The Computation of the Informational Status of Discourse Entities

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Summary

During language production, processes of information structuring constitute a relevant part. These processes are regarded as a mapping from a conceptual structure to a perspective semantic structure. I will focus on one aspect of information structuring, namely the verbalization of the current mental representation of entities. For this verbalization, the informational status of the entities is used. This property is expressed by different means in different languages. My approach constitutes a cognitively oriented and highly context-dependent model for computing the informational status embedded in a concept-to-speech model of language production. The processes are illustrated by examples taken from the implementation.

1. Introduction

Vallduvi (1990) postulated that not only a propositional content is transferred by an utterance, but also an instruction for the hearer to extract this propositional content. By the process of information structuring, the speaker intends to create the conditions for realizing this utterance within the set of possible utterances which presumably offers the hearer the most efficient way for grasping the underlying proposition. Information structuring is highly context-dependent and can be divided into many subprocesses. One important aspect is the current mental representation of entities marked by the informational status.

The informational status refers to an absolute property which depends only on contextual criteria of salience, like knowledge and consciousness. Hence, discourse entities permanently have a certain informational status, even if they are not verbalized within the current utterance.

The computations on information structuring constitute an adjustment of parameters determining the realization of a felicitous utterance in the following processes. Concerning the informational status, this means that all verbalized entities within an utterance have to be marked in a way that the hearer can easily identify these entities.

The putative informational status on the part of the hearer is manifested in various ways in different languages: accentuation, pronominal or lexical coding, or definite or indefinite marking. Lambrecht (1994) mentioned the problem that the attitudes marking the current mental representation are in principle a matter of degree whereas the linguistic possibilities of manifestation are partly discrete, e.g. determiner. Hence, for modelling the mapping from an informational status to a linguistic manifestation, it seems useful to employ discrete taxonomies structuring the informational status. The most important taxonomies are provided by Prince (1981) and by Lambrecht (1994), based on Chafe (1987).

In section 2 the computation of the informational status based on these taxonomies is described. This is followed by an example in section 3.

2. The computation of the informational status

The computation of the informational status is modelled within the framework of the SYNPHONICS system[2] which is particularly suitable for this task due to its very detailed representation of context. This concept-to-speech approach on modelling language production is cognitive, combining results from research on psycholinguistics, on theoretical linguistics as well as on computational linguistics.

Due to psycholinguistic evidence, the properties modular, incremental, parallel, monotonous and robust are assumed for the model. It consists of the three central processing units Conceptualizer, Formulator, and Articulator (cf. Levelt (1989)). Recent findings in theoretical linguistics are taken into account by encoding semantic, syntactic, and phonological information declaratively in a special variant of HPSG for German. In addition, it is a computational linguistic approach using methods suitable for implementation: linguistic objects are represented as typed feature structures and are processed by unification.

The SYNPHONICS-system operates on a context structure[3] which contains four classes:

- The discourse knowledge comprises the relevant parts of the previous discourse.
- The perceived knowledge consists of the information the interlocutors perceive during the utterance situation besides speech comprehension, e.g. visual, tactile or further auditory perceptions.
- The hearer knowledge contains the knowledge relevant for the current utterance which the speaker assumes the hearer already to have beforehand.
- The inferrable knowledge consists of the relevant knowledge potentially inferrable from the remaining context-classes by means of common sense and sufficient knowledge of the currently spoken language. This means that knowledge is considered which is not made directly available by the discourse or by sense-organs, but indirectly by means of reasoning.

The main data structure on the conceptual level, where the computation of the informational status takes place, are so-called "referential objects" ("refo") based on Habel (1986). A refo is modelled by a typed feature structure consisting, among other, of the features "predications" which comprise a set of conceptual, i.e. preverbal, predications and "pointer" which establishes an address used for reference.

The Conceptualizer creates a bipartite output stream which consists of an incremental conceptual structure CS comprising the propositional content of the intended utterance and a contextual structure CT with the currently relevant parts of the contextual environment. Both CS and CT are composed of refos. Afterwards, for every refo-increment of the CS-stream the informational status is computed.

The general principle of the computation of the informational status is the following, based on the current CT.

Principle of informational status: A refo is assigned to a certain informational status depending on which - if any - contextual classes contain this refo.

Constel-lation	Discourse knowledge	Perceived knowledge	Hearer knowledge	Inferrable knowledge	Prince (1981)	Chafe (1987)/ Lambrecht (1994)
I	-	-	-	-	brand_new, new	unidentifiable
II	-	-	-	+	inferrable	accessible
III	-	-	+	-	unused, new	inactive
IV	-	-	+	+	inferrable	accessible
V	-	+	-	-	sit_evoked, evoked	active
VI	-	+	-	+	#	#
VII	-	+	+	-	sit_evoked, evoked	active
VIII	-	+	+	+	#	#
IX	+	-	-	-	text_evoked, evoked	active
X	+	-	-	+	#	#
XI	+	-	+	-	text_evoked, evoked	active
XII	+	-	+	+	#	#
XIII	+	+	-	-	evoked	active
XIV	+	+	-	+	#	#
XV	+	+	+	-	evoked	active
XVI	+	+	+	+	#	#

Table (1): Possible distributions of the refos within the contextual classes.

The computation of the informational status is implemented based on the ALE-formalism (Attribute Logic Engine, cf. Carpenter (1992)). For four contextual classes, 16 constellations are possible, as illustrated in table (1). Ten of these constellations are realistic; they are assigned to the informational status according to the taxonomy of Prince (1981) in the sixth column and according to the taxonomy of Lambrecht (1994) based on Chafe (1987) in the seventh column, respectively. Compared to that, the constellations VI), VIII), X), XII), XIV), and XVI) are nonsensical because it is not necessary to infer knowledge which is available in an explicit way in discourse or perceived knowledge. Hence, refos contained in the discourse or perceived knowledge can not be simultaneously elements of the inferrable knowledge.
Afterwards, besides the descriptive information of the refo which should be verbalized, the computed informational status is handed as referential information to the lemma-selector, a submodule of the SYNPHONICS-formulator. The lemma-selector chooses with this information suitable lemmata of the lexicon's lemma-partition which guarantee besides descriptive adequacy referential adequacy of the linguistic increment. In German for instance, articles or pronouns are used for that. These structures are then mapped onto the content value of the corresponding HPSG sign.

3. Examples and refinement

In this section I will provide a concrete example for illustration followed by a refinement of the rules. The example concerns the informational status "textually evoked" (see (1)):

(1) A book lay on the table. Mary saw it.

A refo is assigned to the informational status "textually evoked" if the discourse knowledge contains this refo, but neither the perceived knowledge nor the inferrable knowledge do so, whereas the hearer knowledge does not have to be taken into account (cf. table (1): constellation IX) and XI)). Concerning the refo representing the book in the second sentence in (1), the Prolog clause in figure (1) is applied because the comparison of the pointer-values confirms these constellations.
I will close with the analysis of a special phenomenon pointed out by Lambrecht (1994:80).

(2) Mary is looking for a book.

(2) can be uttered to refer to a specific book as well as to a non-specific book. The difference is revealed by continuing either by (3a) or by (3b):

(3) a) She found it.
b) She found one.

While the anaphoric expression in (3a) is easy to explain because it is referred exactly to the same entity as in the preceding utterance in (2), the case in (3b) is more difficult. The anaphoric expression "one" refers to a concrete entity which is new, therefore only identifiable for the speaker but not for the hearer. The question arises why this anaphoric expression is nevertheless felicitous. It seems that the entity is activated due to the activation of the category it belongs to. In this non-specific case, the category "book" is activated in (2) and therefore obviously any instances of this category are activated, too. This means that the informational status "textually evoked" has to be divided into two cases "textually evoked/specific" and "textually evoked/non-specific".
My approach is able to handle this phenomenon by the following clause in figure (2) whereas the clause in figure (1) strictly speaking determines the informational status "textually evoked/specific". A refo is assigned to the informational status "textually evoked/non-

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informational_status(object_refo, context, info_status).

informational_status(pointer:A, (discourse_knowledge:B, perceived_knowledge:C,
inferrable_knowledge:D), text_evoked) if
        element(pointer:A,B),
        not element(pointer:A,C),
        not element(pointer:A,D).
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Fig. (1): prolog clause concerning the informational status "textually evoked"

informational_status(object_refo, context, info_status).

informational_status(predications: A, (discourse_knowledge:C, perceived_knowledge:D, inferrable_knowledge:E), text_evoked/non-specific) if
element((predications: A, pointer: var),C),
not element((predications: A, pointer: var),D),
not element((predications: A, pointer: var),E).

Fig. (2): prolog clause concerning the informational status "textually evoked/non-specific"

specific" if it is an instance of a category which is only given by the discourse knowledge, so far. By the clause in figure (2), it is checked whether only the discourse knowledge contains a refo which has the same predication set as the refo which should be verbalized but an underspecified pointer ("var"). This refo represents the category with this predication set (e.g. "book"), but no special instance.

4. Conclusion

I have introduced a cognitively oriented approach for modelling a phenomenon within the processes of information structuring, namely the informational status of discourse entities. Information structuring creates conditions for producing the most felicitous utterance within the set of all possible utterances. One important parameter of information structuring is the informational status. This value is expressed by different means in different languages for marking verbalized entities in a felicitous way, i.e. so that the hearer gets the intended reference. Hence, a precise computation of the informational status is a crucial subprocess within the whole process of utterance production. Accordingly, I have described and illustrated an implemented algorithm based on a detailed representation of context.

5. References

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[2] Synphonics stands as an acronym for: syntactic and phonological realization of incrementally generated conceptual structures. For a detailed description of the Synphonics system see Abb et al. (1995) or Günther et al. (1995).

[3] It is important to emphasize that this context structure is not created especially for computing the informational status, but it also serves to model other phenomena of information structure. For a detailed description see Günther et al. (1995) and Ziesche (1995).