SQUIB

Context updates are hierarchical

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This squib studies the order in which elements are added to the shared context of interlocutors in a conversation. It focuses on context updates within one hierarchical structure and argues that structurally higher elements are entered into the context before lower elements, even if the structurally higher elements are pronounced after the lower elements. The crucial data are drawn from a comparison of relative clauses in two head-initial languages, English and Icelandic, and two head-final languages, Korean and Japanese. The findings have consequences for any theory of a dynamic semantics.

1 Introduction

This squib examines pragmatic effects where it matters what was said first. The point to be made is simple; when two elements are entered into the Common Ground (Stalnaker 2002) and they are both part of the same hierarchical structure, the structurally higher element is entered first and not necessarily the one which was pronounced first. The proposed generalization is supported by cross-linguistic facts and it has consequences for the implementation of any theory of a dynamic semantics.

The empirical phenomenon to be studied is redundancy effects in natural language. Consider the following pair of sentences.

(1) a. John met a professor who is a woman and a widow.
     b. #John met a professor who is a widow and a woman.

The examples express the same truth conditional content using the same words and they are both syntactically well formed. They are interesting because they nevertheless differ sharply in their naturalness. The first one is normal English but the second one invokes a strong reaction of redundancy. Redundancy effects are appropriate for studying the order in which elements are entered into the Common Ground because speakers have clear intuitions about them and they are easily interpretable. For example, when we have made it clear that someone is a widow, we already know that she is a woman and therefore it is redundant at that point to state again that she is a woman.

There are two issues which obscure the generalization under discussion in the examples above. First, the hierarchical structure of a conjunction is controversial.[1] Second,

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[1] This is reflected in early approaches like Chomsky (1957: 36) where a symmetric structure was assumed for conjunction. Later work generally assumes an asymmetric structure in which one conjunct is higher in the structure than the other (Munn 1993; Johannessen 1993; 1998; Kayne 1994). However, as Carston & Blackmore (2005: 354) note, "despite the dominance of asymmetry in structural analyses, there remains a strong pretheoretic intuition that coordinate structures are in some important sense symmetric (the conjoined constituents have the same or equal status), at least when considered alongside standard cases of subordination (where the conjoined constituents plainly differ in status)". Therefore, it will be assumed here that coordinate structures are not the right starting point when we would like to be sure about hierarchical structure.

in a head-initial language like English, it does not matter whether we say that *widow* is structurally higher or pronounced first, the result is the same. To ameliorate the situation we will analyze relative clauses rather than conjunction structures and bring to the table facts from two head-final languages, Korean and Japanese. The paper is organized as follows. Section 2 introduces the notion of context update and relates it to the notion of redundancy. Section 3 shows that context updates are determined by hierarchy rather than linear order. Section 4 argues that the effects of the previous section cannot be explained in terms of a constraint on uninformative modification. Section 5 discusses the implications of the findings for dynamic theories of semantics. Section 6 concludes.

2 Updating the context

The interlocutors in a conversation must maintain some shared understanding of the context and the context can be updated dynamically to reflect what has been said. We will follow Stalnaker (2002) in referring to the context as the Common Ground without committing to a particular implementation. We can view it as a fact about the Common Ground that the following example is infelicitous.

(2)   (Context: Out of the blue in a bookstore. No book has been mentioned.)
        #The book was expensive.

Definite articles can be licensed by uniqueness or by an anaphoric link to an established discourse referent (Schwarz 2009; 2013).[2] In this case, uttering *the book* is odd out of the blue because this noun phrase does not denote uniquely in the context of a bookstore and there is no previous mention of a book to refer back to. The example becomes felicitous if it is preceded by some mention of a book.

(3)   (Previous discourse: Mary bought a book and a magazine.)
        The book was expensive.

In the file change semantics of Heim (1983), the explanation comes from the types of updates that indefinites and definites impose on the context. An indefinite adds a new discourse referent and a definite updates an already added referent. It is therefore acceptable to say *the book* when a previous utterance has introduced *a book.*

Returning to the words *widow* and *woman,* we can observe how they behave in terms of updating the Common Ground by looking at similar examples.

(4)   a.   (Previous discourse: John met a widow and her son at the store.)
              The woman was wearing a black dress.
        b.   (Previous discourse: John met a man and a woman at the store.)
              #The widow was wearing a black dress.

It is felicitous to use a more general definite description like *the woman* to refer back to a specific one like *a widow* but not vice versa.[3] The examples demonstrate that *widow* enters

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[2] The study of the meaning of the definite article has a long history. One approach holds that definite articles express uniqueness (Frege 1892; Russel 1905; Strawson 1950) whereas another, going back to Christophersen (1939), states that definite articles express anaphoricity (or familiarity) (Kamp 1981; Heim 1982). The view by Schwarz that there are two distinct definite articles, one for uniqueness and one for anaphoricity, has gained support in some recent studies, including Simonenko (2013); Arkoh & Matthewson (2013); Irani (2015); Jenks (2015); Sereikaite (2015); Goodwin Davies (2016); Ingason (2016a; b); Irani & Swhwartz (2016).

[3] An anonymous reviewer points out that examples of type (4b) are usually not judged completely bad because of the possibility of accommodation. Such an example is, however, judged infelicitous unless some contextual accommodation is made.

the information 'woman' into the Common Ground about its referent but *woman* does of course not enter the information 'widow' about anyone.

3 Hierarchy rather than linear order

The redundancy effect which we observed in the introduction is also found in examples like (5) and the parallel Icelandic example in (6) which is included in order to demonstrate the effect for more than one head-initial language.[4]

(5)   a.   John met [a woman [who is a widow]].
       b.   #John met [a widow [who is a woman]].

(6)   a.   Jón   hitti   [konu   [sem er ekkja]].
             John   met   [woman   [that is widow]]
             'John met a woman who is a widow.'
       b. #Jón   hitti   [ekkju   [sem er kona]].
             John   met   [widow   [that is woman]]
             'John met a widow who is a woman.'

It is reasonable to believe that the head noun is higher in the structure than the relative clause, at least if we exclude nonrestrictive uses with an appositive comma intonation (Partee 1975; Wiltschko 2012; 2013). The examples are consistent with the view that the structurally higher element is entered first into the Common Ground. However, because English and Icelandic are head-initial languages, the examples are also compatible with the view that the word which is uttered first is entered first into the Common Ground for the purpose of redundancy effects.

Hierarchical status can be distinguished from linear precedence by inspecting parallel examples in head-final languages. In a head-final relative clause the head noun which is higher in the structure is uttered after the relative clause which modifies it.[5] The following examples show that in Korean (7) and Japanese (8), the redundancy effect is of the same type as in English and Icelandic and it is determined by hierarchy and not by linear order.

(7)   a.   Mary-nun   [[acessi-in]   sengin   namca-lul]   mannassta.
             Mary-TOP   [[mister-ADN] adult   male-ACC]   met.
             'Mary met an adult male who is a mister/uncle'
       b. #Mary-nun   [[sengin   namjcaa-in]   acessi-lul]   mannassta.
             Mary-TOP   [[adult   male-ADN]   mister-ACC]   met.
             'Mary met a mister/uncle who is an adult male'

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[4] An anonymous reviewer brings up the issue of whether the fact that the person in question is a woman can only come from the lexical meaning of 'woman' (and 'widow') and not from some other grammatical information, such as grammatical gender. While Icelandic has gender features which are morphologically realized and may in some cases be interpretable in the sense of Kramer (2009; 2014; 2015), these features only influence the inflection of the relevant nouns here and they do not trigger any kind of agreement in the examples under discussion. Therefore, I do not believe grammatical gender affects the argument in any way.

[5] This is uncontroversial. The relevant hierarchical facts are independently shown by the Korean reflexive *caci-casin* when it is bound by the head noun of a relative clause. Parallel examples can be constructed for Japanese.

(i)   Mary-nun   [[caki-casin-ul   coaha-nun] namca-lul]   mannassta.
       Mary-TOP   [[caki-casin-ACC   like-ADN]   man-ACC]   met.
       'Mary met a man$_i$ who likes himself$_{i/*j}$.'

(ii)   Mary-nun   [[ku-lul   coaha-nun]   namca-lul]   mannassta.
       Mary-TOP   [[he-ACC   like-ADN]   man-ACC]   met.
       'Mary met a man$_i$ who likes him$_{*i/j}$.'

(8)   a.   Taro-ga   [[yamome-dearu]   zyosei-ni]   atta.
             Taro-Nom   [[widow-COP]   woman-DAT]   met
             'Taro met a woman who is a widow.'
       b.   #Taro-ga   [[zyosei-dearu]   yamome-ni]   atta.
             Taro-Nom   [[woman-COP]   widow-DAT]   met
             'Taro met a widow who is a woman.'

The Korean examples involve the pair *ajeossi,* a respectable title for a 'mister, uncle' and an expression for 'adult male'. The sociolinguistic nuances of the expressions are not important here but the set denoted by *ajeossi* is crucially a subset of 'adult male' and the pair of expressions is appropriate for testing redundancy effects in Korean. The (b) examples show that it is redundant to add the information of the superset expression in a relative clause, even if this clause is pronounced first. Thus, the head-final data support the view that context updates are hierarchical.

4 Subset modification is not the issue

One alternative interpretation of the above data is that there is an independent constraint against modifiers which denote a superset of the element which they modify. If that were the case, the infelicitous examples might be odd because of that constraint rather than a redundancy effect that is attributable to the order in which elements are added to the Common Ground. This alternative can be ruled out on the basis of examples in which the relative clause has been supplemented with intersective material like the following English and Icelandic examples demonstrate.

(9)   a.   John met [a woman [who is a teacher and a widow]].
       b.   #John met [a widow [who is a teacher and a woman]].

(10)   a.   Jón   hitti   [konu   [sem er málfræðingur   og   ekkja]].
             John   met   [woman   [that is linguist   and   widow]]
             'John met a woman who is a linguist and a widow.'
       b.   #Jón   hitti   [ekkju   [sem er málfræðingur   og   kona]].
             John   met   [widow   [that is linguist   and   woman]]
             'John met a widow who is a linguist and a woman."

The examples show that the redundancy effect associated with 'woman' in the (b) examples is not avoided by making sure that the head noun does not denote a proper subset of the modifier. Note that the infelicity of the (b) examples here does not simply result from some peculiarity of coordinate syntax within the relative clause. The same contrast is attested if the same information is expressed in one noun phrase using an adjective, as the following examples demonstrate.

(11)   a.   John met [a woman [who is a widowed teacher]].
       b.   #John met [a widow [who is a female teacher]].

Because the crucial evidence for the main hypothesis of the paper comes from head-final languages, it is important to confirm that Korean (12) and Japanese (13) behave the same with respect to modification. This is borne out.

(12)   a.   Mary-nun [[acessi-iko   enehakca-in] sengin   namca-lul]   mannassta.
             Mary-TOP [[mister-and linguist-ADN]adult   male-ACC]   met
             'Mary met an adult male who is a mister and a linguist.'
       b.   #Mary-nun [[sengin   namca-iko   enehakca-in] acessi-lul]   mannassta
             Mary-TOP [[adult   male-and   linguist-ADN] mister-ACC] met
             'Mary met a mister/uncle who is an adult male and a linguist.'

(13)   a.   Taro-ga   [[yamome-de   gengogakusha-dearu]   zyosei-ni]   atta.
            Taro-NOM   [[widow-and   linguist-COP]   woman-DAT]   met
            'Taro met a woman who is a widow and a linguist.'
       b.   #Taro-ga   [[zyosei-de   gengogakusha-dearu]   yamome-ni]   atta.
            Taro-NOM   [[woman-and linguist-COP]   widow-DAT]   met
            'Taro met a widow who is a woman and a linguist.'

The set of examples in this section shows that the issue which invokes a feeling of redundancy for speakers is not simply a matter of some constraint against modifiers which are uninformative. Rather, speakers experience redundancy when an element like 'woman' is to be added to the description of an individual in the context but a structurally higher element like 'widow' has already stated that this is the case.

5 Implications for dynamic theories

The findings speak in favor of approaches to incremental interpretation which proceed top-down rather than from left to right. It is beyond the scope of a squib to develop a full theory of the update mechanics but we can hypothesize that the general shape of a proper theory should be along the lines of the incremental evaluation in Schlenker's (2005) analysis of *Minimize Restrictors!* Schlenker focuses on a semantic approach to Condition C effects in which the repetition of a salient and structurally higher discourse referent triggers a type of a reduncancy effect if a proper noun is used instead of a pronoun:

> Each time a pronoun or an R-expression which denotes d is processed in a context c, its sister is evaluated with respect to $c^\wedge d$, which is the context c to which d has been added. In other words, processing an R-expression has the effect of making it 'super-salient' for the expressions that are contained within its sister.

It is a non-trivial task to generalize such a theory to account for all update orderings. However, the general intuition behind such a top-down approach seems to be on the right track according to the present findings.[6]

   Our results are interesting because it is a common point of view in dynamic approaches to meaning that temporal left-right asymmetries are crucial for sentence processing. For example, in Chemla & Schlenker (2012), the literature on dynamic aspects of presupposition projection is discussed as the task of accounting for the left-right asymmetry which results from the fact that utterances "unfold in time".[7] Their example of a conjunction structure has a similar redundancy flavor as the core data in the present study.

(14)   a.   Moldova is a monarchy and the king of Moldova is powerful.
       b.   #The king of Moldova is powerful and Moldova is a monarchy

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[6] An anonymous reviewer brings up examples of the following type.

   (i)   [[zyosei-dearu]   kyooshi]-wa   yamome   datta
         woman-COP   teacher-TOP   widow   COP
         'The teacher who is a woman was a widow.'

   (ii) #[[yamome-dearu]   kyooshi]-wa   zyosei   datta
         widow-COP   teacher-TOP   woman   COP
         'The teacher who is a widow was a woman.'

Here there is a question how a hiererchical update procedure should evaluate the sentence. This kind of an example seems to support an analysis along the lines of Schlenker, i.e., that 'the teacher who is a woman' in (i) and 'the teacher who is a widow' (ii) are R-expressions and their sisters are evaluated with respect to a context to which the denotations of these R-expressions have been added.

[7] Advances on this topic include Stalnaker (1974); Heim (1983); Schlenker (2008; 2009); Fox (2008); Rothschild (2008); Chemla (2009).

Here, the definite description *the king of Moldova* triggers the presupposition that Moldova has a king and in general, "a presupposition triggered by an expression E must be entailed by what is usually called the 'local context' of E", i.e., by information that comes before E in the sentence or discourse (Chemla & Schlenker 2012: 178). The present study raises issues about what it means for an expression to be there first. In particular, it suggests that top-down order is more important than left-right order, at least for certain purposes. If we take it for granted that at least some of the current work assumes that context updates proceed from left to right, then the same work straightforwardly makes the wrong predictions about head-final languages like Korean and Japanese in our examples above. This is important because some current work even places a special emphasis on the role of linear precedence over hierarchical structure in the processing of sentences (e.g., Bruening 2014).

Once we move on from basic data and into more fine-grained processing issues, experimental approaches are necessary in addition to eliciting judgments from native speakers. This is evidenced from the wealth of knowledge that is accumulating from experimental approaches to presuppositions (see especially Schwarz 2015). Our findings suggest that there is an important role to be filled by future experiments which systematically contrast the update mechanism in head-inital and head-final languages in the spirit of the current methodology.

6 Conclusion

This squib provides evidence in favor of the view that context updates in natural language are hierarchical. The crucial evidence comes from redundancy effects in relative clauses in head-final languages like Korean and Japanese. In such languages, the structurally higher element is added to the context before lower elements which are pronounced first.

Relative clauses were chosen as the core data in order to control the relevant hierarchical relationships with some confidence. We noted at the outset that coordinate structures are not the best starting point for an investigation such as this one because their hierarchical structure is known to be controversial. However, now that we have established the basic redundancy facts as they are attested in relative clauses, the fact that we also find similar kinds of redundancy effects in coordinate structures speaks, of course, in favor of asymmetric approaches to coordination.

It remains to be seen whether the effects described apply to all context updates within a hierarchical structure and not just redundancy effects. However, any theorist who aims to implement a precise theory of a dynamic semantics needs to be able to account for the order of context updates which is revealed by the empirical facts discussed here.

Abbreviations
ACC = accusative; ADN = adnominal; COP = copula; DAT = dative; TOP = topic

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Competing interests

The author declares that he has no competing interests.

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