

Mapping Conceptual onto Grammatical Structures: The Case of Psych-Verbs*

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1. Conceptual Similarity and Grammatical Diversity

The mapping mechanisms between the extra-linguistic and the grammatical level pose a challenge for any model of language generation. A central question in this context is how to motivate seemingly identical meanings that are realized in systematically divergent ways on the grammatical level. Consider the following examples:

- (1) a. John copied the book.
b. John ran off the book.
- (2) a. Mary read the book.
b. The book was read (by Mary).
- (3) a. Mary broke the plate.
b. The plate broke.
- (4) a. Mary cut the bread.
b. The bread cut easily.
- (5) a. Mary lent a book to John.
b. John borrowed a book from Mary.
c. John was lent a book by Mary.
- (6) a. Mary frightens John.
b. John fears Mary.
c. John is frightened by Mary.

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Intuitively, the paired examples given above seem to denote similar situations to a certain extent. All of them, however, differ crucially with regard to their grammatical realization. The sentences in (1) are instances of a genuine synonymy that reflects grammatically merely a stylistic difference. In contrast, (2) and (3) are examples of a difference in information structure. In the (b)-sentences the AGENT of the event is demoted with regard to its information structural value. The AGENT constituent, thus, does not appear in the highest syntactic position. In spite of its demotion the AGENTive entity of the passive structure (2) can still be expressed by means of a *by*-phrase, whereas with the inchoative form in (3) there is no systematic way of grammatically realizing the corresponding entity.¹ With regard to (3) the question now is whether there is an AGENTive entity present in the underlying conceptual, i.e. extra-linguistic, structure. Similar considerations have to be weighed regarding the examples in (4). But here an additional factor turns out to be relevant. Whereas the inchoative verbal complex in (3) denotes an event that can be determined clearly in space and time, the middle structure in (4) allows this to a limited extent only. This behaviour is due to the fact that middle constructions express properties of entities that are of a generic character and are therefore stative in event structural terms. A different picture emerges concerning the structures in (5) and (6). A comparison of the (a)- and (b)-sentences shows that in both cases the number of arguments is preserved. What has shifted, however, is the ranking of thematic relations:² While in (5)a) the RECIPIENT (*John*) is positioned lowest in the syntactic configuration, it is promoted to the highest syntactic position in the corresponding (b)-example where the converse verbal predicate *borrow* is expressed. What is happening in the passive sentence in (5) then? Is it a syntactic means of expressing a thematic ranking that can also be encoded lexically as in the case of verbs like *borrow*? A similar question arises with regard to the examples of psych-

¹ Throughout this paper 'entity' is to be understood in a narrow sense, namely in the sense of 'object' as defined in sortal terms.

² Thematic relations embed entities into events or conceptual representations of events, respectively. Thus thematic relations define how entities are related to each other and to the event in which they participate. For a more detailed discussion see section 2 and Härtl (1999). For the time being the standard definitions of 'thematic roles' as they can be found in Haegeman (1991) and others will suffice.

verbs in (6). Here, however, the change in thematic ranking correlates with a change in event structure: In (6), *frighten* expresses an internally structured event, whereas in (6) the psych-complex denotes a state. No such difference can be found in the passive of *frighten* where the original event structure is preserved despite of the shifting of thematic arguments.

What do these examples that are selected rather arbitrarily show us? They demonstrate the disparity of levels from which distinct expressions with similar meanings can originate. At least three components of the overall cognitive-grammatical system need to be taken into consideration. Most obviously, there is the component of information structure. I shall associate information structural features of expressions with the level of *preverbal*, i.e. *extra-linguistic, message* that precedes the computation of a corresponding grammatical structure. Both levels will be dealt with in some more detail in the next section. Information structure can determine thematic structure. More specifically, the thematic ranking of arguments is considered one way of realizing information structural requirements, as when the AGENT of the event heads the structure in syntactic terms.

A thematic ranking that matches the conditions of the preverbal message is accomplished in various way on the grammatical level. On the one hand there is the option of selecting an appropriate lexical entry as in the case of either *borrow* or *lend*. This means that the related thematic ranking is lexicalized and need not to be derived by specific lexical or syntactic operations. A different picture emerges in the case of passives. Here one single lexical entry is operated on in syntactic terms.³ Although limited to predictable classes of verbs, passivization is freely applicable. The inchoative structuring, however, is limited to a specific group of verbs (cf. **The picture destroyed*), which needs to be defined lexically. Thematic ranking also corresponds to event structure. Again, event structural features, understood as conceptually based, can be expressed by various grammatical means. In middle constructions (cf. example (4) above) the stative reading of the verbal complex – though restricted to a specific class of verbs – is derived compositionally by syntactic means. In contrast, the shift

³ To be more exact: Passive participles must be derived lexically. This operation is then directly reflected in syntax by means of the passive auxiliary and the *by*-phrase.

in event structure regarding the two groups of psych verbs (cf. (6)) is determined in the lexical entry of the verbs itself and is thus not computed in syntax *per se*.

The aspects discussed so far vividly illustrate the spectrum of how similar meanings can be grammaticalized. For an adequate formulation of the underlying mechanisms we need to formulate a network of several types of information in a much more systematic fashion than indicated above. Most importantly, however, we need to define the locus of these pieces of information specifying the levels on which the information enters the process of generating a linguistic expression. In order to do so another aspect has to be considered: Can certain conceptual meaning similarities in different grammatical structures be taken for granted at all? What needs to be done here is to define exactly those conceptual features that the corresponding expressions have in common.

Against the background sketched so far the group of psych-verbs will be the main concern of the present paper. Psych-verbs can be divided into two classes that differ with regard to the syntactic realization of the thematic arguments involved. Upon first glance the thematic relations of the two groups seem to be identical:

- | | | | | |
|-----|----|------|----------------------|--------------------|
| (7) | a. | S-E: | Mary frightens John. | John = EXPERIENCER |
| | b. | E-S: | John fears Mary. | Mary = STIMULUS |

In both cases two entities are involved: one can be described as experiencing a psychological state (i.e. fear) and the other as the entity that evokes the psychological state by some unspecified property it possesses or action it undertakes. As the examples show, however, these thematic relations are realized inversely in syntax: With *fear*-verbs (or E-S-verbs) the EXPERIENCER-entity is placed in the subject position whereas with *frighten*-verbs (or S-E-verbs) it occupies the object position. The same holds for the STIMULUS-entity in the inverse order.

This curious constellation has been discussed in linguistic theory mainly against the background of the principle of *Universal Theta Assignment Hypothesis* (UTAH, Baker 1988). In its strong version, UTAH predicts that thematic relations are realized homomorphically in corresponding

syntactic positions. It is in this sense that psych-verbs seem to violate UTAH. Several solutions to this problem have been proposed. A syntactic approach is taken by Belletti & Rizzi (1988). Assuming that both verb groups indeed express identical thematic relations, the authors argue that the group of S-E-verbs lacks an external argument. With S-E-verbs both the STIMULUS- and the EXPERIENCER-argument are generated internally to the verb, whereas only in E-S-verbs is the EXPERIENCER assigned the status of an external argument. According to this analysis, E-S- as well as S-E-verbs obey a thematic hierarchy in deep structure. The only difference between the two lies in the indication of an external argument. Although this approach has the theory-internal advantage of preserving UTAH as well as a thematic hierarchy, it lacks convincing evidence for the equality of the thematic relations in both S-E- and E-S-verbs. Grimshaw (1990) explicitly discusses this aspect. In her analysis, that centres around semantic aspects of the expressions in question, Grimshaw argues for two argument hierarchies. In the *thematic hierarchy* the arguments of both S-E- and E-S-verbs are ordered alike: The EXPERIENCER precedes the STIMULUS. In contrast, in the *aspectual hierarchy*, that encodes the event structural properties of the arguments, the STIMULUS of S-E-verbs only is higher than the EXPERIENCER. According to Grimshaw, this difference is due to the causativity of S-E-verbs – a property that E-S-verbs as purely stative verbs lack.⁴ Thus the STIMULUS in S-E-verbs is embedded in a causal relation and therefore realized in the subject position. By definition ‘CAUSES’ are always realized as syntactic subjects. What is left unexplained, however, is how to motivate the difference in causality between the two verb classes. Trying to find evidence, for this distinction Grimshaw argues that S-E-complexes can be paraphrased with a causal expressions in an analytical way (Grimshaw 1990:22):

- (8) a. The storm frightened us.
 a.’ The storm caused us to experience fear.

To my mind, however, there is nothing – at least no conceptual factor – that prevents E-S-complexes to be paraphrased in the same way:

⁴ Cf. similar argumentations in Croft (1993), Pesetsky (1995) and others

- (9) a. We feared the storm.
a.' The storm caused us to experience fear.

The question here is whether looking at causativity relates to the investigation of merely the *grammatical* properties of expressions or whether it also takes into consideration their *conceptual* implications. From a conceptual vantage point, the examples in (8) and (9) seem to offer evidence that both verb groups express causal relations. This is exactly the analysis that I shall argue for in this paper. Before I turn to this, I will outline briefly the theoretical framework that underlies my analysis.

2. Generating a Grammatical Expression

The model that is used here is based on a merger of theoretical linguistic and psycholinguistic assumptions. The general architecture of the model according to Levelt (1989) can be divided into three components that generate component specific representations in a strictly modular way. First, on the basis of information taken from a *conceptual knowledge base* (CKB) the *conceptualizer* produces a *preverbal message* (PM).⁵ PM contains all extra-linguistic information that is needed in order to adequately convey a communicative act. PM encodes the propositional content (CS=*conceptual structure*) of the structure to be verbalized and assigns focal features that reflect the information structural value of the entities involved. The latter information is determined contextually and encoded as such in a *contextual structure* (CT) of PM (cf. Härtl & Witt 1998, Herweg & Maienborn 1992).

The subsequent component or module produces a grammatical structure that matches PM in the most adequate way. This component – the *formulator* – operates over the output structure (i.e. PM) of the conceptualizer, thus encoding PM in grammatical terms. The formulator represents the linguistic system of a speaker.

According to Bierwisch & Schreuder (1992) and Härtl (1999, 2000) the formulator produces a so-called *semantic representation* SR encoding

⁵ The conceptualizer can be associated with *working memory* insofar as it reacts to perceptual stimuli and keeps all necessary information active in order to respond appropriately.

all the meaning components of the expression that are related to grammatical aspects.⁶ SR being strictly compositional encodes the meaning that can be derived from the overt parts of complex expressions. SR has been formulated in the so-called *two-level-semantics* (cf. Bierwisch 1983, Bierwisch & Lang 1987). The core assumption of this theory is a level of meaning independent of contextual – i.e. extra-linguistic – influences. This enables us to define exactly those components of meaning that are visible in syntax only. Thus an inflation of representations can be avoided that denote expressions which adjust their meaning under several contextual conditions.

SR is generated on the basis of the *lexicon* which structures the context-independent meaning of lexical entries according to their argument structure, and event structural and idiosyncratic aspects.⁷ Semantic constants such as the predicates CAUSE or BECOME encoded in the lexical entries and operated on in SR are directly linked to syntactic representations.

Leaving aside the components of phonological *articulation* and *self-monitoring* (cf. Levelt 1989, Härtl 1999) two central questions are left unanswered. The first one is related to the way the modules interact. The second one is related to the status of thematic relations such as AGENT or EXPERIENCER in the system. In the next paragraph it will become evident that the answers to these questions are profoundly interwoven. Thematic relations as reflexes of the embedding of entities in events form the basis of the regular mechanisms that underly the mapping from concepts to grammar, i.e. from PM to SR.

It has been mentioned above the components of the system work in a modular fashion. That means that the components can operate only on level-specific structures and are not capable of using information from either a subsequent or a preceding level. Obviously, what needs to be formulated here is a systematic interface mechanism that can read information from one component and transfer it into information of the adjacent input component. Bierwisch & Schreuder (1992) define a generalized verbalization function VBL that regulates the mapping of information from the con-

⁶ SR is composed in a typed predicate logic that makes use of semantic types such as e (=entity) and t (=truth value). Argument variables are bound by lambda operators.

⁷ Cf. graph 1 below.

ceptualizer onto the formulator. In order for such a function to work, however, an exact specification of the sort of information that can serve as input to VBL is essential. Otherwise one would have to assume that the interface mechanism between the conceptual and the grammatical system can operate over any type of information that the cognitive system provides. A mechanism as powerful as this is beyond theoretical justification.

A solution to this problem is presented in Härtl (1999). A specific interface mechanism TP (= *thematic processor*) is formulated as an operative instantiation of the VBL function.⁸ TP operates on information that is related to the thematic relations encoded in PM. Thematic relations are defined in strictly extra-linguistic terms. That means that the specific content of a thematic relation cannot function as a basis for grammatical computations per se (i.e. in the formulator as defined above). Now, let us examine in some more detail on how to define the PM or its thematic information that has to be processed by TP.

In the preverbal message thematic relations are established reflecting the function of entities that are embedded in the event representation. On the basis of a rule system that originates in the conceptual knowledge base or its sub-parts the conceptualizer establishes two prototypical thematic relations: PROTO-AGENT and PROTO-THEME.⁹ This is achieved by means of a process that checks certain conceptual features of the entities involved. These features are directly related to the cognitive concepts of (abstract) movement and causality (CHANGE and CAUSE). Entities are assigned these

⁸ The term *thematic processor* is related to psycholinguistic findings as presented in Rayner et al. (1983) and Frazier (1987). According to these works the thematic processor regulates the second stage of language processing (so-called second pass parse). The idea is that at this stage a linguistic representation that has been established by the parser up to this point can be revised on the basis of extra-linguistic information. Frazier (1987) points out that the thematic processor has access to argument structural properties of the linguistic expression, to its thematic structure as well as to pragmatic background knowledge. In this sense the thematic processor is able to translate certain pieces of information and map them onto the adjacent level.

⁹ The rules in question can be subsumed under the set of *coordination principles* as they have been defined by Oberauer (1993). Coordination principles organize the capacities of the working memory (of which the conceptualizer is considered a part here). They operate on several types of knowledge structures activated simultaneously.

features by the conceptualizer if they match certain requirements that derive from basic (and ideally innate) cognitive principles. For instance, in order for an entity to be conceptualized as CAUSING an event there needs to be some kind of contact between this entity and another entity. Contact alone, however, is not sufficient: CAUSATION also implies a discharge of some kind of force.¹⁰

Movements or CHANGES of entities establish events. So CHANGES must be associated with the event structural properties of telicity and duration. In Härtl (1999) this is done by a network that relates any type of CHANGE to types of events that are specified temporally. An event like *John dances* implies a CHANGE (instantiated by the movement) in general which has to be further specified according to the properties of its atelicity (-TEL) and its duration (+DUR).

In order to assign appropriate thematic relations, the conceptualizer has to calculate the features CAUSE and CHANGE that are attached to salient entities in the discourse set. Entities are assigned thematic functions by means of a statistical method – similar to Dowty's (1991) conception of thematic role assignment – which embeds them into conceptualized event representations. For example, in an event conceptualization like *John killed a flea* the two entities involved CHANGE in some way, however, it is only *John* who CAUSES an event (the dying of the flea). Thus the corresponding entity (*John*) wins the competition for functioning as PROTO-AGENT in the event conceptualization.

This system of thematic relation assignment has the advantage of relying on two plain features: CHANGE and CAUSE. The conceptualization task is to select specific entities out of a set of salient entities by checking the features CAUSE and CHANGE and to assign them appropriate prototypical thematic functions thus embedding them into a conceptualized event representation or PM.¹¹ Now the corresponding PM-structure contains specific information that the thematic processor (TP, see above) is able to

¹⁰ For the details that rely on psychological findings as they are presented in Spelke et al. (1995) see Härtl (1999).

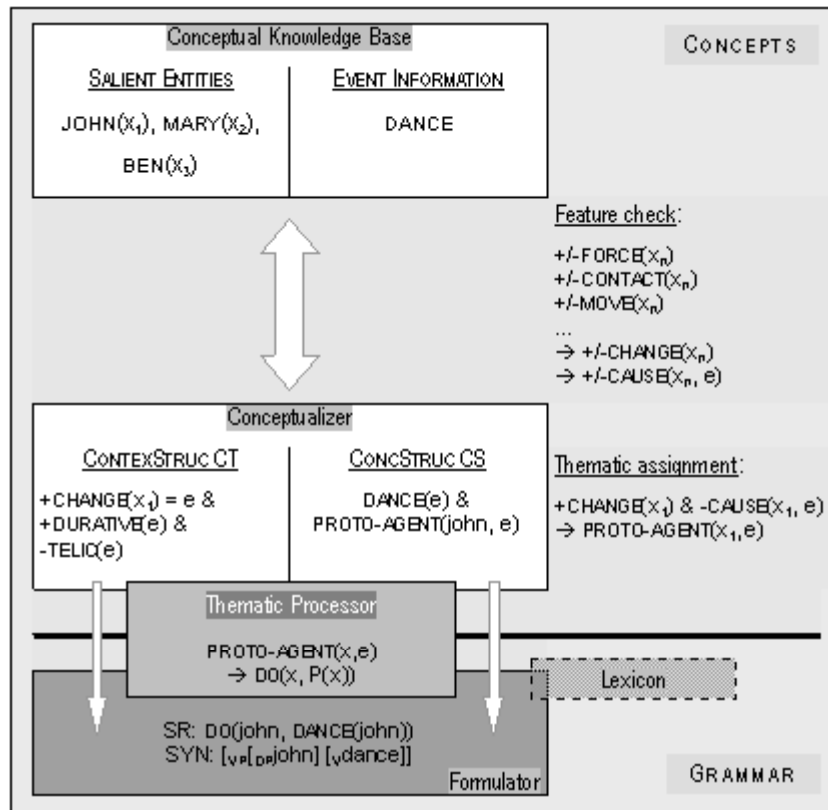
¹¹ As it has been mentioned above, in the approach presupposed here the conceptualizer produces a *preverbal* message that contains only the extra-linguistic components that are relevant for the *verbalization* of an intended communicative act.

process. According to a restricted interface rule system, TP maps this information onto a corresponding grammatical structure SR by selecting appropriate lexical entries. In SR thematic relations are not encoded directly and thus need to be inferable from the lexico-semantic representation SR that is sensitive to event structural differences such as ACTIVITY (*dance*) vs. ACHIEVEMENT (*win*).¹² Whether to establish either the corresponding DO-vs. BECOME-predicates is determined on the basis of the temporal conceptual features of durativity and telicity that are associated with the thematic relations in PM_{CT}. It is the specific relation which holds between the SR-predicates and their arguments (such as DO(x)) and that allows a correct inference as to what conceptual thematic relation is implicitly expressed in the SR. Graph (1) on the opposite page sums up what has been sketched so far.

It is important to note that the mapping mechanism of TP itself is not able to produce its own structures: It blindly transfers PM (CS/CT) onto SR by means of a restricted rule system. The conceptualizer also establishes thematic relations via a restricted rule system.

In the next section I shall discuss how psych-verbs can be analyzed against this background. It will be argued that both S-E- and E-S-verbs express causal relations on the level of PM (i.e. CS/CT). They differ, however, with regard to their thematic and event structure, the latter being directly reflected in grammar in general and SR in particular.

¹² Evidence is given by the fact that hardly any language encodes thematic relations homomorphically. Thematic relations need to be inferred from more basic configurational attributes such as syntactic function or – as it is done here – from event structure that is encoded directly in SR: Differences in event structure are visible in grammar (Härtl 2000).



Graph 1: Conceptualization and mapping of thematic information onto SR (cf. Härtl 1999)

3. Conceptual and Grammatical Properties of Psych-Verbs

First evidence that in their conceptual pendants S-E- as well as E-S-verbs express causal relations of the entities involved can be found by looking at subordinate causal sentences. They typically assign causal attributes to the entity that causes the event denoted in the matrix sentence (cf. Brown & Fish 1983). Therefore the assignment of a causal sentence to the EXPERIENCER in psych-complexes is somewhat odd (10a',b'):

- (10) a. S-E: Mary fascinates John because she is intelligent.
 a.' ??Mary fascinates John because he is intelligent.
 b. E-S: John adores Mary because she is intelligent.
 b.' ??John adores Mary because he is intelligent.

Note that this regularity – so-called *implicit verb causality* – holds for both S-E- and E-S-verbs. This property has been tested in several empirical

studies (see Fiedler 1978, Rudolph 1997, cf. also Wegener, this volume) which exhibit overwhelming evidence for the implicit causality inherent in psych-verbs as with interpersonal verbs in general.¹³

Associated with implicit verb causality is the *principle of balance* (cf. Rudolph & Hecker 1997) that is also based on extra-linguistic constellations. The psychological state of the EXPERIENCER and a causal expression are balanced if both carry the same value on an abstract (conceptual) scale that determines the ‘positivity’ or ‘negativity’ of the psych-state. If the two match, the causal sentence is assigned to the STIMULUS by default as defined by the principle of implicit verb causality. If the two differ, however, the causal expression can also be assigned to the EXPERIENCER not triggering any oddity (cf. (10)):

- (11) a. S-E_{POS}: Mary fascinates John because she is intelligent_{POS}.
 a.’ Mary fascinates John because he is immature_{NEG}.
 b. E-S_{POS}: John adores Mary because she is intelligent_{POS}.
 b.’ John adores Mary because he is immature_{NEG}.

Again this regularity holds for both E-S- and S-E-verbs. It is important to note that the thematic relations in the psych-expressions themselves do not change with the causal attribution at all. What changes with the causal sentences is the assignment of explicit causal attributes.¹⁴ This constellation may give us insight into the intrinsic properties of the entities involved.

¹³ In socio-psychological studies implicit verb causality has been associated with *principles of covariation* (Kelley 1967)) that regulate the assignment of causal attributes in a broader sense (for the details see Brown & Fish 1983, Rudolph 1997, and Härtl 1999). A calculation of covariation features related to properties of CONSENSUS and DISTINCTIVENESS of entities allows causal inferences about the sources of certain effects. In Härtl (1999) covariation features are used to explain the establishment of preverbal CAUSE-relations in more abstract mental domains from which e.g. psych-verbs originate.

¹⁴ While causal sentences with *because* in psych-complexes typically describe the intrinsic CAUSE for the event expressed, they can – when assigned to the EXPERIENCER – also describe an extrinsic CAUSE. This becomes more evident when comparing grammatically causative examples like *John destroyed the painting because he poured acid over it* (= intrinsic CAUSE) vs. *John destroyed the painting because he hated it* (= extrinsic CAUSE); see Härtl (1999) for a more detailed discussion.

3.1. An ERP Study on Causality in Psych-Sentences

On the basis of the argumentation presented above let us assume that S-E- as well as E-S-verbs denote causal relations. And if the causal principles just sketched are indeed at work they should be somehow anchored cognitively. This hypothesis was tested in a study that investigated event-related brain potentials (ERP). The ERP-method offers the opportunity to look at the processing of the structures in question in an on-line fashion. Event-related brain potentials represent electro-physiological activities of the brain that reflect the processing of certain stimuli in relation to a temporal dimension (cf. Friederici 1997, Urban & Friederici 1999). Thus from the inducement of different brain potentials in different time windows it can be concluded that different processes of comprehension are at work. In the literature three such processing components are typically distinguished (cf. Friederici 1997). Firstly, there is the component of early syntax (ELAN) that is understood as a reflex of a first, merely structural, parse of the linguistic input. Furthermore, there is empirical evidence for a component of semantic/lexical processing (N400 = electrophysiological negativity at 400 ms after stimulus presentation). The N400 can be seen as a reflex of the lexical and semantic integration of single words into more complex structures. In contrast, processes of revising structures that have already been established by the parser evoke a positivity after 600 ms (P600). Note that the components just sketched always represent reflexes of an increased processing load and parsing difficulties in general.

Concerning the linguistic material discussed here, we could hypothesize that the assignment of causal attributes to the entity not implicitly marked as the causer of the psychological state evoke certain parsing difficulties. If the principles of implicit verb causality indeed hold for both S-E- and E-S-verbs, a corresponding effect should show up with both verb groups.

In order to test this a study was conducted where (German) stimulus material was presented visually on a screen word by word (each for 300 ms). Electro-physiological activity was measured with an EEG-method by

means of a mask that positioned 26 electrodes on the skull.¹⁵ The participants, all native speakers of German, were instructed to judge the grammaticality of each sentence presented. Twenty-five subjects, age 20–30, took part in the study. For the statistical analysis a MANOVA was used.

In the material the two factors ‘verb group’ and ‘causal attribution’ were varied. Consider the following examples in which the most appropriate English equivalents are given. Note that German does not exhibit explicit aspect marking:

- (12) a. VERB GROUP:
 S-E: Karl *disappoints* Heike because he is unromantic.
 E-S: Tobias *fears* Maria because he is rational.
- b. CAUSAL ATTRIBUTION (exemplified with E-S-verbs):
 E-S: Tobias fears Maria because *he* is rational.
 E-S: Tobias fears Maria because *she* is rational.

In order to avoid repetition effects two different versions were assembled. In sum 4 blocks of 12 sentences were (pseudo-randomly) presented. 48 filler sentences without psych-verbs were integrated. These occurred with different types of ungrammaticalities to be detected by the subjects. Apart from not having psych-verbs, the fillers were of exactly the same type as the critical sentences (regarding transitivity, proper names, animacy, subordinate causal sentences).

The critical position in the psych-sentences is the pronoun. Note that the influence of the semantics of the subordinate sentences is irrelevant, since electro-physiological activity was measured on the pronoun only. In agreement with the hypothesis for both S-E- and E-S-complexes significant effects that reflect parsing difficulties were found on those pronouns that unexpectedly assign causal attributes to the EXPERIENCER. No significant effects were found when the pronoun was related to the STIMULUS entity of the matrix sentence (cf. Härtl 2000a).

The plots show two components different in amplitude: For S-E-verbs a negativity in the time window 400–450 ms (‘N400’) was deter-

¹⁵ The study reported on here is the product of a cooperation with Silke Urban (University of Leipzig and Max-Planck-Institute for Cognitive Neuroscience, Leipzig)

mined,¹⁶ for E-S-verbs, however, a positivity after 550-600 ms ('P600') occurred.¹⁷

- (13) a. E-S: Tobias fears Mary because *he* is rational.
 ⇒ POSITIVITY after 550-600ms
 b. S-E: Maria frightens John because *he* is rational.
 ⇒ NEGATIVITY after 400-450ms

I shall not argue that this difference is due to any distinct intrinsic properties of S-E- vs. E-S-verbs. An explanation that considers similar semantic anomalies in both cases is more plausible. In the case of E-S-verbs, however, the integration of the structure '*because* [PRONOUN_{EXP}] *is* ...' requires an additional syntactic revision. This might be attributed to the fact that in the E-S-complexes the antecedent of the pronoun is placed in the more distant subject position.¹⁸ A similar difference was found by Long & de Ley (2000). In their studies using the probe detection method they showed that effects of implicit causality are limited to verb complexes that realize the implicit cause in the syntactic object position (NP₂ verb) and not in the subject position (NP₁ verb). The effect was found for verbs of implicit verb causality in general and not for psych-verbs only. The authors explain this effect with regard to a *post hoc* corpus analysis demonstrating that NP₂ verbs seem to be better predicators of a succeeding mentioned implicit cause than NP₁ verbs. Connected to this is the finding that NP₂ verbs occur more often in the active voice.

The parsing difficulties detected support the hypothesis that both S-E- and E-S-verbs express causal relations as determined by the principles of implicit verb causality. Against the background of recent studies on working memory the effect reported on above can be attributed to the grade of accessibility of arguments or entities in discourse. With verbs which denote implicit causal relations (such as psych-verbs) the accessibility of the implicit cause entity is increased in a discourse model (cf. Long & de Ley 2000). So when encountering a pronoun in a causal connective the

¹⁶ F(3,25)=2.87, p<0.0466

¹⁷ F(3,25)=4.33, p<0.0073

¹⁸ This additional factor did not have any influence on the regular constructions where the *because*-sentences were assigned to the STIMULUS of the matrix clause.

pronoun can be more easily assigned the reference of the implicit cause entity than any other entity integrated in the actual discourse. In terms of working memory capacities the corresponding entity (i.e. the implicit cause) is activated faster out of a set of salient entities than other entities.¹⁹

The property of implicit causality in psych-verbs is based on the conceptual properties of the expression in question. Against the background of the model sketched in section 2 we seem to have enough evidence to assign both S-E- and E-S-verbs a (still incomplete) underlying preverbal structure where causal relations are encoded as in (14); cf. graph 1 above:

- (14) a. John frightens Mary.
 a.' Mary fears John.
 b. PM_{CT}: +CAUSE(john,e) & -CAUSE(mary,e)

The question now is what properties make the two verb groups differ in their syntactic realization as described above. This question can be answered by specifying the type of event the entities are embedded in. I shall argue that S-E- and E-S-verbs do not display their common conceptual feature of causality on the grammatical level, i.e. they are not grammatically causative. In contrast, S-E-verbs in general have to be considered simple activities of AGENTS (=STIMULUS) in grammatical, i.e. lexico-semantic terms. E-S-complexes express states that contain a THEME (=STIMULUS) besides the EXPERIENCER.

3.2. Activities vs. States: Theoretical and Empirical Arguments

The first piece of evidence for the non-causativity of S-E-complexes on the grammatical level comes from their inherent temporal properties or *Aktionsart* (cf. Vendler 1967). Genuine causative expressions with verbs such as *build* or *sew*, that usually express an AGENT bringing about a resultant state, do not denote a process that is temporally homogeneous. That is, the truth conditions that hold for the entire event do not hold for parts of it. Casually speaking, in causative verb complexes, parts of the denoted event

¹⁹ Long & de Ley (2000) argue that this effect depends on the characteristics of the reader. Their studies using the probe detection method show that early effects on pronoun resolution show up only with skilled readers. The ERP results presented above do not show any such effect.

are not equivalent to the whole event as is the case with expressions like *John is dancing* or *Peter is running* (cf. Bennett & Partee 1972). The property of non-homogeneity correlates with the incrementality of causative expressions: The corresponding event is completed step by step. These characteristics allow causative expressions to be modified with a frame adverbial:

- (15) a. Peter built a house *in less than two years*.
 b. Joanna sewed a dress *in three hours*.

Note that with (German) S-E-verbs this option is not given:

- (16) a. *Peter langweilte Mary *in fünf Minuten*.
 ‘Peter bored Mary *in five minutes*’
 b. *Joanna faszinierte Tom *in einer Stunde*.
 ‘Joanna fascinated Tom *in an hour*’

In contrast S-E-verbs allow a modification that is typical of activities, which are indeed homogeneous in their temporal process:

- (17) a. Peter langweilte Mary *fünf Minuten lang*.
 ‘Peter was boring Mary *for five minutes*’
 b. Joanna faszinierte Tom *eine Stunde lang*.
 ‘Joanna was fascinating Tom *for an hour*’

S-E-complexes that contain an animate stimulus can realize activities easily. With E-S-verbs, in contrast, this choice is not given. They allow activity modification to a limited extent only:

- (18) a. ??Mary verabscheute Peter *fünf Minuten lang*.
 ‘Mary was disliking/disliked Peter *for five minutes*’
 b. ??Tom bewunderte Joanna *eine Stunde lang*.
 ‘Tom was adoring/adored Joanna *for an hour*’

Supporting evidence for the hypothesis that the STIMULUS in S-E-complexes is to be analyzed as a participant in an ACTIVITY comes from the AGENTIVE properties of the entity in question. Activities like *John is watching the competition* always contain an AGENT and, therefore, allow an

instrumental modification,²⁰ which then should be licensed with S-E-verbs also:

- (19) a. Peter langweilte Mary *mit lächerlichen Geschichten*.
 ‘Peter was boring Mary *with ridiculous stories*’
 b. Joanna ängstigte Peter *mit fürchterlichem Heulen*.
 ‘Joanna was frightening Peter *with a dreadful howl*’

Note that this kind of modification – to a limited extent – is possible also with S-E-complexes that contain an inanimate STIMULUS indicating that in these cases some kind of conceptual extension of the sortal restrictions on the AGENT is at work.

The event structural differences between S-E- and E-S-verbs were tested empirically. Again, the systematic property of implicit verb causality, that is reflected in subordinate causal sentences, provided a reliable factor. Making use of a certain ambiguity between a stative and an AGENTive reading of S-E-verbs that shows up in the (German) simple present tense, the study shows that the AGENTive reading of German S-E-verbs is indeed the preferred one. Recently, similar results have been reported for English S-E-verbs in Sponholz (2000).

According to the argumentation above, it is hypothesized that in ambiguous linguistic situations S-E-verbs preferably realize AGENTive activities rather than states. This was tested in an off-line questionnaire study. Participants (all native speakers of German aged between 20–30) were instructed to choose between two options like those indicated in (20) thus completing 24 S-E- and 24 E-S-complexes:

- (20) a. E-S: Irene bewundert Max, weil er...
 ...eine bestimmte Eigenschaft hat. ...gerade etwas tut.
 ‘Irene adores/is adoring Max because he has a certain quality/is doing something.’
 b. S-E: Eva amüsiert Hans, weil sie...
 ...eine bestimmte Eigenschaft hat. ...gerade etwas tut.
 ‘Eva amuses/is amusing Hans because she has a certain quality/is doing something.’

²⁰ Note that this, of course, is also possible with causative expressions: *John killed the lion with a knife*. The argument here is that the STIMULUS in S-E-complexes cannot be regarded a THEME as compared to the STIMULUS in E-S-complexes.

The subordinate sentences expressed either an activity (*to be doing something*) or a state (*having a certain quality*). They were the same for all items. In the material 24 filler sentences were included. Apart from not having psych-verbs, they had the same properties as the critical items. Participants (German native speakers, students of Leipzig University) were instructed to judge the acceptability of either option by ticking the appropriate box. The boxes represented a continuum that ranges from the left-most box meaning the left *because*-sentence fits the matrix sentence best, the right box meaning the right-most fits best. The inbetween boxes indicate a corresponding tendency. For the statistical analysis the boxes were assigned digits from 1 (i.e. the left *because*-sentence) to 5 (i.e. the right *because*-sentence).

Since the study is designed with one factor only (the adequacy of a *because*-sentence with S-E- vs. E-S-verbs) conducting a simple t-test sufficed for figuring the statistics. The overall mean values show that the S-E-complexes were preferably associated with the subordinate activity sentences (M=2.8). In contrast, the E-S-verbs were associated with the stative *because*-sentences (M=3.8). The t-test indicates that this difference is statistically significant ($t_1=10.75$ (df=62), $p<0001$).

The results support the hypothesis stated above. In ambiguous linguistic constellations for S-E-verbs an activity reading is favored. This implies that the STIMULUS entity is conceptualized as an AGENT rather than a THEME as is the case in E-S-complexes. This goes along with differences in event structure: S-E-verbs denote temporally homogeneous activities of an AGENT. In contrast, E-S-verbs express states. This difference is relevant for their grammatical realization. But on the conceptual level both S-E- and E-S-complexes express causal relations as determined by the principles of implicit verb causality. Thus the causal relations, not being directly encoded in grammar, need to be inferred from these principles on the basis of extra-linguistic directives.

These assumptions suggest a structuring of the preverbal message PM of S-E-verbs as given in (21):

- (21) a. *Mary was boring John.*
 b. $PM_{CT}: \begin{array}{l} +CAUSE(mary,e) \ \& \ +CHANGE(mary) \\ -CAUSE(john,e) \ \& \ \alpha CHANGE(john) \end{array} \left| \begin{array}{l} +DURATIVE(e) \ \& \ -TELIC(e) \end{array} \right.$
 $PM_{CS}: \text{BORE}(e) \ \& \ \text{PROTO-AGENT}(mary,e) \ \& \ \text{PROTO-THEME}(john,e)$

As the representations indicate, in the PM of S-E-verbs the STIMULUS-entity is assigned the status of a prototypical AGENT. The conceptualizer establishes this type of thematic relation on the basis of a comparison of the CAUSE- and the CHANGE-features attached to the entities in question (cf. section 2). In E-S-complexes the STIMULUS (=Mary) is also assigned causal features. Here, however, because of the stative properties the STIMULUS does not undergo any kind of CHANGE to achieve the psychological state in the EXPERIENCER-entity:

- (22) a. *John disliked Mary.*
 b. $PM_{CT}: \begin{array}{l} +CAUSE(mary,e) \ \& \ -CHANGE(mary) \\ -CAUSE(john,e) \ \& \ \alpha CHANGE(john) \end{array} \left| \begin{array}{l} \alpha DURATIVE(e) \ \& \ -TELIC(e) \end{array} \right.$
 $PM_{CS}: \text{DISLIKE}(e) \ \& \ \text{PROTO-THEME}(john,e) \ \& \ \text{PROTO-THEME}(mary,e)$

Here, due to the feature distribution, an ambiguous situation occurs: *John* as well as *Mary* are assigned the status of a PROTO-THEME. What distinguishes them from one another, however, is their status in the proposition: While *John* has to be in a certain state, no such truth condition holds for the entity *Mary*. Casually speaking, one could argue that the propositional status of *Mary* (= STIMULUS) is totally irrelevant, while with the stative predication of the EXPERIENCER (*John*) it is not. This curious constellation that occurs with all ‘bi-thematic’ verbs such as *know* or *resemble* still needs to be investigated in more detail.

The representations in (21) and (22) are formulated on the basis of the empirical as well as the theoretical findings presented above. The corresponding structures form the input of the grammatical level of SR. They are transferred onto grammatical structures by the interface mechanism TP that makes use of a restricted rule system. The following representation exemplifies the application of TP-rules on PM.

- (23) a. *Mary was boring John.*
 b. PM_{CT}: +DURATIVE(e) & -TELIC(e)
 PM_{CS}: BORE(e) & PROTO-AGENT(mary,e) & PROTO-THEME(john,e)
 TP: PROTO-AGENT(x,e) & (e = +DURATIVE(e) & -TELIC(e)) →
 DO(x, P(x))
 SR: DO(mary, P(x))

Whenever TP is confronted with an AGENTive entity embedded in a durative event that is not telic, TP applies a rule that transfers the corresponding PM onto an activity expression SR encoded with a predicate DO. The first argument of DO represents the AGENT in grammatical, configurational terms. The predicative variable P provides the idiosyncratic aspects that characterize this special type of activity (i.e. to *bore*). Omitting the details, psych-verbs are assigned the following semantic representations SR on the grammatical level by the formulator:

- (24) a. S-E: $\lambda y \lambda P \lambda x \lambda e [e \text{ INST } [DO(x, P(x)) \& \text{PSYCH-STATE}(y, z)]]$ ²¹
 b. E-S: $\lambda y \lambda x \lambda e [e \text{ INST } [\text{PSYCH-STATE}(x, y)]]$

In the two structures above differences in event structure of the two verb groups are explicitly defined. Grammatically, neither encodes causal relations directly. S-E-verbs as activities predicate over an AGENTive entity (x) that is systematically linked to the subject position.²² In E-S-verbs, however, this entity being a THEME (y) is realized in the syntactic object position and the EXPERIENCER (x) is placed in the subject position. Thus the order of the thematic arguments comes about naturally by virtue of the lexical properties of the verbal predicates involved without any stipulation.

Assuming that S-E-verbs denote activities indeed we have to ask why these verbs do not allow middle constructions, which are in general

²¹ The predicate INST anchors an event variable e in the semantic representation of a verbal complex. INST can be seen a reflex of the Davidsonian idea that verbs contain a situational variable in their logical structure (cf. Maienborn 1996). In type logical terms INST is of type $\langle t, \langle e, t \rangle \rangle$.

²² The SR in (24) contains a so-called free variable (=z) that is not bound by a λ -operator. This is due to the requirements of compositionality and based empirically on sentences like *He was boring her with long stories* where it is in fact the stories that are responsible for the psychological state of the EXPERIENCER. The variable z in these cases has to be associated with the prepositional phrase, otherwise it remains unbound (cf. Härtl 1999 for further details).

possible with any type of activity verb.²³ Consider the following examples of English and German middles:

- (25) a. These books read without any effort.
 b. This wall paints easily.
 c. Diese Bücher lesen sich ohne weitere Anstrengung.
 d. Diese Mauer streicht sich leicht.

With psychological S-E-verbs middles are not possible.

- (26) a. ??Linguists amuse easily.
 b. ??Scientists please without any effort.
 c. ??Linguisten erheitern sich leicht.
 d. ??Wissenschaftler erfreuen sich leicht.

In middle constructions the AGENTive argument is demoted and cannot be realized grammatically, as this is possible with passives by means of a *by*-phrase (cf. Fagan 1988 and section 1). An externalization of the internal argument (i.e. the THEME) that is syntactically realized in the subject position comes along with the demotion of the AGENTive argument. In German middles the reflexive pronoun *sich*, that is semantically empty, reflects the derivative operation (cf. Haider 1985). The resulting expression loses the event structural properties of the base verb: Middles denote properties of objects that cannot be defined in space and time, and are of a generic character.

Why are middles not possible with S-E-verbs? An answer to this question may be of a somewhat deeper nature and cannot be given by looking at S-E-verbs alone. Compare the following examples of middles, which contain either an animate or inanimate object in the subject position:

- (27) a. §Kleine Kinder waschen sich leicht.
 ‘small children wash easily’
 b. §Weibliche Patienten behandeln sich besonders leicht.
 ‘female patients treat easily’
 a.’ Pirelli-Reifen waschen sich besonders leicht.
 ‘tires by Pirelli wash easily’

²³ This includes causative verbs such as *break* and *cut* (cf. Rappaport-Hovav & Levin 1995).

- b.' Kinderkrankheiten behandeln sich besonders leicht.
'children's diseases treat easily'

Whether the marked examples are ungrammatical can only be decided empirically. At least in German there is a clear contrast in acceptability between those middle structures that contain an inanimate object and those containing an animate object. Only the latter (i.e. (27)) elicit a strong AGENTive reading that results in a – somewhat odd – reciprocal interpretation: '*small children wash each other easily*'. This might be attributed to the fact that in these cases an AGENT-first principle is at work. Though being odd the middle structures in question can still be saved by assigning the intended THEME-reading to the corresponding argument thus identifying it as the internal argument. One might argue that with verbs such as *treat* or *wash* this strategy is supported by the option of having either an animate or an inanimate object in the position of the THEME-argument. As THEMES are proto-typically inanimate (cf. Dowty 1991) the appropriate interpretation can be achieved. This option is not given with S-E-verbs for the EXPERIENCER entity can never be inanimate. Thus in sentences like (26) the inappropriate AGENTive reading cannot be eliminated.

Another aspect needs to be taken into consideration. As mentioned above middles are allowed with activity verbs only. Consider the following examples where the middles are out because of the stative event structure of the verbs in question:

- (28) a. *These answers know easily.
b. *Those books possess without any effort.

As argued above S-E-verbs denote (non-causative) activities. However, their lexical-semantic structure still contains a stative element PSYCH-STATE, which encodes the psychological state of the EXPERIENCER (cf. (24) above). It is this stative element that excludes middles with S-E-verbs. Thus the ungrammaticality of S-E-middles can be considered an expected consequence that is due to the lexical-semantic structure of S-E-verbs.

4. Summary

The overall goal of this paper was to initiate a discussion of expressions with similar denotations that are, however, realized differently in grammatical terms. In order to discuss this problem in a coherent fashion, it is necessary to specify the different types of information involved and their origin. I have distinguished thematic from event structural information and formalized how both are to be established within a model of language generation that is subject to cognitive findings. By means of a calculation of two features (i.e. CAUSE and CHANGE) thematic structure is established by the conceptualizer that creates a preverbal message. In grammar, thematic structure is encoded indirectly by means of event structural components that determine a lexico-semantic structure SR.

In this context I elaborated an analysis of psych-verbs that relies on theoretical as well as (experimental) empirical findings. The problem connected with psych-verbs has often been solved stipulatively on the grounds of either syntactic or semantic configurations. As both levels interact, I first determined those features that both verb groups have in common. I argued that both S-E- and E-S-verbs express causal relations conceptually as they are determined by the principles of implicit verb causality. Evidence comes from an ERP-study showing for both verb groups that the atypical assignment of causal attributes to the EXPERIENCER evokes certain processing difficulties. The two verb groups differ with regard to their event structure. S-E-verbs are realized grammatically as non-causative activities, E-S-verbs as genuine states. Supporting evidence comes from a questionnaire study. The event structural difference triggers a distinct syntactic realization of the thematic arguments: The AGENTIVE (STIMULUS-) entity in S-E-complexes is placed in the subject position. In E-S-expressions which denote states it is the EXPERIENCER – being in fact a THEME in event structural terms – that is placed in the subject position.

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