Lexical entry format and contextual information

Joaquín Garrido

Abstract

In order to establish the appropriate format for lexical entries which could be used in the modeling of discourse understanding, a characterization of some discourse inference process in undertaken here in a conversational setting first, and it is then extended to the interpretation of lexical meaning. On the basis of an example of a Spanish verb meaning, a tentative format for lexical entries is sketched which allows for connections of lexical meanings with world knowledge, providing access to the necessary contextual information.

1. Lexical meaning and world knowledge in lexical entries

A traditional problem in lexicographic definitions is the distinction between lexically encoded information and encyclopaedic knowledge of the world. In the case of a discourse dictionary for computerized text interpretation, lexical entries must make inferences possible, the same way that the mental lexicon of a speaker enables him or her to make the necessary inferences in order to understand a given text. The question then is to decide what encyclopaedic information should be included (or excluded) in the entries, and to determine the relationship between this kind of information and what is traditionally acknowledged to be lexical meaning. Such lexical entries could then be used in the modeling of the inference processes that take place in discourse understanding.

In order to establish the format of lexical entries for this purpose, a characterization of some inference processes that take place in discourse understanding will be undertaken here in a conversational setting first, and then extended to the interpretation of lexical meaning in general (sections 2 and 3; for a previous version, see Garrido, 1989a). In section 4 a tentative format for lexical entries will be sketched which allows for connections with world knowledge.

2. Inferences in text interpretation

2.1. Relevance

One well-known way of approaching the inference processes that take place in linguistic communiction is to explain them by means of Grice's cooperation principle (Grice, 1975). Let us examine the following piece of conversation:

(1)　(a) Mary: I'd like to have a pizza for dinner tonight.
　　　 (b) Peter: I'm so tired.

Mary interprets Peter's utterance by assuming that it is relevant (and thus follows Grice's maxim of relation); the idea expressed in (1c) makes it relevant, by letting Mary infer (1d):

(1) (c) Being tired one cannot make or get a pizza.
     (d) Peter is not going to make or get a pizza.

Sperber and Wilson (1986, section 3.3) consider relevance as the main factor involved in interpretation (and not just one of them, as Grice does). Dealing with a similar example, they argue that the individual selects the context —in our example, (1c)— among the assumptions about reality available for him ('manifest' to him), trying to maximize the relevance of the utterance he is interpreting. The relevance of an utterance in a context is directly proportional to the contextual effects it has, that is, to the inferences that can be made, and inversely proportional to the processing effort it requires (see also Wilson and Sperber, 1988: section 3). Every speaker communicates his presumption of optimal relevance (i.e., the presumption that what is communicated is worth the interpretation effort for the hearer, and that the utterance produced is the most relevant one; see Sperber and Wilson, 1986: section 3.7).

The problem that remains to be explained is how it is that the hearer selects the context intended by the speaker, and not any other. For Sperber and Wilson, the fact that speaker and hearer are behaving rationally warrants the optimal relevance of both the utterance and the interpretation (and therefore the selection of the appropriate context). Any rational speaker, they argue, will expect a first interpretation which will be the most relevant one just by being the first one obtained (without having to access other contexts).

2.2. Interpretation and context

The principle of relevance warrants not just any deduction, but a particular one intended by the speaker, or, better, a deduction that follows automatically from the hearer's context, if the utterance is relevant. Sperber and Wilson (1986: sec. 3.3, p. 133) write: 'We can reasonably assume that in a situation where Peter's remark was relevant, it would have implicated something like [...]'. So relevance here is just appropriateness, felicity. The important thing is 'reasonably assume': the context that makes the utterance relevant must be available for the hearer.

Instead of the analysis of the expectative of relevance just outlined, rational communicative (linguistic) behaviour can be taken to be:

(2) (a) The calculation by the speaker of the information available to the hearer;
     (b) The construction of the utterance so that its interpretation fits in the information calculated in (a).

This amounts to the design of an optimal context (or set of contexts) for the utterance.

In hearer does not choose the most appropriate context because it is the one that requires the least processing effort; he is forced (or, in a weaker version, helped) to

use it by the utterance itself. The utterance is so constructed that it requires the use of a certain contextual information, and its processing gives access to it. In order to fully interpret the utterance, that is, to fit its interpretation somewhere in his general representation of reality, the hearer must access certain contextual information available to him, i.e., he must use a given context (or a given subset of several different contexts).

Let us define C_0, U, P, C_1 and Q in our previous example (1):

(3) C_0: proposition obtained from (1a).
        U: speaker's utterance, (1b).
        P: proposition obtained from (1b).
        C_1: proposition that relates P to C_0, thus making P relevant; proposition represented by (1c).
        Q: inference from C_0 & P & C_1; interpretation of (1b); proposition represented by (1d).

In example (1), the speaker, Peter, wants to convey to the hearer, Mary, that, even if Mary would like a pizza for dinner —proposition obtained from (1a)—, he is tired —(1b)—, and, because being tired one is not in a position to get or make a pizza —(1c)—, his answer to (1a) is no —(1d). Generally speaking, the speaker wants to communicate P and Q to the hearer, given C_0; he knows that the hearer knows C_1, and he makes C_1 available for him by means of forcing him to relate P to C_0. He thus conveys both P and Q by uttering only U, i.e. the linguistic representation of P:

(4)   P   = information encoded into the utterance U.
        C_0 = explicit (because previously processed or perceptually available) contextual information (shared by speaker and hearer, available in the working memory of both, if the speaker is right).
        C_1 = information retrieved from permanent (encyclopaedic) memory.
        Q = such that $P \\& C_0 \\& C_1 \rightarrow Q$

The principle of relevance is then reformulated as follows:

(5)   The speaker's utterance is relevant because:
(a) the intended full interpretation of the utterance (P & Q) in the communicative act is guaranteed in so far as the availability of the necessary context (C_1) for the hearer is guaranteed;
(b) the utterance is the most effective one in that it conveys the intended interpretation with a minimal processing effort (its context (C_1) is the most accessible one for the hearer from the utterance, and the utterance linguistically represents everything that cannot be obtained from the combination of the utterance's interpretation with the context).

Let us suppose that speaker and hearer obtain different interpretations, by drawing different conclusions Q_S and Q_H:

(6) Q_S = deduction calculated, intended by the speaker.
   Q_H = deduction attained to by the hearer.

Communication succeeds if $Q_S = Q_H = Q$; it doesn't if there is more than one Q or if $Q_H \neq Q_S$ (that is, conditions (7a) or (7b) are not met):

(7) Conditions for successful communication:
   (a) There is only one C_1 to relate P and C_0.
   (b) There is only one Q to P & C_0 & C_1.
   (c) P is enough to get C_1 given C_0.
   (d) All of P is necessary to get C_1 given C_0.

Note that in (7b), with a different C_0 or C_1, there will be other Q's.
   Conditions (7c) and (7d) amount to the principle of relevance (5) as reformulated above.

3. Meanings as nets

A precious repository of information in order to gain access to the appropriate context is the information stored in the lexical entries used in the utterance. In our previous example, the lexical entry for 'tired' must give access to the information that being tired one is generally not in a position to wish to do things, so that the necessary context C_1 (1c), is accessed. Generally speaking, entries have either to be available so that they render the necessary information, or they have to be reanalyzed in order to give it. The procedure to carry out the reanalysis is a search for coherence: the hearer tries to make sense of everything he finds in the text, and, when something apparently does not make sense on the first impression, it must be reconsidered until it does make sense. (The problem for the speaker is to decide what he can leave to be inferred without making his text incoherent.) It is a maximization procedure (Goguen, 1975: section 2): for each lexical meaning (defined in terms of fuzzy representations) the hearer chooses the interpretation that maximizes the overall sense of the utterance. In this process, the appropriate context is constructed or selected; the maximization of sense is measured on terms of relevance as defined above.
   The processing of a given lexical item thus requires a hypothesis about the higher-level units where the item fits, up to the text unit, and even higher up, until the text information is integrated into wider information units stored in the hearer's memory (scripts, frames). From the processing point of view, every lexical entry can be taken to be a net that requires parallel processing (cf. Rumelhart and McClelland, 1986), where different components (nodes) in the net place mutual restrictions on each other. Every (lexical) net is the node of a higher-level information unit, corresponding, in a compositional approach, to meaning of phrases, then to meaning of sentences, up to the text level. The highest-level net, that of general encyclopaedic knowledge, can be accessed from the highest-level linguistic unit (the text interpretation), but also from the lower-level units (such as phrase units or lexical units), with the possibility of returning to the nodes from which access took place during the processing. The general structure is thus similar to that of hypertext, where information chunks can be accessed from certain places in the text, through loops that take the user back

to the place where he left the text. The integration of linguistic information units in higher-level units (which organize the structure of the language user's world know-ledge) makes the system robust (in the sense of Goguen, 1975: section 1): the linguistic system of communication is thus capable of coping —without ad hoc mo-difications— with conditions always slightly disturbed or, rather, inherently undeter-mined.

4. Lexical entries for Spanish verbs: an example

In order to sketch a lexical entry format that could eventually meet this type of re-quirements a look at an example of a verb meaning could be useful. The reason to start with verbs is twofold. First, given its central position in the sentence syntactic structure, the verb provides a propositional schema (as part of its lexical meaning) that is the basis for the meaning of the sentence. The second reason is that this pro-positional schema is a formula of a predicate-logic language, and there has been con-siderable work on the ontology of verb meanings as predicates (for instance, Dahl-green 1988, chapter 4). Leaving these two central questions aside for the time being, I will concentrate on the interplay between linguistic and encyclopaedic information in a specific example of the Spanish verb 'pretender' (see Garrido, 1989b).

The proposition expressed by sentence (8), obtained by supplying the necessary additional information, such as, for instance, deictic data, entails the proposition that might be expressed using sentence (9):

(8) María pretende llegar a la cima.
     ('María intends to reach the top.')
(9) María quiere llegar a la cima.
     ('María wants to reach the top.')

There are uses of 'pretender', as in (10), where there is no extra information conveyed:

(10) Los objetivos que se pretenden son importantes.
     ('The intended goals are important'.)

Between (8) and (9) —that is, between the corresponding propositions ex-pressed in a given situation; from now on, I will refer to the propositions by means of corresponding sentences— there is a difference, though; in (8), an additional piece of information is conveyed, so that (8) entails (11):

(11) The utterer of (8) considers difficult or impossible for María to reach the top.

More generally, in that type of interpretation, (12) entails both (13) and (14):

(12) x pretende$_1$ Y.
(13) x wants Y.
(14) the speaker considers Y difficult or impossible.

(Notice that the propositions expressable by the corresponding sentences are involved, and not the sentences themselves, so that it is possible to represent propositions by means of sentences in different (natural) languages that may be used to express them. The subscript is used to show that 'pretender' is used in a given sense; we will be able to get rid of it later on.) As for the other type, that of (19), there is no extra evaluation: (15) entails just (16):

(15) x pretende$_2$ Y.
(16) x wants Y.

In order to account for this difference, between (12) and (15), or between these two interpretations of 'pretender', let us apply the interpretation pattern (4) described above.

The point to be kept in mind is that María herself may say (17) without thinking that she will not make it:

(17) Pretendo llegar a la cima.
('I intend to reach the top.')

So, the utterance of sentence (8) can be interpreted in two ways, depending whether the speaker thinks that the goal is attainable or not. What has to be explained then is how does (14) get in or out of the picture. One obvious way is to have two separate entries, one for 'pretender$_1$' and another one for 'pretender$_2$'. This would make sense if there were not an independently motivated general inference process that can take care of the difference.

In order to explain the difference, I will assume that in (8) —and also in (17), for that matter— the information encoded, P, is (13); we no longer need subscripts, since there is only one reading. The interpretation, on the other hand, might be just P, (13), Q$_1$ being null, or P and Q$_2$, (13) plus (14), depending on the way the interpretation process runs. If the hearer uses (18) as C$_1$, that is, as extra contextual information, the interpretation will be (19); if (20) is used, (21) will be the interpretation:

(18) María is able to reach the top.
(19) María wants to reach the top.
(20) María is not able to reach the top.
(21) María wants to reach the top, but I do not think she will make it.

Actually, (18) and (20) are a summary of an inference process. If the top of a mountain is involved, (18) and (20) sum up a host of data, such as María's mountain-climbing abilities, her physical condition, and so on. If it is the top of a professional field, other types of information will be taken into account. The use of encyclopaedic knowledge of (20) will lead to (21). But the odds are not even between (18) and (20). There is an unmarked option: only where there is conflict between the information about Y and that about x (in 'x pretende Y') there will be need for an inference that will lead to (14), that is, to the interpretation of 'pretender' as expressing doubt or denial. In other words, in this case the default value of Q is zero, so that the interpretation is just P, where no extra contextual information is involved.

The lexical entry for 'pretender' must have a device that alerts the hearer to

check for the difficulty of the goal involved. (In other uses of 'pretender', where 'pretender' entails a claim, such as (22), this device will always set an inference process in motion.)

(22) Juan pretende haber ganado.
('Juan claims to have won.')

This device (what Fradin, 1988, sec. 4.2, p. 156, calls a mark) can be an instruction to look at Y for difficulties, for requirements to be met if the goal is to be accomplished, and to check at x whether these requirements are met. For instance, if Y is interpreted as having social success in high society, the requirement could be to donate valuable art work to a museum; this requirement would then be checked at x (Can María do that?), and if it isn't met, then (14) would be incorporated to the interpretation as Q_2. If Y does not present any special difficulty, the whole process will not take place, no extra conclusion will be added, and the interpretation, Q_1 being null, will just be equal to P:

(23) (a) María pretende llegar a la cima.
    (b) To reach the top requires the donation of important artwork to a museum.
    (c) María does not have the means to donate as in (b).
    (d) María is not able to reach the top.
    (e) P and Q_2: María wants to reach the top but I do not think she will make it.

(Notice how the logical connective in (23c) is interpreted as 'but'; this, though interesting enough, is not strictly necessary for the sake of the present argument.) The lexical entry for 'pretender' would then have such a device (b), that would call for extra information (Z in Y and in x), and could as a result add (c) to the interpretation:

(24) x pretende Y:
    (a) x wants Y.
    (b) if Y has requirement Z, check whether x meets Z; if x does not, add (c).
    (c) the speaker does not think x will get Y done.

The lexical entry would of course be much richer (for one thing, 'want' does not cover the whole of 'pretender'); the point is that its format should include not just definitional information such as (a) but also inferential triggers such as (b). Besides, the procedure in (b) allows for different degrees, so that (c) might range from a slight suspicion up to absolute certainty about Y not coming into being. So (c) will not just be true (truth value of 1), but it will be more or less true (truth value ranging from 0 to 1), so that the speaker might communicate different degrees of disbelief. (Notice by the way that continued use with no special requirements in Y amounts to a reduced entry; that is why some style critics would consider it an impoverishment of the vocabulary.)

5. Conclusion

Thus, in a lexical entry for a Spanish verb meaning it is useful to distinguish two sets of properties: a predicate-argument structure that correlates with the syntactic properties of the verb, and a set of features, in propositional format, that accounts for the semantic relations that hold between the verb and other units in the lexicon. Besides these two types of lexical information, an example of an Spanish verb meaning shows that a lexical entry must have devices to trigger access to encyclopaedic information. As a result, some of the properties that would otherwise be included in the verb's lexical entry can in fact be accounted for in terms of an independently motivated deductive interpretation process triggered by the verb's lexical entry.

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