 4.1).

and adults ($\chi^2(3) = 1.04$, $p = .7915$). As the child data was not affected by age, the child data were summarized as one group in the subsequent analysed.

Table 4.7: Frequency of the IO-DO and pre-DO word order in each age group

	IO-DO	DO-IO
Adults	85 % (597)	15 % (103)
Children (2-years)	87 % (46)	13 % (7)
Children (3-years)	83 % (102)	17 % (21)
Children (4-years)	81 % (25)	19 % (6)
Children (total)	84 % (173)	16 % (34)

4.3.2.2 Annotations

The givenness and pronominality of the subject, the indirect object and direct object were considered.

Givenness. The givenness annotation was based discourse-givenness and distinguished between "given", "accessible" and "new" referring expressions. Referents were "given" when had already been introduced in the previous 30 utterances. Forms of the personal pronouns *ich* ("I") and *du* ("you") were annotated as "given". Referents that had not been introduced in the previous 30 utterances were "new", unless they were "accessible", i.e., inferrable from the discourse (e.g., via poset-relationships) or present in the visual discourse (e.g., indefinite pronouns, deictic expressions, see 4.6).

(4.6) a. [das]$_{acc}$ schenk ich dir
          that.acc give   I   you
          'That I give to you as a present.' (Pauline, 4;08.04)

       b. [eine]$_{acc}$ gebe dir hin
          one.acc   give you there
          'One (I) give to you.' (Caroline, 2;03.02)

Pronominality. The annotations were the same as in corpus analysis 1b. The Pronominality of the direct object distinguished between "NPs" (full lexical NPs including proper names), "clitic pronouns", "personal pronouns", "demonstrative pronouns" and "indefinite pronouns". The Pronominality of the indirect object considered differences between "pronouns" and "NPs".

4.3.3   Results

4.3.3.1   Impact of givenness on word order

Table 4.8 presents the frequency of the givenness status of the direct object, subject and indirect object in each word order and group.

Table 4.8: Frequency of the givenness status of the direct object, subject and indirect object in each word order and group

	CL		CDS	
	IO-DO	IO-DO	IO-DO	DO-IO
	(N=173)	(N=34)	(N=597)	(N=103)
Givenness of the direct object				
Given	18 % (32)	68 % (23)	21 % (125)	70 % (72)
Accessible	27 % (47)	18 % (6)	28 % (169)	20 % (21)
New	54 % (94)	15 % (5)	51 % (303)	10 % (10)
Givenness of the subject				
Missing	34 % (58)	12 % (4)	37 % (222)	7 % (7)
Given	64 % (110)	82 % (28)	60 % (357)	83 % (85)
Accessible	1 % (2)	0	2 % (11)	0
New	2 % (3)	6 % (2)	1 % (7)	11 % (11)
Givenness of the indirect object				
Given	95 % (165)	91 % (31)	93 % (557)	82 % (85)
Accessible	3 % (5)	3 % (1)	5 % (30)	11 % (11)
New	2 % (3)	6 % (2)	2 % (10)	7 % (7)

Again similar patterns occurred in child language (CL) and child-directed speech (CDS). Direct objects that were new tended to occur on the IO-DO word order while given direct objects tend to be placed in the prefield. The proportions for accessible direct objects were similar in both word orders. This pattern suggests that direct objects tended to be placed in the prefield when they were "given" rather than "new".

The results of the givenness of the subject indicate that in general subjects tended to be given or missing. When the subject was missing (e.g., omitted as part of an imperative sentence) the IO-DO word order was slightly more likely than the pre-DO word order whereas the reverse pattern occurred when the subject was given. However, new and accessible subject in general were rare and did not appear to influence word order.

Indirect objects also tended to be given rather than new. In CL, the givenness of the indirect object did not influence word order due to the low proportion of new and accessible indirect objects. In CDS, givenness influenced word order in that the proportion of given indirect objects was somewhat lower in the pre-DO word order than in the DO-IO word order.

4.3.3.2   Impact of the type of referring expression

Table 4.9 illustrates the frequency of the pronominality (types of referring expressions) of the indirect and direct object in each word order and group. The different pronoun types realizing the indirect object were summarized as pronouns because clitics, personal pronouns and demonstrative pronouns were rare. As can be seen in the table, the pronominality of the indirect object did not differ between both word orders in CL but did so in CDS. In CDS, indirect objects were more likely to be realized as an NP when the direct object was placed in the prefield than when it followed the indirect object in the IO-DO word order.

The pronominality of the direct object distinguished between different pronoun types. As expected, direct objects in the prefield were rarely realized as clitics and personal pronouns. Rather they were realized as demonstrative pronouns, especially in CDS. Direct objects realized as indefinite pronouns and noun phrases were less likely to occur in the prefield than in the middlefield.

Table 4.9: Frequency of the type of referring expression realizing the indirect and direct object in each word order and group

	CL		CDS	
	IO-DO	IO-DO	IO-DO	DO-IO
	(N=173)	(N=34)	(N=597)	(N=103)
Pronominality of the indirect object				
Pronoun	91 % (158)	88 % (30)	85 % (507)	67 % (69)
Noun phrase	9 % (15)	12 % (4)	15 % (90)	33 % (34)
Pronominality of the direct object				
Clitic pronoun	3 % (5)	0	4 % (24)	0
Personal pronoun	1 % (1)	0	1 % (4)	0
Demonstrative pronoun	15 % (26)	59 % (20)	8 % (50)	83 % (85)
Indefinite pronoun	21 % (37)	3 % (1)	19 % (114)	5 % (5)
Noun phrase	60 % (104)	38 % (13)	68 % (405)	13 % (13)

4.3.3.3 Impact of givenness and type of referring expression on word order

Logistic LME models were calculated to assess the relative impact of givenness and pronominality on word order. The models included the predictors Pronominality and Givenness of the direct object (Pron_DO, Giv_DO) and of the indirect object (Pron_IO, Giv_IO). Giv_DO and Giv_IO distinguished between the levels "given", "accessible" and "new", with the level "given" being taken as baseline. Pron_IO distinguished between "pronouns" vs. "lexical NPs". Pron_DO distinguished between "demonstrative pronouns", "indefinite pronouns" and

"lexical NPs", with demonstrative pronouns as baseline. Direct object realized as clitics and personal pronouns were excluded because they did not occur in the pre-DO word order.

The Givenness of the subject was not included as a predictor because differences in its givenness status did not influence word order. However, given that the presence or absence of the subject influenced word order, the predictor Subject was included that distinguished between "subject absence" vs. "subject presence".

Model fitting started with the most complex model containing the predictors Pron_DO, Giv_DO, Pron_IO, Giv_IO and Subject as fixed effects and Speaker as random effect. The models were trimmed down in a step-wise fashion via model comparisons using likelihood ratio tests (cf., Baayen, 2008). A predictor was excluded when the model excluding the predictor performed equally well as the model including the predictor.

Table 4.10 presents the fixed effects of the final models for child language (left panel) and child-direct speech (middle panel) and the model comparing both groups (right panel).

Child language (CL). The Pronominality and Givenness of the direct object were the only significant predictors influencing word order. The probability of the pre-DO word was reduced when the direct object was realized as an NP rather than as a demonstrative pronoun (Pron_DO_np) and marginally reduced when it was an indefinite pronoun rather than a demonstrative pronoun (Pron_DO_indpr, p = .0654). The probability of the pre-DO word order was also decreased when the direct object was accessible or new rather than given (Giv_DO_acc, Giv_DO_new).

Child-directed speech (CDS). The Pronominality and Givenness of the direct object, the Pronominality of the indirect object and Subject presence influenced word order. The probability of

Table 4.10: Fixed effects of the LME models assessing the impact of Pronominality and Givenness on the probability of the pre-DO word order. Left panel – CL, right panel – CDS.

	CL			CDS			CL vs. CDS		
	b	SE	z	b	SE	z	b	SE	z
(Intercept)	0.30	0.41	0.727	0.32	0.54	0.603	0.32	0.54	0.603
Pron_DO_indpr	−2.11	1.15	−1.842+	−3.06	0.57	−5.333***	−3.06	0.58	−5.333***
Pron_DO_np	−1.05	0.49	−2.152*	−3.53	0.39	−9.012***	−3.53	0.40	−9.012***
Giv_DO_acc	−1.70	0.56	−3.036***	−0.36	0.41	−0.900	−0.36	0.41	−0.900
Giv_DO_new	−2.07	0.60	−3.430***	−1.80	0.47	−3.862***	−1.80	0.47	−3.862***
Pron_IO_pronoun				−1.73	0.40	−4.375***	−1.73	0.40	−4.375***
Subject_present				2.31	0.49	4.730***	2.31	0.49	4.730***
Group							−1.16	1.06	−1.098
Group x DO_indPr							0.95	1.26	0.754
Group x DO_np							2.54	0.62	4.082***
Group x DO_acc							−1.11	0.69	−1.624
Group x DO_new							−0.32	0.76	−0.420
Group x IO_pronoun							1.98	0.81	2.443*
Group x Sbj_present							−1.18	0.78	−1.513

b: estimate, SE: standard error; z: z-score
$^{+}p < .1, *p < .05, **p < .01, ***p < .001$

the pre-DO word was decreased when the direct object was realized as an NP or indefinite pronoun rather than as a demonstrative pronoun (Pron_DO_np, Pron_DO_indpr) and when the direct object was new rather than given (Giv_DO_new). The probability of the pre-DO word order was also decreased when the indirect object was realized as a pronoun rather than as a lexical NP (Pron_IO). Note that the givenness of the indirect object was correlated with the pronominality of the indirect object in that given indirect objects tended to be pronominal and new objects nominal, but Pron_IO was a stronger predictor than Giv_IO. Finally, the probability of the pre-DO word order was increased when the subject was present, reflecting the finding that subjects were more likely to be omitted in the IO-DO word order.

Child language (CL) vs. child-directed speech (CDS). The baseline for the model comparing CL and CDS was CDS, so that the main effect of the predictors resemble the effects of the model for the CDS. The model revealed significant interactions between Group and Pron_DO_np and Group and Pron_IO. The first interaction indicates that the difference between direct objects realized as demonstrative pronouns and those realized as NPs was stronger in CDS than in CL, and reflects that direct objects that were NPs were somewhat more likely to occur in the prefield in CL than in CDS. The second interaction indicates that the Pronominality of the indirect object influenced word order in CDS but not in CL.

4.3.4   Discussion

The results of this corpus analysis indicate that both, givenness and the type of referring expression influenced movement of the direct object to the prefield in child language and child-directed speech. Children and adults placed direct objects in the prefield when they were discourse-given and realized as demonstrative pronoun.

Word order in child language and child-directed speech followed the given-before-new or given-before-given order rather than the new-given order, indicating that children and adults followed a given-new rather than new-given strategy. Furthermore, word order interacted with the type of referring expression in that clitics and personal pronouns did not occur in the prefield and in that demonstrative pronouns were more likely to occur in the prefield than lexical NPs and indefinite pronouns.

Children differed from adults with respect to the impact of the indirect object. In child-directed speech, direct objects were more likely to be placed in the prefield when the indirect object was a lexical NP rather than a pronoun. In this case, word order may be influenced by the pronominality constraint that would be violated in the IO-DO word order (see first corpus analysis). However, given that the pronominality and givenness of the indirect object were correlated in child-directed speech, it is also possible that the information status influenced word order variation, that is, direct objects (realized as demonstrative pronouns) might be more accessible or given than indirect objects that were realized as lexical NPs. In children, the pronominality and givenness of the indirect object may not influence word order variation because indirect objects were usually given and realized as pronouns.

While the results indicate that givenness influenced word order variation, it is important to note that in general the subject and the indirect object tended to be given. In this way, the pre-DO word order usually followed the given-given order whereas the IO-DO word order followed the given-new order. This largely corresponds to the corpus results for transitive sentences reported by Fleischhauer (2009).

However, it still remains open what actually "triggers" the placement of a constituent in the prefield. In comparison to the middlefield, it seems that given direct objects are placed to

the prefield when they are realized as demonstrative pronoun and are placed before the indirect object in the middlefield when they realized as weak pronoun or clitic. However, even if givenness triggers word order variation, it is unclear why the direct object rather than the subject or indirect object (which are usually also given) are placed to the prefield.

Crucially, as mentioned in Chapter 3, most theoretical approaches do not link the prefield to givenness but rather to topic status (and focus). Accordingly, it might be that the topic status of the referents in the sentence is the crucial factor influencing word order variation. This factor is investigated in corpus analysis 3.

4.4 CA 3: Topic status and referring expression

4.4.1 Introduction

This corpus analysis investigated the impact of the topic status and the type of referring expression on movement to the prefield and word order variation in the middlefield. Recall that Frey (2006, 2010) proposed that topics may not only be placed to the prefield but may also occur towards the beginning of the middlefield. Accordingly, it may be that the topic status of the direct object triggers the DO-IO word order and the pre-DO word order. Two sets of analyses were conducted. On the one hand, the relationships between topic status and word order and between the referring expression realizing topical direct objects were investigated. These indicate whether the referring expression realizing the topical direct object influenced whether object occurs in the prefield or the middlefield. The second set of analyses investigated whether topic status may be a better predictor than givenness in the statistical models predicting word order variation.

Table 4.11: Frequency of the three word orders in each age group

	IO-DO	DO-IO	pre-DO
Adults	69 % (597)	19 % (162)	12 % (103)
Children (2-years)	82 % (51)	6 % (4)	11 % (7)
Children (3-years)	72 % (108)	13 % (20)	14 % (21)
Children (4-years)	63 % (25)	22 % (9)	15 % (6)
Children (total)	73 % (184)	13 % (33)	14 % (34)

4.4.2   Method

4.4.2.1   Data extraction and data basis

The data basis only consider main sentences (to allow the comparison between the prefield and the middlefield) and comprised the data of 9 children and 9 adults who produced the IO-DO word order and the DO-IO and/or pre-DO word order.[6] Table 4.11 gives the frequency (with actual numbers) of each word order for each age group. As can be seen, the IO-DO word order occurred more often than the DO-IO and pre-DO word order, with no differences between the age groups ($\chi^2(6) = 9.73$, $p = .1363$).

4.4.2.2   Annotations

Topic status. The annotations for (aboutness-) topics were based on the annotation guidelines for information structure reported in Götze et al. (2007). The tests for aboutness topics are given in (4.7) (taken from Götze et al., 2007, p. 164), with all three criteria being required to be satisfied by topic candidates. While the annotation guidelines may lead to the identification of several "possible candidates" for the sentence topic, only the

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6   Note again, that the number of utterances and speakers differs from the previous analyses because the data basis changed.

most likely[7] candidate (or most likely topic annotation) was
considered in the analyses reported below.

(4.7) An NP *X* is the aboutness topic of a sentence *S* contain-
      ing *X* if

   a. *S* would be a natural continuation to the announce-
      ment *Let me tell you something about X*

   b. *S* would be a good answer to the question *What about
      X?*

   c. *S* could naturally be transformed into the sentence
      Concerning X, S′
      where *S′* differs from *S* only insofar as *X* has been
      replaced by a suitable pronoun.

The data were annotated by me and another independent an-
notator. For the analyses, we compared the annotations for the
most likely topic candidate. Clear cases of the annotations were
usually cases in which the topic was mentioned in the previous
context, as in (4.8) where the topic (*ring, car*) was mentioned in
the previous utterances.

(4.8) a. RIG: **der** is(t) zu gross, siehst du, ja
         ('it (ring) is too large, you see')
         CHI: [**den**]$_{Top}$ kann ich   dir schenken (pre-DO)
         CHI: **it.acc**   can   I.nom you give

         "It/That, I can give to you as a present." (Cosima,
         4;05.04)

   b. RIG: **mein Lieblingsauto** für die Pauline
         ('My preferred car for Pauline')
         ROB: ja (yes)
         CHI: ja, ich bring [**(e)s**]$_{Top}$ dir zu meinem
         CHI: yes, I   bring **it.acc**   you for my
         Geburtstag wieder (h)ier (h)er (DO-IO)
         birthday   again   here there

---

7   "Most likely" was determined by the personal judgements of the annotators.

"Yes, I will bring back it to you on my birthday."
(Pauline, 2;07.09)

Discrepancies between our annotations concerned 248 cases in
the IO-DO word order (32 %), 50 cases in the DO-IO word order
(26 %) and 20 cases in the pre-DO word order (15 %). We dis-
cussed these discrepancies and annotated the critical sentences
together. Most of the critical cases concerned the question of
how to deal with imperative sentences or sentences that may be
interpreted as an imperative (4.9a). Probably, these sentences do
not contain an aboutness topic because imperatives usually do
not provide information (a comment) about a topic, and thus,
the first two criteria of the tests usually could not be applied.
Accordingly, they were considered as a separate category.

(4.9)   a. Context: Child and her parents are baking.
            gib   uns.dat noch ein.acc Ei   raus
            give us   PRT one   egg out
            "Bring us another egg." (Simone, 2;06.26)
        b. Context: Father was asked by the child to read
            books.
            ich.nom hol dir.dat noch ein(e)s.acc
            I   get you   PRT one
            "I will bring you another (book)." (Kerstin, 3;02.08)

The remaining cases, which were ambiguous or unclear with
respect to the topic annotation, were annotated as "ambiguous"
(4–8 %) and occurred to a similar proportion in each group
and word order. These mostly concerned sentences which may
have a topic or not (64 %) or sentences in which it was not clear
which referent (subject, indirect object or direct object) is the
topic (30 %) (see 4.9b).

Pronominality. The pronominality annotations were the same
as in the previous corpus analyses. The annotations of the
pronominality of the direct object distinguished between the

clitics, personal pronouns, demonstrative pronouns, indefinite
pronouns and lexical NPs, and the pronominality of the indirect
object between "pronoun" and "NPs".

4.4.3   Results

4.4.3.1   Topicality and word order

Figure 4.4 presents the frequency of the topic annotations in
all three word orders in child language (CL) and child-directed
speech (CDS), excluding ambiguous topic annotations (see
Table A.5 in Appendix 3 for the actual numbers).
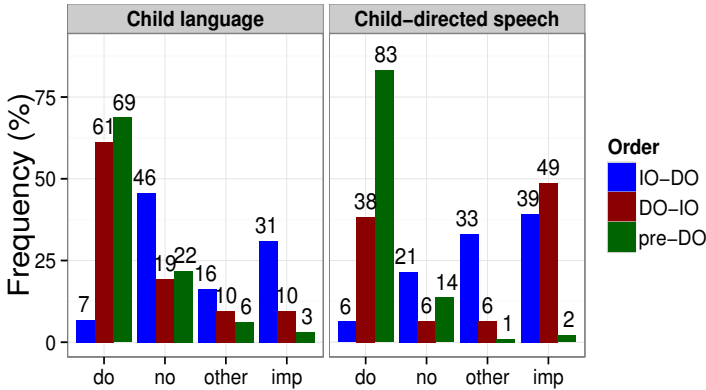
Figure 4.4: Frequency of the topic annotations in each word order and group

Similar patterns emerged for CL and CDS. In CL, direct objects
tended to be the topic (*do*) in the pre-DO word order (69 %) and
DO-IO word order (61 %). Topic-less sentences (*no*) and sen-
tences wherein the direct object was not the topic (*other*) mainly
occurred in the IO-DO word order. In CDS, topical direct objects
(*do*) also occurred in the pre-DO word order (83 %) and sen-
tences with another topical constituent (*other*) occurred in the

IO-DO word order. Topical direct objects also occurred in the DO-IO word order but this proportion was considerably lower than in the pre-DO word order. A reason for this may be the high proportion of imperatives (*imp*) in the DO-IO word order (49 %). Crucially, imperatives occurred in the IO-DO and DO-IO word order but rarely in the pre-DO word order in CL and CDS (2–3 %), which was basically due to the fact that in most imperatives the prefield was empty.

For statistical analysis, chi-square tests were calculated to assess whether the topic annotations were related to word order. The chi-square tests were significant in both child language and child-directed speech (CL: $\chi^2(6) = 93.72$, $p > .001$; CDS: $\chi^2(6) = 365.14$, $p > .001$). This indicates that topic status differed between the word orders.

To investigate these relationships, mosaic plots were created. The mosaic plots for the child language (left figure) and child-directed speech (right figure) are presented in Figure 4.5.
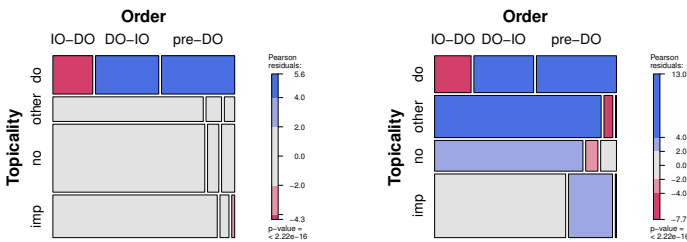
Figure 4.5: Relationship between topic status (rows) and word order (columns) in CL (left panel) and CDS (right panel)

Each plot illustrates the residuals for the topic status in each word order and basically tests whether the topic status differ between the word orders. The topic status (rows) includes cases when the direct object was the topic (*do*), when another constituent was the topic (*other*), when no topic was present

(*no*), or when the sentence was an imperative sentence (*imp*). Ambiguous cases were not included in these analyses.

The size of each cell reflects the absolute frequency of the data in each cell. The colour of each cell reflects the residuals, i.e., the relationship between the observed frequency of the data points in each cell in relation to the expected frequency of the data points in each cell (on the basis of the total frequency of data points in each row (topic annotation) and column (word order)). Red coloured cells indicate that the frequency is lower than would be expected whereas blue coloured cells indicate that the frequency is higher than would be expected when word order and topic annotations were independent.

For instance, the first cell in the figure (*do*, IO-DO) reflects how often the direct object was the topic (*do*) in the DO-IO word order in relation to the overall frequency of topical direct objects (do) and to the overall frequency of DO-IO word order. Given that is cell is red, this indicates that the direct object was less often (than expected) realized as topic in the IO-DO word order.

Thus, the first row of the plot illustrates that direct objects was more often the topic in the DO-IO and pre-DO word order (blue cells) than in the IO-DO word order (red cells) in both CL and CDS. The other rows are less relevant for our analyses. Yet the results for the CDS (right plot) indicate that topic-less sentences and sentences in which another constituent (not the direct object) was the topic (third and second row) tended to occur in the IO-DO word order rather than in the DO-IO and pre-DO word order. In CL, however, there were no differences in these topic annotations between the word orders, as indicated by the grey bars. Given that both annotations (*no* and *other*) were most difficult to annotate it is difficult to evaluate the differences between CL and CDS.

Finally, the last row indicates that, imperatives (*imp*) occurred less often in the pre-DO word order than in the IO-DO and DO-

IO word order in both CL and CDS. This is expected because in imperatives the prefield is usually not filled.

4.4.3.2   Pronominality of the direct object

The results so far indicate that topic status (especially the topic status of the direct object) is related to word order. Nevertheless, it is possible that the impact of the topic status interacts with the type of referring expression, especially if topics are realized as personal pronouns and thus should not occur in the prefield.

The previous corpus analyses have demonstrated that the type of referring expression realizing the direct object influenced word order, but these analyses only considered two of the word orders. For sake of exposure, the mosaic plots for the type of referring expression realizing the direct object in all three word orders are illustrated in Figure 4.6 (see Table A.6 in Appendix A for proportions and actual numbers). Again red cells indicate that the amount of data is lower than expected, blue cells that the amount of data is higher than expected and grey cells that there is no difference.
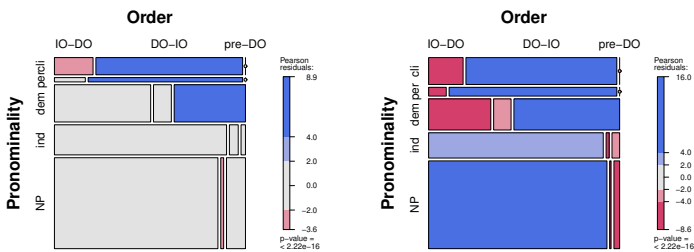
Figure 4.6: Relationship between type of referring expression (rows) and word order (columns) in CL (left panel) and CDS (right panel)

These plots confirm that the referring expression interacts with word order: in both CL and CDS clitics and personal pronouns tended to occur in the DO-IO word order rather than in the IO-

DO and pre-DO word order whereas demonstrative pronouns occurred in the pre-DO word order rather than in the IO-DO and DO-IO word order. In CL, the occurrence of indefinite pronouns did not vary between the word orders and lexical NPs occurred less often in the DO-IO word order but equally often in the IO-DO and pre-DO word order. In CDS, indefinite pronouns and lexical NPs tended to occur in the IO-DO word order rather than DO-IO and pre-DO word order.

This pattern also occurred with respect to topical direct objects. Table 4.12 presents the proportions of the different referring expressions realizing topical direct object. Topics tend to be realized as personal pronouns and clitics in the middlefield and as demonstrative pronouns in the prefield, although the preference of demonstrative pronouns to occur in the pre-DO word order rather than in the IO-DO word order seems to be weaker in CL than in CDS. A reason for this may be the occurrence of topical NPs. In CDS, topical NPs were more likely to occur in the IO-DO word order than in the pre-DO word order, whereas in CL they occurred only in the pre-DO word order. Taken together, these patterns indicate that the referring expression realizing a topical direct object may influence word order variation.

Table 4.12: Frequency of the type of referring expression of the topical direct object in each word order and group

	CL			CDS		
	IO-DO (N=12)	DO-IO (N=19)	pre-DO (N=22)	IO-DO (N=36)	DO-IO (N=59)	pre-DO (N=79)
Clitic	33 % (4)	74 % (14)	0	22 % (8)	61 % (36)	0
Pers_pr	0	21 % (4)	0	0	36 % (21)	0
Dem_pr	67 % (8)	5 % (1)	82 % (18)	39 % (14)	3 % (2)	91 % (72)
Indef_pr	0	0	0	3 % (1)	0	0
NP	0	0	18 % (4)	36 % (13)	0	9 % (7)

4.4.3.3   Models predicting word order in the middlefield and prefield

To assess whether topic status is a better predictor of word order variation than givenness and/or the type of referring expression, topic status was considered as a predictor in the logistic LME models predicting the non-canonical word order. The predictor Topic distinguished between two levels, i.e., whether the direct object is the topic (doTop) or whether the direct object is not the topic (notDO). Note that the basic pattern of results did not change when this simplified predictor rather than a more complex predictor that distinguished between five topic levels, i.e. "doTop", "noTop", "otherTop", "imperative" and "ambig" was used, although the complex predictor led to slightly better model fits in CDS (but not in CL).

Direct objects realized as clitics and personal pronouns were excluded from the models predicting word order in the prefield in CL and CDS, and direct objects realized as personal pronouns from the models for the middlefield in CL.

Table 4.13 presents the parameters of the fixed effects of the final models predicting the pre-DO word order (prefield) and DO-IO word order for child language (left panel) and child-direct speech (right panel). In these models the IO-DO word order was taken as the baseline, with the models for the prefield predicting the pre-DO word order and the model for the middlefield predicting the DO-IO word order.

Table 4.13: Fixed effects of the revised models assessing factors influencing the probability of the pre-DO and DO-IO word order. Left panel – CL, right panel – CDS.

	CL			CDS		
	b	**SE**	**z**	**b**	**SE**	**z**
Models for the prefield						
(Intercept)	1.00	0.42	2.352*	1.59	0.65	2.447*
Topic_notDO	−3.59	0.52	−6.960***	−2.58	0.39	−6.660***
Pron_DO_indPr				−2.25	0.57	−3.964***
Pron_DO_np				−2.86	0.40	−7.117***
Pron_IO_pronoun				−1.50	0.42	−3.554***
Subject_present				1.46	0.54	2.684**
Models for the middlefield						
(Intercept)	−0.62	0.60	−1.033	1.78	0.80	2.223*
Giv_DO_new	1.34	0.67	−2.011*			
Pron_DO_perPr				5.17	0.87	5.907***
Pron_DO_cli	2.25	0.75	3.015***	4.34	0.72	6.072***
Pron_DO_indPr	−0.88	0.95	−0.924	−4.30	1.05	−4.090***
Pron_DO_np	−2.32	0.89	-2.610**	−5.18	0.93	−5.585***
Pron_IO_pronoun				−4.99	0.91	−5.527***

b: estimate, SE: standard error, z: z-score
$^+p < .1$, $^*p < .05$, $^{**}p < .01$, $^{***}p < .001$

Prefield. The models for the prefield considered Topic status (Topic), the Givenness and Pronominality of the indirect and direct object, and Subject presence as predictors of the pre-DO word order. The latter five predictors were defined as in corpus analysis 2. As in corpus analysis 2, the models were trimmed down in a step-wise fashion so that the "final" model only includes the relevant predictors. The statistics of the final models are presented in Table 4.13, with positive estimates indicating an increase in the probability of the pre-DO word order. The results demonstrate that in both CL and CDS Topic status was a significant predictor influencing word order variation. However in CL, only Topic status turned out to be a significant predictor whereas – in contrast to corpus analysis 2 – the type of referring

expression did not influence word order. In CDS Topic Status, the Pronominality of the indirect and direct object (Pron_DO, Pron_IO) and the presence of the subject (Subject) influenced word order. These factors, i.e., Pronominality and Subject presence, were also significant in the models presented in corpus analysis 2. They may explain word order variation in CDS when the direct object was not the topic or when a topical direct was not placed in the pre-field whereas these cases could not be accounted for in CL.

Middlefield. The models for the middlefield considered Topic status, the Givenness and Pronominality of the indirect and direct object as predictors of the DO-IO word order. The latter five predictors were defined as in corpus analysis 1b. These models were also trimmed down in a step-wise fashion. Topic status did not turn out as a significant predictor in neither CL nor CDS. The Pronominality and the Givenness of the direct object influenced word order in CL, whereas the Pronominality of the direct object and the indirect object influenced word order in CDS.

4.4.4   Discussion

The first set of analyses revealed that topic status and the type of referring expression influenced word order. The mosaic plots indicated that direct objects tended to be the topic of sentences in the pre-DO and DO-IO word order, indicating that topical constituents are placed in the prefield or to the left edge of the middlefield. The referring expression determined where topics were placed, i.e., topical direct objects realized as demonstrative pronouns were placed in the prefield and personal pronouns toward the beginning of the middlefield. However, the models predicting word order revealed that topic status only influenced movement to the prefield whereas its impact on word order in the middlefield could not be separated from the impact of the referring expression.

In comparison to the corpus analyses investigating the impact of givenness on word order variation, this suggests that topic status was a better predictor than givenness in the prefield (though both were correlated) but not in the middlefield. Interestingly, the models in the present analyses revealed an effect of givenness in CL whereas the models in corpus analysis 1b did not. These differences may result from differences in the data set, i.e., corpus analysis 1 did not only consider main clauses but also subordinate clauses, and suggest that the effect of givenness in the middlefield is not stable or only weak. Thus, while the results for the middlefield could not demonstrate clearly whether information structure (IS) influenced word order (as IS was correlated with the type of referring expression), the results for the prefield indicate that 3-year olds are already sensitive to the impact of topic status (and/or givenness) on word order variation.

Personal pronouns and demonstrative pronouns have been linked to different information status and discourse properties. That is, personal pronouns tend to refer to aboutness topics, i.e., highly salient referents, and indicate topic continuity, whereas demonstrative pronouns refer to less salient referents and indicate topic shift (Bosch et al., 2003; Bosch, Katz, & Umbach, 2007; Hinterwimmer, 2014; Hörnig et al., 2013). The results of the present study did not capture these differences (indeed pilot annotations of the topic and information status of the antecedent of topical direct objects did not lead to clear results). Thus, it is not clear whether the differences proposed between personal and demonstrative pronouns also occur in spoken discourse (Weinert, 2009; Gärtner & Steinbach, 2000). Moreover, German-speaking children may not have acquired the differences in the information status indicated by demonstrative pronouns and personal pronouns before age 5 (Bittner & Kuehnast, 2011) so that it is not clear whether the 3-year-olds in the corpus data considered the different topic properties of different pronoun types.

4.5   General discussion

The corpus analyses investigated the impact of givenness, topic status and the type of referring expression on word order variation in the middlefield and movement to the prefield in child language and child-directed speech. In general, children and adults placed given or topical referents in the prefield and towards the beginning of the middlefield, corresponding with the given-new, given-given and/or topic-comment order. However, this pattern was influenced by the type of referring expression, that is, depending on the referring expression realizing the topical direct object, it was placed in the prefield or middlefield. Nevertheless, the impact of givenness and topic status could not be separated from the impact of the referring expression in the middlefield while both the type of referring expression and topic status had separate effects on word order variation involving the prefield.

With respect to the middlefield, the results indicate that word order variation mainly resulted from pronoun movement and children were more adult-like in word order variation resulting from pronoun movement than scrambling. As suggested in Chapter 3, reasons for this may lie in the frequency of the pronoun movement and in the factors influencing pronoun movement and scrambling.

The results also indicate that children mirror the adult pattern with respect to word order variation in the prefield and middlefield. On the one hand, the proportion of the word orders in child language and child-directed speech were quite similar and children were more likely to produce the DO-IO and pre-DO word orders when these were also produced by their mothers. On the other hand, children and adults were similar in the general patterns with respect to the factors influencing word order variation, especially when word order variation depended on the characteristics of the direct object, i.e., its pronominality and topic status. These results can be explained by accounts that

suggest and interaction between structural economy and the input frequency in the acquisition of word order variation (e.g., Snyder, 2007; Westergaard, 2008).

Nevertheless, the data do not clearly indicate whether the IO-DO or the DO-IO word order may be the underlying word order. The results of corpus analysis 1a indicate that the word order constraints were almost always satisfied in the IO-DO word order but often did not apply (or were violated, especially the animacy constraint) in the DO-IO word order. This may indicate that the DO-IO word order is the underlying word order and the constraints triggered the IO-DO word order.

However, corpus analysis 1b indicates that the IO-DO and DO-IO word order were solely predictable from the type of referring expression, especially from the distinction between different pronoun types. Most of the utterances in the IO-DO and DO-IO word order probably resulted from pronoun movement, in the first case from movement of the indirect object and in the second case from movement of the indirect object and the direct object. Thus, the utterances in the IO-DO and DO-IO word order that involved weak pronouns or clitics may not be productions of the basic word order (see also footnote 4 in section 4.2 above).

Utterances which involved lexical NPs and thus may be more informative concerning the underlying word order were relatively rare and occurred mainly in the IO-DO word order. These utterances tended to satisfy the word order constraints, especially the animacy constraint. Accordingly, the problem of differentiating between the impact of animacy and verb semantics that occurred in previous studies (e.g., Bader & Häussler, 2010) also holds in the present study.

In general, word order in the middlefield was predictable from the characteristics of the direct object. That is, the direct object was placed before the indirect object (DO-IO) when it was real-

ized as a weak pronoun or a clitic, while it followed the indirect object when it was realized as a lexical NP or an indefinite pronoun (IO-DO). This pattern was quite systematic and thus children may have acquired the factors triggering the production of the DO-IO word order (weak pronouns, the phonological or IS correlates of weak pronouns) quite early.

When the direct object was realized as a demonstrative pronouns the case was less clear. Adults placed the direct object only before the indirect object when the indirect object was realized as noun phrase, while children did not reveal a systematic pattern. This may suggest that children have more problems with scrambling than with pronoun movement.

Crucially, the results for the prefield indicate that demonstrative pronouns were much more likely to be placed in the prefield, in both children and adults. Thus, children may have more "problems" acquiring the factors influencing the placement of demonstrative pronouns within the middlefield because it is less frequent.

In addition, the information status or phonological realization of the demonstrative pronouns may vary because demonstrative pronouns may be weak or strong pronouns, especially in spoken discourse (e.g., Gärtner & Steinbach, 2000; Weinert, 2009). The result of the first corpus analysis indicate that adults may consider demonstrative pronouns as strong pronouns, whereas children may consider them as weak or strong because they may consider them as "default" pronoun for (third person) referents (e.g., Bittner & Kuehnast, 2011).

Finally, the lack of indirect object realized as lexical NPs in child language may explain the differences between children and adults in the placement of demonstrative pronouns. In child-directed speech, the positions of direct objects in the middlefield was influenced by the pronominality of the indirect objects. In child language, however, indirect objects realized

as lexical noun phrases were rare, which is compatible with results by Eisenbeiß (1994) on German and by Anderssen et al. (2014) and Stephens (2010) on Norwegian and English.

The reason for this discrepancy is less clear. Apparently, it is not the case that children in general prefer to produce pronouns over lexical NPs because children realized direct objects as pronouns and lexical NPs. But the lack of realizing indirect objects as lexical NPs may be related to differences in the acquisition of case marking of indirect and direct objects, i.e., case marking of indirect objects may be acquired later than that of direct objects (Eisenbeiß, 1994), or to the impact of the preferred argument structure (e.g., Theakston, 2012; see also Du Bois, 1987), i.e., the correlation between indirect objects, IS (givenness) and pronominality in the input.

Nevertheless, the results of the corpus analyses indicate that 3-year-olds are sensitive to the relationship between information structure, the type of referring expression and word order, in particular movement to the prefield.

In addition, the results indicate that three-year-olds children may not in general follow the new-before-given preference with respect to word order in the prefield (with respect to word order in the middlefield we still do not know). This agrees with the results by Fleischhauer (2009) and differs from the new-before-given preference at the phrasal level (Dimroth & Narasimhan, 2012; Narasimhan & Dimroth, 2008).

Nevertheless, the results also agree with the hypothesis that there may be a preference for a "prominent before less prominent" order (e.g., Lamers & de Hoop, 2005; Pappert et al., 2007). In the corpus data, topical referents are usually prominent and in the focus of attention of the speaker and the hearer. In the study by Narasimhan and Dimroth (2008), the second element added to the scene may be more prominent to the child because it was added to the scene at last. Children may have preferred

to place the prominent before the less prominent element because they may not be able to adapt to the hearer-perspective, i.e., consider that the second object is not visible to the hearer; in contrast adults do consider the hearer-perspective and thus mention the old referent before the new referent.

5 Comprehension of word order variation

5.1 Introduction

While the main challenges in production concern the lineariza-
tion of the arguments and the acquisition of the factors influenc-
ing the linearization, the main problem in comprehension is the
assignment of thematic or semantic roles, that is, the question
of who is doing what to whom.

Thematic role assignment is influenced by several factors,
among them morphology, animacy, plausibility, subject-first
bias and context. Notably, children may not consider the same
sources of information as adults do when assigning thematic
roles. In particular, children usually have problems understand-
ing non-canonical sentences, especially when the assignment
of thematic roles depends on morphological information and
semantic cues such as animacy or plausibility cannot be used.

Explanations for these differences between children and adults
depend on the language acquisition and processing model
adopted. From a usage-based or cue-based perspective, it
is usually assumed that children consider different cues to
thematic role assignment (e.g., morphology, animacy, the
subject-first bias) but differ from adults in that they rely on dif-
ferent cues (e.g., the subject-first bias rather than morphology)
when these cues are in conflict, as it is the case in non-canonical
sentences (e.g., E. Bates et al., 1984; E. Bates & MacWhinney,

1987; Chan et al., 2009; MacWhinney, 1987; Tomasello, 2003).
Recall that these models usually emphasize that the grammar
and the parser are the same.

Approaches that are more in line with the minimalist gram-
mar often distinguish between the grammar and the parser (e.g.,
Crain & Thornton, 1998). Thus, if children are able to produce
non-canonical sentences, they are able to construct the syntac-
tic representation of the sentence and should be able to com-
prehend them. Problems understanding sentences in the non-
canonical word order may thus be related to structural factors,
i.e., the question why children may not always be able to con-
struct the "correct" syntactic representation (e.g., Friedmann,
Belletti, & Rizzi, 2009), and to discourse factors, i.e., whether
children may be more sensitive to the discourse context and
the felicity requirements on the non-canonical word order than
adults (Crain & Thornton, 1998).

In this dissertation, I investigated whether information struc-
ture (IS), i.e., the topic-first context, and the modification of the
type of referring expression, i.e., the use of pronominal refer-
ents, influence the comprehension of non-canonical sentences.
Crucially, both usage-based and minimalist accounts propose
that IS and pronouns may influence sentence comprehension,
yet they provide different explanations. From a usage-based
perspective, context and pronouns may be seen as frequency-
related cues to thematic role assignment (e.g., Brandt et al., 2009;
Kidd et al., 2007), whereas minimalist approaches may link the
effects to the reduction of processing difficulties in terms of con-
textual licensing or the reduction of memory costs that affect the
construction of the syntactic representation (e.g., Adani, van der
Lely, Forgiarini, & Guasti, 2010; Friedmann et al., 2009).

5.2 Adult sentence comprehension

5.2.1 Adult comprehension of word order variation

Psycholinguistic models on syntactic processing agree that sentence processing is incremental and involves the consideration of different sources of information. However, the models differ in their assumptions about when certain types of information are used during online sentence processing and whether several syntactic representations of ambiguous sentences are constructed (see Pickering & van Gompel, 2006).

Especially the first question is related to the nature of the language architecture assumed. The Minimalist Program proposes a modular architecture of syntactic, phonological and semantic information but with interfaces between the levels (Chomsky, 1995). Accordingly, the language architecture proposed by the minimalist grammar is compatible with modular processing accounts (e.g., Frazier, 1987; Crain & Thornton, 1998), but not with strongly interactive models like the cue-based model (e.g., E. Bates & MacWhinney, 1987; MacWhinney, 1987) and constraint-satisfaction models (e.g., MacDonald, Pearlmutter, & Seidenberg, 1994; Seidenberg & MacDonald, 1999; Trueswell & Tanenhaus, 1994).

Processing models propose different explanations of the processing difficulties that usually occur during the processing of non-canonical sentences, both with respect to temporarily ambiguous and unambiguous sentences. Previous studies have demonstrated a subject-first (or agent-first) preference in sentence processing because sentences in the non-canonical (object-before-subject) word order are usually more difficult to process than sentences in the canonical (subject-before-object) word order (e.g., Bader & Meng, 1999; Hemforth, 1993; Rösler et al., 1998; Schipke, 2012; Schlesewsky, Bornkessel, & Frisch, 2003).

Online studies investigating the processing of unambiguous SVO and OVS sentences wherein the non-canonical word order is indicated by case marking at the first NP (see 5.1) demonstrated that processing difficulties usually occur at the first NP of OVS sentences (e.g., Hemforth, 1993; Schipke, 2012; see also Rösler et al., 1998; Schlesewsky et al., 2003 on word order variation in the middlefield).

(5.1) a. **Der**   Onkel besucht den   Jungen. (SVO)
          the.nom uncle visit   the.acc boy
          "The uncle visits the boy."

     b. **Den**   Onkel besucht der   Junge. (OVS)
          the.acc uncle visit   the.nom boy
          "The uncle, the boy visits."

Other work (e.g., Bader & Meng, 1999) suggests that the parser adopts the canonical SO analysis during the processing of temporarily ambiguous sentences like those presented in (5.2).

(5.2) a. Ich glaube, dass Maria   die Lehrerinnen gesehen
          I   believe, that Mary.SG the teachers.PL seen
          hat.
          has.SG
          "I believe that Mary has seen the (female) teachers."

     b. Ich glaube, dass Maria   die Lehrerinnen gesehen
          I   believe, that Mary.SG the teachers.PL seen
          haben.
          has.PL
          "I believe that the (female) teachers have seen Mary."

The NPs *Maria* and *die Lehrerinnen* ("the teachers") are ambiguous with respect to case marking and thus with respect to the syntactic structure and thematic role assignment. The sentences are disambiguated at the auxiliary (*hat* "has" vs. *haben* "have")

via subject-verb-agreement and readers experience processing difficulties when the sentences are disambiguated towards the non-canonical object-before-subject (OS) word order (5.2b) rather than towards the subject-before-object (SO) word order (5.2a). This indicates that the parser initially follows the SO analysis when processing temporarily ambiguous sentences and gardenpath effects occur when the ambiguity is resolved towards the OS word order.

The subject-first or agent-first preference may be explained in terms of frequency, discourse factors, or structural factors. Processing difficulties may occur because in general the non-canonical word order is less less frequent than the canonical word order (e.g., Kempen & Harbusch, 2003; MacDonald et al., 1994; Trueswell & Tanenhaus, 1994). They may also occur because the use of the non-canonical word order is unexpected or not licensed or felicitous without an appropriate discourse context (Altmann & Steedman, 1988; Crain & Steedman, 1985) whereas the canonical word order is licensed without a context (or in an all-new context).

Finally, processing difficulties may be related to structural factors, in particular the characteristics of filler-gap dependencies. A filler-gap dependency occurs when a constituent (filler) was moved out of its base position (gap). This is illustrated for SVO and OVS sentences in (5.3) where the sentence-initial constituent, *der Onkel* ("the uncle") is the filler and the trace *t* the gap position. (The movement of the verb is excluded for sake of simplicity).

(5.3) a. Der   Onkel$_i$ besucht t$_i$ den   Jungen. (SVO)
           the.nom uncle$_i$ visit   t$_i$ the.acc boy
           "The uncle visits the boy."

       b. Den   Onkel$_i$ besucht der   Junge t$_i$. (OVS)
           the.acc uncle$_i$ visit   the.nom boy   t$_i$
           "The uncle, the boy visits."

Explanations regarding the filler-gap dependency may be related to grammatical factors or memory factors. On the one hand, OVS sentences may lead to intervention effects. Rizzi (2013) proposed intervention effects occur with filler-gap dependencies when the object is moved over the subject (because this movement violates locality constraints). On the other hand, OVS sentences may lead to processing difficulties because they "violate" the active-filler strategy, which describes the preference to assign a filler to the first potential gap position (e.g., Frazier & Clifton, 1989; Frazier & Flores D'Arcais, 1989). In SVO sentences (5.3) the filler can be placed in the first gap position but in OVS sentences the position is already filled by the subject.

Note, however, that in adults the processing difficulties for OVS sentences are restricted to the initial NP. Accordingly, contextual and/or frequency-related explanations may be more likely to explain the processing difficulties in OVS sentences because processing difficulties related to the structural factors, e.g., the active-filler strategy, may be expected at the second NP. Intervention effects may play a role but it is less clear when they occur during online sentence processing.

5.2.2 Impact of IS on sentence comprehension

Information structure (IS) may influence sentence processing in different ways: on the one hand, a context (or the IS of a subsequent sentence)[1] may license the non-canonical word order, i.e., the non-canonical word order may be felicitous or even preferred to the canonical word order. This might be the case in a context in which the non-canonical word order satisfies the given-before-new preference. Indeed, studies on the

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1   Note that, the impact of the context is linked to the IS structure of the subsequent sentence. A context may define a referent as given, focus or topic and thus imposes a certain IS on the subsequent sentence. This IS is marked at the sentence-level, e.g., by prosody or word order. Due to this marking, it is often difficult to disentangle the impact of context from the impact of prosody on sentence comprehension.

dative alternation in English demonstrated that the given-new order is usually easier to process than the new-given order (e.g., Benatar & Clifton, 2013; Brown, Savova, & Gibson, 2012; Clifton & Frazier, 2004). Similarly, results from Finnish (Kaiser & Trueswell, 2004) showed that non-canonical OVS sentences were easier to process when the object was given and the subject new in comparison to an all-new context wherein the subject and object were new.

On the other hand, IS may provide a frequency-related cue to thematic role assignment (Grünloh, Lieven, & Tomasello, 2011; Weber, Grice, & Crocker, 2006). That is, while a given-before-new context may license the non-canonical word order by making its use felicitous, it may not be a strong cue to thematic role assignment because it may occur with the canonical and non-canonical word order. In contrast, a focus-first context may be better cue to thematic role assignment because it occurs more often with the non-canonical word order and less often with the canonical word order (Weber et al., 2006).

Research for German seems to support this pattern. While the given-new (or focus-final) word order may ease the processing of the non-canonical sentences it seems to have weaker effects on sentence processing in comparison to focus.

Concerning the middlefield, a self-paced reading study by Meng, Bader, and Bayer (1999) showed that question contexts like (5.4) that define the first NP as given and the second NP as focus, reduce the processing difficulties at the sentence final auxiliary in non-canonical OS (object-subject) sentences when the sentences were disambiguated at the first NP (*den Opa* vs. *der Opa*) but not when the sentences were temporarily ambiguous (*die Oma*) and disambiguated late, i.e., at the sentence-final auxiliary via subject-verb-agreement (cf., 5.2 above).

(5.4)   Wer hat den Opa gesehen? (Who saw the grandfather?)
        Ich glaube, dass den   Opa   einige
        I   believe, that the.acc grandpa some.nom/acc
        der   Kinder   besucht haben.
        the.gen children visited   have.PL
        "I believe that some of the children have seen the grandpa."

Bornkessel, Schlesewsky, and Friederici (2003) used the event-correlated-potential (ERP) technique to investigate the impact of context on online processing. They showed that processing difficulties at the first NP for unambiguous OS sentences were not reduced when the object was given rather than new. However, processing difficulties of OS sentences were reduced when the object was contrastively focused rather than given or new. Thus, even though given objects reduce the processing difficulties at the sentence-final verb (as Meng and colleagues showed), their givenness status does not influence processing of the object itself. A reason for this may be that focus rather than givenness licenses the OS word order (cf., Bornkessel et al., 2003). Related to this, Stolterfoht (2005) suggest that the preferred focus structure of non-canonical OS sentences requires the object to be in narrow focus.

Concerning word order variation in the prefield, previous studies also indicate that givenness of the direct object may not be a strong predictor of the OVS word order. A self-paced reading study by Weskott (2003) showed that givenness and inferrability of the object "alone" did not ease the processing of unambiguous OVS sentences in comparison to SVO sentences. However, subsequent work by Weskott et al. (2011) showed that a poset-relation (e.g., whole-part relation) between the object (side-mirror) and an antecedent in the context (car) licensed the OVS word order, resulting in higher acceptability ratings for OVS sentences (5.5b, taken from Weskott et al., 2011) than for the corresponding SVO sentence (5.5a). This indicates that

a more explicit link between the object and the preceding discourse (rather than inferrability per se) may ease the processing of OVS sentences.

(5.5) Peter has washed the car.

    a. Er   hat den   Außenspiegel ausgelassen.
       he.nom has the.acc side-mirror   left-out

       "He left out the side mirror."

    b. Den   Außenspiegel hat er   ausgelassen.
       the.acc side-mirror   has he.nom left-out

       "The side mirror, he left out."

ERP-studies by Schumacher and Hung (2012) and Burmester et al. (2014) extend Weskott's work to online processing. Schumacher and Hung (2012) found that information status of the sentence-initial NP in unambiguous OVS sentences influences processing, that is, given constituents may be easier to be integrated into the previous discourse than inferrable items.

Burmester et al. (2014) showed that the impact of topicality on sentence processing interacted with word order. Their study revealed lower processing costs at the first NP in OVS sentences (*Den Uhu malt der Igel.* "The owl, the hedgehog paints.") following the topic context ("What about the owl?") in comparison to neutral ("What's going on here?") context, but no effects on the processing of SVO sentences (*Der Uhu malt den Igel.* "The owl paints the hedgehog."). Burmester et al. (2014) suggest that the topic status of the sentence-initial object may ease the update of the discourse (cf., Schumacher & Hung, 2012).

Finally, a visual world study by Weber et al. (2006) showed that prosodic cues to contrastive focus influence processing of temporarily ambiguous sentences like (5.6).

(5.6) Die   Katze jagt   womöglich den   Vogel /
       the.nom/acc cat   chases possibly   the.acc bird   /
       der   Hund
       the.nom dog
       "The cat chases the bird. / The cat, the dog chases."

The sentences were disambiguated at the second NP by case morphology towards the SVO order (*den Vogel*) or the OVS order (*der Hund*). The sentences were presented together with a visual scene depicting a cat, a bird and a dog. The results show that prosody influenced the eye-movements to the expected referent of the second NP (bird vs. dog) even before the second noun phrase was mentioned. Neutral intonation led to a preference for the SVO reading as revealed by more looks to the possible patient (bird) than to the agent (dog) in the verb and adverb region. When the object was focused, the SVO preference was reduced in the verb region and absent in the adverb region. Weber and colleagues suggested that the contrastive interpretation was facilitated in OVS interpretation because prosodic focus on the first NP is unexpected for SVO sentences in neutral contexts.

5.2.3 Impact of pronouns on sentence comprehension

Several studies showed that the use of pronouns may ease the comprehension of non-canonical sentences in the middlefield. Schlesewsky et al. (2003) showed that processing difficulties at the first object NP in non-canonical sentences like (5.7a) were reduced when the object was realized as a pronoun (*ihn*) rather than as an NP (*Schnuller*). Bader and Meng (1999) and Stolterfoht (2005) showed that temporarily ambiguous sentences that were resolved towards the OS word order led to less processing difficulties when the object was realized as a pronoun rather than as a lexical NP (5.7b).

(5.7)   a. Dann hat [den   Schnuller / ihn]   der
           Then has [the.acc pacifier   / it.acc] the.nom
           Vater dem   Sohn gegeben.
           father the.dat son   given
           "Then the father gave the pacifier/it to the son."

        b. Maria glaubt, dass [sie / Lisa] die Lehrerinnen
           Mary believes that [she / Lisa] the teachers
           gesehen haben.
           have   seen.PL
           "Mary believes that the teachers have seen her/Lisa."

Reasons for the ease in comprehension may be related to the focus structure or to memory factors. Bader and Meng (1999) propose and Stolterfoht (2005) shows that OS sentences in which the object is realized as a lexical NP are not felicitous in an all-new context that imposes a wide focus structure on the sentences. Thus, the focus structure of the sentence has to be revised from wide focus (on the entire sentence) to narrow focus (on the object), with the latter being felicitous for OS sentences (cf., Bornkessel et al., 2003). When the object is realized as a pronoun, however, the wide focus structure is felicitous and the focus structure does not have to be revised.

The impact of pronouns on sentence processing may also be linked to the characteristics of filler-gap dependencies. Previous research demonstrated that object relative sentences (5.8b) are more difficult to process than subject relative sentence (5.8a) (e.g., Gibson, 1998; King & Just, 1991; Gordon et al., 2001).

(5.8)   a. The reporter who$_i$ t$_i$ attacked the senator admitted
           the error.

        b. The reporter who$_i$ the senator attacked t$_i$ admitted
           the error.

However, these processing difficulties are reduced when the subject in object relative clauses (e.g., *the senator* in 5.8b) is real-

ized as a pronoun rather than as an NP (e.g., Warren & Gibson, 2002).

This ease in processing may be due to the differences in the features (pronoun vs. lexical NP) between the subject and the object that may reduce intervention or interference effects (e.g., Gordon et al., 2001; Gordon, Hendrick, Johnson, & Lee, 2006; Rizzi, 2013) or due to the discourse status of the pronoun, i.e., given pronouns (or the referents of the pronouns) may be easier to integrate into the discourse model (Warren & Gibson, 2002, 2005).

Crucially, the processing difficulties in relative clauses usually occur at the lexical verb when the subject and object are integrated and possibly the thematic roles are assigned. Thus, the subject and object need to be stored in the working memory or reactivated at the verb.

However, with respect to the processing of non-canonical sentences in German, adults usually experience processing difficulties at the first NP. Thus, it is not clear how interference and integration costs may explain the reduction of the processing difficulties at the first NP, although they may explain the results for the non-canonical word order of sentence-final structures as in (5.7).

Nevertheless, it may be possible that pronouns (or their givenness status) eases processing in that they reduce memory demands and ease lexical access or contextual integration (Warren & Gibson, 2002, see also Burmester et al., 2014; Schumacher & Hung, 2012).

Alternatively, it has been suggested that pronominal subjects ease the processing of object relative clauses because the subject in these sentences is usually realized as a pronoun rather than as a lexical NP (Brandt et al., 2009; Kaan, 2001; Kidd et al., 2007). Thus, pronouns may be used as frequency-related cue

for thematic role assignment. This link between pronouns and subjects may be modulated by the IS factors because pronouns are usually topics and subjects (Kaan, 2001). However, the link between pronouns and the subject status cannot explain why sentence processing is also eased when the object is realized as pronouns, as the studies on the middlefield showed (5.8).

5.3 Child sentence comprehension

5.3.1 Child comprehension of word order variation

Preschoolers often have problems understanding sentences in the non-canonical OS word order (e.g., Dittmar et al., 2008a; Grünloh et al., 2011; Mills, 1977, but see Schaner-Wolles, 1989), even though they produce the sentences in natural discourse around age 2;6 (e.g., Fleischhauer, 2009 for German OVS sentences).

On the one hand, the problems understanding sentences in the non-canonical word may be related to the grammatical competence, especially problems with morphology. As mentioned in Chapter 3, there is a debate whether German-speaking 2;6-year-olds already create adult-like sentence representations and whether adult-like representations depend on the acquisition of morphological knowledge (e.g., Clahsen, 1990; Poeppel & Wexler, 1993; Weissenborn, 1990, 1994; see also Tomasello, 2003).

Crucially, experiments that revealed comprehension difficulties for OVS sentences in children usually tested sentence with lexical NP referents whereas children and their caretakers are more likely to use pronominal referents in spoken language (Fleischhauer, 2009; Dittmar et al., 2008a). Children may have more problems with the processing of sentences containing lexical NPs because they may acquire the case marking of lexical NPs later than the case marking of pronouns.

Indeed a study by Dittmar et al. (2008a), reported below, demonstrated that even in 7-year-olds performance on OVS comprehension depends on morphological productivity, i.e., on their performance on producing the singular and plural forms for known and novel objects. However, ERP studies by Schipke (2012) reveal that even 3-year-olds are sensitive to the case marking information, i.e., to the differences between nominative vs. accusative case, even though they may not be able to use this information successfully in sentence comprehension.

On the other hand, problems understanding OVS sentences may be linked to processing factors. Research into children's sentence processing (see Snedeker, 2009; Trueswell & Gleitman, 2007 for reviews) is mainly concerned with (i) the question of whether the parser of children is adult-like or not, e.g., whether the same sources of information are used during sentence processing (e.g., E. Bates et al., 1984; E. Bates & MacWhinney, 1987; Crain, 1991; Crain & Thornton, 1998; Clahsen & Felser, 2006; MacWhinney, 1987; Snedeker & Trueswell, 2004), and (ii) the extent to which sentence processing is influenced by cognitive factors, like memory capacity (e.g., Clahsen & Felser, 2006; Weighall & Altmann, 2011; Zhang & Knoeferle, 2012) and executive functions (e.g., Choi & Trueswell, 2010; Novick, Trueswell, & Thompson-Schill, 2005).

Accordingly, problems understanding OVS sentences may result from problems integrating different sources of information that are required for thematic role assignment, from a lack of a context that license the non-canonical word order, or from intervention effects or memory factors that are related to the syntactic structure. The following discussion will be restricted to the use of different cues in sentence comprehension; the impact of contextual factors and memory factors will be addressed in the two subsequent sections.

Several studies revealed that children – in contrast to adults – are less likely to rely on morphological information during the-

matic role assignment. Rather they rely on an agent-first (or subject-first) strategy or on plausibility and animacy information. Bever (1970) suggests that children around the age 2 apply a lexical NVN-strategy (agent-first strategy) with the thematic actor-action-object mapping when they interpret transitive sentences. This leads them to understand OVS and passive sentences as SVO and active sentences.

Yet, cross-linguistic studies demonstrated that the reliance on the agent-first strategy is language-specific, with children learning languages with more flexible word order, e.g., Turkish, being more likely to be influenced by morphological cues (e.g., Slobin & Bever, 1982) and children learning languages with less flexibility, e.g., English and German, being influenced by an interaction between the agent-first strategy and the use of semantic cues, e.g., animacy (e.g., E. Bates et al., 1984; Chan et al., 2009).

Indeed, English-speaking 2.5- to 3-year-olds may use animacy and plausibility information for sentence comprehension, resulting in an improvement of the comprehension of non-canonical sentences when the semantic cues support the non-canonical reading (e.g., Bever, 1970; Strohner & Nelson, 1974) but also in problems understanding of sentences in the canonical word order (e.g., Bever, 1970; Cannizzaro, 2012; Strohner & Nelson, 1974).

Similarly, Chan et al. (2009) showed a developmental change in the use of the agent-first strategy and animacy information in the interpretation of case-ambiguous NVN sentences in English-speaking and German-speaking children. In 2.5-year-olds, the assignment of thematic roles was influenced by animacy information, that is, they chose the first NP most often as the agent when the first NP was animate and the second NP inanimate (86 % for English, 71 % for German), slightly less often when both NPs were animate (78 %, 67 %) and around chance level when the first NP was inanimate and the second animate (58 %, 57 %). In contrast, 3-year-olds and 4-year-olds

applied the agent-first strategy regardless of the animacy contrast (95–100 %), but the German-speaking 3-year-olds animacy applied it slightly less often (88–89 %), especially when the first NP was inanimate (79 %).

With respect to the comprehension of transitive sentences in German, results by Lindner (2003) support the findings that the use of different cues for thematic role assignment changes with age. She used an act-out task to investigate the interaction between animacy, agent-first strategy, case marking and subject-verb-agreement on sentence comprehension of SO and OS sentences in 2- to 9-year-olds. 2-year-olds only considered animacy as a cue to thematic role assignment. This cue (together with the agent-first strategy) was also the most important cue in 3-year-olds. Starting from age 3, children relied more and more on case and agreement information, and from age 4 less on animacy and the agent-first strategy. However, they were not successful in interpreting OS sentences on the basis of morphological information until the age of 6 years. 9-year-olds show the same cue pattern as adults, i.e., they mainly relied on morphological information such as agreement and case.

The separate effects of the agent-first preference and morphological information were also investigated by Dittmar et al. (2008a). They investigated the understanding of SVO and OVS sentences in 2-, 4- and 7-year-olds, using three sentence types: a) sentences in the SVO word order with unambiguous case marking at the subject and object (5.9a, prototype condition), b) ambiguous sentences (5.9b, word order condition), which should be interpreted as SVO sentences due to the agent-first strategy, and c) OVS sentences with unambiguous case marking on the subject and object (5.9c, conflict condition).

(5.9)   a. Der   Hund wieft den   Löwen. (prototype)
           the.nom dog   VERB the.acc lion
           "The dog VERB the lion."

   b. Die   Katze wieft die   Ziege. (word order)
      the.amb cat   VERB the.amb goat
      "The cat VERB the goat."

   c. Den   Tiger wieft der   Bär. (conflict)
      the.acc tiger VERB the.nom bear
      "The tiger, the bear VERB."

Dittmar and colleagues used a video pointing task wherein the SVO and OVS interpretation of a test sentence were shown simultaneously in two videos and participants had to decided for (pointed to) one of them. The 2;7-year-olds interpreted the prototype condition as SVO sentence (76 %) but performed at chance level in the other two conditions. The 4;10-year-olds interpreted the prototype and ambiguous sentences as SVO sentences but the unambiguous sentences at chance level. The 7;3-year-olds interpreted the prototype and ambiguous sentences as SVO sentences and the OVS sentences as OVS sentences but their performances was correlated with morphology productivity. That is, 7-year-olds who had less problems forming the singular and plural forms of known and novel word (or objects) were more likely to understand the sentences correctly.

Dittmar et al. suggest that children may start comprehending sentences from a prototype construction in which the agent-first strategy and the morphological markers cue the same interpretation and only gradually disentangle the effect of both cues. The 2-year-olds have not disentangled the impact of each cue and thus have problems when only the agent-first cue is provided (word order condition, 5.9b). The 4-year-olds do not have problems when only one cue is available (5.9b) but have problems when both cues are in conflict (5.9b). Only the 7-year-olds manage to deal with the cue conflict condition, relying in this case mostly on morphological information.

Notably, the performance of the 2-year-olds in the (ambiguous) word order condition is unexpected if it is assumed that

children (and adults) apply the agent-first strategy because it corresponds to the simplest or most frequent structure. These accounts would predict that children and adults should build the syntactic representation for SVO sentence structure (e.g., Frazier, 1987; MacDonald et al., 1994) and that the syntactic representation should be used for thematic role assignment especially in situations in which animacy and plausibility could not be used for thematic role assignment.[2]

The results so far indicate that different cues influence sentence comprehension in children and that children and adults may differ in the weighting on these cues. Nevertheless, most of these studies employed offline studies to investigate sentences comprehension so that it is not clear when these different cues are used during online sentence comprehension.

More recently, Schipke (2012) investigated the comprehension of SVO and OVS sentences in 3-, 4-, and 6-year-olds using on-line and off-line measures. In a sentence-picture matching task and a preferential looking task, children were presented with two pictures showing the SVO and OVS interpretation. In the sentence-picture matching task children gave explicit responses, i.e., they had to choose the picture matching the sentence, whereas the preferential looking task measures sentence interpretation indirectly as revealed by the proportion of looks to each picture. In addition, the ERP technique was used to investigate the processing of the unambiguous SVO and OVS sentences but also of ungrammatical sentences with case marking violations (nom-verb-nom, acc-verb-acc). Crucially, the different methods showed different results in the processing of OVS sentences.

The 3-year-olds showed an SVO-preference in the sentence-picture matching task, but performed at chance-level in the

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2   But these accounts usually consider sentences with known verbs (verbs are usually seen as a source for both frequency effects and thematic role assignment). Thus, it may be that the use of novel verbs influenced the pattern of results (see Snedeker & Yuan, 2008 for criticism of the novel verb paradigm).

preferential looking task. Together with the ERP results, this indicates that they were sensitive to the case marking morphology but possibly could not construct the syntactic representation of the OVS sentences. This is supported by the results on the argument structure violations that indicated that 3-year-olds show evidence for argument structure expectations only for SVO sentences but not for OVS sentences.

The 4-year-olds performed at chance level on both the sentence-picture matching and preferential looking task. The ERP-results showed an initial SVO-preference, regardless of the case marking on the first NP, but also a sensitivity to case-marking and argument structure expectations at the second NP.

The 6-year olds performed at chance level in the sentence-picture matching task but above chance level in the preferential looking task. The ERP results for the first NP revealed similar effects as in adults, however, the processing at the second NP differed from adults, indicating that the 6-year-olds had problems processing the OVS sentences. That is, although they may be successful in the processing of case information, they still may had problems integrating the second NP in the syntactic structure and assigning the correct thematic roles.

5.3.2   Impact of IS on sentence comprehension

Problems understanding sentences in the non-canonical word order may also result from the lack of an appropriate context that licenses the non-canonical word order (e.g., Dittmar et al., 2008a; Schaner-Wolles, 1989; see also Crain & Steedman, 1985; Crain & Thornton, 1998).

As mentioned above, context and information structure (IS) may influence sentence comprehension. They may make the use of the non-canonical word order felicitous (e.g., Crain & Thornton, 1998; Schaner-Wolles, 1989) or may provide frequency-related

cues for thematic role assignment or the non-canonical word order (e.g., E. Bates, 1976; Grünloh et al., 2011; Weber et al., 2006).

Crucially, context may only license the non-canonical word order if children consider contextual information during sentence processing and are sensitive to the IS constraints licensing the non-canonical word order. There is an ongoing debate whether children consider contextual information during the processing of temporarily ambiguous sentences (e.g., Crain & Thornton, 1998) or whether they may rather rely on sentence-level (prosodic, lexical) information and may not use contextual information for disambiguation until age 8 (e.g., Snedeker & Trueswell, 2004; Snedeker & Yuan, 2008; Trueswell, Sekerina, Hill, & Logrip, 1999; Weighall, 2007).

With respect to the processing of non-ambiguous sentences, a felicitous (referential) context may ease the comprehension of subject relative clauses and pronoun resolution even in 3-year-olds (e.g., Crain & Fodor, 1989; Crain & Thornton, 1998 for reviews).

With respect to the impact of IS factors, the results are heterogenous. The debate basically relates to the issue whether children may acquire the local marking of IS (in terms of prosody or referring expressions) before the global marking of IS (in terms of word order), as discussed in Chapter 2.

Hornby (1971) argues that 6-year-olds are sensitive to the syntactic marking of the topic-comment structure in English. He used a picture-selection task wherein the children were presented with a test sentence (*The boy is riding the horse.*) and two pictures (A boy riding a bicycle. vs. A girl riding a horse.). Both pictures were infelicitous but Hornby assumed that children would choose the picture with the topic of the test sentence so that picture selection would reflect the topic-comment interpretation (e.g., the first picture for interpreting *the boy* as topic). The 6-year-olds were sensitive to the topic-comment structure

in it-clefts and pseudo-clefts, even though they did not show adult-like performance. The topic identification in pseudo-clefts and passives improved with age and all sentence types tested provided a clear topic-comment effect in 10-year-olds.

However, MacWhinney and Price (1980) could not replicate these results when controlling for the impact of prosody. They found that English-speaking 6- to 7-year-olds could not identify the topic. Rather there was a developmental change in the response strategy: 6- to 7-year-olds selected the accented referent as topic, 13- to 14-year-olds selected the deaccented referent, and 9- to 10-year-olds performed in between.

Paul (1985) also found that English-speaking 8-to-10-year olds may use prosodic information for the identification of topical or new information in active sentences. Yet, there were individual differences with respect to the givenness restrictions of passives and clefts. When presented with two context pictures (*A boy climbs a tree.* vs. *A man climbs a fence.*) and the target sentence (*It's a MAN that climbs a tree.*) only half of the children selected the pictures based on the givenness restrictions of passives and clefts, i.e., they choose the first picture for the cleft sentence.

Gourley and Catlin (1978) showed that context and prosody influenced sentence comprehension, but their impact was structure dependent. They used a picture selection task to investigate the comprehension of different sentence types in English-speaking 4- to 7-year-olds. The sentences were presented in isolation or in an appropriate or inappropriate verbal context. In the appropriate context, the IS regularities of the test sentences corresponded to the context and the construction tested (see 5.10a). In the inappropriate context, the target sentence violated IS regularities of the construction tested (see 5.10b).

(5.10)   a. Appropriate context
              Gordon hit someone. It was SUSAN that Gordon
              hit.

b. Inappropriate context
Someone hit Susan. It was Susan that GORDON hit.

The comprehension accuracy of agent-clefts (*It was Gordon that hit SUSAN.*) and active sentences was not influenced by the context and always quite high. The comprehension of passive sentences and patient-cleft sentences (5.10) was enhanced when the constructions were presented in an appropriate context compared to constructions presented in an inappropriate context. However, context did not influence the understanding of the English dative alternation. Regardless of the context, double object constructions (*Susan took the girl the boy.*) and prepositional dative constructions (*Susan took the boy to the girl.*) appeared to be interpreted as preposition dative constructions (patient before goals). This contradicts the results of the production studies mentioned in Chapter 2 that showed that givenness influenced the production of both constructions.

Taken together, these results indicate that children may be sensitive to the contextual restrictions of sentences but it is difficult to disentangle the impact of contextual (often visual) information and prosodic information.

Grünloh et al. (2011) tried to disentangle both effects. They investigated the impact of contrastive focus accent and context on the processing of OVS sentence in German-speaking 4- to 5-year-olds. Similar to Dittmar et al. (2008a), they employed a video-pointing task. Sentences were presented either with ambiguous case marking (5.11a) or with unambiguous OVS case marking (5.11b), and either with contrastive focus intonation on the initial NP or with a neutral (flat) prosody.

(5.11)   a. Die   Katze VERB die   Kuh
             the.amb cat   VERB the.amb cow
             "The cat VERB the cow."

   b. Den   Hund VERB der   Löwe
      the.acc dog   VEB   the.nom lion
      "The dog, the lion VERB."

Adults interpreted the ambiguous sentences as SVO sentences and the unambiguous sentences as OVS sentences, regardless of the prosodic manipulation. Children also interpreted the ambiguous sentences as SVO sentences. Crucially, prosody influenced the interpretation of the unambiguous sentences in that their performance for OVS sentences was above chance level (around 65 %) in the contrastive intonation condition but at chance level in the flat prosody condition.

A second experiment investigated the comprehension of the unambiguous and ambiguous sentence within a supportive context (see 5.12 for unambiguous sentences).[3]

(5.12) a. Puppet 1:
        Der   Löwe VERB den   Frosch.
        the.nom lion   VERB the.acc frog
        "The lion VERB the frog."

      b. Puppet 2:
        Nicht den   Forsch VERB der   Löwe,
        not   the.acc frog   VERB the.nom lion
        "The lion did not VERB the frog..."
        sondern den   Hund VERB der   Löwe
        but   the.acc dog VEB   the.nom lion
        "...but the dog. the lion VERB."

Participants understood the unambiguous sentences above chance level regardless of whether the sentences were spoken with a contrastive or flat intonation (75 % vs. 60 %). Case ambiguous sentences were understood at chance level with

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[3]   For ambiguous sentences, the context sentences were also ambiguous with respect to case marking.

contrastive prosody and as SVO sentences with flat prosody, but in both cases the preference of the SVO interpretation was reduced in comparison to Experiment 1.

These results show that the contrastive context influences sentence comprehension. Note however, that the agent of the target sentence, i.e., the tiger, was the agent in all three sentences, in particular, in the first context sentence of puppet 1 which had the SVO word order. This indicates that the thematic roles of the second context sentence (first sentence of puppet 2) and of the target sentence may be inferrable. Due to this confound, it is difficult to interpret the effect of context in this experiment. Nevertheless, the study clearly demonstrates that contrastive prosody on the object NP eases the understand of (unambiguous) OVS sentences.

Grünloh and colleagues suggest that children may use the focus accent as cue to the non-canonical word order because focus on the initial argument indicates a deviation of the final-focus accent (as suggested by Weber et al., 2006 for the adult data). Alternatively, it may also be possible that contrastive focus itself eased processing merely because OVS sentences are felicitous with contrastive, narrow focus intonation but not with a flat intonation (cf., Stolterfoht, 2005, see also Fanselow & Lenertová, 2011).

5.3.3   Impact of pronouns on sentence comprehension

Finally, problems understanding OVS sentences may result from the characteristics of the sentences used in comprehension experiments. That is, in comprehension experiments both arguments of the transitive sentences were usually realized as lexical NPs whereas in natural language children and their caretakers rarely realize both arguments as lexical NP (Dittmar et al., 2008a; Fleischhauer, 2009).

Previous research on the impact of pronouns on sentence comprehension in children investigated the comprehension of relative clauses. Similar to the adult research, research into the comprehension of object relative clauses in children demonstrated that the comprehension accuracy of object relative clauses was increased when the subject was a pronoun rather than a lexical NP (e.g., Brandt et al., 2009; Friedmann et al., 2009; Kidd et al., 2007).

Similar to the research in adults, several explanations have been proposed how pronouns may ease sentence comprehension in children. In particular, pronouns may ease the comprehension of the object relative clauses because intervention effects are reduced when the subject and object differ with respect to grammatical features like pronominality or number (e.g., Adani et al., 2010; Friedmann et al., 2009).

Alternatively, realizing the subject as a pronoun may also ease processing because the pronoun may be used as experienced-based cue to the subject status given that subjects are usually realized as pronouns in natural speech (e.g., Brandt et al., 2009; Kidd et al., 2007).

While the previous child studies only investigated the impact of pronouns in the processing of relative clauses, it may be the case that realizing the object or the subject as a pronoun may also ease the comprehension of non-canonical OVS sentences in German. The adult studies already showed that pronominal objects ease sentence comprehension in the middlefield (e.g., Schlesewsky et al., 2003; Stolterfoht, 2005). Thus, testing whether pronominal subjects and objects ease sentence comprehension of OVS sentences will show whether pronominal referents also ease comprehension in other constructions and will also contribute to the issue whether pronouns ease processing regardless of the grammatical role of their referent.

5.4   Summary

Previous research on children's sentence comprehension has shown that children often have problems understanding sentences in the non-canonical word order, especially when thematic role assignment depends on morphological information and cannot be inferred from semantic information such as plausibility or animacy. Problems understanding non-canonical sentences may result from problems with morphology, the lack of a context licensing the non-canonical word order or processing factors related to the frequency and the syntactic structure of non-canonical sentences.

Contextual information and prosody may ease the processing of non-canonical sentences in children but the effects of both factors are difficult to disentangle. However, disentangling both effects contributes to the debate in psycholinguistic research whether preschoolers may use discourse-level cues during sentences processing or whether they are restricted to the use of sentence-level cues.

The experiments reported in Chapter 6 try to address this issue. Experiment 1 tests whether the topic status of the object eases the comprehension of OVS sentences in German-speaking children, while controlling for the impact of prosody. This may indicate whether children may consider contextual information, i.e., a felicitous context, during for sentence processing of non-canonical sentences.

Experiment 2 investigates the impact of pronouns on OVS comprehension and its interaction with the grammatical role. This experiment may shed more light into the debate on whether pronominal topics may ease processing because they reduce interference effects or because pronominal topics are a cue to the subject status and thus ease thematic role assignment.

6 Comprehension: Experiments

6.1 Introduction

The comprehension part of this thesis comprises two experiments investigating the impact of topic status and the type of referring expression on the comprehension of SVO and OVS sentences. Experiment 1 aimed to clarify whether a context that marks the initial constituent as topic eases the understanding of OVS sentences. Experiment 2 aimed to investigate whether realizing the topic as a pronoun eases the comprehension of OVS sentences and if so, whether the impact of the pronoun interacts with its grammatical role.

The study by Schipke (2012, see Chapter 5) demonstrated that children's performance differed depending on whether an implicit measure (e.g., eye-movement recordings in a preferential looking task) or an explicit measure (e.g., responses in a picture selection task) was used to assess sentence comprehension, possibly due to task demands (e.g., Brandt-Kobele & Höhle, 2010; Davies & Katsos, 2010; Schipke, 2012).

Accordingly, the current experiments employed an implicit and an explicit measure to assess sentence comprehension. However, in contrast to Schipke, the preferential looking task was not used. First, presenting two pictures showing the two referents of the test sentences may be less felicitous in a topic context that introduces one referent, i.e., the topic, because this referent is shown twice. Second, previous research demon-

strated that depicting the action expressed by non-canonical sentences seems to ease sentence comprehension in children with higher verbal memory span (Zhang & Knoeferle, 2012; Weighall & Altmann, 2011). Thus, some children may profit from looking at the correct picture, while others (those with lower verbal memory span) may not. This may add another factor influencing the pattern of results.

To avoid both problems, test sentences were presented together with one picture showing the two referents mentioned in the sentences. Sentences were followed by a movie sequence in which one referent moved to the other referent and performed the action mentioned in the test sentence. Eye-movements to the expected agent, i.e., the referent that was going to move, were taken as implicit measure for sentence interpretation.

Yet, sentence interpretation may be more difficult to assess by the proportion of looks to the agent because topical referents in general may attract attention, regardless of their semantic role (agent or patient) (cf., Gleitman et al., 2007; Tomlin, 1995). Thus, sentence comprehension was also measured explicitly using comprehension questions.

6.2   Experiment 1: Impact of the topic context

Experiment 1 tested whether the topic status of the object eases the processing of OVS sentences in German-speaking children, while controlling for the impact of prosody. Sentences in the SVO and OVS word order followed a neutral context sentence or a topic context that defined the referent in the prefield, i.e., the first NP of the sentence, as the topic. The target sentences were produced in the hat-contour pattern that is often taken to indicate the topic-comment structure (Féry, 1993; Jacobs, 2001; Mehlhorn, 2001; Steube, 2001, but see Braun, 2004) and is compatible with both SVO and OVS sentences. In this way, neither context nor prosody was a strong cue for thematic role assign-

ment because the sentence initial topic could be the subject or the object. Thus, the experiment would show whether the topic status of the object that may make the use of the OVS word order felicitous (e.g., Frey, 2006), eases OVS sentence comprehension.

Schumacher and Hung (2012) and Burmester et al. (2014) demonstrated that the givenness and topic status of the initial object eases OVS sentence processing in adults because it may ease contextual integration of the referent. Given that 3-year-olds seem to be sensitive to the impact of topic status on word order (as the corpus analyses suggest), the topic status of the object may ease the comprehension of OVS sentences, especially if the lack of an appropriate context or contextual licensing is a crucial factor explaining children's problems understanding OVS sentences (cf., Crain & Thornton, 1998; Kidd et al., 2007; Schaner-Wolles, 1989).

The experiment tested the impact of a topic context on sentence comprehension in 4-year-olds, 5-year-olds and 7-year-olds and adults. Previous studies have shown that 4- and 5-year-olds have problems understanding OVS sentences in a neutral context. 7-year-olds in general understand OVS sentences above chance level but they do not perform at ceiling (e.g., Dittmar et al., 2008a; Mills, 1977; Schipke, 2012). Thus, if context merely eases integration of topical referents, 7-year-olds may profit more from contextual licensing than younger children because in principle they can process the sentences. Adults should perform at ceiling regardless of the sentences because sentence comprehension was measured after the offset of the sentence and processing difficulties usually only show up during sentence processing, i.e., at the first NP (Hemforth, 1993; Schipke, 2012).

6.2.1 Method

6.2.1.1 Participants

Adults. 28 monolingual speakers of German were tested (9 men, mean age: 24 years). They were students of the University of Potsdam and participated in the experiment for course credits or payment (5 Euro).

Children. 105 monolingual German-speaking children were tested. All children were born on time, and none of them had a diagnosed speech or language impairment. Children from three age groups participated in the experiment: 45 4-year-olds (24 boys, mean age: 4;7, range: 4;1–4;11), 44 5-year-olds (22 boys, mean age: 5;7, range: 5;1–5;11), and 26 7-year-olds (10 boys, mean age: 7;6, range: 7;0–7;11). All children finished the experiment.

6.2.1.2 Design and materials

The experiment employed a 2 x 2 within-participant design with Word Order (SVO vs. OVS) and Context (neutral vs. topic) as independent variables, resulting in four experimental conditions (see 6.1). The dependent variables were the accuracy to a comprehension question and the eye-movement to the agent of the sentence (for details see below).

(6.1) a. *SVO word order, neutral context*
           Schau mal was hier passiert.
           Ich wette, **der Tiger** kitzelt gleich das Schwein.
           "Look what is happening here. I bet, the tiger will
           tickle the pig."

       b. *OVS word order, neutral context*
           Schau mal was hier passiert.
           Ich wette, **den Tiger** kitzelt gleich das Schwein.
           "Look what is happening here. I bet, the tiger the
           pig will tickle."

   c. *SVO word order, topic context*
      Nun kommt eine Geschichte über den Tiger.
      Ich wette, **der Tiger** kitzelt gleich das Schwein.
      "Now you hear a story about the tiger. I bet, the tiger
      will tickle the pig."
   d. *OVS word order, topic context*
      Nun kommt eine Geschichte über den Tiger.
      Ich wette, **den Tiger** kitzelt gleich das Schwein.
      "Now you hear a story about the tiger. I bet, the tiger
      the pig will tickle."

Target sentences started with a lead-in (*ich wette* "I bet") followed by a transitive sentence in the SVO or OVS word order. Word Order of the target sentence was modified using case marking on the first NP in the target sentence. Nominative case marking at the determiner of the first NP (*der*) indicated that the first NP was the subject (SVO word order, 6.1a, 6.1c) whereas accusative case (*den*) indicated that it was the object (OVS word order, 6.1b, 6.1d). Case marking on the second noun phrase was ambiguous.

Context was modified by a context sentence that was presented before the target sentence. The context sentence defined either the referent of the first NP as the topic of the target sentence (*Nun kommt eine Geschichte über den Tiger.* "Now you hear a story about the tiger.", topic context, 6.1c, 6.1d) or did not mention any of the animals and defined the "neutral" context (*Schau mal was hier passiert.* "Look what happens here.", neutral context, 6.1a, 6.1b).

24 experimental items were created. Each item was used to create the four conditions, as illustrated in (6.1). See Appendix B.1 for the whole set of items. The acoustic stimuli were transitive sentences like those in (6.1) with each sentence describing an action involving two out of 48 animals. The animal labels were mono- or bisyllabic words. The grammatical gender of 24 of

the animal labels was masculine and allowed the identification of the grammatical role via morphological case marking. The grammatical gender of the other 24 animal labels was feminine or neutral (12 each) and were ambiguous with respect to case marking.

Two of the animal labels were used to construct the test sentences (SVO and OVS) of each item, with the animal labels with masculine grammatical gender being combined with animal labels in neutral or feminine grammatical gender. Masculine animal labels always occurred in the first position of the sentence. The actions described by the test sentences were either "tickling" or "chasing" with "dangerous" animals (e.g., tiger, wolf) being usually involved in tickling actions.

To ensure that children know the animal, the age of acquisition of the names was checked using a database provided by Schröder, Gemballa, Ruppin, and Wartenburger (2012). 40 of the animal labels occurred in the database with a mean age of acquisition of 2.23 (range 1.35 to 3.85). The remaining eight were searched in the German corpora provided by the CHILDES database (MacWhinney, 2000) and were produced at a mean age of 2.80 years (range 2.29 to 4.16). Potentially difficult animal labels with later age of acquisition (e.g., toad, lama, badger) were combined with "easy" animal labels (cock, bird, pony) with earlier age of acquisition. In addition, the parents were asked in a questionnaire to indicate which of the animal names their children would understand (i.e., whether they would be able to identify the animal). Post-hoc analyses revealed that performance in the experiment did not depend on the knowledge of animal labels.

Prosodic characteristics of the target sentence
The target sentences comprised of two parts, i.e., the lead-in (*ich wette*, "I bet") and the sentences in the SVO or OVS word order (e.g., *Der Tiger kitzelt gleich das Schwein*, "The tiger will

tickle the pig"). Both parts were separated by an intonation phrase boundary. The SVO and OVS sentences were produced using the hat pattern intonation (e.g., Féry, 1993; Jacobs, 2001; Mehlhorn, 2001; Steube, 2001). This pattern is characterized by two prominent accents, i.e., a rising accent and a falling accent, and is compatible with both word orders.
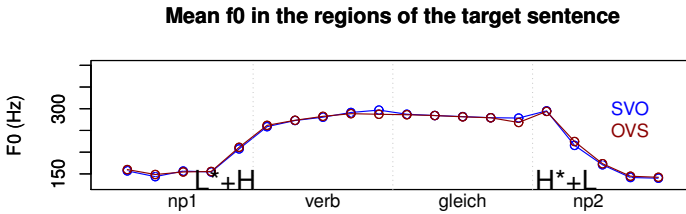
Mean f0 in the regions of the target sentence

Figure 6.1: Mean F0-contour of the target sentences in each word order

Figure 6.1 illustrates the prosodic pattern for the target sentences (starting after the prosodic boundary). It shows the mean f0-contour for SVO and OVS sentences in four regions (NP1, verb, gleich, NP2).[1] Means were calculated on the basis of all 24 sentences in each word order, with the f0-contour being smothered by 10 hertz. For each region in the target sentences, three to five data points were taken.

As shown in Figure 6.1, the first accent (topic accent), realized as L*+H (rising accent, cf. Féry, 1993), was placed on the first NP and the second accent (focus accent), realized as H*+L (falling accent), on the second NP. In addition, the prosodic pattern was similar in both word orders.

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1   The Praat-scripts used for the f0-analysis were adapted from those written by Frank Kügler, retrieved from (2013): http://www.ling.uni-potsdam.de/˜kuegler/.
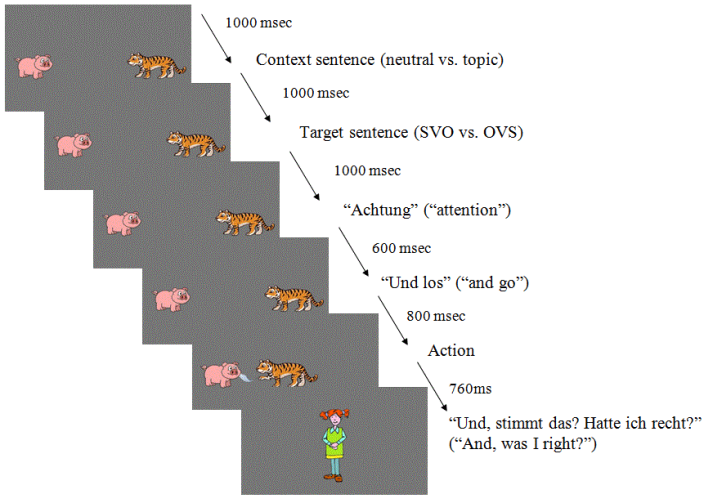
Figure 6.2: Illustration of an experimental trial

Experimental movies

The cover story of the experiment introduced a cartoon charac-
ter, Anna, who was going to predict what the two animals in
each movie would do. The participant had to decide whether
the animals indeed did what Anna had predicted.

The general course of an experimental trial is illustrated in
Figure 6.2. Each trial involved the presentation of the static
pictures of the animals and the presentation of the action, in
which one of the animals moved to the other animal to per-
form the action. The animal pictures were of equal size but
varied in shape, e.g., 270 x 120 pixel (3 x 7 cm) or 180 x 180
pixel (4.7 x 4.7 cm). The two static pictures on the screen were
separated from each other by approximately 260 pixel (6.8 cm).

As Figure 6.2 illustrates each trial started with a preview of the
static pictures in silence (1000 msec) before the context sentence
(neutral: 2040 msec; topic: 2652 msec) and the target sentence
(SVO/OVS: 3645 msec) were presented. Then the auditory cues

achtung ("attention", 720 msec) and *und los* ("and go", 640 msec) were presented and the action (1800 msec) was shown. One animal moved towards the other animal and performed the action (tickling/running) while the other animal did not move. Then the cartoon character Anna reappeared and asked the participant whether she was right, i.e., whether the animals did what she had predicted.

Overall 192 (24 x 4 x 2) experimental movies were created, i.e., eight for each of the 24 items, with half of them showing the action with the correct agent and patient and half of them showing the action with reversed thematic roles. The animal mentioned by the first NP appeared in half of the trials on the right side and in the other half on the left side. Each participant saw 24 experimental trials, each lasting about 18.4 sec.

The responses given by the participants were the explicit measure of the understanding of the target sentences. In addition, an implicit measure for sentence comprehension, that is, the eye-movements, weas employed. Participants were expected to look at the agent of the action even before the movie was shown. Thus, the looks to the referent of the first NP was used as an implicit measure for sentence comprehension.

6.2.1.3   Procedure

The eye-movements of the participants were recorded using the Tobii 1750 eye-tracking system with a tracking rate of 50 hertz, providing data points approximately every 20 msec. The movies were presented on a 17"(1280 x 1024 pixel) screen. Participants sat comfortably in an arm chair in viewing distance to the screen of approximately 60 cm.

The experiment started with the presentation of the cover story. Participants were introduced to a cartoon character, Anna, who would watch movies about animals with them. Anna would predict what the animals would do and the participant had to

say whether she was right or wrong (i.e., whether the animals did what she had predicted). Then a short 5-point calibration procedure was conducted to adjust the eye-tracking system. The experiment started with three practice trials to familiarize the participants with the task and to show that Anna may also make incorrect predictions. The practice trials were intransitive sentences with a locative adjunct, e.g., *Ich wette, das Kamel rennt gleich zum Haus.* "I bet, the camel runs to the house." (see Appendix B.1), with one of the practice trials requiring a correct no-answer. During the practice trials verbal feedback on the accuracy of the response was given. Following the practice trials, the experimental items were presented.

Each participant saw 24 experimental trials, i.e., 24 movies. No feedback on the accuracy of the responses was given. The presentation of the movies was counterbalanced using a Latin square design so that each participant saw only one condition of each experimental item (animal pair) and saw an equal amount of movies in each experimental condition. Presentation of the movies was also controlled for the amount of (correct) yes- and no-answers, the positioning of the moving animal and the order of presentation. The movies were presented in four blocks with each block being separated by a filler movie showing a moving cartoon character (e.g., running Snoopy). Yet the experimenter started each trial after the participant had given a response so that breaks could be taken after each trial. To control for order effects, the order of the movies was reversed for half of the participants. Post-hoc tests investigating the performance in each block confirmed that performance in the experiment was not influenced by the order of the presentation. The whole experiment lasted about 15–17 minutes.

6.2.1.4   Data analyses

For statistical analyses, linear mixed-effects (LME) models (Baayen, 2008; Baayen, Davidson, & Bates, 2008) were calculated using the lmer function of the lme4 package (D. M. Bates

et al., 2013) in the R environment (R Core Team, 2013). These models resemble regression analyses but take the variation due to participants and items into account. The models for the accuracy data were defined as logit LME models (e.g., Baayen, 2008). The models for the eye-movement data were calculated on the proportion of looks to the referent of the first NP mentioned in the sentence. These analyses were calculated on both the untransformed data and the data transformed by the empirical logit function (Barr, 2008). Although the transformed data provide a better fit of the data, in the following only the results for the untransformed data will be reported because both analyses led to similar results and the figures plot the untransformed proportion of looks.

Model fitting was performed in a step-wise fashion, starting with the most complex model that included the full factorial set of random effects (random slope-adjustment for all fixed effects and their interactions for both random effects, i.e., Participants and Items). During model fitting, the complex models were trimmed down in a step-wise fashion using log-likelihood tests for model comparisons (Baayen, 2008; Baayen et al., 2008). Slope-adjustments were kept in the models if the models fitted the data better than the less complex models. Model reduction started with the random effects for Items and excluded first the random slope adjustment for the interactions, then for main predictors (in descending order of the fixed effects as listed in the tables in Appendix B.1).

6.2.2   Accuracy: Adults

The mean accuracy of the explicit responses of the adults, separated by Word Order and Context, is shown in Table 6.1. As can be seen in the table, the participants performed at ceiling in all four experimental conditions. LME models assessing the impact of Word Order, Context and the Word Order x Context interaction on Accuracy did not identify any effect.

Table 6.1: Mean accuracy (with 95 %-CI) for SVO and OVS sentences in the neutral and topic context (adults)

neutral		topic	
SVO	OVS	SVO	OVS
98 % (2)	98 % (2)	96 % (3)	98 % (2)

6.2.3 Eye-movements: Adults

6.2.3.1 Data treatment

The eye-movement data were extracted and preprocessed using the Clearview software version 2.5.1 provided by the Tobii system that provided information about the location of the looks on the screen. Track loss was calculated on the basis of the data available in the auditory regions of interest (ROIs, see below) and concerned 9% of the data. Trials with more than 50% track loss in the combined critical regions were removed, affecting 1% of the data.

6.2.3.2 Regions of analysis

The visual areas of interest (AOI) were defined to assess the looks to the referent of the first NP and the second NP. The AOIs had an average size of 300 x 300 pixel (7.8 x 7.8 cm) and were separated by 180 pixel (4.7 cm) (see Figure 6.3).
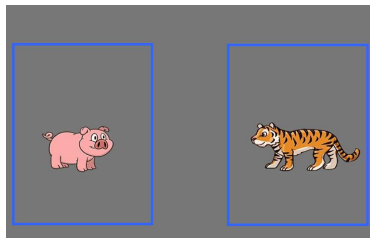

Figure 6.3: Illustration of the areas of interest

The analyses only considered the proportion of looks to the referent of the first NP. It was calculated based on the number of looks to both referents so that the proportion of looks to the first referent were complementary to the looks to the second referent. Looks to other parts in the picture were not considered in the analyses as the results did not differ whether they were considered or not.

The eye-movement data were analyzed in five auditory regions of interest (ROIs) between the offset of the target sentence (SVO/OVS-sentence) and the beginning of the action:

- *region 1 (1000 msec)*: the silence region between the offset of the target sentence and the onset of region 2

- *region 2 (720 msec)*: the word *achtung* ("attention") was presented

- *region 3 (600 msec)*: the silence region between region 2 and region 4

- *region 4 (640 msec)*: the words *und los* ("and go") were presented

- *region 5 (800 msec)*: the silence region between region 4 and the beginning of the action

6.2.3.3   Eye-movement analysis

Due to the high accuracy rates, only trials with correct answers were analyzed. Figure 6.4 illustrates the mean proportion of looks to the referent of the first NP in the five ROIs. The left panel shows the proportion of looks to the referent in the neutral context and the right panel the proportions of looks in the topic context. Blue lines show the proportion of looks to the referent following SVO sentences and red lines following OVS sentences.

Recall that higher proportions of looks were expected for SVO
sentences (because the first animal is the agent of the action)
whereas lower proportions of looks were expected for OVS sen-
tences (because the second animal is the agent of the action).
The plot in Figure 6.4 shows exactly this pattern in each region.
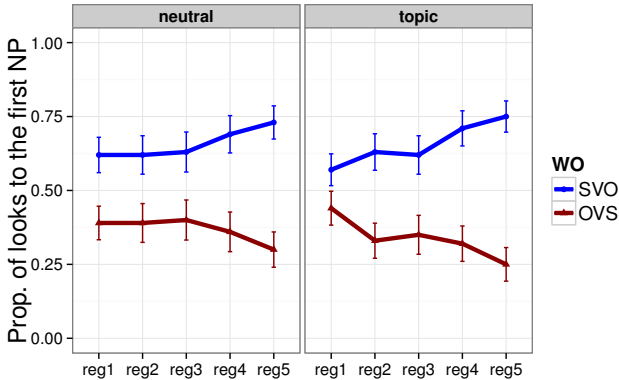
Figure 6.4: Proportion of looks (with 95 %-CI) to the first NP for SVO and OVS
sentences in the neutral and topic context (adults)

LME model were calculated to estimate the fixed effects of Word
Order, Context and the Word Order x Context interaction, and
the random effects of Participants and Items. The contrast cod-
ing used for Word Order (SVO: -0.5, OVS: 0.5) and Context (neu-
tral: 0.5, topic: -0.5) and the interaction resembled the contrast
coding in traditional ANOVA analyses. The fixed effects of the
models are given in Table B.1 in Appendix B.2.

There were significant effects of Word Order lasting from region
1 to region 5, resulting from higher proportions of looks to the
referent of the first NP in SVO trials compared to OVS trials.
Neither the main effect of Context nor the interaction between
Word Order and Context reached significance in any of the re-
gions, indicating that the Word Order effect was equally strong
in both contexts.

6.2.4 Accuracy: Children

6.2.4.1 Subgroups based on the accuracy results

The accuracy results indicated that children could be split up into three response groups: yes-bias children, svo-bias children and non-biased children. The groups were defined on the basis of binomial tests that compared the responses against chance level (chance level set at 50 %). Yes-biased children were determined on their answers for SVO and OVS-trials. Children were assigned to this group when they gave 18 or more yes-answers ($\geq 18/24$), i.e., they gave yes-answers above chance level regardless of whether the movie showed the correct action or not.

SVO-bias children were determined on the basis of the accuracy of their answers to OVS-trials. They answered the SVO trials correctly, i.e., they said "no" when the movie showed the incorrect action and "yes" when the movie showed the correct action. However, they answered only two or less of the OVS trials correctly ($\leq 2/12$), i.e., they applied an agent-first strategy and apparently treated OVS like SVO sentences.

All other children were assigned to the "non-biased" group, except for one 4-year-old child who showed an OVS-bias (only 25 % of SVO sentences correct). This child was excluded from the further analyses.

Table 6.2 presents the percentage of the children in each response group separately for each age group. The yes-bias and SVO-bias were more common in the younger age groups. The number of yes-bias children decreased from 4-year-olds to 5-year-olds whereas the number of non-biased children increased. Due to low number of 7-year-olds who showed a yes-bias or SVO-bias, the statistical analyses on the accuracy and eye-movement data in the two bias groups considered only the data of the 4- and 5-year-olds. Yet, the analyses for the non-biased children were calculated for all three age groups.

Table 6.2: Frequency (actual number) of yes-bias, SVO-bias and non-biased children in each age group

Age group	yes-bias	SVO-bias	non-biased
4-year-olds (N = 44)	48 % (21)	25 % (11)	27 % (12)
5-year-olds (N = 44)	32 % (14)	23 % (10)	45 % (20)
7-year-olds (N = 26)	8 % (2)	23 % (6)	69 % (18)

6.2.4.2   Data analysis

Logit LME model were calculated to estimate the fixed effects of Word Order, Context and the Word Order x Context interaction, and the random effects of Participants and Items on the accuracy in each response group and age group. The contrast coding used for Word Order (SVO: -0.5, OVS: 0.5) and Context (neutral: 0.5, topic: -0.5) and the interaction resembled the contrast coding in traditional ANOVA analyses. Additional logit LME models were calculated for the comparisons between the age groups. The models included the fixed effects of Word Order, Context, the Word Order x Context interaction, the effect of Age Group and interactions between Age Group and the other factors. Age Group used a treatment contrast with the 4-year old children as the baseline, i.e., comparing 4- vs. 5-year-olds in the analyses for the yes-bias and SVO-bias children, and 4- vs. 5-year-olds and 4- vs. 7-year-olds in the analyses for the non-biased children.

6.2.4.3   Yes-bias children

Figure 6.5 illustrates the mean accuracy for the yes-bias children. It shows that the yes-bias children responded at 50 %-chance level across all conditions, i.e., they responses were neither influenced by Word Order nor Context.

6.2.4.4   SVO-bias children

The mean accuracy for the svo-bias children is depicted in Figure 6.6. As defined by their group assignment, response ac-

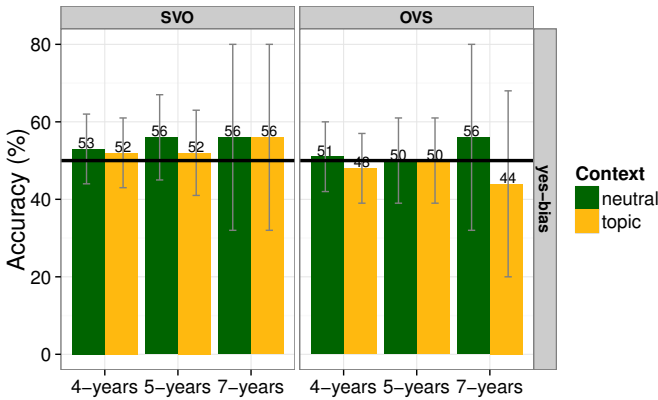Figure 6.5: Mean accuracy (with 95 %-CI) for SVO and OVS sentences in the neutral and topic context (yes-bias children)

curacy was high for SVO sentences but low for OVS sentences. The figure (and statistical analyses) confirm that the pattern of results was not influenced by the Context.
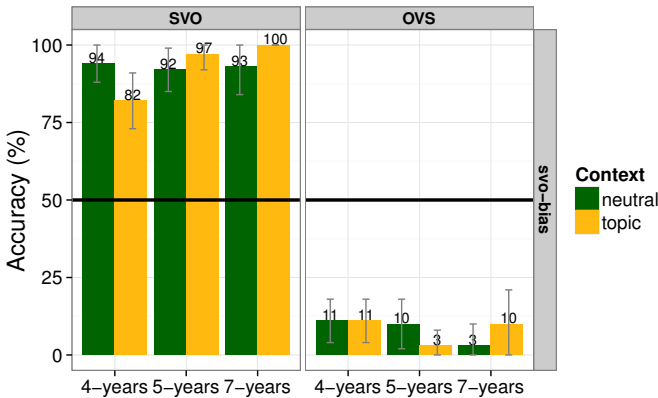
Figure 6.6: Mean accuracy (with 95 %-CI) for SVO and OVS sentences in the neutral and topic context (SVO-bias children)

6.2.4.5   Non-biased children

The mean accuracy for the non-biased children is depicted in Figure 6.7. The results of the statistical analyses are given in Table B.2 in Appendix B.2.
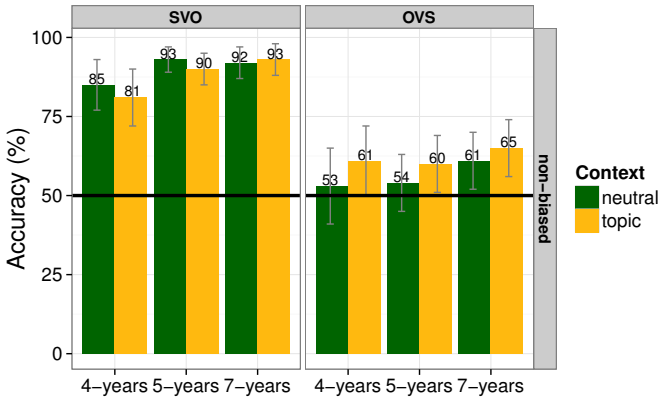
Figure 6.7: Mean accuracy (with 95 %-CI) for SVO and OVS sentences in the neutral and topic context (non-biased children)

The models revealed a main effect of Word Order in each age group, resulting from a higher accuracy for SVO than for OVS sentences. There was no effect of Context, indicating that the accuracy was not effected by the preceding context.

The overall model testing for age differences in the accuracy of the responses revealed a higher overall accuracy in the 7-year-olds than in the 4-year-olds but no further differences between the age groups. There was also a significant interaction between Word Order and Age Group, indicating a larger effect of Word Order in the 5-year-olds than in the 4-year-olds. Both effects may arise from the somewhat lower accuracy for SVO sentences in the 4-year-olds.

Further logistic LME models tested the accuracy of OVS sentences in the two contexts against 50 %-chance level.[2] The results indicate that the 4- and 5-year-olds performed at chance level in both contexts (all $t < 1.8$, $p > .08$), whereas the 7-year-olds performed above chance level in the topic context ($b = 0.71$, $SE = 0.29$, $z = 2.487$, $p < .05$) and marginally above chance level in the neutral context ($b = 0.53$, $SE = 0.28$, $z = 1.865$, $p = .062$).

6.2.5   Eye-movements: Children

6.2.5.1   Data treatment and regions of analysis

The same data treatment procedures and definitions of the visual and auditory regions of interest were employed as for the adult data. Track loss affected 10 % of the data of the 4-year-olds, 7 % of the 5-year-olds and 6 % of the 7-year-olds. The removal of trials with more than 50 % track loss in the critical regions affected less than 1 % of the data in each age group.

6.2.5.2   Data analysis

For the data analyses LME models were calculated. The statistics of the models are reported in Appendix B.2. Within each response group and age group, LME models were calculated to assess the impact of Word Order and Context on the proportion of looks to the referent of the first NP. Contrast coding for these models was the same as in the analyses of the adult data. The Analyses of the data for the non-biased children also assessed the impact of Accuracy and Context on the proportion of looks for OVS sentences.

In addition, LME models were calculated to test for age differences within each response group. These models merely mirrored the results of the single models for each age group and

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2   These models led to similar results as t-tests.

did not reveal any further information about effect strength so
that these models are not reported here.

6.2.5.3   Yes-bias children

Figure 6.8 illustrates the proportion of looks to the referent of
the first NP for SVO and OVS sentences (blue vs. red lines) in
both contexts (neutral context – left panel, topic context – right
panel) for the yes-biased children (4-year-olds – upper panel,
5-year-olds – lower panel). Given that the accuracy of the re-
sponse is not meaningful for this group, the data summarized
trials answered correct and incorrectly.

Figure 6.8: Proportion of looks (with 95 %-CI) to the first NP for SVO and OVS
sentences in the neutral and topic context (yes-bias children)

Both age groups show similar results (see Table B.3 in Appendix
B.2): The model for the 4-year-olds revealed a main effect of
Word Order in regions 3 to 5, resulting from a higher propor-
tion of looks to the referent of the first NP for SVO than OVS
sentences. In the 5-year-olds, this effect only occurred in regions
2 and 5 (and marginally in region 3). Context did not influence
the eye-movements in both groups.

Taken together, the eye-movements of the yes-bias children indi-
cate that they were sensitive to the case marking morphology (as

their eye-movements differed between SVO and OVS sentences), even though they showed the yes-bias in the explicit responses.

6.2.5.4   SVO-bias children

Figure 6.9 illustrates the proportion of looks to the referent of the first NP for SVO and OVS sentences for the 4- and 5-year-old SVO-bias children. Figure 6.9 did not distinguish between trials answered correctly and incorrectly because children in general tended to answer SVO trials correctly and OVS trials incorrectly.
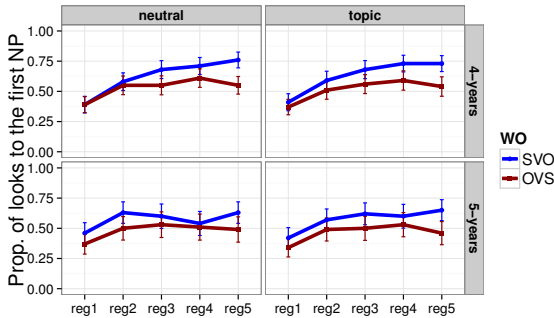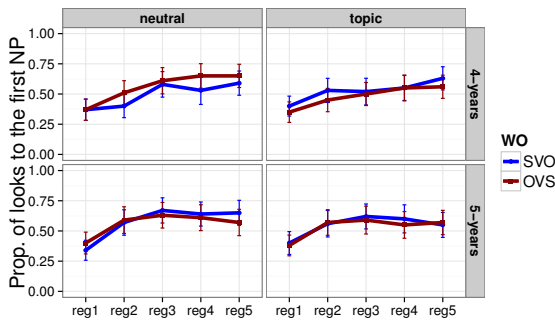

Figure 6.9: Proportion of looks (with 95 %-CI) to the first NP for SVO and OVS sentences in the neutral and topic context (SVO-bias children)

The statistical models (see Table B.4 in Appendix B.2) revealed no significant effects on the proportion of looks to the referent of the first NP in both groups, except for an interaction between Word Order and Context in region 2 in the 4-year-olds. As shown in Figure 6.9, this interaction resulted from a higher proportion of looks to the referent of the first NP in SVO than OVS sentences in the neutral context and the reversed pattern in the topic context. This effect, however, was restricted to this region and did not occur in the subsequent regions.

Overall, the eye-movement results correspond to the explicit responses, i.e., both offline measures suggest that SVO-bias children may have relied on the agent-first strategy.

6.2.5.5   Non-biased children

The non-biased children showed some variability in their accuracy for OVS sentences so that two sets of analyses were calculated. The first set of analyses investigated the impact of Accuracy and Context on the proportion of looks to the referent of the first NP following OVS sentences.

Figure 6.10 illustrates the corresponding eye-movement pattern for correct and incorrect responses for OVS sentences in both contexts for each age group (4-year-olds – upper panel, 5-year-olds – middle panel, 7-year-olds – lower panel). The solid red lines correspond to the looks for OVS sentences answered correctly, and the dotted red line the looks for OVS sentences answered incorrectly. The fixed effects of the models are given in Table B.5 in Appendix B.2.

The models for the 4-year-olds revealed a main effect of Accuracy in regions 3 to 5, arising from a higher proportion of looks to the referent of the first NP in trials answered incorrectly than answered correctly.

The models for the 5-year-olds also showed an effect of Accuracy but only in the last region, region 5. Moreover, there was an effect of Context in regions 2 to 4. This effect resulted from less looks to the referent of the first NP in the topic than in the neutral context. It may correspond to looking at the correct agent, however, this effect did not interact with Accuracy and did not occur in the final region, where the effect of Accuracy finally occurred.

The 7-year-olds did not show an effect of Accuracy in any of the regions. Nevertheless, the plots in Figure 6.10 indicate that

Figure 6.10: Proportion of looks (with 95 %-CI) to the first NP for OVS sentences answered correctly and incorrectly in the neutral and topic context (non-biased children)

even 7-year-olds showed a tendency of an effect of Accuracy in the final region. The statistical model did not reveal an effect of Accuracy when the model considered the individual differences in the slope adjustment with respect to Accuracy, but it did reveal an effect of Accuracy when the models did not consider the slope adjustment. This indicates that the effect of Accuracy on the eye-movement may be triggered by individual differences in the children, i.e., some children showed the effect of Accuracy while others did not.

The second set of analyses investigated the impact of Word Order and Context on the proportion of looks to the referent of the first NP in trials that were answered correctly. Figure 6.11 illustrates the proportion of looks to the referent of the first NP for SVO and OVS sentences answered correctly for each age group. The fixed effects of the models are given in Table B.6 in Appendix B.2.
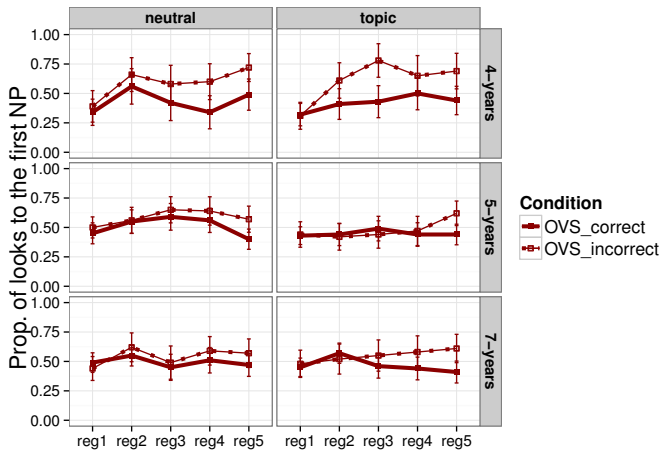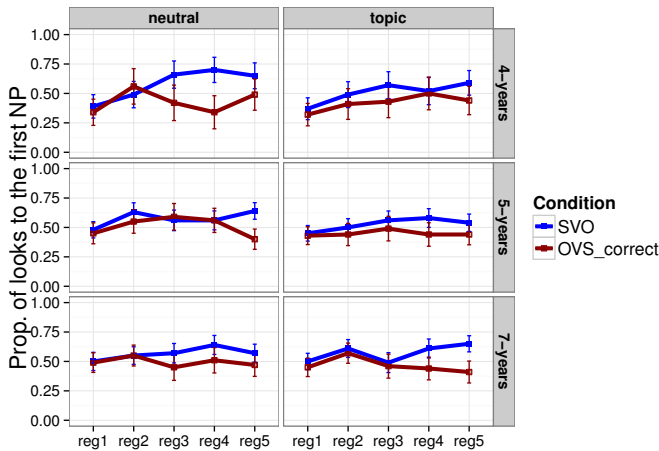
Figure 6.11: Proportion of looks (with 95 %-CI) to the first NP for SVO and OVS sentences answered correctly in the neutral and topic condition (non-biased children)

The analyses of the 4-year-olds revealed an effect of Word Order in region 3 to 5, resulting from less looks to the referent of the first NP for OVS sentences compared to SVO sentences. In addition, there was an interaction between Word Order and Context in region 4. In this region, the Word Order effect occurred only in the neutral context but not in the topic context. However, this interaction did not occur in the other regions.

The analyses for the 5-year-olds also show the main effect of Word Order, but only in region 5. This effect, however, was influenced by the Context as indicated by an interaction between Word Order and Context. Post-hoc comparisons confirm that the Word Order effect only occurred in the neutral context ($b =$ -0.26, SE = 0.05, t = -4.666) but not in the topic context ($b =$ -0.08, SE = 0.06, t = -1.42). This interaction seemed to be triggered by the looks in the SVO trials that appeared to be lower in the topic context than in the neutral context (cf. Figure 6.11). Moreover,

there was a main effect of Context in region 2, resulting from less looks to the referent of the first NP in the topic context than in the neutral context (already shown in the analyses of the OVS sentences above).

The analyses for the 7-year-olds revealed a main effect of Word Order in region 4 and region 5, resulting from less looks to the referent of the first NP in OVS than SVO trials but no further effects.

Taken together, the results of the eye-movements reflect the offline responses, that is, the eye-movements for SVO and OVS sentences differed and the eye-movements for OVS sentences answered incorrectly resemble those of SVO sentences. Differences between the age groups mainly concerned the timing, i.e., in which region the effects occurred.

6.2.6   Discussion

The results of the experiment revealed two main results. First, context did not influence the comprehension of SVO and OVS sentences either in children or in adults. Second, the results of the implicit and explicit measures largely correspond, that is, the results for the accuracy of the explicit responses correspond to the eye-movement patterns (except for the yes-bias children).

With respect to the accuracy data, the results showed that the 4- and 5-year-olds did not understand OVS sentences in an adult-like fashion and even the 7-year-olds had problems. This largely agrees with the results by Dittmar et al. (2008a). Children also demonstrated individual differences with respect to their response patterns resulting in three response groups: yes-bias children, SVO-bias children and non-biased children.

The results of the explicit responses were reflected by the eye-movements in the groups, except for the yes-bias children. Their responses did not reflect their understanding of the sen-

tences, apparently because they misunderstood the intended task, that is, they may have focused on the issue of whether the action rather than the agent was correct. Their eye-movement patterns differ between SVO and OVS sentences, indicating that they were sensitive to the case marking morphology. However, sentence interpretation could not be assess clearly on the basis of the eye-movement because the looks to the first referent in OVS sentences were around chance level.

The explicit responses of the SVO-bias children corresponded to their eye-movements. That is, their eye-movement patterns did not differ between SVO and OVS sentences. Given that the experiment measured the eye-movements after the offset of the target sentence, it is not clear why and when the children applied the agent-first strategy. On the one hand, it is possible that they were not sensitive to the case marking morphology. On the other hand, they might be sensitive to morphological information but not able to integrate it or use it for thematic role assignment. However, given that their eye-movements differed from the non-biased and yes-biased children, it seems that they applied the agent-first strategy quite early after the offset of the sentence.

The responses of the non-biased children were also reflected by their eye-movements. In general, eye-movement patterns for OVS sentences answered incorrectly differed from the eye-movement for OVS sentences answered correctly and largely corresponded to the eye-movement patterns for SVO sentences (which were usually answered correctly). This indicates that OVS sentences may have been interpreted as SVO sentences.

Moreover, the eye-movement patterns were similar across the age groups but differed in the timing of the effects. While the 4-year-olds showed the effects of Accuracy and Word Order from region 3 to 5, the 5-year-olds sorely showed the effects only in the last region and the 7-year-olds in the last two regions. In principle, the occurrence of the early and persistent effects that were

similar to the adult pattern may indicate that the 4-year-olds understood the OVS sentences. However, given the general poor offline comprehension accuracy of the 4-year-olds (only two of the 12 non-biased 4-year-olds understood OVS sentences above or almost above chance), it is also possible that the 4-year-olds applied a guessing strategy, i.e., they (possibly randomly) decided for the "agent" early and expected this animal to move. In this way, they did not comprehend the sentences better than the older children.

Crucially, the results could not demonstrate that context influence the comprehension of OVS sentences because the accuracy of the responses and the eye-movement patterns did not differ between the topic and the neutral context neither in children nor in adults.

The results for the adults differ from those by Burmester et al. (2014) who demonstrated that the topic status of an initial NP eased OVS sentence processing. Given that adults usually show processing difficulties only early during OVS sentence processing (Hemforth, 1993; Schipke, 2012) and the adults in our study performed at ceiling with respect to the offline responses, it is not surprising that context did not influence the eye-movements and offline responses of the adults in this study.

Nevertheless, the results of the children indicate that children may be less likely to rely on contextual than sentence-level cues to information or that the topic-first context may not address the main problems children have in processing the OVS sentences. That is to say, children may have problems understanding OVS sentences because OVS sentences lead to intervention effects and impose working memory costs, or because the referents in OVS sentences, especially subjects, are usually realized as pronouns in child language and child-directed speech (Fleischhauer, 2009; Kidd et al., 2007).

This issue was addressed in the second experiment wherein the topic that was either the subject or object of SVO and OVS sentences was realized as personal pronoun.

6.3 Experiment 2: Impact of the type of referring expression

Experiment 2 investigated whether the type of referring expression, i.e., realizing the topic as a pronoun, influences the comprehension of OVS sentences in 4- and 5-year-olds. Realizing the topic as a pronoun may ease comprehension because children and their caretakers tend to realize topics as pronouns in natural speech (as the corpus analyses reported in Chapter 4 showed) and thus pronouns may make the sentences more felicitous (Gordon et al., 1993; Grosz et al., 1995, see Chapter 2).

Additionally, the impact of pronouns on comprehension may be related to the characteristics of the syntactic structure, i.e., the filler-gap dependency (see Chapter 5). Pronominal referents may ease processing because they constitute given information which may impose lower discourse integration costs (Warren & Gibson, 2002, 2005). If a pronominal referent occurs together with a lexical NP referent in a sentences it may reduce intervention effects if the two referents differ in grammatical features such as pronominality (Rizzi, 2013).

Finally, pronominal topics may also influence processing in that pronouns may be seen as a cue to their topic status (E. Bates, 1976). This preference may interact with the grammatical role of the topic in a sentence. That is, if there is a link between pronouns, topics and subjects (e.g., Brandt et al., 2009; Du Bois, 1987; Kaan, 2001), OVS sentences may be easier to process when pronominal topic is the subject rather than the object of an OVS sentence.

Experiment 2 investigated the comprehension of SVO and OVS sentences in two contexts that defined either the first NP (topic-first) or the second NP (topic-last) as the topic of the subsequent target sentence (SVO or OVS sentence). In both contexts, the topic was realized as a pronoun so that in the topic-first condition, the first NP was the topic and realized as a pronoun whereas in the topic-last condition, the second NP was the topic and realized as a pronoun.

The sentences in the topic-first context corresponded to those in the topic context condition in Experiment 1 but differ from them in that the topic was realized as a pronoun rather than as a lexical NP. Thus, a comparison between both experiments would show the effect of the type of referring expression.

A comparison between the comprehension of OVS sentences in the topic-first and topic-last context in this experiment would indicate whether the impact of pronouns on sentence comprehension is influenced by the grammatical role of the pronoun. Given that topics were always realized as pronouns, the pronominal topic was the object in the OVS sentences in the topic-first context but the subject in OVS sentences in the topic-last context. Thus, if the impact of pronouns on sentence comprehension mainly results from the link between pronouns, topics and subjects, children may perform better in the topic-last context (when the subject is the pronoun) than in the topic-first context (when the object is the pronoun).

6.3.1 Method

6.3.1.1 Participants

Adults. 24 students of the University of Potsdam (5 men, mean age: 24 years) participated in the experiment for course credits or payment (5 Euro).
Children. 28 4-year-old children (18 boys, mean age: 4;6, range 4;1–4;11) and 25 5-year-old children (15 boys, mean age: 5;5,

range 5;1–5;10) were tested. No language acquisition or hearing problems were reported for any of the children.

6.3.1.2   Design and materials

The experiment employed a 2 x 2 between-subjects design, with Word Order and Context as independent variables (see 6.2). Sentences were presented in the SVO or OVS word order, with the unambiguous case marking of the first NP (*der* vs. *den*) or the pronoun (*er* vs. *ihn*) indicating the SVO (6.2a, 6.2c) or OVS word order (6.2b, 6.2d). Context imposed either a topic-first or topic-last information structure on the subsequent target sentence by defining either the referent of the first NP (6.2a, 6.2b) or of the second NP (6.2c, 6.2d) as the topic of the sentence. In all conditions, the topic was realized as a pronoun.

(6.2)   a.   *SVO word order, topic-first context*
Nun kommt eine Geschichte über den Tiger.
Ich wette, **er** kitzelt gleich das Schwein.
"Now you hear a story about the tiger. I bet he will tickle the pig."

b.   *OVS word order, topic-first context*
Nun kommt eine Geschichte über den Tiger.
Ich wette, **ihn** kitzelt gleich das Schwein.
"Now you hear a story about the tiger. I bet the pig will tickle him."

c.   *SVO word order, topic-last context*
Nun kommt eine Geschichte über das Schwein.
Ich wette, **der Tiger** kitzelt es gleich.
"Now you hear a story about the pig. I bet the tiger will tickle it."

d.   *OVS word order, topic-last context*
Nun kommt eine Geschichte über das Schwein.
Ich wette, **den Tiger** kitzelt es gleich.
"Now you hear a story about the pig. I bet it will tickle the tiger."

Prosodic characteristics of the target sentence

Figure 6.12 illustrates the mean f0-contour for the target sentences (lead-in and transitive sentence) in the topic-first (upper panel) and topic-last (lower panel) context. The prosodic pattern in the topic-first context resembled the hat contour, yet it differed from the one in Experiment 1 due to the occurrence of the pronoun. The led-in and transitive sentence were not separated by a intonation phrase boundary and the rising L*+H accent was realized on the verb of the lead-in sentence (*wette*, "bet"). The falling accent (H*+L) was realized on the second NP of the transitive sentence.
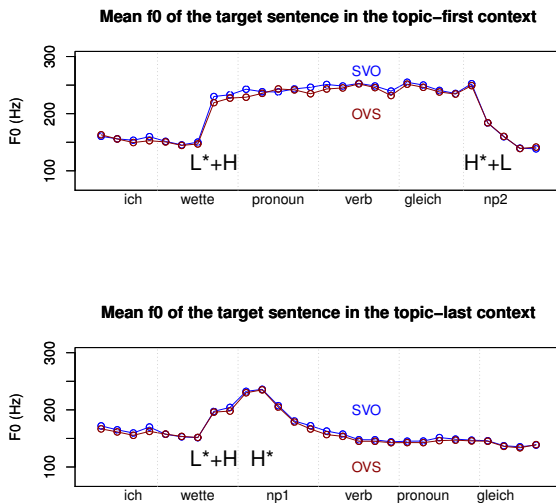

Figure 6.12: Mean F0 of the target sentence

In the topic-last context, the prosodic pattern was characterized by a rising accent on the verb of the lead-in sentence (*wette*, "bet") and a contrastive accent (H*) on the first NP, strictly speaking, a H* accent on the determiner and a downstep accent

(!H*) on the first syllable of the noun. The pronoun following verb was deaccented.

6.3.1.3   Procedure

The procedure of the experiment was the same as employed in Experiment 1. However, given that the practice trials in Experiment 1 may have led children to pay attention to the action rather than the actors and thus may have contributed to the high number of yes-bias children, the practice trials were modified (see Appendix B.3). Four practice trials were developed. They were intransitive sentences like *Ich wette, der Panda hüpft gleich* ("I bet, the panda will jump.") that were presented together with the pictures of two animals (e.g., eagle and panda) or an animal and an object (e.g., camel and tree). Two of the trials were correct and two incorrect. Animals that occurred in the practice trials were not used in the experimental trials.

6.3.1.4   Data treatment and data analysis

The same data treatment procedures and definitions of the visual areas of interest (AOIs) and auditory regions of interest (ROIs) were employed as in Experiment 1. Track loss of the eye-tracker was calculated on the basis of the data available in the auditory regions of interest. Track loss affected 7 % of the data in adults, 8.3 % of the 4-year-olds and 7.5 % of the 5-year-olds. The removal of trials with more than 50 % track loss in the critical regions affected less than 1 % of the data in each age group.

The same data analyses methods and model fitting procedures were used as in Experiment 1, i.e., ANOVA contrast coding was used for the predictors of Word Order (SVO: -0.5, OVS: 0.5) and Context (topic-first: 0.5, topic-last: -0.5) and treatment contrast for the effect of Age group for the accuracy data of the children, with the 4-year-olds as the baseline.

6.3.2 Accuracy: Adults

Table 6.3 illustrates the accuracy of the adults in all four conditions. As it was the case in Experiment 1, the adults performed at ceiling in all four conditions and their accuracy was not influenced by Word Order or Context.

Table 6.3: Mean accuracy (with 95 %-CI) for SVO and OVS sentences in the topic-first and topic-last context (adults)

topic-first		topic-last	
SVO	OVS	SVO	OVS
99 % (1)	99 % (1)	99 % (1)	99 % (1)

6.3.3 Eye-movements: Adults

Figure 6.13 shows the proportion of looks to the referent of the first NP for SVO (blue lines) and OVS sentences (red lines) in the topic-first (left panel) and topic-last (right panel) context. The results (fixed effects) of the statistical models calculated for each ROI (region 1 to 5) are given in Table B.7 in Appendix B.2.1. The models revealed a significant effect of Word Order in all regions resulting from higher proportions of looks to the referent of the first NP following SVO sentences compared to OVS sentences. There was a also significant and a marginal effect of Context in regions 3 and 4, resulting from lower proportions of looks to the referent of the first NP in the topic-last context than in the topic-first context. This indicates that the adults were more likely to look at the topic of the sentence.

6.3.4 Accuracy: Children

On the basis of the criteria for Experiment 1, the children were assigned to different response groups. Two 4-year-olds had a yes-bias, two further a SVO-bias, while the remaining 4-year-olds showed no response bias. None of the 5-year-olds had a
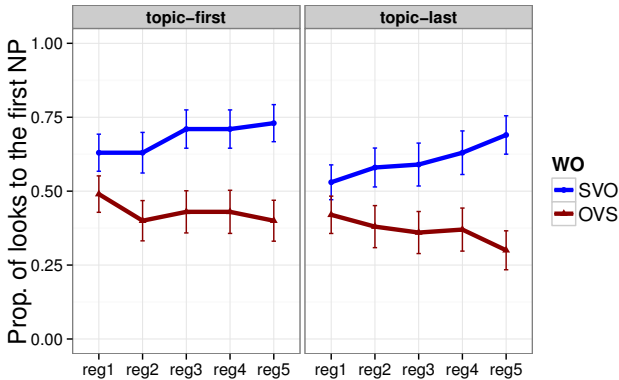
Figure 6.13: Proportion of looks (with 95 %-CI) to the first NP for SVO and OVS sentences in the topic-first and topic-last context (adults)

yes-bias or SVO-bias. The subsequent analyses only considered the "non-biased" children.

The mean accuracy for the explicit responses in each condition are presented in Figure 6.14. Logit LME models were calculated to assess the impact of the effects of Context and Word Order on accuracy. The results of the statistical models are given in Table B.8 in Appendix B.4.

The results for the 4-year-olds revealed a main effect of Word Order, resulting from a higher accuracy for SVO than for OVS sentences. There were no further effects, indicating that the effect was not modulated by Context. Logit LME models testing the performance on OVS sentences against 50 % chance level revealed that the 4-year-olds understood the OVS sentences above chance level in both the topic-first ($b = 0.92$, $SE = 0.24$, $z = 3.819$, $p < .001$) and the topic-last ($b = 0.92$, $SE = 0.24$, $z = 3.819$, $p < .001$) context.[3]

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3   T-tests revealed similar results: (topic-first: $t(23) = 4.058$, $p < .001$; topic-last: $t(23) = 3.126$, $p < .01$).
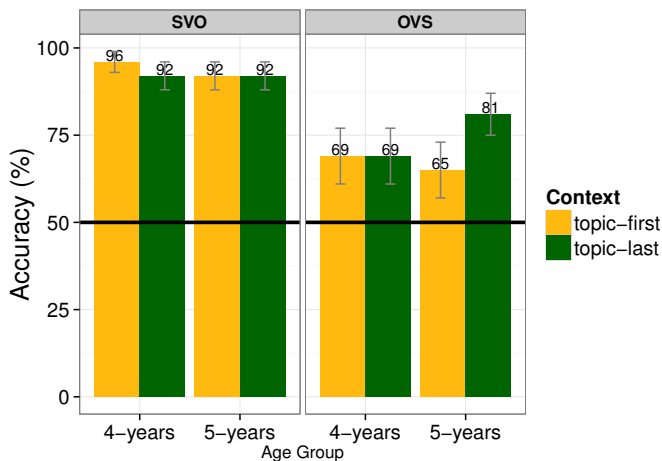
Figure 6.14: Mean accuracy (with 95 %-CI) for SVO and OVS sentences in topic-first and topic-last context (non-biased children)

Results for the 5-year old revealed a main effect of Word Order and a marginally significant interaction between Word Order and Context ($p = .0522$), indicating that the effect of Word Order was modulated by Context. As illustrated in Figure 6.14, the effect of Word Order seemed to be stronger in the topic-first context than in the topic-last context. Nevertheless, logit LME models testing the accuracy of OVS sentences against chance level showed that the 5-year-olds understood the OVS sentences above chance level in the topic-first ($b = 0.92$, $SE = 0.36$, $z = 2.546$, $p < .05$) and topic-last context ($b = 1.99$, $SE = 0.39$, $z = 5.164$, $p < .001$).[4]

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4   T-tests revealed different results. While the accuracy of OVS sentences was above chance level in the topic-last context ($t(23) = 5.834$, $p < .001$), it was just marginally above chance in the topic-first context ($t(23) = 1.943$, $p = .0639$). This difference may result from the aggregation required for the t-test. However, logit LME models are more appropriate for the analyses because the children gave categorical answers and the aggregated data for the t-test did not form a normal distribution (cf., Jaeger, 2008).

The statistical models testing for differences between the 4-year-olds and 5-year-olds did not reveal significant differences (see Table B.8 in Appendix B.4). Nevertheless, the 5-year-olds apparently performed better in the topic-last context. This is also indicated by the individual response patterns for OVS sentences in both groups.

Table 6.4: Frequency of the children performing above 50 % chance level, at chance level and below change level on OVS sentence

	$\geq$ **83 %**	**33–67 %**	$\leq$ **17 %**
4-year-olds (N = 24)			
topic-first	54 % (13)	46 % (11)	0
topic-last	50 % (12)	33 % (8)	12 % (4)
5-year-olds (N = 25)			
topic-first	52 % (13)	20 % (5)	28 % (7)
topic-last	72 % (18)	24 % (6)	4 % (1)

Table 6.4 presents the number of children that performed above chance level ($\geq$ 83 % correct), at chance level (33–67 %) and below chance level ($\leq$ 17 %) on OVS sentences. Binomial tests against a chance level of 50 % were used to determine the number of responses for above chance and below chance performance.

In the topic-last context, half of the 4-year-olds performed above chance level, four children below chance and the remaining in between. The 5-year-olds performed better. The majority of the children performed above chance level and only one child below chance level.

Differences also occurred in the topic-first condition. Around half of the children in both groups understood the sentences above chance-level. Yet, seven 5-year-olds performed below chance level in this condition, but only one of the 4-year-olds. Crucially, the seven 5-year-olds apparently had no problems

understanding OVS sentences, in general, because six of them performed above chance level on OVS sentences in the topic-last context. Thus, it seems to be the case that for these children the link between pronouns and subject status (which was "violated" in the topic-first context) influenced OVS comprehension.

In comparison to the results of Experiment 1, the results revealed that the use of pronouns eased sentence comprehension in the 4-year-olds and 5-year-olds. Recall that in Experiment 1, the 4-year-olds and 5-year-olds performed at chance level on OVS sentence in the neutral and topic context and were more likely to show an SVO-bias.

A direct comparison between the experiments confirmed that response accuracy on OVS sentences was higher in Experiment 2 than Experiment 1 (4-year-olds: $b = 0.59$, $SE = 0.31$, $z = 1.908$, $p = .0564$[5]; 5-year-olds: $b = 0.91$, $SE = 0.41$, $z = 2.196$, $p < .05$). Notably, in the 5-year-olds, the effect was triggered by the high performance in the topic-last context.

6.3.5 Eye-movements: Children

As in Experiment 1, two sets of analyses were calculated for the eye-movement data of the non-biased children. The first set (see Table B.9 in Appendix B.4) assessed the effect of Accuracy on the eye-movements for OVS sentences. Figure 6.15 illustrates the mean proportion of looks to the referent of the first NP for OVS sentences that were answered correctly (solid line) and incorrectly (dotted line).

The models for the 4-year-olds revealed an effect of Accuracy only in region 3, resulting from a higher proportion of looks for trials answered incorrectly than those answered correctly. There was also an effect of Context in region 1, resulting from a higher

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5   Note that the effect was only significant when the model considered by-subject random intercepts ($b = 0.63$, $SE = 0.30$, $z = 2.117$, $p < .05$), indicating that individual differences influenced the effect.
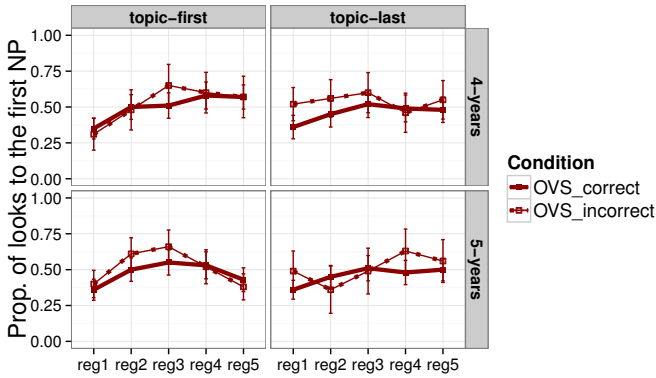
Figure 6.15: Proportion of looks (with 95 %-CI) to the referent of the first NP for OVS sentences answered correctly and incorrectly in the topic-first and topic-last context (non-biased children)

proportions of looks to the referent of the first NP in the topic-last context than in the topic-first context. However, this effect was restricted to OVS sentences answered incorrectly, as indicated by an interaction between Context and Accuracy. Thus, even though there was no main effect of accuracy, the results reflect a higher proportion of looks to the referent of the first NP in incorrect OVS sentences in the topic-last contexts (see upper left panel of Figure 6.15).

The models for the 5-year-olds did not reveal any effect of Accuracy in any region, indicating that the eye-movements were not related to response accuracy. Nevertheless, the statistical models revealed main effects of Context in region 3 and 5. There was a higher proportion of looks to the referent of the first NP in the topic-first than in the topic-last context in region 2 and the reversed pattern in region 5. These effects were not predicted and it is unclear how to interpret them.

The second set of analyses assessed the impact of Word Order and Context on SVO and OVS sentences that were answered correctly (see Table B.10 in Appendix B.4 for the statistics). Figure 6.16 presents the mean proportion of looks to the referent of the first NP for SVO and OVS trials answered correctly.
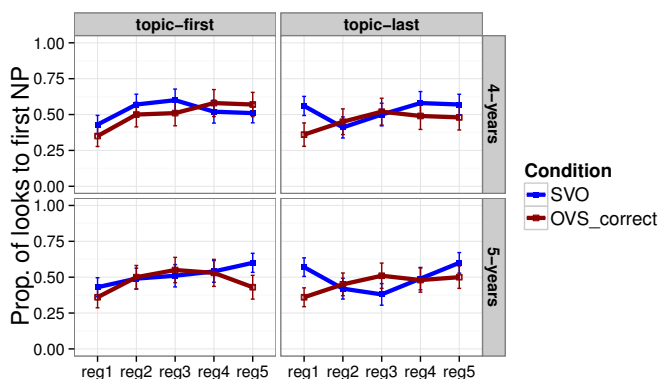
Figure 6.16: Proportion of looks (with 95 %-CI) to the first NP for SVO and OVS sentences answered correctly in the topic-first and topic-last context (non-biased children)

The models for the 4-year-olds revealed a main effect of Word Order in region 1, resulting from a higher proportion of looks to the referent of the first NP following SVO than OVS sentences. Although the interaction with Context was not significant, the plots in Figure 6.16 indicate that this effect mainly resulted in the topic-last context. There was also a main effect of Context in region 1 and 2 that resulted from higher proportions of looks to the referent of the first NP in topic-first than topic-last contexts, indicating that in general children looked at the topic more often.

The models for the 5-year-olds revealed an effect of Word Order in region 1 and region 5, resulting from higher proportions of looks to the referent of the first NP for SVO than OVS sentences.

However, in region 1, this effect was influenced by Context, as indicated by a significant interaction between Word Order and Context. Post-hoc comparisons confirmed that the effect of Word Order in region 1 was restricted to the topic-last context (b = -0.21, SE = 0.05, t = -4.684) and did not occur in the topic-first context (b = -0.08, SE = 0.05, z = -1.491). The models also revealed effects of Context and Word Order in region 3, reflecting higher proportions of looks to the referent of the first NP in topic-first contexts than topic-last contexts and higher proportions of looks to the referent of the first NP following OVS than SVO sentences. These effects were not predicted and are difficult to interpret, yet the Context effect may indicate that children prefer to look to the topic of the sentence.

Taken together, the results for the 4- and 5-year-olds were similar for the topic-last context in that they showed an effect of Word Order early in region 1. In the topic-first context, 4-year-olds showed an effect of Word Order in region 1 whereas the 5-year-olds showed an effect of Word Order only in the final region 5.

6.3.6 Discussion

The accuracy results of the second experiment show that realizing the topic as a pronoun increased comprehension accuracy of OVS sentences above chance level. The finding that the use of pronominal referents eased the processing in 4- and 5-year-old children agrees with the results of relative clause studies that demonstrated that the use of pronominal rather than lexical referents eases the processing of relative clauses in 3- to 5-year-olds (e.g., Brandt et al., 2009; Friedmann et al., 2009).

Additionally, the results of the present study indicate that 5-year-old children performed better in the topic-last context than in the topic-first context. In this condition, the topical pronoun was the subject in OVS sentences. This may indicate that the link between pronouns, subject status and topic status influenced

sentence comprehension (e.g., Brandt et al., 2009; Kaan, 2001; Kidd et al., 2007). Alternatively, the prosody used in these sentences improved sentence comprehension, given that in these sentences the first NP was contrastively focused. Grünloh et al. (2011) demonstrated that contrastive prosody eases the comprehension of OVS sentences in 5-year-olds and suggested that children may use prosodic focus as a cue for thematic roles assignment (see also Weber et al., 2006).

The results of the eye-movements appear to be less clear than in Experiment 1. With respect to the topic-last context, both age groups were more likely to look at the referent of the first NP in SVO sentences than in OVS sentences, that is, children tended to look more at the agent of the action. This effect occurred early, in the first region of interest, and did not (or only weakly) affect the eye-movements in the subsequent regions. Moreover, the eye-movement patterns of both the 4-year-olds and 5-year-olds were not strongly linked to response accuracy, although there was a tendency for a correspondence between response accuracy and eye-movements in the 4-year-olds.

Regarding the topic-first context, clear effects only occurred in the 5-year-olds. Their eye-movements for correct SVO and OVS sentences in the last region, region 5, corresponded to their responses. However, there was no effect of accuracy for OVS sentences, that is, children looked "correctly" even if they responded incorrectly. This discrepancy between the explicit and implicit measure may indicate that the source of the error in the 5-year-olds may be relatively late just before the explicit response is required.

The results of the 4-year-olds do not reveal any clear effects for the topic-first contexts. Their eye-movements were not affected by the word order of the target sentence (although there seem to be small differences between the sentences in the first three regions) and did not reflect their response accuracy. These effects clearly differ from the results of Experiment 1 that revealed dif-

ferent eye-movement patterns for SVO and OVS sentences and for OVS sentences that were answered correctly and incorrectly. If the clearer and earlier effects of the 4-year-olds in Experiment 1 indicated that children employed a guessing strategy, i.e., they merely looked at one of the animals and expected this animal to move, children apparently did not apply this strategy in Experiment 2, possibly because children could comprehend the sentences to some extent.

In general, the eye-movement results did not provide clear effects. With respect to the topic-first context, this might be because both the agent of the sentence and the topic might be looked at because both are salient (e.g., Gleitman et al., 2007; Tomlin, 1995). This "competition" may have reduced the eye-movements at the topic in OVS sentences, however, it is less clear why children also looked less at the topic in SVO sentences.

It may also be the case that the time window between the offset of the sentence and the onset of the action in general was too long and that the presentation of incorrect trials reduced the looks to the expected agent. Both factors may be likely to influence children's eye-movements if they have less problems processing the sentences and may less likely to be guessing or using the agent-first strategy for thematic role assignment.

Furthermore, it is feasible that possible effects on the topic-first and topic-last context occur during the processing of the SVO and OVS sentences as the results by Burmester et al. (2014) suggest. The present study measured eye-movements after the offset of the sentence so that the effects during online sentence processing could not be captured.

6.4   General discussion

The comprehension experiments aimed at investigating the impact of the topic status and the type of referring expression

on the comprehension of OVS sentences. The experiments used response accuracy and eye-movement measures as explicit and implicit measures of sentence comprehension. Experiment 1 demonstrated that the topic context did not influence comprehension of OVS sentences in 4-, 5- and 7-year-old children when both referents were realized as lexical NPs. Experiment 2 demonstrated that realizing the topic as a pronoun eased OVS sentence comprehension in 4-year-olds and 5-year-olds in both the topic-first and topic-last context, that is regardless of the grammatical role of the pronoun. Yet, OVS comprehension in 5-year-olds was better in the topic-last than topic-first context, that is to say, when the initial object was prosodically focused and the subject was the (pronominal) topic.

The lack of an effect of the topic context in Experiment 1 may indicate that the topic-first context does not address the main problems children experience in processing OVS sentences, i.e., the strong agent-first preference.

Notably, children may be sensitive to the topic-first preference, as the results of the corpus analyses reported in chapter 4 suggest. Yet, the advantages of the topic-first order may not be strong enough to overcome the difficulties that children experience when processing OVS sentences.

Crucially, the topic-first order induced by the context does not provide a frequency-based cue for thematic role assignment because it is compatible with the SVO and OVS word order – and possibly even more frequent with the SVO word order. In this way, it may "only" make the use of the OVS word order felicitous and may be associated with advantages of discourse-processing, in that is to say, it may ease the integrating the topic referent in the preceding discourse (Schumacher & Hung, 2012). These processing advantages may only be evident in children who have fewer problems processing OVS sentences per se, e.g., the 7-year-olds.

However, the 7-year-olds tested in Experiment 1 were not affect by the context at all. This suggests that the topic context either did not ease processing nor did it induce comprehension difficulties due to the repeated name penalty. The repeated name penalty (Almor, 1999; Gordon et al., 1993, cf. chapter 2) usually leads to processing difficulties when the topic is realized as a lexical NP rather than as a pronoun.

That being said, however, it is open to debate from which age children are sensitive to the discourse expectations underlying the repeated name penalty. Previous research revealed instances of the repeated name penalty in French-speaking 7-year-olds (Megherbi & Ehrlich, 2009) but the results for younger children on discourse-expectations are less conclusive (e.g., Hendriks, 2014; Song & Fischer, 2005). With respect to the present study, the lack of an effect of the topic context (and the topic-first order) in the 7-year-olds (and in the other groups) may suggest that it does not influence sentence comprehension or that the effect occurred early as online studies in adults demonstrated (Burmester et al., 2014).

While the impact of the context is less clear, Experiment 2 showed that sentence comprehension was improved when the topic was realized as a pronoun rather than as a lexical NP. Given that the ease in comprehension also occurred in the topic-first context, this suggests that pronouns per se ease comprehension, but the frequency-based link between pronouns and subjects also influence comprehension as the results of the 5-year-olds suggest.

In addition to the possibility that realizing the topic as a pronoun may avoid the repeated name penalty, pronouns may ease sentences comprehension because they may avoid problems with morphological case marking. As mentioned in chapter 3, children may have more problems with morphological case marking of lexical noun phrases than of pronouns (Eisenbeiß, 1994) and the ability to form the singular and plural forms of

novel and known nouns, possibly indicating a higher sensitivity to morphological information, was linked to OVS sentence comprehension in 7-year-olds (Dittmar et al., 2008a).

In the present study, the eye-movement patterns of yes-biased and non-biased children demonstrated that most of the 4- and 5-year-olds were already sensitive to case marking information. Only the SVO-biased children may have problems with case marking per se. This corresponds to the results reported by Schipke (2012) who showed that even 3-year-olds were sensitive to case marking morphology on lexical NPs but that preschoolers (3- and 4-year-olds) may have problems integrating this information. The results of the present study also agree with the results by Dittmar et al. (2008) that 7-year-olds still have problems understanding OVS sentences. However, given that the present study employed offline measures and did not assess morphological competences, it is less clear whether their problems in sentence comprehension are linked to problems integrating morphological information or due to other processing problems, e.g., memory costs arising from structural factors like the filler-gap dependency.

Crucially, research on the impact of structural effects and the associated memory costs mainly investigated the processing of relative clauses or other verb-final structure. These studies revealed that processing difficulties usually occurred at the sentence final verb. Results on OVS sentences processing, however, demonstrated that adults usually experience processing difficulties at the initial NP (Hemforth, 1993; Schipke, 2012) so that the processing problems in adults may not be due to the memory cost arising from the filler-gap dependency.

In children the processing difficulties at the first NP (Schipke, 2012) may also be crucially because modifications of the first NP may improve sentence comprehension. Grünloh et al. (2011) demonstrated that providing prosodic focus accent on the first NP of OVS sentences eases comprehension (see also Weber et

al., 2006) and in the experiments of this thesis changes from the Experiment 1 to Experiment 2 also involved a modification of the first NP: in the topic-first context the first NP was realized as a pronoun, and in the topic-last context it was prosodically focused. However, Schipke (2008) demonstrated that 6-year-olds also experience processing difficulties at the second NP that may be linked to the characteristics of the filler-gap dependency.

Finally, discourse factors may explain why pronouns eased OVS sentence comprehension. It has been argued that pronouns may ease processing because they establish discourse coherence and are easier to integrate into the discourse model (Grosz et al., 1995; Warren & Gibson, 2002). While similar processing advantages have been proposed with respect to the givenness status of the initial objects (Schumacher & Hung, 2012), pronouns may also provide a more explicit link to the previous discourse or the topic status (Grosz et al., 1995; E. Bates, 1976). Thus, even though Experiment 1 demonstrated that the givenness or topic status of an lexical NP did not ease sentence comprehension in children, it might be that they need a pronoun as a cue to the topic status and a more explicit link to the preceding discourse. This might especially be the case because children usually use pronouns rather than lexical NPs to refer to given referents, even if a lexical NP is required by discourse conditions (e.g., Hendriks et al., 2014).

Taken together, the results suggest that pronouns ease processing, but it is less clear how exactly they ease processing. The offline results are compatible with explanations in terms of intervention, memory costs, and discourse properties. Further research using online methods are required to disentangle the impact of these factors.

While the effect of the pronouns is compatible with the view that structural or discourse factors influence OVS sentence comprehension, the results of the 5-year-old children indicate that additional factors also played a role.

The 5-year-olds demonstrated a higher comprehension accuracy for OVS sentences in the topic-last context, wherein the object was contrastively focused and the subject realized as a pronoun, than in the topic-first context. This suggests that they may have used focus prosody or the link between pronouns and the subject status as a cue to the OVS word order.[6]

The first option agrees with results by Grünloh et al. (2011) who demonstrated that focus on the object eased the comprehension of OVS sentences in German-speaking 5-year-olds even when both arguments were realized by lexical NPs. Moreover, Weber et al. (2006) demonstrated that contrastive accent on the initial NP of temporarily ambiguous sentences can reduce the adoption of the subject-first (or agent-first) analysis during online sentence processing in adults. Both Grünloh and Weber suggest that focus influences sentence comprehension because it provides a frequency-related cue to the OVS word order due to the fact that the initial NP may more often be focused in OVS than in SVO sentences. It may be that children use this cue because it is provided in the input. Indeed, the corpus results by Fleischhauer (2009) revealed that even 3-year-olds may be sensitive to the impact of focus on word order variation because objects that were focused by a question context were more likely to occur in OVS than in SVO sentences.

Notably, the 4-year-olds did not show the comprehension advantage in the topic-last context. This may suggests that 4-year-olds may not use focus as a cue to word order. However, Snedeker and Yuan (2008) demonstrated that 4- to 6-year-olds used prosodic cues in sentence disambiguation, possibly suggesting that 4-year-olds are sensitive to prosodic cues during sentence processing. Moreover, as just stated above, Fleischhauer's (2009) production results indicate that children

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6 Alternatively it may be possible that focus prosody influenced processing in that it reduces intervention effects (Fanselow & Lenertová, 2011) or affects the processing of the focus structure (Stolterfoht, 2005).

may be sensitive to the impact of focus on word order around age 3.

Thus, it is possible that the 4-year-olds in the present study did not reveal an advantage of the focus-first context because this context violates the topic-first order. That is, even though, the prosodic focus might have provided a cue to the OVS word order, the violation of the topic-first preference may have led to processing and comprehension difficulties.

Finally, the 5-year-olds may also have relied on the link between personal pronouns and the subject role that may be used in the topic-last context. Support for this hypothesis and the impact of the link between grammatical role and referring expression was revealed by the individual performance in the topic-first context. Seven 5-year-old apparently showed an agent-first bias in this condition, indicating that they might be influenced by the link between personal pronouns and subject role. Crucially, only one 4-year-old child showed the bias, possibly indicating that the correlation between personal pronouns and subject role is learned over time (e.g., Brandt et al., 2009; Kidd et al., 2007).

Interestingly, these results may be related to results on the acquisition of different pronoun types. Bittner and Kuehnast (2011) argued that 3-year-olds use demonstrative pronouns as a default for anaphoric reference (for 3rd person referents) whereas 5-year-olds gradually develop the differences in the properties between personal pronouns and demonstrative pronouns, with personal pronouns referring to more salient referents. Thus, the 5-year-olds in the present study may already be sensitive to the link between personal pronouns and topic status (and possibly subject status) whereas 4-year-olds are still acquiring the discourse properties of personal pronouns and demonstrative pronouns. If this is the case, the link between pronouns and grammatical role is not a "direct" mapping (as suggested by Theakston, 2012) but may be modulated by information struc-

ture and discourse factors like topic status (Kaan, 2001; Kidd et al., 2007).

Discourse factors may also be a reason why children did not perform at ceiling in the comprehension experiments. The corpus analyses reported in chapter 4 demonstrated that objects in object-initial sentences were usually realized as demonstrative pronouns. Thus, children may not have performed at ceiling in the present study because objects in OVS sentences are usually realized as demonstrative pronouns rather than as personal pronouns.

Further research modifying the type of referring expression (personal pronoun vs. demonstrative pronoun) and prosody (demonstrative pronoun occurring in a hat contour vs. being contrastive focused) will clarify whether demonstrative pronouns *per se* or a contrastive accent may further enhance comprehension OVS sentences.

In summary, the present studies demonstrated that topical personal pronouns but not topical lexical NPs eased OVS sentence comprehension. Pronouns eased sentence comprehension regardless of their grammatical role, indicating that they eased discourse processing or reduced problems resulting from the syntactic structure. However, the link between personal pronouns, topic status and subject status also influenced sentence comprehension and may explain the differences in the comprehension accuracy between 4-year-olds and 5-year-olds. While context did not ease sentence comprehension (at least not when both arguments in sentence are realized as lexical NPs), it may be a crucial factor licensing the use of pronouns.

7 General discussion

7.1 Summary

The studies reported in this dissertation were aimed at investigating the impact of information structure (IS) and the type of referring expression on the production and comprehension of word order variation in German-speaking preschoolers. Of particular interest was the role of the type of referring expression as a sentence-level cue to IS, word order and thematic role assignment.

Three corpus studies were conducted to assess the impact of givenness, topic status and the type of referring expression on word order in child language and child-directed speech to clarify whether different types of referring expressions could be used as a cue to word order. The analyses confirmed this hypothesis. Word order in the middlefield was predictable from the type of referring expression in both child language and child-directed speech, yet the type of referring expression was correlated with givenness. Movement to the prefield was also influenced by the type of referring expression but topic status also had an independent effect in both child language and child-directed speech. Both findings indicate that the type of referring expression may be a crucial factor in the acquisition of word order regularities.

Two comprehension experiments were conducted to investigate the impact of topic status induced by a preceding context, and

the type of referring expression on the comprehension of non-canonical sentences. The topic status of the initial constituent did not influence sentence comprehension, indicating that children may not fully consider contextual information or that the advantages of the topic-first order may not address the main problems they have with processing non-canonical sentences. However, sentences comprehension was eased when the topic was realized as a personal pronoun, regardless of the grammatical role of the pronoun. This suggests that pronouns may reduce processing difficulties related to structural factors (intervention effects, memory costs) or may provide a more explicit link to the topic status and the preceding discourse. Crucially, additional factors, such as the frequency-based link between pronouns and subject status or the use of prosodic focus, also influenced sentence comprehension.

7.2   Acquisition of the marking of information structure

The marking of IS may be seen as involving two steps, i.e., determining the information status (and IS category) of a referent and applying the appropriate means to mark the IS category (Krifka, 2008). Determining the IS category often involves taking the perspective of the hearer into account and this may impose difficulties on children (e.g., De Cat, 2011; Gundel & Johnson, 2013). Children may mark information structure from their perspective, that is, they may use pronouns for referents that are discourse-new or not salient to the hearer (Campbell et al., 2000; Hendriks et al., 2014) or may produce utterances that follow the new-before-given ordering from the perspective of the hearer (Dimroth & Narasimhan, 2012; Narasimhan & Dimroth, 2008).

Additionally, previous studies suggested that children may acquire the local means to mark IS, such as prosody and the type of referring expression, earlier than the global means, such

as word order (e.g., MacWhinney & Bates, 1978; Hickmann et al., 1996). However, other research suggests that children may also use syntactic IS marking quite early (e.g., Anderssen, Fikkert, Mykhaylyk, & Rodina, 2012; De Cat, 2009) and may demonstrate non-adult-like patterns for prosodic IS marking (e.g., Chen, 2010; Grünloh, Lieven, & Tomasello, 2014)[1] and referential choice, even if the hearer and the speaker share the linguistic and visual context (e.g., Bittner & Kuehnast, 2011; Hickmann & Hendriks, 1999; Karmiloff-Smith, 1981).

The corpus results cannot reveal whether children considered the hearer perspective when determining and marking the IS status of referents because the perspective of the hearer and the speaker could not be distinguished. Moreover, the information status of the referents was not modified systematically and discourse-givennness was taken to capture givenness so that discourse-new referents may have been inferrable or present in the visual discourse and thus hearer-new. This makes it difficult to assess whether children used the appropriate means to mark the IS status.

Nevertheless, the correlations between the type of referring expression, (discourse-)givenness and topic status showed similar patterns in children and adults. This suggests that 3-year-olds are sensitive to the relationship between givenness and referential choice (see also Wittek & Tomasello, 2005). That said, it is still unclear whether they are already sensitive to the finer, discourse-related differences between demonstrative pronouns and personal pronouns (cf., Bittner & Kuehnast, 2011).

With respect to the syntactic marking of information structure, the results demonstrate a strong effect of the type of referring ex-

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1   Note that adults' use of prosodic means to mark IS may differ depending on whether they are talking to an adult or to an child. Grünloh et al. (2014) showed that German-speaking 2-to-3-year-olds were less likely to de-accent given information than adults. Yet, adults demonstrated a similar pattern as children when speaking to children rather than adults.

pression. The strong impact of the type of referring expression in the middlefield results from the observation that word order variation was influenced by weak pronouns and mainly resulted from pronoun movement. Yet, given the correlations between the type of referring expression, givenness and topic status, it is unclear whether the referring expression itself, its phonological correlate (cf., Müller, 1999) or IS (e.g., Lenerz, 2001) triggered word order variation.

Movement to the prefield was influenced by both topic status and the referring expression. Thus, in agreement with the hypothesis that topic status influenced movement to the prefield, children and adults placed a topic constituent in the prefield. This pattern is not trivial given the fact that focused or discourse-new constituents may also be placed in the prefield (e.g., Weber & Müller, 2004; Fleischhauer, 2009). This indicates that 3-year-olds (similar to adults) do not follow a general new-before-given preference.

However, the placement of the topical direct object to the prefield was also influenced by the referring expression. Topics occurred in the prefield when they were realized as demonstrative pronouns but towards the beginning of the middlefield when they were realized as personal pronouns. This suggests that additional factors such as focus or contrast may influence the movement of non-subjects to the prefield.

The results of the present study indicate that children may not follow a general new-before-given strategy. This contrasts with the study by Narasimhan and Dimroth (2008) who demonstrated a new-before-given strategy in 4- to 5-year-olds. These differences may result from differences between word order at the sentence level and phrasal level and the status of the hearer perspective. That is, Narasimhan and Dimroth looked at the ordering of conjoined NPs and used an experimental setting wherein the perspective of the hearer and speaker differed, whereas the present analyses look at the ordering of argu-

ments in spontaneous speech where the speaker and hearer perspective may usually overlap.

Nevertheless, the result are compatible with the hypothesis that 3-year-olds may also follow a topic-first or given-before-new strategy but that this strategy may compete with a new-before-given strategy (E. Bates, 1976; Narasimhan & Dimroth, 2008). If the given-before-new order and new-before-given order are both linked to production advantages (Jaeger & Tily, 2011; Narasimhan et al., 2010, November), it may be reasonable that these strategies may be quite general and acquired early. Accordingly, children may merely have to determine which strategy is used in a given construction (e.g., given-new in the middlefield, topic-first in the prefield, focus-first in it-clefts) and to learn that determining the information status of a referent also depends on the speaker perspective.

The type of referring expression (or their prosodic correlates) may indicate which IS marking strategy is used in a certain construction (because referring expressions are correlated with IS) and thus may be a means to acquire syntactic IS marking. In principle, children may acquire the word order regularities in the prefield and middlefield by considering the information status of the referents. However, this may be a challenging task because similar factors may influence the word order variation involving the middlefield and prefield (prominence, aboutness status). Moreover, in spoken discourse many referents are often given and differ only gradually in terms of their givenness status, children usually seem to have problems considering the finer differences in the discourse status of referents (Bittner & Kuehnast, 2011; Hickmann & Hendriks, 1999; Karmiloff-Smith, 1981).

The corpus results suggest that referring expressions (or their prosodic correlates) provide clear sentence-level cues to the word order patterns in the prefield and middlefield in child language and child-directed speech. Children are already sen-

sitive to the statistical regularities in their input by age 7.5 to
8 months (e.g., Saffran, Aslin, & Newport, 1996; for a review
see Romberg & Saffran, 2010) so that they may use them in
the acquisition of word order patterns (e.g., Gervain, Nespor,
Mazuka, Horie, & Mehler, 2008). Moreover, German-speaking
children are sensitive to the prosodic focus marking at around
8 months (Schmitz, Höhle, Müller, & Weissenborn, 2006) and
to the relation between morphological and phonological in-
formation and word order at around 18 months (B. Höhle,
Weissenborn, Schmitz, & Ischebeck, 2001, see also Soderstrom,
White, Conwell, & Morgan, 2007 on English), indicating that
this relation may be salient and possibly easy to acquire.

In this way, children may initially rely on morphological or
prosodic information as a cue to word order and later general-
ize how IS and discourse factors influence word order variation.
This may explain why 3-year-olds already perform in an almost
adult-like way with respect to word order variation in the
present study even though experimental studies (and corpus
studies) previously demonstrated that they did not always get
the finer differences in the information status associated with
different referring expressions right (e.g., Bittner & Kuehnast,
2011; Gundel & Johnson, 2013; Hickmann & Hendriks, 1999;
Karmiloff-Smith, 1981).

7.3   Production-comprehension asymmetry

The second issue that this dissertation aimed at addressing
regarded the differences between the comprehension and
production of word order variation, i.e., the observation that
preschoolers and even 7-year-olds have problems understand-
ing OVS sentences (e.g., Dittmar et al., 2008a; Mills, 1977;
Schipke, 2012) even though they already produce OVS sen-
tences by age 3 (e.g., Fleischhauer, 2009; Poeppel & Wexler,
1993, see also the corpus results of the present study on object-
initial ditransitive sentences). These differences are unexpected

because it is usually assumed that children have to comprehend syntactic structures in order to produce them (Hendriks & Koster, 2010).

Production-comprehension asymmetries in language acquisition may be explained by several factors: they may be linked to experimental artefacts, the lack of pragmatic knowledge, cognitive limitations, or the grammar itself (see e.g., Hendriks & Koster, 2010 for an review). Within the framework of Minimalist Grammar, meaning is determined by the syntactic structure. Given that children produce OVS sentences this would suggest that they are able to construct the syntactic representation of the sentences. Thus, grammar is usually not taken to account for the production-comprehension asymmetry but rather experimental, pragmatic and cognitive factors.

In the following, I will discuss the results with respect to each of these three factors. In general, the results of the dissertation suggest that there is no production-comprehension asymmetry (at least when the hearer and speaker share the discourse). Rather problems understanding OVS sentences in experiments probably resulted from experiment artefacts, problems considering contextual information or processing problems related to the non-canonical word order.

With respect to the impact of experimental artefacts on comprehension results, Schipke (2012) demonstrated that the use of different methodologies revealed different results. Particularly relevant are the differences between the sentence-picture matching task and the preferential looking task. Both tasks involved the presentation of two pictures depicting the action of the target sentence, one showing the correct thematic role assignment and the other the revered thematic role assignment. The sentence-picture matching task required an explicit response, i.e., children had to choose the picture matching the target sentence. In the preferential looking task, sentence comprehension was indicated by the eye-movements at the correct (or incorrect) pic-

ture but no explicit response was given. Schipke (2012) found that 4-year-olds performed at chance level in both tasks. Yet, 3-year-olds showed an agent-first bias in the sentence-picture matching task and at chance performance in the preferential looking task, whereas 6-year-olds performed at chance level in the sentence-picture matching task but above chance level in the preferential looking task. This indicates that 3- and 6-year-olds performed differently on the implicit and explicit task (see also Brandt-Kobele & Höhle, 2010 for similar results using explicit and implicit measures in 3- to 4-year-olds).

In the present study, sentence comprehension was measured explicitly and implicitly, i.e., in terms of the responses and the looks to the expected agent. Yet, the results for the eye-movements, i.e., the implicit measure, were not strong. On the one hand, Experiment 1 demonstrated that the results for the implicit and explicit measure did not differ, except for the yes-bias children. A reason for the lack of a difference may be that the present study combined both measures (Brandt-Kobele & Höhle, 2010). Another reason may be that the presentation of incorrect trials that was required for the explicit measure may have decreased the amount of looks to the expected agent. In this case, children may look less at expected agent because they realize that sometimes the unexpected agent may move as well.

On the other hand, Experiment 2 indicates that the method, i.e., measuring looks to the agent when the patient is the topic, might not be appropriate because not only the agent but also the topic of a sentence may be salient and may be looked at (see Gleitman et al., 2007; Tomlin, 1995 for evidence that salient patients draw attention).

This hypothesis may be supported by the comparison between Experiment 1 and 2. Recall that in Experiment 1, the eye-movement pattern largely corresponded to the offline accuracy, i.e., children looked more to the animal they expected to move. Yet, in the corresponding (topic-first) context in Experiment 2

no clear eye-movement effects were demonstrated, even though children seemed to understand the OVS sentences above chance level. If topics are more likely to be looked at, children may not have shown any effect in Experiment 2 because there was a competition between the agent and the topic that could be looked at. This effect may not occur in Experiment 1 because children may not have treated the lexical NP as topic and thus may be more likely to look at the agent.[2]

Using the preferential-looking task might have been a better method. Still, the presentation of two pictures involving the same animals may be less felicitous in a setting that introduces a topic because the topic referent occurs twice (once in each picture) and it might be less clear which topic referent is being referred to. This problem may even be more pronounced when pronouns are used.

Pragmatic factors have also been considered to explain the production-comprehension asymmetry. In particular, a lack of pragmatic knowledge has been linked to comprehension difficulties in anaphora resolution (Chien & Wexler, 1990). With respect to word order variation, the pattern is reversed. Problems considering pragmatics or IS were mainly linked to the production of the word order variation (e.g., Narasimhan & Dimroth, 2008; Schaeffer, 2000), whereas in comprehension, children may be more likely to rely on pragmatic and discourse (Crain & Thornton, 1998, but see discussion below). Pragmatic factors may lead to problems in production because children may not consider the perspective of the hearer. In comprehension, processing problems may occur when non-canonical sentences are presented without an appropriate context and

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2   Nevertheless, it is not clear why children did not demonstrate a strong preference for looking at the agent in SVO sentences, especially when it was the topic. This might be ascribed to design factors, for example, the presentation of incorrect trials and a long time window between the offset of the target sentence and the onset of the movie, as noted above.

thus are infelicitous. In this way, they do not fully consider the perspective of the hearer, i.e., the child.

Thus, problems in comprehension may arise from a lack of an appropriate context or the issue of whether children consider contextual information during sentence comprehension, but probably not from a lack of pragmatic knowledge. Given that the corpus analyses demonstrated that children were sensitive to the impact of the topic status on movement to the prefield, it is surprising that children in the comprehension experiments had problems understanding OVS sentences when the object was the topic.

On the one hand, it might be that the topic-first context is not an appropriate context for the OVS word order in spoken language. The corpus data of the present thesis and the results by Fleischhauer (2009) suggest that children and adults realized the object of object-initial sentences as demonstrative pronoun that may be accented or focused. Thus, it is possible that the OVS word order may be licensed if the object is a contrastive topic rather than "merely" an aboutness topic.

On the other hand, it is also possible that children may not always consider contextual information during sentence comprehension, as has been discussed with respect to the processing of temporarily ambiguous sentences (e.g., Trueswell et al., 1999; Snedeker & Yuan, 2008 vs. Crain & Thornton, 1998) and reference resolution (e.g., Arnold, Brown-Schmidt, & Trueswell, 2007 vs. Song & Fischer, 2005, 2007). The present comprehension results did not reveal any effect on sentence comprehension in children or adults. Although the adults in the present study were also not affected by the context, it is important to note that they performed at ceiling in all conditions in the present study and that previous research showed effects of topic status during online sentence comprehension (Burmester et al., 2014). Thus, the measures in the present study may not be sensitive enough to capture processing difficulties in adults.

While children may not consider the context at all, they may rather need a more explicit link to the preceding context and the discourse status, for instance by a pronoun. Crucially, children also have problems in the linking between lexical NPs and givenness in production, that is, they use pronouns for given referents even if the referent is not uniquely identifiable or highly prominent (e.g., Hendriks et al., 2014, see also Karmiloff-Smith, 1981; Hickmann & Hendriks, 1999). In this way, the results of the comprehension study complement these production findings, and indicate that there may be no asymmetry between comprehension and production.

The question as to whether children consider contextual and sentence-level cues in comprehension and whether they are influenced by the contextual felicity may also be linked to processing issues. That is, during sentence comprehension children may not have the resources to consider all types of information available to them, or may value them differently (e.g., E. Bates & MacWhinney, 1987; MacWhinney, 1987; Snedeker, 2009; Tomasello, 2003; Trueswell & Gleitman, 2007). In principle, these issues should also play a role in production but may occur less frequently because in language production, at least in natural discourse, contextual factors and sentence-level cues to IS are often correlated. For instance, pronouns are usually given and deaccented, whereas lexical NPs are usually new and accented. Nevertheless, the results of the corpus analysis suggest that even in production, children may rely on sentence-level cues like the type of referring expressions.

The impact of cognitive factors on production and comprehension may also be related to the memory demands arising from the filler-gap-dependency that impose processing difficulties upon both children and adults. As argued in Chapter 6, pronouns may ease OVS comprehension because they reduce memory costs associated with the syntactic structure and ease discourse processing (e.g., Adani et al., 2010; Friedmann et al., 2009; Gordon et al., 2001, 2006; Warren & Gibson, 2002). These

factors may not only influence comprehension but production as well.

The results of the present corpus analyses indicate that in spontaneous speech, at least one argument, usually the subject, is realized as a pronoun (see also Fleischhauer, 2009; Kidd et al., 2007). In this way, sentence production of OVS sentences may be easy because they involve pronouns. Yet, further research needs to clarify whether pronouns, in general, may be preferred and easier to produce, as Hendriks et al. (2014) proposed. Crucially, further studies should also included measurements of memory capacity and cognitive control to investigate the correlations between these cognitive factors and the production and comprehension of non-canonical sentences.

In summary, the results of the present experiments are compatible with a view that there is no "real" production-comprehension-asymmetry and that differences between the production and the comprehension of non-canonical sentences may be related experimental factors, discourse factors and cognitive factors. In this way, the type of referring expression influences sentence comprehension (and production) because it provides a cue to the information and discourse status of a referent and may influence memory costs resulting from structural factors. Crucially, the comprehension results may also indicate that testing the comprehension of OVS sentences in a setting that resemble that of OVS sentences produced in natural language, may ease comprehension and reduce the differences found between the corpus studies and comprehension experiments.

7.4 Conclusions

The results of the dissertation demonstrated that referring expressions have a strong impact on the production and comprehension of word order variation in child language. In produc-

tion, they may be seen as a frequency-based cue to both word order and information status and may be used as means of acquiring the IS regularities influencing word order. In comprehension, pronouns influence sentence comprehension because they provide a link to the information or discourse status of a referent and interact with structural factors; however, they also provide a cue to thematic role assignment that may be mediated by IS.

These results contribute to recent developments in generative linguistics, in both theoretical linguistics (e.g., Chomsky, 2005) and language acquisition (Snyder, 2007; Westergaard, 2008), that (re)consider the impact of experience-related factors, and their interaction with innate principles and performance factors (e.g., processing factors).

The results are also compatible with usage-based and frequency-based approaches that emphasize the close relationship between production, comprehension and acquisition (e.g., Dell & Chang, 2014; MacDonald, 2013; Tomasello, 2003). However, they suggest that additional factors, that is, discourse or structural factors, interact with frequency-related factors and may account for the differences in the frequency of SVO and OVS sentences.

Given that the results of the present study are compatible with several approaches to language acquisition and processing, further research using online measures is required to clarify the impact of pronouns on sentence comprehension and to disentangle the impact of structural, discourse and experience-based factors during online sentence processing.

A Corpus analyses

A.1 Corpus analysis 1

Table A.1: Percentage of the types of referring expression realizing the indirect object in each word order and group

	CL		CDS	
	IO-DO (N=166)	DO-IO (N=35)	IO-DO (N=625)	DO-IO (N=168)
Clitic pronoun	0	0	0 % (1)	1 % (1)
Personal pronoun	72 % (120)	80 % (28)	62 % (388)	52 % (88)
Reflexive pronoun	17 % (28)	6 % (2)	22 % (136)	6 % (10)
Demonstrative pronoun	1 % (1)	6 % (2)	1 % (7)	1 % (1)
Indefinite pronoun	1 % (2)	0	0 % (2)	0
Noun phrase	9 % (15)	9 % (3)	15 % (91)	40 % (68)

Table A.2: Fixed effects of the LME models assessing frequency of the referring expression realizing the indirect object in each word order for CL and CDS

	CL			CDS		
	b	SE	z	b	SE	z
Personal pronoun	0.43	0.46	0.936	−0.36	0.18	−2.034*
Reflexive pronoun	−1.31	0.77	−1.698^{+}	−1.44	0.35	−4.180***
Noun phrases	−0.06	0.66	−0.088	1.34	0.20	6.600***

b: estimate, SE: standard error, z: z-value
$^{+}p < .1$, *$p < .05$, **$p < .01$, ***$p < .001$
No analyses for clitics, demonstrative and indefinite pronouns calculated due to lack of data.

Table A.3: Percentage of the types of referring expression realizing the direct object in each word order and group

	CL		CDS	
	IO-DO	**DO-IO**	**IO-DO**	**DO-IO**
	(N=166)	**(N=35)**	**(N=625)**	**(N=168)**
Clitic pronoun	3 % (5)	54 % (19)	4 % (24)	64 % (108)
Personal pronoun	0	14 % (5)	1 % (4)	23 % (39)
Demonstrative pronoun	13 % (22)	20 % (7)	9 % (55)	9 % (15)
Indefinite pronoun	22 % (36)	6 % (2)	19 % (118)	1 % (2)
Noun phrase	62 % (103)	6 % (2)	68 % (424)	2 % (4)

Table A.4: Fixed effects of the LME models assessing the frequency of the referring expression realizing the direct object in each word order for CL and CDS

	CL			CDS		
	b	**SE**	**z**	**b**	**SE**	**z**
Clitic pronoun	3.66	0.60	6.158***	3.93	0.28	14.190***
Personal pronoun[1]				4.12	0.56	7.371***
Demonstr. pronouns	0.65	0.51	0.162	−0.01	0.31	−0.043
Indefinite pronouns	−1.60	0.76	−2.091*	−3.00	0.72	−4.123***
Noun phrase	−3.32	0.76	−4.342**	−4.46	0.51	−8.690***

b: estimate, SE: standard error, z: z-value
[+]$p < .1$, *$p < .05$, **$p < .01$, ***$p < .001$
[1] No analyses for personal pronouns in CL due to lack of data.

A.2 Corpus analysis 3

Table A.5: Percentage of the topic status in each word order and group

	Children			Adults		
	IO-DO	DO-IO	pre-DO	IO-DO	DO-IO	pre-DO
	(N=173)	(N=33)	(N=34)	(N=597)	(N=162)	(N=103)
DO_topic	7 % (12)	58 % (19)	65 % (22)	6 % (36)	36 % (59)	77 % (79)
NoTop	44 % (81)	18 % (6)	21 % (7)	20 % (122)	6 % (10)	13 % (13)
OtherTop	16 % (29)	9 % (3)	6 % (2)	31 % (188)	6 % (10)	1 % (1)
Imperative	30 % (55)	9 % (3)	3 % (1)	37 % (223)	46 % (75)	2 % (2)
Mmbiguous	4 % (7)	6 % (2)	6 % (2)	5 % (28)	5 % (8)	8 % (8)

Table A.6: Pronominality of the direct object in each word order and group

	Children			Adults		
	IO-DO	DO-IO	pre-DO	IO-DO	DO-IO	pre-DO
	(N=173)	(N=33)	(N=34)	(N=597)	(N=162)	(N=103)
Clitic	3 % (5)	58 % (19)	0	4 % (24)	65 % (105)	0
Pers_pr	1 % (1)	15 % (5)	0	1 % (4)	23 % (38)	0
Dem_pr	15 % (27)	15 % (5)	59 % (20)	8 % (50)	9 % (14)	83 % (85)
Indef_pr	21 % (39)	6 % (2)	3 % (1)	19 % (114)	1 % (2)	5 % (4)
NP	61 % (112)	6 % (2)	38 % (13)	68 % (405)	2 % (3)	13 % (13)

B Comprehension experiments

B.1 Experiment 1: Materials

Practice items

1. Ich wette, das Kamel rennt zum Geschenk. (SVPP)
   I bet the camel will run to the present.

2. Ich wette, zum Baum rennt das Kamel. (PPVS)
   I bet the camel runs to the tree.

3. Ich wette, das Kamel rennt zum Haus. (SVPP)
   I bet the cam runs to the house.

Experimental items

The experimental items below are listed in the SVO word order, without the lead-in (*Ich wette*, "I bet"). Sentences in the OVS word order corresponded to the SVO sentences but the first NP was marked by the accusative case, i.e., the determiner was *den* ("the.acc") rather than *der* ("the.nom").

1. Der Affe fängt gleich die Maus. (The monkey will chase the mouse.)

2. Der Forsch fängt gleich die Katze. (The frog will chase the cat.)

3. Der Hase fängt gleich die Kuh. (The bunny will chase the cow.)

4. Der Löwe kitzelt gleich das Pferd. (The lion will tickle the horse.)

5. Der Bär fängt gleich das Schaf. (The bear will chase the sheep.)

6. Der Hund kitzelt gleich das Zebra. (The dog will tickle the zebra.)

7. Der Igel fängt gleich die Ente. (The hedgehog will chase the duck.)

8. Der Dino fängt gleich die Biene. (The dino will chase the bee.)

9. Der Hamster fängt gleich die Ziege. (The hamster will chase the goat.)

10. Der Fuchs kitzelt gleich das Küken. (The fox will tickle the chick.)

11. Der Wolf kitzelt gleich das Nashorn. (The wolf will tickle the rhino.)

12. Der Tiger kitzelt gleich das Schwein. (The tiger will tickle the pig.)

13. Der Hahn fängt gleich die Kröte. (The cock will tickle the toad.)

14. Der Krebs fängt gleich die Gans. (The crab will tickle the goose.)

15. Der Esel fängt gleich die Spinne. (The donkey will chase the spider.)

16. Der Hai kitzelt gleich die Schnecke. (The shark will tickle the snail.)

17. Der Wurm kitzelt gleich die Robbe. (The wurm will tickle the seal.)

18. Der Fisch kitzelt gleich die Schlange. (The fish will tickle the snake.)

19. Der Dachs fängt gleich das Pony. (The badger will tickle the pony.)

20. Der Panther fängt gleich das Huhn. (The panther will chase the chicken.)

21. Der Käfer fängt gleich das Reh. (The beetle will chase the deer.)

22. Der Wal kitzelt gleich das Meerschwein. (The whale will tickle the guinea pig.)

23. Der Uhu kitzelt gleich das Nilpferd. (The owl will tickle the hippo.)

24. Der Vogel kitzelt gleich das Lama. (The bird will tickle the lama.)

B.2 Experiment 1: Statistics

Table B.1: Fixed effects of the LME models for the eye-movements of the adults (correct trials)

	b	SE	t	m
region1				
(Intercept)	0.50	0.02	26.320	
Word Order	**−0.19**	**0.03**	**−6.479**	
Context	−0.01	0.03	−0.185	
WO x Context	−0.05	0.03	−1.675	
region2				
(Intercept)	0.49	0.02	22.000	
Word Order	**−0.26**	**0.05**	**−5.300**	id
Context	0.02	0.03	0.791	
WO x Context	0.04	0.03	1.213	
region3				
(Intercept)	0.50	0.02	22.274	
Word Order	**−0.23**	**0.06**	**−4.078**	id
Context	0.02	0.03	0.661	
WO x Context	0.02	0.03	0.550	
region4				
(Intercept)	0.52	0.02	26.783	
Word Order	**−0.35**	**0.06**	**−6.012**	id
Context	0.02	0.03	0.509	
WO x Context	0.03	0.03	0.960	
region5				
(Intercept)	0.51	0.02	29.619	
Word Order	**−0.46**	**0.05**	**−8.489**	id
Context	0.02	0.03	0.557	
WO x Context	0.04	0.03	1.355	

b: estimate, SE: standard error, t: t-value, m: model adjustment (id: participant, it: item)
$|t| > 2$ indicate significance at the 5 % level.

Table B.2: Fixed effects of the LME models for the accuracy data of the non-biased children

	4-years				5-years				7-years			
	b	SE	z	m	b	SE	z	m	b	SE	z	m
(Intercept)	0.95	0.18	5.347***		1.63	0.22	7.398***		1.56	0.189	8.280***	
Word Order	−1.32	0.28	−4.699***		−2.52	0.47	−5.326***	id	−2.00	0.30	−6.757***	
Context	−0.03	0.28	−0.098		0.10	0.29	0.333		−0.15	0.30	−0.504	
WO x Context	−0.33	0.28	−1.156		−0.38	0.29	−1.317		−0.19	0.30	−0.064	
overall model												
(Intercept)	0.97	0.21	4.535***									
Word Order	−1.35	0.28	−4.756***									
Context	−0.03	0.28	−0.105									
WO x Context	−0.33	0.28	−1.172									
Age (4 vs. 5)	0.46	0.29	1.620									
Age (4 vs. 7)	0.60	0.29	2.056*									
Age (5) x WO	−0.89	0.40	−2.242*									
Age (7) x WO	−0.66	0.41	−1.614									
Age (5) x Context	0.13	0.40	0.319									
Age (7) x Context	−0.12	0.41	−0.293									
Age (5) x WO x Con	−0.02	0.50	−0.058									
Age (7) x WO x Con	0.31	0.41	0.762									

b: estimate, SE: standard error, z: z-score, m: model for slope adjustment
$^+p < .1, *p < .05, **p < .01, ***p < .001$

Table B.3: Fixed effects of the LME models for the eye-movements of the yes-bias children (correct and incorrect trials)

	4-years				5-years			
	b	**SE**	**t**	**m**	**b**	**SE**	**t**	**m**
region1								
(Intercept)	0.39	0.03	11.260		0.40	0.03	13.050	
Word Order	−0.03	0.03	−1.002		−0.08	0.04	−1.969[+]	
Context	0.00	0.03	−0.072		0.03	0.04	0.817	
WO x Context	0.03	0.03	1.089		0.01	0.04	0.010	
region2								
(Intercept)	0.56	0.03	18.411		0.55	0.03	20.115	
Word Order	−0.06	0.04	−1.643		**−0.11**	**0.05**	**−2.301**	
Context	0.01	0.04	0.355		0.03	0.05	0.691	
WO x Context	0.02	0.04	0.573		−0.03	0.05	−0.676	
region3								
(Intercept)	0.62	0.03	22.483		0.56	0.03	21.246	
Word Order	**−0.12**	**0.05**	**−2.438**	id	−0.10	0.05	−1.898	
Context	0.00	0.04	0.105		0.01	0.05	0.138	
WO x Context	−0.01	0.04	−0.236		0.02	0.05	0.488	
region4								
(Intercept)	0.66	0.02	30.183		0.55	0.04	15.526	
Word Order	**−0.12**	**0.04**	**−3.202**		−0.04	0.05	−0.796	
Context	0.00	0.04	−0.053		−0.05	0.05	−0.926	
WO x Context	0.02	0.04	0.446		0.02	0.05	0.367	
region5								
(Intercept)	0.65	0.02	26.362		0.55	0.05	12.013	
Word Order	**−0.21**	**0.06**	**−3.532**	id	**−0.15**	**0.07**	**−2.105**	id
Context	0.02	0.03	0.680		0.00	0.04	0.010	
WO x Context	0.00	0.03	−0.116		0.01	0.04	0.307	

b: estimate, SE: standard error, t: t-value, m: model adjustment (id: participant, it: item)

$|t| > 2$ indicate significance at the 5 % level.

Table B.4: Fixed effects of the LME models for the eye-movements of the svo-bias children (correct and incorrect trials)

	4-years				5-years			
	b	SE	t	m	b	SE	t	m
region1								
(Intercept)	0.37	0.04	10.024		0.38	0.04	9.736	
Word Order	−0.01	0.04	−0.163		0.02	0.04	0.395	
Context	−0.02	0.04	−0.500		0.00	0.04	0.073	
WO x Context	0.02	0.04	0.461		0.04	0.04	0.866	
region2								
(Intercept)	0.47	0.04	13.400		0.57	0.03	20.866	
Word Order	0.01	0.05	0.206		0.01	0.05	0.210	
Context	−0.05	0.05	−0.944		0.01	0.05	0.188	
WO x Context	**0.11**	**0.05**	**2.162**		0.00	0.05	0.083	
region3								
(Intercept)	0.55	0.04	15.469		0.62	0.04	15.338	
Word Order	0.01	0.05	0.118		−0.04	0.05	−0.766	
Context	0.08	0.05	1.571		0.04	0.05	0.750	
WO x Context	0.03	0.05	0.537		0.00	0.05	−0.052	
region4								
(Intercept)	0.57	0.03	19.544		0.60	0.04	16.932	
Word Order	0.06	0.05	1.082		−0.04	0.05	−0.705	
Context	0.04	0.05	0.738		0.05	0.05	0.861	
WO x Context	0.06	0.05	1.137		0.01	0.05	0.146	
region5								
(Intercept)	0.61	0.03	22.726		0.59	0.04	13.664	
Word Order	−0.01	0.05	−0.046		−0.02	0.05	−0.406	
Context	0.03	0.05	0.508		0.04	0.05	0.724	
WO x Context	0.06	0.05	1.277		−0.06	0.05	−1.236	

b: estimate, SE: standard error, t: t-value, m: model adjustment (id: participant, it: item)
$|t| > 2$ indicate significance at the 5 % level.

Table B.5: Fixed effects of the LME models assessing the effect of Accuracy on the eye-movements of the the non-biased children (OVS sentences)

	4-years				5-years				7-years			
	b	SE	t	m	b	SE	t	m	b	SE	t	m
region 1												
(Intercept)	0.34	0.04	9.122		0.45	0.04	11.977		0.46	0.03	14.653	
Accuracy	0.02	0.06	0.307		0.02	0.05	0.421		−0.01	0.05	−0.211	
Context	0.04	0.06	0.784		0.03	0.04	0.594		0.00	0.05	0.020	
Acc x Context	0.06	0.11	0.373		0.03	0.09	0.304		−0.09	0.10	−0.902	
region 2												
(Intercept)	0.57	0.04	13.619		0.50	0.03	16.235		0.56	0.03	17.075	id
Accuracy	0.12	0.10	1.229	‡	−0.01	0.05	−0.152		0.01	0.08	0.157	
Context	0.12	0.07	1.805		0.13	0.05	2.387		0.03	0.05	0.640	
Acc x Context	−0.06	0.13	−0.440		0.04	0.11	0.379		0.13	0.10	1.233	
region 3												
(Intercept)	0.55	0.04	14.405		0.54	0.03	15.978		0.49	0.04	12.492	
Accuracy	**0.25**	**0.08**	**3.315**		0.01	0.06	0.043		0.06	0.06	1.023	
Context	−0.11	0.08	−1.394		**0.14**	**0.06**	**2.472**		−0.02	0.06	−0.367	
Acc x Context	−0.19	0.15	−1.257		0.10	0.12	0.877		−0.01	0.12	−0.093	
region 4												
(Intercept)	0.52	0.04	13.444		0.53	0.03	16.276		0.53	0.03	17.645	
Accuracy	**0.20**	**0.08**	**2.612**		0.05	0.06	0.924		0.11	0.06	1.761	
Context	−0.11	0.08	−1.379		**0.14**	**0.06**	**2.534**		0.04	0.06	0.667	
Acc x Context	0.11	0.16	0.679		0.06	0.11	0.561		−0.06	0.12	−0.477	
region 5												
(Intercept)	0.58	0.04	14.106		0.51	0.02	20.487		0.49	0.04	12.632	id
Accuracy	**0.23**	**0.07**	**3.437**		**0.18**	**0.05**	**3.561**		0.13	0.08	1.523	
Context	0.04	0.07	0.603		−0.05	0.05	−0.916		0.02	0.05	0.381	
Acc x Context	−0.06	0.13	−0.477		0.01	0.10	0.051		−0.06	0.10	−0.629	

b: estimate, SE: standard error, z: z-score, m: model for slope adjustment
$+p < .1$, $*p < .05$, $**p < .01$, $***p < .001$

Table B.6: Fixed effects of the LME models assessing the effect of Context and Word Order on the eye movements of the non-biased children (correct trials)

	4-years				5-years				7-years			
	b	SE	t	m	b	SE	t	m	b	SE	t	m
region 1												
(Intercept)	0.35	0.03	13.477		0.45	0.03	17.385		0.49	0.03	18.006	id
Word Order	−0.05	0.05	−0.990		−0.03	0.04	−0.723		−0.04	0.06	−0.655	
Context	0.02	0.05	0.377		0.01	0.04	0.183		0.02	0.04	0.641	
WO x Context	0.00	0.05	0.079		0.00	0.04	−0.103		0.03	0.04	0.673	
region 2												
(Intercept)	0.51	0.04	11.343	it	0.53	0.03	17.380		0.57	0.02	24.054	id
Word Order	0.02	0.08	0.189		−0.06	0.04	−1.463		−0.03	0.06	−0.437	
Context	0.06	0.06	1.068		0.11	0.04	2.549		−0.04	0.04	−1.041	
WO x Context	0.08	0.06	1.416		−0.01	0.04	−0.223		0.02	0.04	0.433	
region 3												
(Intercept)	0.52	0.03	15.693		0.55	0.03	17.219		0.49	0.03	15.907	
Word Order	−0.19	0.07	−2.896		−0.03	0.05	−0.591		−0.07	0.05	−1.514	
Context	0.04	0.07	0.540		0.03	0.05	0.690		0.02	0.05	0.475	
WO x Context	−0.05	0.07	−0.699		0.05	0.05	1.020		−0.04	0.05	−0.885	
region 4												
(Intercept)	0.52	0.03	15.858		0.54	0.03	17.471		0.55	0.03	21.632	
Word Order	−0.19	0.06	−2.911		−0.07	0.05	−1.501		−0.15	0.05	−3.225	
Context	0.01	0.06	0.118		0.04	0.05	0.874		0.04	0.05	1.047	
WO x Context	−0.17	0.06	−2.578		0.06	0.05	1.364		0.02	0.05	0.458	
region 5												
(Intercept)	0.54	0.03	17.003		0.50	0.02	20.758		0.52	0.03	16.440	it
Word Order	−0.16	0.06	−2.576		−0.17	0.04	−4.148		−0.17	0.05	−3.080	
Context	0.05	0.06	0.877		0.02	0.04	0.577		−0.02	0.04	−0.410	
WO x Context	0.00	0.06	−0.036		−0.08	0.04	−2.001		0.06	0.04	1.405	

b: estimate, SE: standard error, z: z-score, m: model for slope adjustment

$^{+}p < .1, {}^{*}p < .05, {}^{**}p < .01, {}^{***}p < .001$

B.3 Experiment 2: Materials

Practice items

1. Ich wette, zum Baum läuft gleich das Kamel. (PPVS)
   I bet the camel will run to the tree. (movie: camel runs to the tree)

2. Ich wette, der Adler fliegt gleich zum Geschenk. (PPVS)
   I bet the eagle flies to the present. (movie: present flies to eagle)

3. Ich wette, der Panda hüpft gleich. (SV)
   I bet the panda (bear) will jump. (movie: eagle jumps, panda does not move)

4. Ich wette, der Biber hüpft gleich. (SV)
   I bet the beaver will jump. (movie: beaver jumps, camel does not move)

B.4   Experiment 2: Statistics

Table B.7: Fixed effects of the LME models for the eye-movements of the adults (correct trials)

	b	SE	t	m
region1				
(Intercept)	0.52	0.02	34.17	
Word Order	**−0.12**	**0.03**	**−3.97**	
Context	0.09	0.05	1.71	id
WO x Context	−0.02	0.03	−0.54	
region2				
(Intercept)	0.50	0.02	29.797	
Word Order	**−0.22**	**0.03**	**−6.499**	
Context	0.04	0.06	0.628	id
WO x Context	−0.02	0.03	−0.474	
region3				
(Intercept)	0.52	0.02	26.753	
Word Order	**−0.25**	**0.05**	**−5.179**	id
Context	**0.10**	**0.03**	**2.804**	
WO x Context	−0.02	0.03	−0.711	
region4				
(Intercept)	0.53	0.02	26.904	
Word Order	**−0.27**	**0.04**	**−7.402**	
Context	0.07	0.04	1.869+	
WO x Context	−0.01	0.04	−0.309	
region5				
(Intercept)	0.53	0.02	34.18	
Word Order	**−0.36**	**0.06**	**−5.83**	id
Context	**0.06**	**0.05**	**1.31**	id
WO x Context	0.03	0.03	1.06	

b: estimate, SE: standard error, t: t-value, m: model adjustment (id: participant, it: item)
$|t| > 2$ indicate significance at the 5 % level.

Table B.8: Fixed effects of the models analysing the accuracy data of the non-biased children

	4-years				5-years				4- vs. 5-years			
	b	SE	z	m	b	SE	z	m	b	SE	z	m
(Intercept)	2.10	0.20	10.241***		2.50	0.29	8.725***		2.30	0.26	9.000***	
Word Order	−2.09	0.36	−5.794***	id	−1.65	0.60	−2.773**	id	−2.40	0.52	−4.618***	id
Context	0.20	0.35	0.588	id	0.10	0.46	0.225	id	0.79	0.48	1.654$^+$	id
WO x Con	−0.48	0.42	−1.136	id	−0.90	0.47	−1.941$^+$	id	−0.89	0.35	−2.530*	id
Age (4 vs. 5)									0.10	0.36	0.284	
Age x WO									0.61	0.72	0.849	
Age x Con									−0.78	0.65	−1.193	
Age x WO x Con									−0.41	0.48	−0.847	

b: estimate, SE: standard error, z: z-score, m: model for slope adjustment
$^+p < .1$, $^*p < .05$, $^{**}p < .01$, $^{***}p < .001$

Table B.9: Fixed effects of the LME models assessing the effect of Accuracy on the eye-movements of the the non-biased children (OVS sentences only)

	4-years				5-years			
	b	SE	t	m	b	SE	t	m
region1								
(Intercept)	0.38	0.04	10.262		0.40	0.03	13.659	
Accuracy	0.04	0.05	0.893		0.08	0.05	1.697	
Context	**−0.11**	**0.05**	**−2.457**		−0.05	0.05	−1.109	
Acc x Context	**−0.21**	**0.10**	**−2.139**		−0.11	0.10	−1.169	
region2								
(Intercept)	0.50	0.04	12.575		0.48	0.03	16.728	
Accuracy	0.07	0.05	1.146		0.01	0.06	0.154	
Context	−0.03	0.06	−0.490		0.15	0.06	2.726	
Acc x Context	−0.16	0.11	−1.392		0.21	0.11	1.848	
region3								
(Intercept)	0.57	0.04	13.637		0.55	0.03	18.250	
Accuracy	**0.12**	**0.06**	**2.014**		0.05	0.06	0.831	
Context	0.04	0.06	0.685		0.11	0.06	1.749	
Acc x Context	0.12	0.12	1.036		0.13	0.12	1.092	
region4								
(Intercept)	0.53	0.03	17.382		0.54	0.03	16.223	
Accuracy	−0.01	0.06	−0.065		0.07	0.06	1.119	
Context	0.11	0.06	1.810		−0.03	0.06	−0.528	
Acc x Context	0.05	0.12	0.388		−0.16	0.12	−1.324	
region5								
(Intercept)	0.54	0.03	18.872		0.47	0.03	17.423	
Accuracy	0.04	0.06	0.616		0.00	0.05	0.082	
Context	0.06	0.06	0.959		**−0.12**	**0.05**	**−2.289**	
Acc x Context	−0.07	0.11	−0.598		−0.11	0.11	−1.043	

b: estimate, SE: standard error, t: t-value, m: model adjustment (id: partici-pant, it: item)

$|t| > 2$ indicate significance at the 5 % level.

Table B.10: Fixed effects of the LME models assessing the effect of Context and Word Order on the eye movements of the non-biased children (correct trials only)

	4-years				5-years			
	b	**SE**	**t**	**m**	**b**	**SE**	**t**	**m**
region1								
(Intercept)	0.42	0.03	14.091		0.43	0.02	19.757	
Word Order	**−0.14**	**0.04**	**−3.894**		**−0.13**	**0.03**	**−4.009**	
Context	**−0.07**	**0.04**	**−2.098**		−0.07	0.03	−1.903	
WO x Context	0.06	0.03	1.746		**0.07**	**0.03**	**2.002**	
region2								
(Intercept)	0.48	0.03	16.452		0.47	0.02	20.337	
Word Order	−0.02	0.04	−0.382		0.02	0.04	0.489	
Context	**0.11**	**0.04**	**2.637**		0.06	0.04	1.469	
WO x Context	−0.06	0.04	−1.482		−0.01	0.04	−0.304	
region3								
(Intercept)	0.53	0.02	21.284		0.49	0.02	21.251	
Word Order	−0.04	0.04	−0.859		0.08	0.04	1.946	
Context	0.04	0.04	0.949		**0.09**	**0.04**	**2.066**	
WO x Context	−0.05	0.04	−1.202		−0.04	0.04	−1.045	
region4								
(Intercept)	0.54	0.03	21.612		0.51	0.02	23.777	
Word Order	−0.02	0.04	−0.461		−0.01	0.04	−0.222	
Context	0.02	0.04	0.358		0.05	0.04	1.233	
WO x Context	0.07	0.04	1.629		0.00	0.04	−0.048	
region5								
(Intercept)	0.53	0.02	23.367		0.53	0.02	24.443	
Word Order	−0.01	0.06	−0.142		**−0.13**	**0.04**	**−3.376**	
Context	0.00	0.04	0.057		−0.04	0.04	−0.948	
WO x Context	0.07	0.04	1.972[+]		−0.03	0.04	−0.784	

b: estimate, SE: standard error, t: t-value, m: model adjustment (id: participant, it: item)
$|t| > 2$ indicate significance at the 5 % level.

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Zuletzt erschienene Ausgaben:

A puzzle in the area of language acquisition concerns the production-comprehension asymmetry for non-canonical sentences like *Den Tiger kitzelt das Schwein*. ("The tiger, the pig tickles."): preschoolers usually have difficulties understanding non-canonical sentences approximately until age six although they produce these sentences already around age three. To address this issue, this dissertation investigated the impact of the type of referring expression on the acquisition of word order variation in German-speaking preschoolers.

Three corpus analyses examined the impact of givenness, topic status and the referring expression on word order in the spontaneous speech of two- to four-year-olds and the child-directed speech produced by their mothers. The results reveal similar ordering patterns for children and adults. Word order was to a large extent predictable from the type of referring expression, especially regarding the word order involving the sentence-medial positions. Information structure had an additional impact only on word order variation that involved the sentence-initial position.

Two comprehension experiments tested whether the type of referring expression and topic status influences the comprehension of non-canonical sentences in four- and five-year-olds. The results demonstrate that children's comprehension of non-canonical sentences improved when the topic argument was realized as a personal pronoun. However, children's comprehension did not improve when the topic argument was realized as a lexical NP.

In sum, the results of both production and comprehension studies support the view that referring expressions may be seen as a sentence-level cue to word order and to the information status of the sentential arguments. The results highlight the important role of the type of referring expression on the acquisition of word order variation and indicate that the production-comprehension asymmetry is reduced when the type of referring expression is considered.