

Singular Quantified Terms^{*†}

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I Introduction

Singular quantified terms are terms (or DPs; linguistic objects that can appear in argument position) with quantifying force whose head noun is singular. Formally, these are terms which contain terms which are in the scope of a quantifier, like *all boys*, *most of the apple*, and *some of the committee*. In English, singular quantified terms must contain a mediating preposition *of* between the quantifier and the singular term, as is demonstrated in (1a).

- (1) a. Most *(of) the menu costs \$20.
b. kol ha-tafrit be esrim jekel
all the-menu in 20 NIS
'Every item on the menu sells for 20 NIS.'

In this paper, I discuss the behavior of singular partitives, focusing on Hebrew. I show that group noun-headed singular quantified terms behave essentially different from other singular quantified terms. Specifically, the domain of quantification in the former is a discrete set (the members of the group), while in the latter the domain of quantification is a set of mass entities. I propose a preliminary analysis of singular quantified terms in Hebrew, respecting the properties peculiar to this language as well as the observations about group vs. non-group singular quantified terms. This analysis is based on a novel class of quantifiers I name 'Measure Quantifiers', which instantiate relations between algebraic sums. Using shifts between algebraic sums, we can represent the different readings of singular and plural individual or group terms.

For simplicity, in this paper I only deal with definite partitives since the analysis of definite partitives is more straightforward and can be generalized to non-definite partitives. Section II is an overview of key observations about singular partitives in English. The major observation is that the domain of quantification within partitives depends on the head noun. With individual nouns (e.g.

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†Hebrew sentences are transcribed using simplified IPA. Glosses are provided word by word and below is a translation of the intended meaning in English. I use '*' to designate sentences which speakers do not accept. '?' designates sentences whose acceptability status is debatable among speakers. For the English data, I consulted native speakers of English, and for the Hebrew data I provided the judgments myself.

book, apple, pen) and mass nouns, the domain of quantification is material stuff. With group nouns (e.g. team, army, committee), the domain of quantification is the set of members of the group.

In Section III, I describe the Hebrew data. I exemplify the uses of several Hebrew quantifiers and how they affect the morphosyntax of partitives. Most prominently, some quantifiers, such as *kol* ‘all’ exemplified in (1b), do not allow the use of an intermediary preposition, while others, such as *harbe* ‘many/much’, require it in all partitives. Numerals greater than 1 are allowed only in plural partitives but not in singular partitives, while fractions between 1 and 0 may also be used in singular partitives.

In Section V, I propose a semantic scheme which captures the behavior of the Hebrew quantifiers, situated in a Boolean semantics framework following Link (1983). Semantically, these quantifiers (‘Measure Quantifiers’) apply relations between degrees of Boolean sums. This is essentially different from relations between sets as in Barwise and Cooper (1981). Crucially, these quantifiers have the same semantics in both singular and plural partitives, which allows a uniform treatment of partitives. The uniformity is made possible by a novel operator, a variant of Landman (1989a)’s \downarrow , which formally discriminates between group, individual, mass and plural nouns. In Section VI, I conclude and suggest directions for further research.

II Definite Partitives in English

In this section I compare group-headed definite partitives with individual-headed and mass-headed quantified terms in English. This shows an essential contrast within singular quantified terms, namely, that the domain of quantification is determined by the head noun. In group-headed definite partitives, the domain of quantification is a discrete set of individuals (group members), while in individual- and mass-headed ones, the domain of quantification is a continuous set of mass entities (material). This shows a crucial distinction which is also shared with Hebrew (and any other language I know) and is therefore directly relevant to the discussion in Sections III-V.

The purpose of this section is to bring out the differences between group and non-group singular quantified terms, which emerge as a result of conceptual distinctions between group entities and individual/mass entities. In the analysis proposed in Section V, I attempt to capture these distinctions formally within the Hebrew data.

Singular quantified terms prove to behave in an essentially different way from their plural counterparts. In a plural quantified term, the domain of quantification is the set of atoms of the plurality. Thus, for instance, in (2), *some* measures atomic boys. In singular quantified terms, on the other hand, the domain of quantification is not fixed. In (3a), the domain of quantification is a sum of material parts (the parts of the schnitzel). In (3b), the domain of quantification is a set of crew members. In (3c), the domain of quantification is again a sum of material parts.

- (2) Some of the boys are smart.
- (3) a. Dan ate all of the schnitzel.
b. ... he was taking most of the crew off [...] ¹
c. Some of the water is poisoned.

¹Found in: Robin Hobb. 2001. *Ship of Destiny*. p. 558. Spectra: New York

The contrast in (3) is mediated by lexical properties of the nouns involved. When quantifying over individual nouns like *schnitzel* the domain of quantification is usually the sum of material parts of an individual. With group nouns like *crew*, *team* and *committee*, the domain of quantification is almost invariably a set of group members. With mass nouns like *water*, *gold* and *coffee*, quantification occurs over a sum of material parts.

The key observation is that singular quantified terms (quantified terms whose syntactic head is singular) can quantify over different domains for individual and group nouns. Individual singular quantified expressions (singular quantified expressions whose head is an individual noun) quantify over material (mass) parts, and group singular quantified expressions (singular quantified expressions whose head is a group noun) quantify over atomic parts. This is demonstrated in (3a) and (3b). I use the term 'singular quantified expressions' rather than 'singular partitives' since in Hebrew, unlike English, not all quantified terms with singular head are partitive.

II.I Group Quantified Terms

Pearson (2011) gives various tests which demonstrate that in British English (BE), group nouns are much more similar to pluralities than in American English (AE). For instance, in BE, they are compatible with reciprocal expressions in the same way that pluralities are, as is demonstrated in (4), adapted from a similar example in Pearson (2011, p. 161). However, such cases are largely restricted to pluralized predicates; the singular version of the reciprocal predicate is still unacceptable, as in AE. Another noticeable observation is that in AE singular quantified expressions cannot be combined with numerals, while in BE, it is possible (according to Pearson (2011)). Thus, (5) is acceptable in BE but not in AE.

- (4) The family like(*-s) each other. (BE)
 (5) He was taking three of the crew off. (✓BE, *AE)

Despite the fact that group nouns exhibit certain behaviors which characterize plural terms, they often behave like individual nouns. For example, pluralities of group nouns distribute exactly like pluralities of individual nouns. The domain of quantification for plural group term is a set of group-atoms - not a set of individual-atoms. This yields particularly interesting distributive subentailment.

Distributive subentailments (following Dowty (1987)) are entailments about the atoms of certain plural expressions, which appear in certain environments but not others. For instance, Dowty gives examples such as the ones below. Both *gather* and *be numerous* are perceived as collective, because they only accept collections as arguments. However, (6b) is peculiar, unlike (6a). Moreover, (6b) seems to be peculiar in the same way as (7b) - a fact which led Dowty to the conclusion that *be numerous* exhibits entailment patterns similar to *meet*. Thus, (7b) means that every student is numerous, which is grammatical but nonsensical.

- (6) a. All the students gathered in the hallway.
 b. * All the students are numerous.
 (7) a. * Every student gathered in the hallway.
 b. * Every student is numerous.

The entailment in (6b) about each the students, which doesn't exist in (6a), is called by Dowty 'distributive subentailment'. These are entailments about the atoms of *all*-marked plurals expressions, which appear in certain environments but not others. In (6a) there is no distributive subentailment that every student gathered, but in (6b) there is a distributive subentailment that every student is numerous, and hence the infelicity in (6b).

Going back to plural group partitives, predicates such as *numerous*, which cannot apply to plural individuals (as in (6b)), can apply to plural groups (as in (8)), since the distributive subentailment in these cases is felicitous. Since being numerous is a possible property of armies, the distributive entailment in (8) that the armies are numerous does not lead to infelicity as in (6b).

(8) All of the armies are numerous.

In (9), on the other hand, the domain of quantification is a set of individual-atoms (soldiers); individual soldiers cannot be numerous, and therefore the distributive subentailment in (9) leads to nonsensicality.

(9) * All of the army is numerous.

In (8) the group noun behaves like a plural individual noun, but (9) is another case where a group noun behaves like a plurality - the unacceptability of (9) is akin to the unacceptability of (6b). In both cases, the source of unacceptability is a distributive subentailment which applies the property *be numerous* to an individual atom, which is infelicitous.

Another point of similarity between group terms and plurals is their interaction with stubbornly distributive predicates (following Schwarzschild (2011)). As was observed by Schwarzschild, some predicates have only a distributive interpretation regardless of their conceptual content. He gives examples such as the ones below. (10a) can only mean that each of the phone calls took up a lot of time, while (10b) can also mean that the phone calls collectively took up a lot of time. In other words, (10a) is only distributive with respect to the phone calls, while (10b) is ambiguous between collective and distributive interpretation.

- (10) a. The phone calls were long.
b. The phone calls took up a lot of time.

Schwarzschild calls such predicates 'Stubbornly Distributive'. There are numerous examples of such predicates, such as *big*, *large* and *round*.

A committee can be old, and the members of a committee can be old, but only (11a), unlike (11b), is ambiguous (see the discussion in Pearson (2011, p. 161)). The former can say something either about the committee or its members, and the latter says something only about the committee members. Thus, in (11a), *committee* is ambiguous between atomic interpretation and sum interpretation. In (11b), in contrast, *committee* behaves like a plurality: it **forces** distribution to the committee members. This demonstrates that quantified singular expressions behave essentially different from non-quantified ones (plain definites). The quantifier *all*, even though it is a universal quantifier, makes the plural interpretation of *the committee* much more salient compared to (11a), in which there is no quantifier.

- (11) a. The committee is old.
b. All of the committee is old

The collective readings of group quantified expressions are not identical to the readings available for non-quantified definite group nouns. Properties which apply exclusively to groups cannot apply to collections, and thus the collective interpretation of a group quantified expressions is not a possible argument for certain predicates. For example, (12a) is far better than (12b), since only committees (which are groups) can win the Best Committee Prize. (12a) allows the subject to refer to a group, but (12b) does not. In (12b), the presence of *all* blocks the group interpretation, and allows only the distributive and collective interpretations, analogously to the two readings of (1b). As evidence that *all of the committee* indeed can be interpreted as a collection, note the acceptability of (12c). Additionally, (12b) can in fact be acceptable if it is taken to mean that the members of the health committee won the prize as a collection, i.e., through collaborative effort. In such a case, this sentence doesn't say something about the health committee itself, but about its members.

- (12) a. The health committee won the Best Committee Prize for 2015.
 b. ? All of the health committee won the Best Committee Prize for 2015.
 c. All of the health committee met.

The distributive interpretation of group terms, the one demonstrated in (4), is not as easily accessible without overt marking. In the case of (4), the marking comes in the form of a pluralization of the predicate. In other cases, such as (1b), it comes in the form of a quantifier. Without overt marking, in the vast majority of the cases, the distributive reading is not available to group terms.

To conclude, we have seen that group nouns can sometimes have a distributive interpretation. Groups are composed of individual members, and in certain cases, the members of a group can be made salient and thus distributive predicates can apply to the group members. When group terms are quantified, the group members are often more salient, meaning that distributive interpretation is more easy to achieve. Additionally, predicates which are only defined for groups/collections (such as *be numerous*) can sometimes have a distributive interpretation with quantified group plurals (e.g. *all of the army*) but not with quantified plural individuals (e.g. *all of the boys*), since the atoms of a plural group term can have collective properties such as being numerous.

In Section V, I will attempt to model this property of group nouns using shifting operators which can shift them between their group and plural interpretations.

II.II Individual and Mass Quantified Expressions

In this section I point out that individual and mass quantified expressions denote collections of mass entities. In the same way that group entities are composed of individuals, individual and mass entities are composed of mass entities. I also argue that quantified individual terms are essentially different from definite ones, similarly to group terms. That is, *all of the N* is not codenotational with *the N*. As for groups, this stems from the fact that quantifiers over singular definites trigger a distribution effect. The difference is, however, that quantified group definites distribute into a set of individual members, while quantified individual definites distribute into a set of mass entities.

Individual and mass quantified expressions behave rather similarly. In both, the domain of quantification is a sum of mass entities. This was demonstrated in (3a) and (3c) above, repeated here as (13a) and (13b), respectively.

- (13) a. Dan ate all of the schnitzel.

- b. Some of the water is poisoned.

Individual and mass quantified terms exhibit the distributive subentailment effect that is observed for group quantified expressions. The domain of quantification being a mass entity, distributive subentailments apply to mass entities. Therefore distributive subentailment-triggering predicates must be applicable to mass entities in order to be felicitous. To exemplify, *smart* is a property of individuals. It is not defined for mass entities. In (14a), due to the presence of *all*, *smart* triggers distributive subentailments which apply to all the parts of the boy. Since the parts of the boy are mass sums, these distributive subentailments cause unacceptability. Hebrew (14b) is acceptable since the predicate doesn't trigger distributive subentailments despite the presence of *all*. This sentence can be interpreted as saying something about the sum of material parts of the schnitzel - that its price is 20 NIS.

- (14) a. * All of the boy is smart
- b. kol ha- $\widehat{\text{fnit}}\text{sel}$ be esrim jekel
 all the-schnitzel in 20 NIS
 'It is possible to get all of the schnitzel for 20 NIS'

It was pointed out by Seth Cable (p.c.) that the same effect is observable with mass quantified expressions. For example, note the contrast in 15. The source of the contrast is the difference between the predicates applied to the mass quantified expressions. It seems that *fill the glass*, but not *be drunk*, generates distributive subentailments in the presence of *all*. It can't be the case that every part of the water fills the glass, and therefore the distributive subentailments triggered are inherently false, since they apply to all the parts of the water. In the same way that a plurality is composed of atoms, a mass entity is composed of mass entities. The parts of *the water* are a set of material parts of the water. *All*-triggered distributive subentailments apply to all the material parts of the argument, and since there must be water parts that do not fill the glass, there's bound to be a false distributive subentailment. Thus, (15a) is inherently false, and hence its oddness.

- (15) a. * All of the water fills the glass.
- b. All of the water was drunk.

This pattern can help us uncover more of the nature of individual and mass quantified expressions. As it turns out, the domain of quantification in these expressions is not actually the set of parts of the quantified expression (e.g. *the water* in (15a)). The domain of quantification is more limited than the set of material parts of the quantified expression. One piece of evidence for this is that *all* does not apply distributive subentailments to all the material parts of the quantified expression - only to a subset of them.

For instance, notice that (16a) is not truth conditionally identical to (16b). Imagine a situation where someone poured poison into the river. The poison did not yet spread into all the waters in the river; only one section of the river is actually poisoned. In such a situation, (16b) is much more acceptable than (16a). (16a) is misleading and verges on an outright lie, since it strongly suggests that the water everywhere in the river is dangerous to drink.

- (16) a. Someone poisoned all of the river.
- b. Someone poisoned the river.

Since (16a) and (16b) are not truth conditionally identical, it means *all* contributes something to the meaning. Presumably, it contributes distributive subentailments that apply to everything in its domain of quantification. Relating this to the above statement that the domain of quantification is more limited than the set of material parts of the quantified expression, note that the distributive subentailments do not apply to all quantities of water inside the river. This shows that the domain of quantification is not the set of material parts of the river. If that were the case, (16a) would assert that every quantity of water is dangerous to drink. But (16a) is consistent with a situation where the water is poisonous only in quantities greater than, say, 1 water molecule. Quite possibly, the poison binds to aggregates of water molecules, and every single molecule does not contain poison. However, (16a) does assert that every *large enough* quantity of water is poisonous. Or in other words, every material part of the river is part of a *small enough* quantity of poisoned water.

My conclusion is that expressions like *all of the river* do not quantify over the entire set of material parts of the river. It quantifies over some cover of this set, in the sense of Schwarzschild (1996). That is, it quantifies over a set S of parts of the river such that every part of the river is part of some $s \in S$. In (16a), the predicate *was poisoned* applies to every element in that cover. This cover divides the river into quantities of water which are big enough to contain poison. Probably, (16a) entails that every quantity of water which is big enough to see with the naked eye contains poison. In such a case, the cover imposed on the material parts of the river would be the set of quantities of water big enough to see.

This is the source of the difference between individual and mass quantified expressions on the one hand and group quantified expressions on the other. The former distribute into mass portions, while the latter distribute into individuals. This leads to another difference - mass portions are formed from mass entities, and mass entities are cumulative. As a result, sums of mass portions can overlap each other, which is not the case for sums of individuals.

The robustness of this distinction can be demonstrated by the fact that when individual nouns are distributed into a sum of individuals rather than chunks, they behave like group quantified expressions. For instance, a pizza is naturally individuated into a set of slices. When a pizza is thought of as a sum of slices, rather than a sum of pizza-chunks, it distributes into individuals, not into chunks, since slices are individuals.

This is the reason why an individual quantified expressions like *most of the pizza* can count slices rather than measure pizza-stuff. Imagine a group of friends orders one pizza, and they want to divide the pizza between the boys and the girls. Since there are more girls than boys, the girls get most of the slices. (17) can be felicitously used to describe this situation. The friends measure pizza in slices, and therefore (17) asserts something about the number of slices the girls will eat, not about the weight of the pizza-stuff they will eat.

(17) The girls will eat most of the pizza.

III Hebrew Singular Partitives

As was shown in (1b), repeated below as (18a), Hebrew singular partitives do not always require an intermediate preposition such as English *of*. (18b) is another example of such a use. As can be seen, there is no syntactic difference between the plural and the singular partitive.

- (18) a. kol ha-tafrit be esrim jekel
 all the-menu in 20 NIS
 ‘Every item on the menu sells for 20 NIS.’
- b. rov ha-fulxan mexuse
 most the-table covered.3SG
 ‘Most of the table is covered.’
- c. dan mexabev et kol (*me-)ha-jeladim
 Dan like.3SG ACC all (of-)the-child.PL
 ‘Dan likes all of the children.’

In this section I provide some more data about the behavior of quantified terms in Hebrew, comparing plural, singular group and singular non-group terms. I present morphosyntactic restrictions and restrictions on counting, and finally counting and measuring. This collection of data will form the basis for the analysis in Section V.

III.I Intermediate Preposition

Hebrew does have a preposition which can be used similarly to English *of* - the prefix *me-*. Certain Hebrew quantifiers necessitate the presence of *me-* within partitives in the same manner that English partitives necessitate *of*, as exemplified in (19).

- (19) a. dan mexabev kama *(me-)ha-jeladim
 Dan like.3SG some *(of-)the-child.PL
 ‘Dan likes some of the children.’
- b. dan axial ktsat *(me-)ha-fnitsel
 Dan ate.3SG little *(of-)the-schnitzel
 ‘Dan ate little of the schnitzel.’
- c. dan axial reva *(me-)ha-fnitsel
 Dan ate.3SG quarter *(of-)the-schnitzel
 ‘Dan ate a quarter of the schnitzel.’

The fact that *me-* is not obligatory to form a partitive construction suggests that it has no contribution to meaning. This idea is supported by the apparent semantic vacuity of English *of* in partitives, a point which will be touched again in the analysis.

Interestingly, group quantified expressions can exhibit collectivity/distributivity ambiguity. For instance, (18a) can either mean that every item on the menu by itself costs 20 NIS, or it can mean that one can buy all the items on the menu put together for 20 NIS. This ambiguity is another point of similarity between group nouns and plurals, which is not (always) shared with individual nouns, as is evident in (20) - this sentence can only mean that the entire schnitzel costs 20 NIS, not that every part of the schnitzel costs 20 NIS (analogously to the distributive reading of (18a)).

- (20) kol ha-fnitsel ole 20 jekel
 all the-schnitzel cost.3SG 20 NIS
 ‘All of the schnitzel costs 20 NIS.’

Note that in certain contexts, the distributive-collective distinction does not exist. For instance, eating events are indifferent to which distribution takes place. For example, consider (21a). There is no sense in which this sentence is collective or distributive, since it is both collective and distributive, in a way. The predicate *be eaten* applies to all the dishes, and it also applies to each dish separately, and therefore the prerequisites for both distributivity and collectivity hold. Similarly, in (21b), the predicate applies to the entire schnitzel, so the sentence can be said to be collective, but it also applies to the elements of every partition of the schnitzel into proper parts, so the sentence is also distributive.

- (21) a. kol ha-manot neexlu
 all the-dishes were.eaten.3PL
 ‘All of the dishes was eaten.3PL’
- b. kol ha- $\widehat{\text{fnit}}\text{sel}$ neexal
 all the-schnitzel was.eaten.3SG
 ‘All of the schnitzel was eaten.’

III.II Numerical Quantifiers

In Hebrew, despite the striking similarity between group and pluralities when it comes to partitive constructions, group members cannot be counted as part of a partitive construction. Thus, (22a) is infelicitous, even though (22b) is acceptable. This shows that the availability of counting depends not only on conceptual criteria, but also on purely morphological features.

- (22) a. * dan hizmin et arba ha-tafrit
 Dan ordered.3SG ACC four the-menu
 Intended: ‘Dan ordered four dishes from the menu.’
- b. * dan hizmin et arba ha-manot
 Dan ordered.3SG ACC four the-dishes
 ‘Dan ordered the four dishes.’

Despite the above restriction, there is a class of numerical quantifiers which can participate in singular quantified expressions in Hebrew: fractions. This kind of quantification is unique in that it does not require the definite marker, even though it allows it, as is shown below. Moreover, regardless of whether the definite marker is present or not, the singular quantified expressions can be either definite or indefinite. That is, (23) below can be definite, or it can be indefinite, regardless of whether the definite marker is present or not.

- (23) dan axal reva (me-ha-) $\widehat{\text{fnit}}\text{sel}$ /tafrit
 Dan ate.3SG quarter (of-the-)schnitzel/menu
 ‘Dan ate a quarter of a/the schnitzel/menu.’

III.III Counting vs. Measuring

There is a class of quantifiers in Hebrew which are compatible both with counting and measuring interpretations, similarly to English *some* and *most*. The two uses are exemplified in (24) and (25) below. It is shown that they both can either count items (in a menu) or measure stuff. In (26)

the behavior of both quantifiers is demonstrated with plural partitives. The data in (26) show two important facts. First, it is shown that both *harbe* and *most* behave the same syntactically in plural and singular partitives. Second, it shows that both can count items. That is, like English *most*, they can either measure cardinality or mass degrees (volume, weight, etc.). Hebrew does not have a semantic distinction analogous to the distinction between *many* and *much*. Instead, there is only one quantifier, *harbe*, which can be assume the use of both *many* and *much*.

- (24) a. * dan hizmin harbe me-ha-tafrit
 Dan ordered.3SG much of-the-menu
 ‘Dan ordered much of the menu.’
 b. * dan axal harbe me-ha-šnitšel
 Dan ate.3SG much of-the-schnitzel
 ‘Dan ate much of the schnitzel.’
- (25) a. dan hizmin et rov ha-tafrit
 Dan ordered.3SG ACC most the-menu
 ‘Dan ate most of the menu.’
 b. dan axal et rov ha-šnitšel
 Dan ate.3SG ACC most the-schnitzel
 ‘Dan ate most of the schnitzel.’
- (26) a. dan hizmin harbe me-ha-manot
 Dan ordered.3SG many of-the-dishes
 ‘Dan ordered many of the dishes.’
 b. dan hizmin et rov ha-tafrit
 Dan ordered.3SG ACC most of-the-dishes
 ‘Dan ordered most of the dishes.’

IV Theoretical Background

In this section I provide the theoretical basis for the formal analysis of the data presented in the previous section, to be provided in Section V. In this paper I do not provide a comprehensive overview of relevant literature. However, I do present theoretical highlights which will be crucial for the analysis.

IV.I Boolean Semantics

I am working in a standard Boolean Semantics framework, based on Link (1983). The major distinction in this framework is between atomic and non-atomic individuals, both of type e , where sums are generated from atoms by the Boolean sum operator \sqcup . $a \sqcup b$ is the sum of two (atomic or non-atomic) individuals. The singular/plural distinction results from application of \sqcup : a singular predicate P denotes a set of atoms, and the plural predicate of Q is the closure under sum of some singular predicate P . By definition, for every two a, b of type D_e , $a, b \sqsubseteq a \sqcup b$. The partial order \sqsubseteq thus defines a Boolean algebra over every predicate. Link also makes use of \sqcap , the meet operator. $a \sqcap b$ is the \sqsubseteq -maximal c such that $c \sqsubseteq a$ and $c \sqsubseteq b$.

To exemplify, assume $[[the\ boys]] = a \sqcup b \sqcup c$. The corresponding structure is depicted in Figure 1, where a line from node x to node y represents $x \sqsubseteq y$. The predicate *boy* denotes the set $\{a, b, c\}$ (atomic boys), and the predicate *boys* denotes the set $\{a, b, c, a \sqcup b, b \sqcup c, a \sqcup c, a \sqcup b \sqcup c\}$.

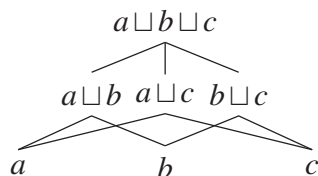


Figure 1: Boolean Structure

IV.II Sums and Groups

According to Landman (1989a,b), pluralized noun phrases are ambiguous between group and sum readings. Landman assumes type shifting principles in the manner developed in Partee and Rooth (1983), Partee (1986). Groups are atomic individuals which represent a sum. Sums are Boolean \sqcup -products of atomic individuals. He defines operators which shift between these two nominal interpretations. Plural definites, in their basic meaning, denote sums of atoms. For a plural definite $X = x_1 \sqcup \dots \sqcup x_n$, $\uparrow X$ is the group which corresponds to $\{x_1, \dots, x_n\}$. \downarrow is the inverse of \uparrow . Simply put, an unshifted plurality (a sum) represents the distributive reading, and the atoms created \uparrow represent the collective reading.

IV.III Group Nouns

The status of group nouns is debatable in this framework. On the one hand, such nouns are morphologically singular (both in Hebrew and English). On the other hand, they denote non-atomic individuals (i.e. groups). There have been several attempts to formalize the meaning of group nouns. According to Landman (1989a,b), group nouns behave like pluralities in that they are ambiguous between atomic and sum interpretations, and the two interpretations can be accessed through application of the shifting operators.

In the analysis of Barker (1992), group nouns are not different semantically from individual nouns, but he defines a function which maps every group to the set of its members. Using this function, he accounts for several phenomena which distinguish group nouns from individual nouns. Schwarzschild (1996) too, among others, offers an account in which group nouns, like individual nouns, denote atoms and are not translated into pluralities.

More recently, scholars such as Pearson (2011) and de Vries (2015) offer accounts of group nouns in which group nouns denote pluralities, and they can be ‘packaged’ into atoms by semantic shifts. Specifically, de Vries (2015) adopts Landman’s \uparrow operator, and uses it as a shifting operator which turns pluralities into atoms.

V Towards an Analysis

In this section, I propose what might be the first steps towards a formal analysis of the semantics of singular quantified expressions. Based on these ideas, I attempt to account for unique characteristics of Hebrew singular quantified expressions, and possibly explain why they behave differently from the English ones.

V.I The Nominal Domain

As described above, *kol* ‘all/every’ and *rov* ‘most’ do not allow the prefix *me-* (which functions like *of*), unlike their English counterparts, which require *of* in partitive constructions. Therefore, I opt for a semantics in which *me-* has no contribution to truth conditions in partitives.

As a first step, it is necessary to define sub-domains within the nominal domain D_e , such that each sub-domain corresponds to a particular kind of entities. For any domain D_X of atoms of sort X , $*D_X$, is the respective closure under sum, and it represents the set of plural individuals whose atoms are elements in D_X .

First, we have the mass domain D_M . This domain is the set of all stuff. To represent the way we conceptualize stuff, D_M is a non-atomic Boolean algebra. Thus, every $m \in D_M$ is a sum of an infinite set of other elements in D_M . The reason is of course that every chunk of stuff is built up from other chunks of stuff, ad infinitum.

We also have the domain of individuals D_I . The elements of D_I are entities which are associated with some sum of material parts, but are not themselves identical to this sum. The relation which associates an individual with its sum of parts is the ‘bulk of’ relation: the bulk of x is exactly the mass entity which forms the sum of mass entities associated with x . The function which maps individuals to the sum of their constituting parts has been defined for example in Link (1983) and Landman (2011).

Groups relate to individuals in the same way that individuals relate to stuff - they are entities which are associated with a sum of individual atoms. The difference of course is that atomic predicates that apply to groups not always apply to individuals and vice versa. A simple example is a predicate like *meet*, which can apply to groups but not to individuals. Therefore, D_G , the domain of groups, is the set of all groups, where every group is associated with a sum of individuals in the same way that every individual is associated with a mass sum.

It follows that for our purposes, $D_e = D_M \cup D_I \cup D_G$. At this point we can redefine Landman’s \downarrow operator so that it is sensitive to this partition of the domain of entities:

- If $x \in *D_e$ (if x is a sum), then $\downarrow(x) = x$
- (\Rightarrow) If x is mass, then $\downarrow(x) = x$
- If $x \in D_I$, then $\downarrow(x) = m_x$, the mass entity which corresponds to the sum of the parts of x
- If $x \in D_G$, then $\downarrow(x) = s_x$, the sum of the members of x

We will also need the σ operator. σ is the formal representation of the definite marker, as in Sharvy (1980): $\sigma(P) = \sqcup P$ iff $\sqcup P \in P$, \perp otherwise. Thus, if P is a plurality, $\sigma(P)$ is always defined. Else, $\sigma(P)$ is defined iff $|P| = 1$. This represents the intuition that *the P* is defined iff P is a set which contains only one element in the context.

V.II Measure Quantifiers

Kol ‘all’ and *rov* ‘most’ are two interesting quantifiers because they both share the property that they do not allow any preposition when they form partitive constructions. It was exemplified in (18a) and (18b), respectively, repeated below. *Kol* also has a Generalized Quantifier (Barwise and Cooper (1981)) interpretation which is seemingly identical to that of *every*, but this interpretation is of no relevance to the current work.

- (27) a. kol ha-tafrit be esrim fekel
all the-menu in 20 NIS
‘Every item on the menu sells for 20 NIS.’
- b. rov ha-fulxan mexuse
most the-table covered.3SG
‘Most of the table is covered.’

There are also quantifiers which require the preposition *me-* ‘of’ in singular but not in plural partitives, as is demonstrated below, one of which is *harbe* ‘many/much’, discussed in (24)–(26) above, and its counterpart *meat* ‘few/little’. This provides further motivation for an analysis of partitives in which *me-* plays no semantic role.

- (28) a. *dan hizmin harbe/meat me-ha-tafrit
Dan ordered.3SG much/little of-the-menu
‘Dan ordered much/little of the menu.’
- b. *harbe/meat me-ha-manot nimkeru
many/few of-the-dishes were.sold.3pl
‘Many/few of the dishes were sold.’

To analyze these quantifiers’ use in partitive constructions, I define a novel class of quantifiers which I name Measure Quantifiers (MQs). Formally, these quantifiers are of the form:

$$\lambda x. \lambda P. \theta(\downarrow x, \sqcup P)$$

where θ is a binary relation between sums. θ functions similarly to the relations between sets established by Generalized Quantifiers, except it operates over sums. In order to compare sums, θ may make use of measure functions, marked μ , which can measure cardinality (in other words, do counting), or it can measure stuff in terms of volume, weight, etc’, as in Schwarzschild (2002) and Solt (2014), among many others. Measure functions apply to a sum S and return the degree of S on its measure scale.

I provide lexical entries for *kol* ‘all’, *rov* ‘most’, *harbe* ‘much/many’ and *meat* ‘little/few’ to this schema. d_h is a contextually dependent degree which represents the contextual standard for *harbe*. d_m represents the contextual standard for *meat*.

$$(29) \quad \llbracket \text{kol} \rrbracket = \lambda x. \lambda P. \downarrow x \sqcap (\sqcup P) = \downarrow x$$

$$(30) \quad \llbracket \text{rov} \rrbracket = \lambda x. \lambda Q. \mu(\downarrow x \sqcap (\sqcup P)) = \frac{\mu(\downarrow x)}{2}$$

$$(31) \quad \llbracket \text{harbe} \rrbracket = \lambda x. \lambda Q. \mu(\downarrow x \sqcap (\sqcup P)) \geq d_h$$

$$(32) \quad \llbracket \text{meat} \rrbracket = \lambda x. \lambda Q. \mu(\downarrow x \sqcap (\sqcup P)) \leq d_m$$

Note that in the case of *kol*, there is no need to make use of a measure function, since if two sums are equal, then their measures are also equal on any measure scale.

These entries do not depend on an intermediate preposition. That is, they are indifferent to whether or not the preposition *me-* 'of' is present. Therefore, partitive *me-* in Hebrew should be semantically vacuous, similarly to English *is* in sentences like *John is a fireman*. The motivation for this is the fact, discussed above, that *me-* does not seem to have any contribution to meaning. This is a point of difference from Ladusaw (1982)'s influential approach to English partitives (developed also by Barker (1998)), in which partitive *of* plays a crucial role in the semantics.

I now exemplify these lexical entries by deriving the truth conditions of (27a), (27b) and (a version of) (28b). These three sentences were chosen because they show the three most crucial cases: group quantified expressions, individual quantified expressions and plural partitive, respectively. This shows how the lexical entries defined above can be used to represent all kinds of partitive constructions uniformly, which is a desirable result.

$$\begin{aligned}
 (33) \quad & \llbracket \text{kol ha-tafrit be-esrim fekel} \rrbracket = \\
 & \llbracket \text{kol} \rrbracket (\llbracket \text{ha-tafrit} \rrbracket) (\llbracket \text{be-esrim fekel} \rrbracket) = \\
 & [\lambda x. \lambda P. \downarrow x \sqcap \sqcup P = \downarrow x] (\sigma(\text{Menu})(\text{Cost}.20.\text{NIS})) = \\
 & \downarrow \sigma \text{Menu} \sqcap \sqcup \text{Cost}.20.\text{NIS} = \downarrow \sigma \text{Menu} = \\
 & s_{\sigma \text{Menu}} \sqcap \sqcup \text{Cost}.20.\text{NIS} = s_{\sigma \text{Menu}}
 \end{aligned}$$

$s_{\sigma \text{Menu}}$ is the sum of members of the menu-group, that is, the sum of the items which are on the menu. This formula says that the meet of the sum of items on the menu and the sum of things which cost 20 NIS equals the sum of items on the menu. Mathematically this means that the sum of items on the menu is a sub-sum of the sum of things which cost 20 NIS, and in prose it means that every item on the menu costs 20 NIS, which is the desired truth conditions of (18a).

$$\begin{aligned}
 (34) \quad & \llbracket \text{rov ha-fulxan mexuse} \rrbracket = \\
 & \llbracket \text{rov} \rrbracket (\llbracket \text{ha-fulxan} \rrbracket) (\llbracket \text{mexuse} \rrbracket) = \\
 & [\lambda x. \lambda Q. \mu(\downarrow x \sqcap (\sqcup P)) = \frac{\mu(x)}{2}] (\sigma(\text{Table})) (\text{Covered}) = \\
 & \mu(\downarrow \sigma(\text{Table}) \sqcap (\sqcup \text{Covered})) = \frac{\mu(\sigma(\text{Table}))}{2} = \\
 & \mu(m_{\sigma(\text{Table})} \sqcap (\sqcup \text{Covered})) = \frac{\mu(m_{\sigma(\text{Table})})}{2}
 \end{aligned}$$

$m_{\sigma \text{Table}}$ is the sum of stuff which comprises the table. μ is some conceptually plausible mass measure function. In this case, the measure scale which makes the most sense is surface area (two-dimensional volume), since the quantified term measures unoccupied space on top of the table.

This formula says that the meet of the sum table-stuff and the sum of covered things equals the sum of items on the menu. Mathematically this means that the the mass entity which represents the covered portion of the table comprises more than half of the mass entity which represents the surface area of the table. In prose it means that most of the surface area of the table is covered, which is the desired truth conditions of (18b).

Recall that *me-* is semantically vacuous, and therefore *me-ha-manot* means *ha-manot* in partitives. Since $\sigma(*\text{Dish})$ is a plurality, it is unaffected by the application of \downarrow by definition. The measure function μ in this case is the counting function since when combined with plurals, *harbe* is translated as *many*, and therefore it must apply a count measure function.

$$\begin{aligned}
 (35) \quad & \llbracket \text{harbe me-ha-manot nimkeru} \rrbracket = \\
 & \llbracket \text{harbe} \rrbracket (\llbracket \text{me-ha-manot} \rrbracket) (\llbracket \text{nimkeru} \rrbracket) =
 \end{aligned}$$

$$\begin{aligned}
& [\lambda x. \lambda Q. \mu(\downarrow x \sqcap (\sqcup P)) \geq d_h](\sigma(*Dish))(Were.Sold) = \\
& \mu(\downarrow \sigma(*Dish) \sqcap (\sqcup Were.Sold)) \geq d_h = \\
& \mu(\sqcup(*Dish) \sqcap (\sqcup Were.Sold)) \geq d_h
\end{aligned}$$

This formula means that the measure of the meet of the sum of dishes and the sum of things that were sold is greater or equal to d_h , the degree that represents the threshold for *harbe*. Since the relevant measure function is the counting function, due to the plurality of the noun, the formula means in prose that the number of dishes that were sold is large enough to be considered many.

VI Conclusions

In this paper I presented some novel observations about the behaviour of singular quantified terms. I started with facts about English and later focused on Hebrew. The situation in Hebrew is remarkable since in some cases there is no overt syntactic difference between singular and plural quantified terms.

Singular group nouns behave differently from individual nouns in singular quantified terms: when quantifying over a group noun, the domain of quantification is the set of group members; when quantifying over an individual noun, the domain of quantification is the stuff comprising an individual. Despite this difference, it is usually not acceptable to combine singular group nouns with numerical quantifiers. That is, even though the domain of quantification is a discrete set, counting is not acceptable.

I proposed a semantic scheme for Hebrew quantifiers which respects the syntactic and truth-conditional observations. I provided formal derivations which show that these schemes provide us with a uniform treatment of individual, group, and plural quantified terms.

There is still much work to be done in this area. One direction for further research is extending the analysis to more quantifiers and generalizing it so that the semantics is language-independent. Additionally, one big issue that remains is the difference between group nouns and plurals when it comes to counting. As was demonstrated in (22a), group quantified expressions cannot be counted in Hebrew (and in most dialects of English), but if their denotation can be identical to a plurality, then one should expect them to be countable. Therefore, one important desiderata from a theory of group nouns would be a formal account which distinguishes between groups and pluralities while maintaining the similarities between them.

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