

Prepositional Semantics and the Fragile Link Between Space and Time

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1. Introduction¹

For several years now, we have been exploring theoretically and experimentally the view held by many cognitive linguists that prepositions are an exceptionally polysemous, if not heterosemous, lexical category.² The main point of this paper is to explore one small and seemingly trivial piece of the polysemy puzzle, namely, the conceptual and, consequently, *lexical* relationship between spatial and temporal senses of many prepositions in English and Dutch. A widely held assumption in cognitive linguistics is that spatial and temporal senses or use types are probably related metaphorically via what we will broadly call here a TIME IS SPACE metaphor. This metaphor (actually, family of metaphors) is pervasive and has been well documented diachronically and typologically. Indeed, the presence of something like a TIME IS SPACE metaphor in most languages suggests that it is a fundamental part of the human conceptual system.

If that is the case, if it is one of the most ubiquitous metaphors-we-live-by, then it might be reasonable to assume that language users should easily perceive the metaphorical link between spatial and temporal usages of inherently spatial lexical items. Accordingly, some lexicologists might argue that temporal and spatial senses may not warrant distinct representation in the lexicon. Instead, both types of senses could be subsumed under either a canonical spatial meaning or a very abstract schematic meaning with the proviso that construal rules, along the lines discussed by Caramazza & Grober (1976) or Nunberg (1979), can be posited and implemented to account for any domain-specific applications. However, if the metaphorical link is not perceived owing to the deep conceptual entrenchment of the metaphor, then monosemy approaches to the lexical representation of prepositions may be insufficient to account for speakers' intuitions about the distinctiveness of senses. What we undertook to find out in the series of admittedly narrow experiments reported on here is whether or not modern language users are at all aware of the metaphorical relationship between spatial and temporal senses of selected prepositions.

We describe this metaphor in Section 2. In Section 3, we review the role of metaphor in grammaticalization and the role of grammaticalization in polysemy. The reason grammaticalization is so important in cognitive linguistics is because it

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is held to be largely responsible for the lexical and constructional polysemy that cognitive linguists claim is highly prevalent in language. In essence, grammaticalization leaves behind semantic footprints. These polysemous traces can be taken as evidence of conceptualization's effects on language, that is, evidence of the reanalysis, abductive reasoning, pragmatic inferencing and, ultimately, semantic extension that is claimed to underlie the complicated tangle of lexical and grammatical structure we find synchronically. What concerns us here is not the claim that metaphor is a basic mechanism of grammaticalization, but the claim that as certain usages become conventionalized in language, those metaphoric processes which gave rise to the different senses may no longer be accessible to modern speakers. This presents a dilemma for those of us trying to grapple with basic questions about the quality and quantity of representation we attribute to the mental lexicon.

We conducted our investigation mindful of the fact that there are a number of disparate hypotheses about the nature of lexical representation in the mental lexicon. The simplest hypothesis, of course, would make the fewest representational demands. Thus, our working hypothesis - but not one in which we had much confidence--was as follows: the TIME IS SPACE metaphor is transparent or at least recoverable for present-day language users even though it may have operated productively only at a much earlier stage in a language. As such, temporal senses of a preposition need not be given special mention as these senses are not all that distinct from spatial ones. We discuss this transparency hypothesis in Section 4. In Section 5, we report on a series of off-line psycholinguistic experiments that we carried out to begin to test this hypothesis. Our first round of findings suggest that modern speakers of English and Dutch seem to have lost conceptual access to the TIME IS SPACE metaphor while other more abstract metaphorical mappings seem to be intact and recoverable. We also discuss limitations of the present experiments. Finally, in Section 6, we conclude by speculating a bit about the ramifications of these findings, tentative though they are, for cognitive linguistics and lexical semantics. We fully acknowledge that, at present, we have not developed sufficiently refined on-line techniques (either psycho- or neurolinguistic) to resolve a more central issue: what the transparency or opacity of metaphor or image schematic mapping means in terms of the organization and access of information in the mental lexicon. Nevertheless, we have gained knowledge about a new round of questions to ask and what might be the best methodologies for pursuing answers.

2. The TIME IS SPACE metaphor

Our central concern in this paper is the cognitive status of what we are loosely calling the TIME IS SPACE metaphor. Actually, there are two broad instantia-

tions of this metaphor. Both versions propose that TIME as a background domain is understood as if it were spatial, and events and time frames predicated against this domain are conceptualized as if they were locatable positions or movable objects within that domain. One version takes time as a moving object; the other takes time as a landscape that entities or events move across. We are only exploring the latter version of this metaphor, that time is like a spatial landscape within which events are located or transpire. Despite the multiplicity of interpretations of this metaphor, most cognitive linguists nevertheless assume the conceptual and experiential priority of space and view time as derivative. By contrast, Givón (1979, Ch. 8) assumes that time is more fundamental than space and Langacker (1987:148-9) claims that space and time are equally primary as cognitive domains. Nevertheless, both positions acknowledge that space routinely provides conceptual structure for our understanding and linguistic encoding of time and assume that some version of a TIME IS SPACE metaphor operates or once operated widely in language.

Needless to say, the metaphorical mapping between the two domains is not quite perfect. Whereas there are three spatial dimensions that we routinely allude to, there is only one temporal dimension, although there could be variously sized expanses within that single dimension. Despite the limited topography in "temporal space," there are several distinct kinds of temporal relations between entities or events that languages make reference to via inherently spatial terms, such as ORDER, DURATION, and SIMULTANEITY.³ For the purposes of this paper, we simply assume that a TIME IS SPACE metaphor operated at some point in the development of the language if a temporal relation is being expressed with spatial language.

There are quite a few proponents of this broadly construed TIME IS SPACE metaphor in psychology and linguistics (cf. Fraisse 1963; Clark 1973; Miller & Johnson-Laird 1976; Cottle 1976; Friedman 1990; Anderson 1971; Traugott 1978, 1985, 1986; Lakoff & Johnson 1980; Jackendoff 1983; Talmy 1983, 1988; Rad-den 1985; Langacker 1987, 1991a; Bybee 1988; Heine, Claudi, & Hünnyer 1991; Svorou 1994; Traugott & Heine 1991; Bybee et al. 1994; Kuteva & Sinha 1994.)⁴ Because of its general ubiquity in language, it is easy to provide examples of this metaphor or at least examples of expressions which get used both spatially (S) and temporally (T). Some examples are given in (1) for English and (2) for Dutch.

- (1) a. S: *The hospital is WAY PAST the police station.*
T: *It's WAY PAST your bedtime.*
b. S: *He's GOING TO the door.*
T: *He's GOING TO open the door.*
c. S: *It's a room WHERE / IN WHICH we can talk.*
T: *It was a situation WHERE / IN WHICH no one was happy.*

d. S: *She TOOK her usual PLACE at the table.*

T: *When did that event TAKE PLACE?*

(2) S: *Hij KOMT.*

'He will come.'

T: *De tijd KOMT.*

'Time will come.'

In fact, it is difficult to find counter-examples to the unidirectionality implied by the metaphor. That is, there are few, if any, specifically temporal terms used to describe purely spatial relationships. We suggest what such expressions would be like in (3). Note that when time is successfully used to describe location, there is nearly always an element of motion or sequence involved, as shown in (3a) and (3b), and one could argue that the resulting expression is more metonymic than metaphoric:

(3) a. *The next McDonald's - only 16 MINUTES AWAY!*

b. *It was THEN, at the dinnertable, WHEN the whole family was together.*

c. **They HOURED their way through the art gallery.*

d. **It was a place WHEN we could go and dance.*

A TIME IS SPACE metaphor is especially pervasive in the meaning relations evidenced by adpositions as shown in (4) and (5), for English and Dutch respectively.

(4) a. S: *John left his keys IN the car.*

T: *She died IN 1886.*

b. S: *She drove right BY his house.*

T: *I had returned the book BY closing time.*

c. S: *The virus spread THROUGHOUT the country.*

T: *It rained THROUGHOUT the night.*

(5) a. S: *OP de tafel*

'on the table'

T: *OP tijd*

'on time'

b. S: *Hij sprong OVER het hek.*

'He jumped over the fence.'

T: *Het is tien OVER 8.*

'It's ten past eight.'

Historically, the metaphor has been so robust that quite a few of the English prepositions have lost almost all semblance of their original spatial meaning and

for all intents and purposes are considered temporal, such as *before*, *after*, and *until*. But, importantly, we can trace them back to their spatial roots, as Traugott (1978, 1985, 1986) has done in a number of analyses and thus something like a TIME IS SPACE metaphor seems quite justified.

In sum, linguists and cognitive and developmental psychologists have long noted that there is considerable overlap between spatial and temporal terms in a wide variety of languages and prepositions in English and Dutch are no exception. However, it is important to bear in mind that the TIME IS SPACE metaphor is fundamentally just a way of describing this overlap. This metaphor has received wide play by cognitive linguists and linguists working under the banner of grammaticalization. They have promoted it and metaphor in general as a vital and commonplace construal mechanism which is capable of constantly shaping and extending language from concrete lexical sources to more abstract grammatical applications. But it is the *cognitive*, not historical, status of the TIME IS SPACE metaphor that concerns us here.

3. Grammaticalization's link to (prepositional) polysemy

Metaphor, as an instrument of grammaticalization, puts old lexical items to work in new ways. Of concern is whether or not these new applications give rise to new senses for those lexical items and, if so, what the lexical status of these new senses would be. The synchronic results of metaphorical extension (i.e. the new senses that a lexical item develops through metaphor) may or may not get accorded any special treatment or distinct representation in the subjective lexicon of speakers. It is this indeterminacy about the cognitive status of separate though clearly related senses of individual prepositions that has been guiding our work for a number of years.

3.1. Polysemy and lexical network models

Essentially, we are trying to find empirical answers to questions implicit in lexical network models, some of which are discussed at length in Sandra & Rice (1995) and Rice (1996) and posed again here. For a complex lexical item like a preposition, at what point do monosemic analyses break down, if ever? Conversely, is there a point where we must resort to homonymic listings in the lexicon? In short, when is polysemy the most viable representational alternative and when is it not and why? Lexical network models depicting multiply interconnected nodes are routinely posited in cognitive linguistic analyses as a way of representing lexical polysemy. A polysemous lexical item is taken to represent a complex lexical category subsuming multiple related senses. However, what criteria determine the separateness and/or degree of interrelatedness of the purported senses? Which

sense(s) is/are basic and which are extended? How should we treat cross-categorical usages (i.e. heterosemous senses as discussed by Lichtenberk 1991)? It remains an open question as to how many separate but related sense types (i.e. individual nodes) should be posited for a single lexical item and what their cognitive status is supposed to be. Sandra & Rice (1995) attempt to address psycholinguistic issues stemming from network models of prepositional meaning, whereas many in the field of lexical and conceptual semantics have looked at meaning relationships independently of speaker's perception of them.

3.2. *Construal mechanisms*

Nearly everyone working in cognitive, lexical, or conceptual semantics recognizes the need for attributing certain inter- and intra-lexemic relationships to a variety of construal mechanisms (cf. Talmy 1983; Jackendoff 1983; Herskovits 1986; Lakoff 1987; Langacker 1987, 1991a/b; and Vandeloise 1991). Examples of some construal mechanisms and how certain shifts in construal can affect linguistic coding are given in (6).

- (6) a. SCHEMATICIZATION (adjusting level of specificity)
Something's there. ↔ *A big spider is under the newspaper.*
- b. IDEALIZATION/ABSTRACTION ("tolerance" for physical differences between reference objects)
The bird sat [in the tree]. ↔ *The dog lay [in the sun].*
- c. PERSPECTIVE (subjective directionality imposed on the scene)
[Her apartment] is below [mine]. ↔ *[Mine] is above [hers].*
- d. PROFILING (shift in focus of attention)
[the lid] to/off/on [the jar] ↔ *[the jar] with [the lid]*
- e. METAPHOR (change of background domain)
He got into [the car]. ↔ *He got into [some trouble].*

Of course, this inventory of construal mechanisms is far from fully determined. There is considerable overlap and proliferation of labels in the literature. And while there is general agreement that shifts in attention or adjustments in conceptualization like those proposed in (6) affect linguistic coding, there is little agreement about whether such mechanisms operated mainly in past stages of a language to give us our present assortment of meaning relations or whether such mechanisms operate each time we speak.⁵ Cognitive linguists focus primarily on the effects of imaging mechanisms or image schemas while conceptual semanticists and those concerned with grammaticalization focus on pragmatic inferencing mechanisms. But both camps rely quite heavily on metaphor as a construal mechanism. And metaphor or, rather, one metaphor in particular is our focus here.

Broadly speaking, metaphor is the process whereby conceptual associations between two domains allow language to extend from one domain to another. Johnson (1987:171) writes that, "(m)etaphor is perhaps the central means by which we project structure across categories to establish new connections and organizations of meaning and to extend and develop image schemata." Yet, he cautions that "(w)e need to know more about what kinds of source-domains there are, about what kinds of projections are possible, and about constraints on them (which keep them from being arbitrary)." These concerns are shared by many in the grammaticalization community who are also intent on mapping out the types of mechanisms and types of changes which happen at various stages of grammaticalization. Loosely speaking, grammaticalization is the process whereby a lexical item may shift in meaning and ultimately lose its phrasal or morphological independence or even reduce to zero as it becomes a grammatical particle or *gram*, eventually carrying more pragmatic force than lexical meaning. We are not interested here in the entire cline of grammaticalization, but in semantic changes going on at or near the onset of this chain of events, when new usages remain clearly lexical and not functional. Bybee (1988, 1993) and Bybee et al. (1994) consider metaphor to be an early stage mechanism of grammaticalization whose result is to extend a lexical item into new domains of usage rather than to change its morphological form or syntactic distribution per se.

In this paper, we are specifically targeting those metaphor-induced associations which allow or allowed time to be conceptually structured and represented linguistically as if it were space. However, as even a small amount of introspection reveals, it is very hard to determine the viability of such an entrenched metaphor as TIME IS SPACE. In general, the distinction between dead, conventional, and productive metaphors is not readily apparent (cf. Traugott 1985). Moreover, dead or unproductive metaphors can still be shown to have been cognitively motivated at an earlier stage in a language. Demonstrating this motivation is what many researchers in cognitive linguistics and grammaticalization theory have been working on for years, although admittedly for different ends. However, both the cognitive linguist and the grammaticalization theorist are concerned with the cognitive mechanisms underlying grammatical form. For both theoretical and representational purposes, the motivation for a metaphor may be stored in the linguist's or even the language user's mind, but may be nonfunctional in on-line processing tasks. But what if the metaphor is also nonfunctional in off-line tasks? Would this not compromise advocates of monosemic representation? With this in mind, we asked ourselves whether conscious awareness of the metaphor by modern speakers might be a better indicator of its relevance to the lexical representation questions that we mentioned in 3.1.

4. The metaphor and the Transparency Hypothesis

We set out to investigate the hypothesis that temporal usages of a still predominantly spatial preposition would be judged more similar to spatial usages than would most abstract usages. This hypothesis is based on an assumption that temporal usages involve a more straightforward metaphorical mapping between the experientially basic domains of SPACE and TIME than do mappings between SPACE and other clearly derivative domains. Thus, since the TIME IS SPACE metaphor is so robust linguistically, it should also be prominent conceptually and therefore transparent to conscious awareness. Operationally speaking, a "transparency hypothesis" such as this would predict that temporal usages of a preposition like *on* shown in (7b) would be judged more similar to canonical spatial usages like that in (7a) than would more abstract or grammaticalized usages like those in (c), (d), or (e), some of which might also involve metaphor rather than other grammaticalization mechanisms.

- (7) a. I met him ON the bus. [SPATIAL]
 b. I met him ON a Tuesday. [TEMPORAL]
 c. I heard him ON the radio. [ABSTRACT]
 d. I depend ON him. [ABSTRACT]
 e. He talked ON and ON. [ABSTRACT]

If evidence supports (or at least fails to refute) the Transparency Hypothesis, we might be led to conclude that as far as spatial and temporal usages are concerned, speakers - like linguists - are aware of the link and we need not burden the lexicon with multiple senses of this type. In short, a monosemy approach is sufficient to capture spatial and temporal usages. Temporal usages would involve an active metaphorical mapping, and metaphor along with other construal mechanisms or construal rules can be implemented to account for the semantic extension. This is essentially the conclusion reached by Bennett (1975), Caramazza & Grober (1976), Jackendoff (1983), Ruhl (1989), and in a weaker form, by Herskovits (1986).⁶

If evidence refutes (or at least fails to support) the Transparency Hypothesis, we may have earned ourselves a licence to speculate further about prepositional polysemy. We may indeed need to list spatial and temporal usages separately in the lexicon since they reflect sufficiently different use types for speakers. This is compatible with what most cognitive linguists already assume. Nevertheless, this finding is also not incongruent with a prepositional homonymy approach such as that advocated by Rauh (1991), who believes that spatial and temporal usages should be listed under separate *entries* in the lexicon as should adverbial and conjunctive usages.

5. Testing the Transparency Hypothesis psycholinguistically

We tested this hypothesis experimentally for a number of English and Dutch prepositions being used both spatially and temporally as well as abstractly. In this still preliminary phase of our investigation, a variety of off-line experimental techniques were applied, including a sorting task, a similarity judgment task, and a task probing cross-linguistic translation intuitions. We report on these results below in Sections 5.1 through 5.3. In Section 5.4, we discuss how the interpretation of these findings is limited unless or until results from on-line tasks are also brought to bear on the research questions under consideration.

5.1. A sorting task

The first experiment could be likened to a "virtual" card-sorting task. Depending on the experimental condition (which simply varied the ratio of usage types presented), the stimulus set contained 50 sentences per preposition representing approximately 20 spatial usages, 20 abstract usages, and 10 temporal usages of *at*, *on*, or *in*. The 20 subjects saw all 50 sentences at once. They were presented on the left side of a two-page computer monitor. Subjects were asked to sort the sentences into groups by moving them with a mouse to the right side of the screen at which point boxes would form around similarly grouped sentences. They were told to sort on the basis of "how the preposition was being used in each sentence." The results of these sorts were tabulated and put into similarity matrices. Hierarchical cluster analyses, based on each similarity matrix, were performed on the data. This descriptive technique takes the frequencies with which pairs of sentences are put in the same group and outputs a hierarchically organized binary branching tree. Figure 1 represents the results of a cluster analysis of subjects' sortings for 50 sentences containing various usages of *on*.

The tree's lateral structure reflects the relative strengths of relations between sentences as they were perceived by the subjects. Pairs of sentences which were most similar are joined first (with lower branching, shown on the right-side of the tree). Higher branching (towards the left) indicates little perceived similarity. An inspection of this tree reveals that subjects were quite able to sort sentences in a non-random way, as there is a discernible pattern in the data. Most interesting was the fact that the major division was brought about by the presence or absence of a *spatial* sense. Moreover, within the non-spatial division, tightly-clustered lower branchings indicating a high degree of perceived similarity tended to occur for *temporal* usages. Abstract usages tended not to cluster at all.

A Principle Coordinates Analysis was also performed on each tabulated sort. This is a descriptive technique for representing multidimensional data in three or fewer dimensions. It can examine a large number of variables without having to

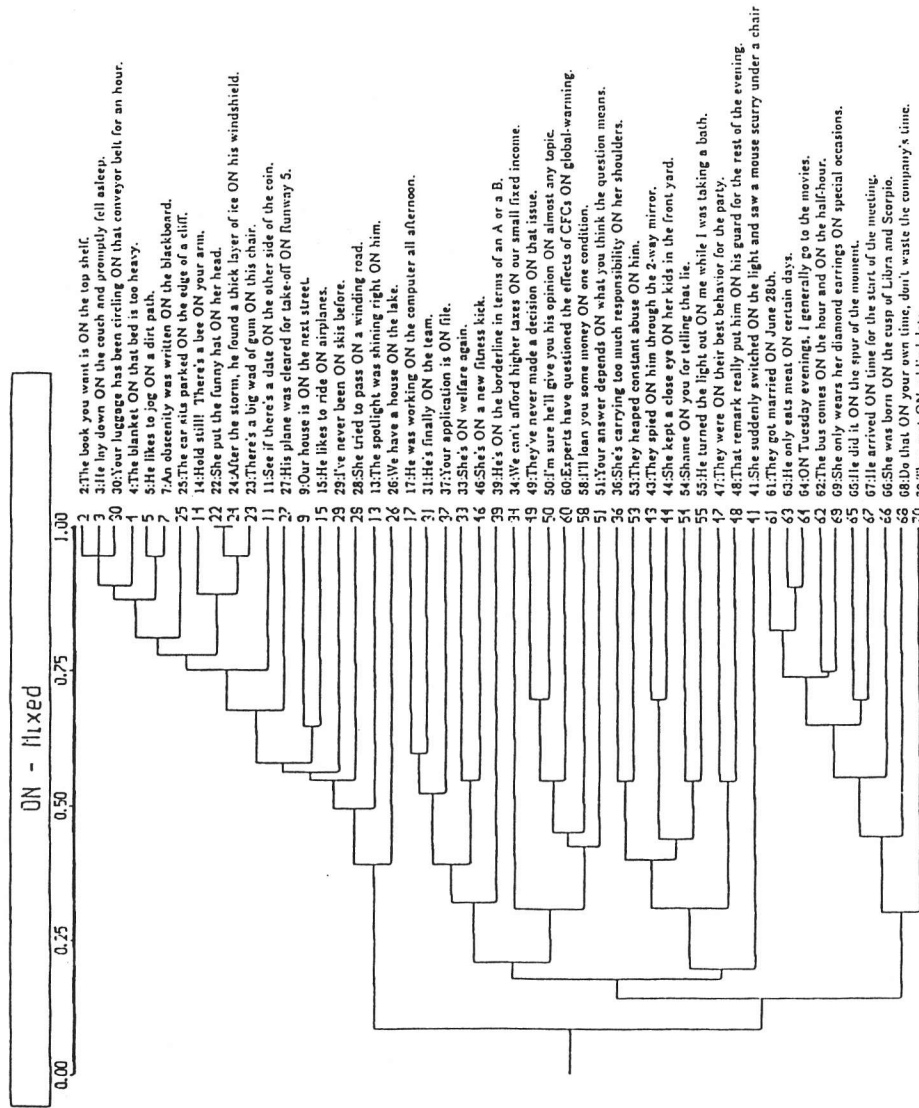


Figure 1. Cluster analysis of subjects' sortings of 50 usages of ON

make any *a priori* assumptions of what the variables are (for instance, our SPATIAL, TEMPORAL, or ABSTRACT categories). This multivariate analysis, which takes the results of a similarity matrix as input, determines the number of variables which give the best account of the data. Essentially, it collapses 50 dimensions (representing the 50 stimulus sentences) into three. Figure 2 represents the PCA results from the MIXED condition for *on*. The analysis has condensed the information from the sorting task into a 3-D space, reflecting the distribution of 20 spatial usages (shown clustering at the right), 10 temporal usages (shown clustering at the top left), and 20 abstract usages (shown spread out along the bottom left).

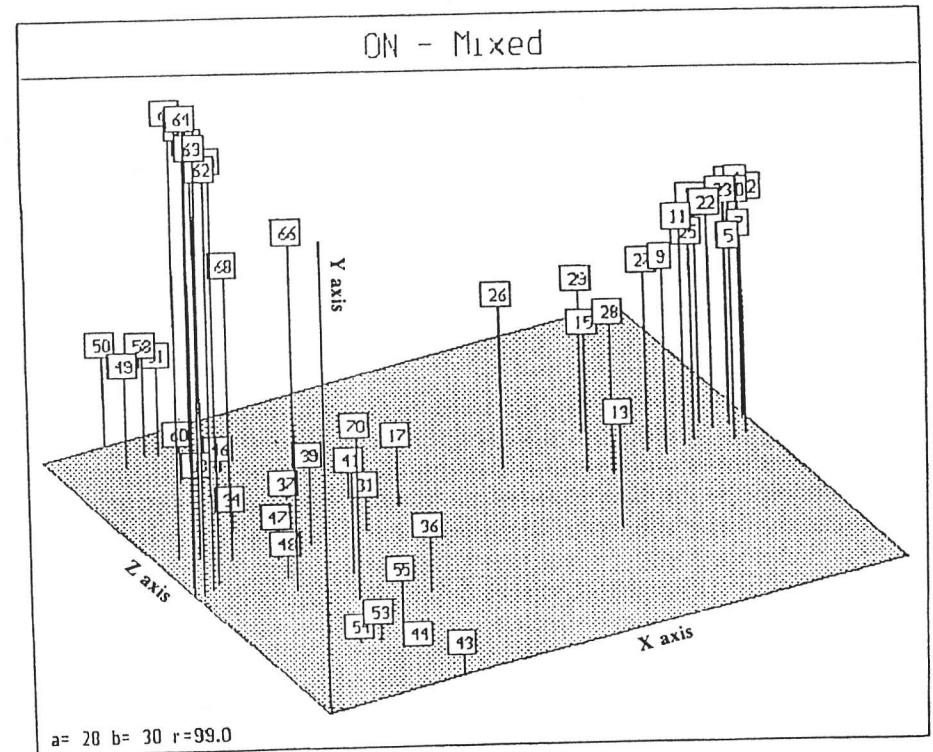


Figure 2. Principle coordinates analysis of sorting responses for the 50 sentences in Figure 1

The first or X axis (horizontal width) in Figure 2 seems to correlate with a *spatio-temporal* dimension, with space and time usages strongly opposed. (The sentence numbers correlate with those in Figure 1.) Sentences (64), *ON Tuesday evenings, I generally go to the movies*, and (2), *The book you want is ON the top shelf*, represent completely polarized values along this dimension. The second or Y axis (vertical height) seems to correlate with a *concrete/non-concrete* dimension which reinforces the idea that usages pertaining to these domains (be they spatial or temporal) are experientially grounded. Most of the sentences involving clear-cut spatio-temporal usages register high values along the Y axis, while nearly all of the sentences containing abstract usages register low values. It is difficult to determine what is being represented by the third dimension or Z axis (depth) at this time, except that there is no clustering along this dimension. The Z axis endpoints are exemplified by sentences (43), *They spied ON him through the two-way mirror*, and (50), *I'm sure he'll give you his opinion ON almost any topic*. In short, it is hard not to conclude that spatial and temporal usages are mutually exclusive, though similar in their opposition to abstract usages. This general pattern was noted for all nine sets of sorting data (3 prepositions x 3 conditions).

It was the fairly pronounced results of this experiment that encouraged us to formulate and test the Transparency Hypothesis in the first place. However, we were concerned that the nature of the sorting task caused a tendency, in effect, to *magnify* any differences between sense types based on background domain. Subjects may have sorted on the basis of clearly recognizable experiential domain and simply ruled out the possibility of semantic overlap between the spatial and temporal domains. For that reason, we decided to run another experiment in which response strategies may have encouraged subjects to *minimize* any differences between uses.

5.2. A similarity judgment task

The second experiment involved a similarity judgment task, also conducted on English prepositions at the University of Alberta. Subjects were presented with pairs of sentences containing the same preposition on a computer screen and were asked to judge whether the preposition in the two sentences was being used in a similar or different fashion. Subjects recorded their judgment by moving a cursor with a mouse along an uncalibrated (the results were later normalized) scale at the bottom of the screen which was labelled ABSOLUTELY IDENTICAL at one end and COMPLETELY DIFFERENT at the other. 20 subjects judged pairs of sentences containing spatial (S), temporal (T), and abstract (A) usages of 7 prepositions. In effect, they compared every possible pairing of 3 spatial, 3 temporal, and 3 abstract usages of a preposition. Each pairwise combination (e.g., S-S, T-A, etc.) of 9 sentences yielded 36 possible comparisons which, when multiplied by 7 for the different prepositions, gave 252 sentence pairs that each subject had to judge.

A 3-way ANOVA revealed that the effects of the actual sentences, the 7 prepositions, and the overall type of usage (either spatial, temporal, or abstract) were all significant. Most telling are the subject response means depicted in Figure 3.

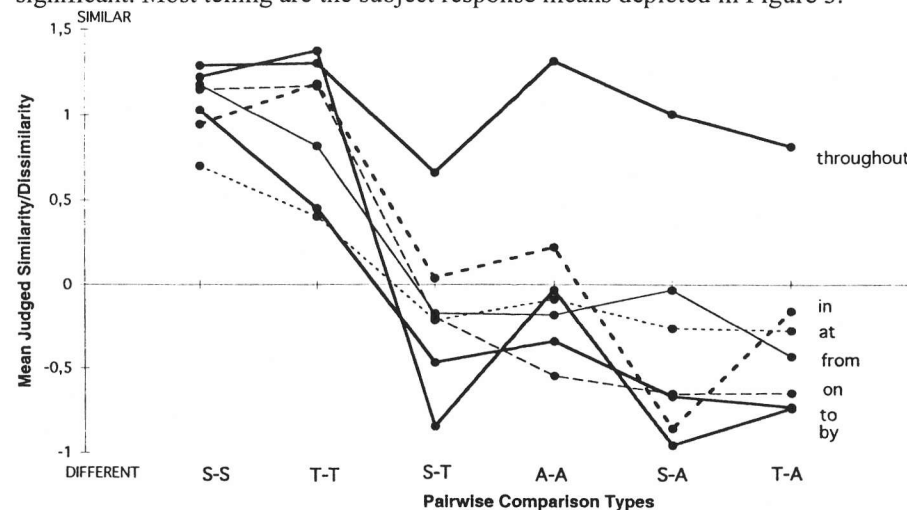


Figure 3. Average ratings for all pairwise comparisons of sentences in similarity judgment task

The graph in Figure 3 shows that, although there were some trends in how subjects responded (note the general downward curve), the individual prepositions behaved differently. Of particular concern for the Transparency Hypothesis is how spatial and temporal pairs were treated compared to other kinds of paired usage types. It would have predicted that S-S, T-T, and S-T pairings would be judged to be more similar to each other than would A-A, S-A, or T-A pairings. As can be seen from this graph, only S-S and T-T pairings were judged to be at all similar. It should be noted, however, that the historically recent compound preposition, *throughout*, especially chosen since it is much newer and has not grammaticalized to the same extent as the others, is the only preposition for which all pairings were rated as positively similar overall. But even for this preposition, the S-T pairings had the lowest mean. For all the others, paired spatial-temporal usages were rated on average as dissimilar as the comparisons between abstract usages, and other cross-domain comparisons between spatial and abstract usages or temporal and abstract ones.

We also conducted a Principle Coordinates analysis on these data. In this case, the analysis only had to collapse 9 dimensions (representing three usages each from the domains of space and time and three representing abstract usages) into 3. Just as we saw for the previous experiment, the best account of the data had spatial and temporal usages maximally separated along a single dimension but

each clustered together more or less, while abstract usages took advantage of the remaining two dimensions. This pattern held for all of the prepositions except *throughout* which we take to be an indication of the continuing transparency of a spatial metaphor operating both for temporal usages and for abstract ones as well. Figure 4 shows the PCA results for *on*, *by*, and *throughout*.

5.3. A translation decision task

In this experiment, carried out at the University of Antwerp, 25 Dutch-speaking subjects had to rate sentence pairs containing temporal (T), abstract (A), and two kinds of spatial (S) use types of a preposition. Specifically, the task required subjects to respond YES or NO as to whether the paired usages of the Dutch preposition, *in*, might be translated by the same word in Turkish, a language judged to be unfamiliar to all of the subjects. They also had to rate the certainty with which they made their response. As a control, subjects rated nearsynonymous (SYN) and clearly homonymous (HOM) usages of some Dutch nouns as well. A sample of the types of stimulus sentences used is given in (8):

- (8) a. S1 *Het muntstuk ligt IN de beker.*
'The coin is IN the cup.'
S2 *Hij woont IN Ohio.*
'He lives IN Ohio.'
- b. T *IN het weekend gaan wij altijd onze oma bezoeken.*
'DURING the weekend, we go visit our grandmother.'
- A *De bomen stann IN bloei.*
'The trees are IN bloom.'
- c. SYN *Hij heeft het VENSTER gebroken met een steen.*
'He broke the WINDOWPANE with a stone.'
SYN *De dieven kwamen langs het VENSTER het huis binnen.*
'The burglars entered ... through the WINDOW.'
- d. HOM *Vraag eerst MONSTERS van de verschillende types voor we een bestelling plaatsen.*
'First ask for SAMPLES of the different types...'
HOM *Zijn hond is een echt MONSTER en hij is al niet veel beter.*
'His dog is a real MONSTER...'

At issue was whether subjects would perceive spatial and temporal usages as being sufficiently similar or dissimilar to warrant the same treatment under translation. More generally, would subjects' responses to S-T pairings be more like their responses to paired synonyms or paired homonyms or would they be something in between?

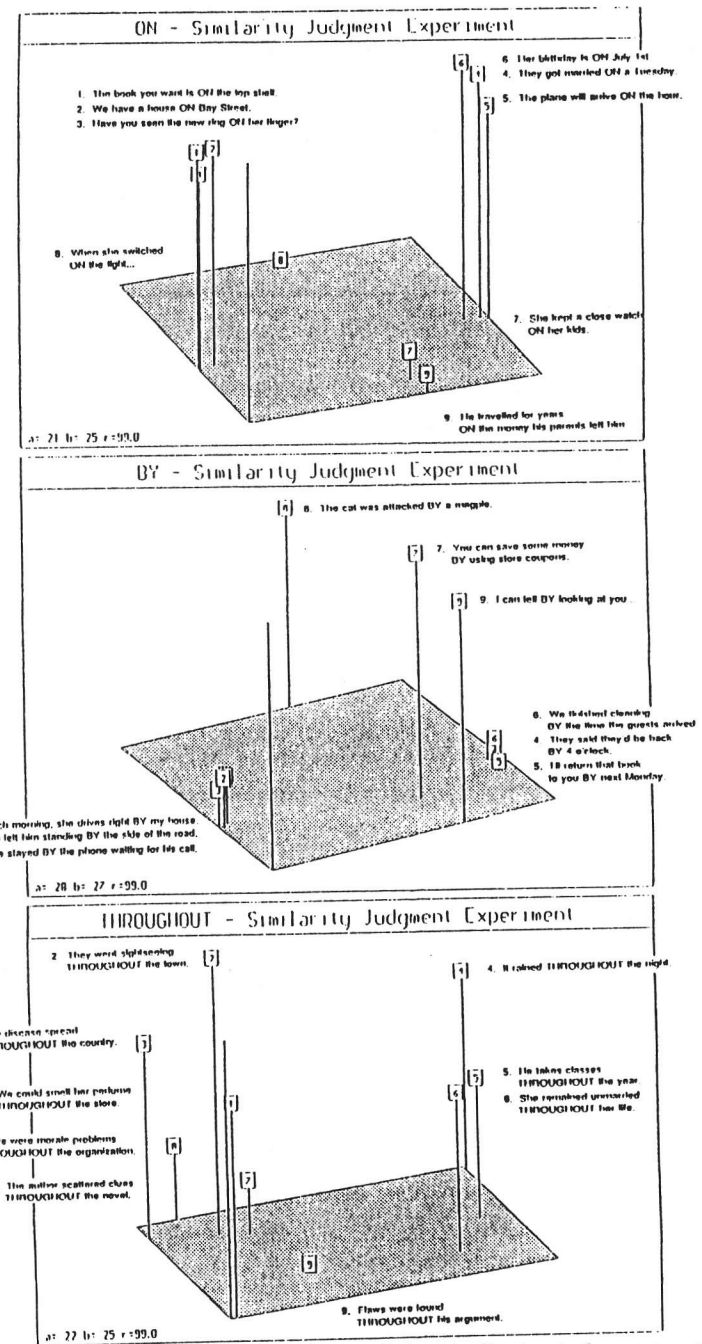


Figure 4. Principle coordinates analysis of the similarity judgment ratings for sentences with *on*, *by*, and *throughout*

As can be seen by the graph in Figure 5, the results show that most subjects believed that Turkish would translate spatial and temporal usages of Dutch *in* differently.

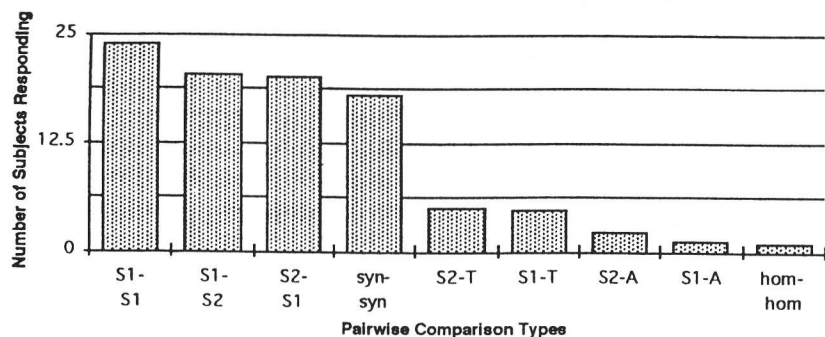


Figure 5. Number of "yes" responses to forced choice question in translation decision task (first version)

A 2-tailed T-test found all of these means to be significant. From the perspective of the Transparency Hypothesis, we again find corroborating evidence in a completely different type of task and in a different language that spatial and temporal senses of a preposition are considered to be more dissimilar than similar by modern speakers.

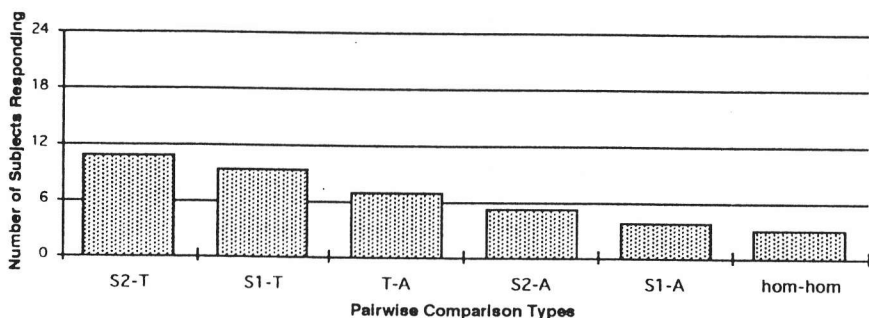


Figure 6. Number of "yes" responses to forced choice question in translation decision task (second version)

It was thought that a large number of synonymous items in the stimulus set would have magnified the perceived differences of the S-T, S-A, and HOM-HOM pairings. For that reason, a second version of the experiment with 24 subjects was run eliminating any S-S or SYN-SYN pairs. Moreover, a new set of T-A stimulus

sentences was included. In the presence of sentential pairs featuring no clear synonyms, S-T pairs were rated as the most similar, relatively speaking. Unfortunately, the response pattern for S-T pairs was not significantly different from chance, as shown in Figure 6.

It seems that subjects behaved as if they did not quite know how to respond to S-T pairs. Since the experiment involved a forced choice response, roughly half of the subjects said that spatial and temporal usages would probably be translated the same way in Turkish, while the other half said they would not.

5.4. What the psycholinguistic evidence does and does not suggest

With respect to the Transparency Hypothesis, similar results obtained across three different experimental tasks, which appears to indicate that the TIME IS SPACE metaphor may not be so transparent for modern speakers. We have reached some tentative conclusions from the psycholinguistic findings thus far and summarized them in (9):

- (9) i. Background domain (space vs. time) is a significant factor.
- ii. Individual prepositions have idiosyncratic properties.
- iii. All metaphors (i.e. cross-domain mappings) are not equally viable or salient.
- iv. Subjects are sensitive to degrees of variation between sense types.
- v. Subjects show a surprising amount of consensus across domains.
- vi. Subjects show a surprising amount of consensus across tasks.

However, we are the first to admit that there are a number of methodological weaknesses in our research which make any conclusions extremely provisional. Chief among these are limitations inherent in off-line tasks. Without corroborating evidence from on-line tasks, we cannot distinguish between true response effects (affecting lexical access and processing) and the perception effects we obtained.

The general question guiding our research is whether or not speaker access to underlying conceptual structure should play a role in motivating *synchronic* relationships between polysemous senses of a lexeme in the lexicon. To that end, we are in the process of developing a battery of psycholinguistic experiments that will help us answer fundamental questions about semantic and conceptual representation. To be sure, these questions could be explored empirically in other ways as well. For example, by looking diachronically at the development of English and Dutch, do we find that synchronic patterns reflect order of emergence in the language? Secondly, do we find that synchronic patterns reflect order of emergence in the child? Thirdly, in text-based studies, we might ask whether or not these same patterns are reflected in terms of their relative frequency across different

modalities and genres? And finally, could clinical evidence be brought to bear on this question? Are synchronic patterns reflected in patterns of loss?

6. Implications for cognitive linguistics and lexical semantics

With respect to the Transparency Hypothesis, our results suggest that the TIME IS SPACE metaphor may not be so transparent. Its purported transparency may not necessarily derive from its cognitive motivation *per se* - cognitively motivated links may or may not be perceived - but from its omnipresence in the lexicon of languages. Be that as it may, how should lexical semanticists respond representationally?

There are a few conclusions that we *can* tentatively draw at this time based on the very preliminary psycholinguistic evidence. Most of these are claims that cognitive linguists have long assumed or taken for granted to be true of all speakers. First, there is some evidence for the polysemic representation of prepositions such that the lexicon may need to reflect in the form of multiple senses the by-product of long conventionalized metaphors. Thus, abstract or purely topological schemas such as those posited by monosemists are probably insufficient.⁷ Secondly, background domain influences meaning to a large extent. Since meaning is contextualized, posited senses must make inherent reference to cognitive domain (cf. Lakoff 1987, Langacker 1987/1991a, 1991b, Croft 1993). Moreover, some background domains, especially concrete domains of immediate experience such as space and time are more distinctive than others. Thirdly, the TIME IS SPACE metaphor appears to be dead or dying for many prepositions. Although we may be able to finesse some of the more abstract extensions by relating them via a set of construal rules or inferencing mechanisms, we cannot do so with those extensions pertaining to unified conceptual domains like time and space.

We conclude by acknowledging what we still do not know about the nature and degree of polysemy in the mental lexicon: What degree of sense similarity and sense differentiation is tolerated within a lexemic network? How much do other background domains affect differentiation of sense type (e.g., the domain of causality as discussed in Radden 1985)? Do either syntactic use or lexical frequency affect differentiation of sense type? To what extent does the vitality or moribundity of the metaphorical mapping (or other inferential mechanism) influence conceptualization and lexical representation (cf. Traugott 1985)? Do speakers display comparable sensitivity to similarities and differences between multiple senses of items from other lexical classes (either "open" or "closed")? And finally, are locative particles indeed sufficiently cognitively special to warrant all the attention they have attracted by cognitive linguists?

Notes

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2. By heterosemous, we mean polysemous and polyfunctional in the sense discussed in Lichtenberk (1991) and Rice (in press).
3. Some examples of these relations and the English prepositions that encode them are given in (i):
 - (i) a. ORDER
I'll do my homework before/after I eat dinner.
 - b. DURATION
We worked for an hour.
We worked from 6:00 to 8:00/between 6:00 and 8:00.
We worked throughout the night.
 - c. SIMULTANEITY
They arrived at 4:00/on my birthday/in the middle of June.
4. Several experiments in the psychological literature (Pavio 1978; Friedman 1983) report on subjects routinely using spatial imagery to solve problems concerning time patterns. For example, when subjects are asked whether the interval between October and February is longer or shorter than the interval between April and November, they will report that they imagine a circle or a line with the months laid out and simply compare distances. Both linguistic and psychological evidence seems to indicate that in western culture, at least, the experience and encoding of time commonly extends from spatial imagery and spatial language.
5. In short, are these active processing mechanisms or have their effects simply become lexicalized?
6. We are aware of the possibility that the activation of the metaphor each time may or may not be correlated with a real-time processing effect. We take up this concern in Section 6.
7. Rice (1992) argued against monosemy on purely theoretical grounds.

References

- Anderson, John. 1971. *The Grammar of Case*. Cambridge: Cambridge University Press.
- Bennett, David. 1975. *Spatial and Temporal Uses of English Prepositions*. London: Longman.
- Bybee, Joan. 1988. "The diachronic dimension in explanation", in J. Hawkins (ed.), *Explaining Language Universals*. Oxford: Basil Blackwell, pp. 350-379.
- Bybee, Joan. 1993. "Mechanisms of semantic change in grammaticalization". Paper presented at ICLA 1993, Leuven, Belgium.

- Bybee, Joan, Revere Perkins and William Pagliuca. 1994. *The Evolution of Grammar: Tense, Aspect, and Modality in the Languages of the World*. Chicago: Chicago University Press.
- Caramazza, Alfonso and Ellen Grober. 1976. "Polysemy and the structure of the subjective lexicon", in Clea Rameh (ed.), *Semantics: Theory and Application [GURT on Languages and Linguistics 1976]*. Washington, DC: Georgetown University Press, pp. 181-206.
- Clark, Herbert. 1973. "Space, time, semantics, and the child", in T. Moore (ed.), *Cognitive Development and the Acquisition of Language*. New York: Academic Press, pp. 28-63.
- Cottle, Thomas. 1976. *Perceiving Time*. New York: John Wiley and Sons.
- Croft, William. 1993. "The role of domains in the interpretation of metaphors and metonymies", *Cognitive Linguistics* 4:335-370.
- Fraisse, Paul. 1963. *The Psychology of Time*. New York: Harper and Row.
- Friedman, William. 1983. "Image and verbal processes in reasoning about the months of the year", *Journal of Experimental Psychology: Learning, Memory, and Cognition* 9:650-666.
- Friedman, William. 1990. *About Time*. Cambridge, MA: MIT Press.
- Givón, Talmy. 1979. *On Understanding Grammar*. New York: Academic Press.
- Heine, Bernd, Ulrike Claudi and Friederike Hünemeyer. 1991. *Grammaticalization*. Chicago: University of Chicago Press.
- Herskovits, Annette. 1986. *Language and Spatial Cognition*. Cambridge: Cambridge University Press.
- Jackendoff, Ray. 1983. *Semantics and Cognition*. Cambridge, MA: MIT Press.
- Johnson, Mark. 1987. *The Body in the Mind*. Chicago: University of Chicago Press.
- Kuteva, Tania and Chris Sinha. 1994. "Spatial and non-spatial uses of prepositions: Conceptual integrity across semantic domains", in Monika Schwartz (ed.), *Kognitive Semantikforschung*. Berlin: Gunter Narr, pp. 215-237.
- Lakoff, George. 1987. *Women, Fire, and Dangerous Things: What Categories Reveal about the Mind*. Chicago: University of Chicago Press.
- Lakoff, George and Mark Johnson. 1980. *Metaphors We Live By*. Chicago: University of Chicago Press.
- Langacker, Ronald. 1987. *Foundations of Cognitive Grammar*, Vol. I, *Theoretical Prerequisites*. Stanford: Stanford University Press.
- Langacker, Ronald. 1991a. *Foundations of Cognitive Grammar*, Vol. II, *Descriptive Application*. Stanford: Stanford University Press.
- Langacker, Ronald. 1991b. *Concept, Image, and Symbol*. Berlin: Mouton de Gruyter.
- Lichtenberk, Frantisek. 1991. "Semantic change and heterosemy in grammaticalization", *Language* 67:474-509.
- Miller, George and Philip Johnson-Laird. 1976. *Language and Perception*. Cambridge, MA: Belknap/Harvard.
- Nunberg, Geoffrey. 1979. "The non-uniqueness of semantic solutions: Polysemy", *Linguistics and Philosophy* 3:143-184.
- Paivio, A. 1978. "Comparisons of mental clocks", *Journal of Experimental Psychology: Human Perception and Performance* 4:61-71.
- Radden, Günter. 1985. "Spatial metaphors underlying prepositions of causality", in Wolf Paprotté and René Dirven (eds.), *The Ubiquity of Metaphor*. Amsterdam: John Benjamins, pp. 177-205.
- Rauh, Gisa. 1991. "Prepositional forms in the lexicon: Problems and suggestions", in Gisa Rauh (ed.), *Approaches to Prepositions*. Tübingen: Gunter Narr, pp. 169-223.
- Rice, Sally. 1996. Prepositional prototypes. In René Dirven and Martin Pütz (eds.): *The Construal of Space in Language and Thought*, pp. 135-165. Berlin / New York: Mouton de Gruyter.
- Rice, Sally. In press. "Aspects of Prepositions & Prepositional Aspect", in Leon de Stadler (ed.): *Issues in Cognitive Linguistics*. pp. 227-249.
- Rice, Sally. 1992. "Polysemy and lexical representation: The case of three English prepositions", in *Proceedings of the Fourteenth Annual Conference of the Cognitive Science Society*, Hillsdale, NJ: Lawrence Erlbaum, pp. 89-94.
- Ruhl, Charles. 1989. *On Monosemy: A Study in Linguistic Semantics*. Albany: SUNY Press.
- Sandra, Dominiek and Sally Rice. 1995. "Network analyses of prepositional meaning: Mirroring whose mind - the linguist's or the language user's?", *Cognitive Linguistics* 6:89-130.
- Svorou, Soteria. 1994. *The Grammar of Space*. Amsterdam: John Benjamins.
- Talmy, Leonard. 1983. "How language structures space", in Pick and Acredolo (eds.), *Spatial Orientation*. New York: Plenum, pp. 225-282.
- Talmy, Leonard. 1988. "The relation of grammar to cognition", in Rudzka-Ostyn, Brygida (ed.), *Topics in Cognitive Linguistics*. Amsterdam: John Benjamins, pp. 165-205.
- Traugott, Elizabeth. 1978. "On the expression of spatio-temporal relations in language", in Joseph Greenberg et. al. (eds.), *Universals of Human Language*, Vol. 3. Stanford: Stanford University Press, pp. 369-400.
- Traugott, Elizabeth. 1985. "'Conventional' and 'dead' metaphors revisited", in Wolf Paprotté and René Dirven (eds.), *The Ubiquity of Metaphor*. Amsterdam: John Benjamins, pp. 17-56.
- Traugott, Elizabeth. 1986. "From polysemy to internal semantic reconstruction", in *Proceedings of the Twelfth Annual Meeting of the Berkeley Linguistic Society*, pp. 406-16.
- Traugott, Elizabeth and Bernd Heine. 1991. *Approaches to Grammaticalization*, Vols. I, II. Amsterdam: John Benjamins.
- Vandeloise, Claude. 1991. *Spatial Prepositions: A Case Study from French*. Chicago: University of Chicago Press.