Semantic shifts from space to time in motion-mediated expressions of distance

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Abstract: The entanglement of space and time is among most intensely debated topics in cognitive science. One linguistic context that appears to be well suited to researching this problem is the domain of prepositional expressions of distance, since they happen to take both spatial and temporal complements. Using standard reference language corpora for English and Polish, this study demonstrates an overall proportion between spatial and temporal expressions of distance for selected prepositions. The data show that the preposition away tends to be used relatively more frequently with temporal units to specify distance in space than other prepositions. This paper proposes a hypothesis that the outstanding temporality of away results from the semantic component of motion, which acts as an underlying modulator that shifts conceptualizations of distance from spatial to temporal terms.

Keywords: space, time, motion, distance, propositions, empirical linguistics

1. Introduction

The semantics of prepositions has been undergoing considerable changes in linguistics. Classical approaches to meaning of prepositions derived from formal conceptions of semantics (e.g. Bennett, 1975) were subsequently contested by cognitive linguistic studies conducted in 1980s (e.g. Brugman 1981/1988; Herskovits, 1986; Lakoff, 1987). Essentially, those proposals assume that prepositions are polysemous items that have a primary sense from

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which non-primary ones extrude in the form of radial network of meanings. From this outlook, the preposition can be viewed as a structure with a centre and a periphery, which goes in line with the assumption that categories are organized with respect to a prototype (see Lewandowska-Tomaszczyk, 2007 for a review of polysemy, prototypes, and radial categories).

Lakoff (1987), following an earlier pioneering work conducted by Brugman (1981/1988), took a highly fine-grained approach to the semantics of over presenting an extensive case study (Lakoff, 1987, pp. 416–461), which discusses more than twenty distinct meanings of that preposition. He argues that the differences observed between various uses of over should be regarded as distinct senses, i.e. distinct representations that language users keep in their mental lexicons.

However, Sandra and Rice (1995) pointed out that a fundamental shortcoming of prepositional networks, as they termed Brugman’s/Lakoff’s methodology, was that they had been designed without the use of any explicit criteria and discovery procedures. It casts a serious doubt on the systematic functioning of prepositional networks in the mental lexicon of language users and makes that framework weak from a methodological point of view.

A subsequently proposed framework of principled polysemy (Tyler & Evans, 2001) attempted to resolve the problem by introducing a methodology for determining distinct prepositional senses. Tyler and Evans proposed two criteria for determining whether a particular instance of a preposition counts as a distinct sense:

First . . . for a sense to count as distinct, it must involve a meaning that is not purely spatial in nature and/or in which the spatial configuration between the trajector and
landmark is changed vis-à-vis the other senses associated with a particular preposition.

Second, there must be instances of the sense that are context-independent, instances in which the distinct sense could not be inferred from another sense and the context in which it occurs. (Tyler & Evans, 2001, pp. 731–732).

More recently, however, Evans (2010) admitted that modeling the complexity of the spatial and functional relations conveyed by prepositions is more complex than initially assumed by the principled polysemy approach. He presented a proposal of refining the framework from the perspective of the theory of *Lexical Concepts and Cognitive Models* (Evans, 2009), which assumes a far greater complexity of interactions between lexis and cognitive models understood as large-scale multi-modal knowledge structures. Evans (2010) suggests that the particular semantics denoted by the prepositions *in*, *on*, and *at* is related to specific *psychosomatic states*. For example, we say *in trouble* because experiencing trouble is like being “enclosed” [**ENCLOSURE**] (cf. Turewicz, 2005), and we say *at risk* because experiencing risk is like being “located” [**CO-LOCATION**] near an external threat.

### 3. Spatial and temporal uses of prepositions

It has been traditionally accepted (e.g. Lyons, 1977) that prepositions serve to express both spatial and temporal relations. There has been a long-lasting debate, started probably in developmental psychology (Clark, 1973), whether temporal meanings of prepositions are derived from cognitively prior representations of space that stem from perceptual-motor experiences. Observations that conceptions of time are not expressed on their own terms but appear to be consistently structured in spatial terms are among fundamental arguments for
the theory of conceptual metaphors (Lakoff & Johnson, 1980).

Haspelmath (1997) conducted a study of spatial-temporal correlations in temporal adverbials based on data collected from fifty-three world’s languages. He specifically stated the goal of his research as “to assemble cross-linguistic evidence for the hypothesis that temporal notions are conceptualized in terms of spatial notions” (Haspelmath, 1997, p. 4). Haspelmath (1997, p. 140) concludes that while it is not possible to prove such a dependency on the basis of linguistic evidence alone, it is highly probable that time is universally secondary to space, irrespective of metaphorical conceptualizations.

However, Tenbrink (2007) points out that there is no language demonstrating, either synchronically or diachronically, an exact identity between spatial and temporal terms. As put by Tenbrink (2007, p. 14): “A closer look at Haspelmath’s data and line of argumentation shows that, overwhelmingly, he simply points to existing similarities between spatial and temporal linguistic expressions.” She adds that his argumentation for the conceptual priority of space is not linguistic, but rather based on intuition (cf. Jackendoff, 2002, pp. 356–360).

Szwedek (2009) analyzed a subset of prepositions including in, over and across in terms of their metaphoricity and polysemycity. Although it has been customary to approach prepositions as inherently polysemous elements, his analysis demonstrates that separate senses of a preposition are, at least in a good number of cases, context dependent. For example, for the sentences “The line stretches over the yard” and “The plane flew over the village” the static or dynamic aspect of meaning of the preposition is not derived from the inherent meaning of over, but depends on the context. As put by Szwedek, “rather than talking about distinct senses of prepositions, we can only say that prepositions are open to
static/dynamic, and possibly other interpretations, in the sense that they appear in such contexts” (Szwedek, 2009, p. 174).

Some cognitive linguists, most notably Langacker (1992, 2012) and Talmy (2000a, Ch. 1) see prepositions as linguistic particles that profile atemporal relations, which relates to an observation that, unlike verbs, prepositions do not express relations evolving over time. Instead, prepositions represent conceptualized relations holding between two entities, independent of sequentially evolving interdependencies. However, a close relatedness of space and time in prepositions makes it difficult to draw an absolute distinction between their spatial and temporal meanings because they seem to form a sort of semantic amalgamation (see Bączkowska, 2011 for an analysis from the perspective of spacetime representation).

The question if space-to-time metaphorical mappings actively influence the way of processing prepositional meanings was investigated by Kemmer (2005), who conducted a series of experiments with four left-hemisphere brain-damaged patients to determine whether spatial and temporal meanings of prepositions can be dissociated from each other by brain injury. His findings suggest that understanding temporal meanings of prepositions does not require establishing structural alignments with their spatial counterparts. Recently, Sullivan and Barth (2012) have observed that temporal perspective taking is not affected equally by any spatial prime, but rather by those spatial primes that engage active mental motor imagery.

Taken together, the results of those studies indicate that thinking about time triggers the activation of corresponding spatial representations most vividly when people are confronted with some specific tasks, especially ones involving motion mediated temporal reasoning. It is noteworthy that studies examining the experiential link between spatial and
temporal language with reference to disambiguation of temporal statements employ motion as the element that interfaces space with time (see Ramscar, Matlock & Boroditsky, 2010 for a review).

4. Space and time in prepositional expressions of distance

This paper investigates a hypothesis that motion acts as a key element that modulates spatial and temporal expressions of distance, which can be observed in prepositional phrases.

According to widespread linguistic intuitions, the relationship between time and space in distance expressions is determined by the asymmetry of space and time reflected in conceptual metaphors (Lakoff & Johnson, 1980). As put recently by Casasanto, Fotakopoulou and Boroditsky (2010):

In English, it is nearly impossible to talk about domains like time without using words that can also express spatial ideas: Vacations can be long or short, meetings can be moved forward or pushed back, deadlines can lie ahead of us or behind us. Yet it is far less common to use temporal words to talk about space... Although we could say that we live "a few minutes from the station," we could just as easily express this spatial idea in spatial words, saying "a few blocks from the station.” (Casasanto et al., 2010, p. 388).

Yet, it appears to be an intuitive opinion. A more credible way to find actual information about that relationship is to gather some tangible data on the distribution of spatial and temporal representations of distance from linguistic corpora. As emphasized by Sinclair (1991, p. 4) “human intuition about language is highly specific, and not at all a good guide to what actually happens when people actually use the language”. One linguistic context that
appears to be well suited to the task of investigating spatial vs. temporal expressions of distance is the domain of prepositions because they happen to take both spatial and temporal complements.

It approaches the problem of relations between space and time in prepositional expressions of distance from the perspective of cognitive corpus-based linguistics, which relies on explanatory notions adopted by the cognitive linguistics framework, but approaches them in such a way that their relevance to a given linguistic phenomenon can be empirically validated in large corpora (Heylen, Tummers & Geeraerts, 2008; see Lewandowska-Tomaszczyk & Dziwirek, 2009 for an edited collection of studies). Essentially, it demonstrates how people actually use language in natural contexts, rather than discusses what is theoretically possible in language.

The investigation is carried out using standard reference language corpora for English and Polish. For English the study employs the British National Corpus (henceforth, the BNC), which is a 100 million word collection of samples of written and spoken contemporary British English from a wide range of texts (see www.natcorp.ox.ac.uk for more information). For Polish this study is based on the Narodowy Korpus Języka Polskiego (the Polish National Corpus, henceforth, the NCP), which is a 240 million word collection of samples of both spoken and written contemporary Polish roughly mirroring the BNC in its structure (see www.nkjp.pl for more information).

This study examines distance in the sense of geographical separation of one point from another in physical space. The research is additionally restricted to expressions specifying absolute distance, i.e. one denoted in spatial or temporal units, e.g. “fifteen miles from
London” or “fifteen minutes from London”. Although such denotations are a basic way of specifying spatial extents, expressions of distance are not limited to information conveyed explicitly (see Carlson, 2010 for a review). However, the aim of this study is not to examine the entirety of ways used to express distance in language, but to observe an overall proportion between spatial and temporal expressions of distance for selected prepositions.

A selection of prepositions analyzed in this study is limited to five lexemes commonly used to express spatial relations: apart, away, between, from and to, which also happen to express temporal relations (Huddleston & Pullum, 2002). The search for representations of distance in spatial and temporal terms was executed by looking for frequencies of prepositional phrases including the following lexical pattern:

**Quantifier + Spatial or Temporal Unit + Spatial Preposition**

In the above pattern, the quantifier is either a cardinal number or a determinative used with countable nouns, e.g. a, an, few, many, several, some, etc. Cardinal numbers are easily identifiable in the BNC thanks to part-of-speech annotation, which marks all cardinal numbers, spelled both in words and digits, with the <CRD> tag included in the C5 tagset of the corpus (Garside, Leech & McEnery, 1997). The use of quantifiers raises the precision of corpus queries by eliminating numerous matches sharing the pattern by coincidence.

Units of space measurement selected for analysis include both metric and imperial units typically used in the U.K., also in their American variants of spelling, i.e. kilometre (kilometer), metre (meter), mile, and yard. Units of time measurement include those that are typically used to express spatial distance in terms of duration, i.e. minutes, hours, and days. A
listing of queries used in this research is included in Appendix, which provides for immediate replicability of the study (see also Waliński, 2012a, 2012b for listings of concordances retrieved from the corpora).

5. Spatial and temporal representations of distance in the BNC

Corpus queries based on the above pattern returned 4,321 matching concordance lines for the spatial units from the BNC. The resulting set was reviewed to exclude matches sharing the defined sequence of lexical items by coincidence, which confirmed that practically all identified examples included representations of spatial distance. Those spotted as coincidental hits involved mainly references to dimensions of “a [house] yard”.

Parallel corpus queries implemented for the temporal units retrieved 3,646 concordance lines from the BNC. However, a review of the resulting set revealed that most of them express distance in time rather than space. For example, a tremendous amount of examples retrieved for the preposition to included infinitive constructions\(^2\) specifying temporal duration, e.g. “cook for 1 minute to soften”. Besides, most examples denoted temporal distance with no direct relevance to spatial relations, e.g. “The crimes were committed twenty-four hours apart”.

\(^2\) The current infinitive descends from the Old English inflected infinitive form of verbal nouns, whose Dative case was preceded by the preposition to, which meant “toward” and indicated purpose toward which the action of the main verb was directed. Hence, the original GOAL directional meaning of that prepositional phrase was implicitly associated with time, more specifically with the future temporal perspective of the intended result of the action (Los, 2005).
As shown in Table 1, all selected prepositions can be observed in the BNC in expressions denoting distance in absolute spatial and temporal terms, however, they are not equally widespread in respective contexts.

<table>
<thead>
<tr>
<th>Preposition</th>
<th>Distance denoted in spatial terms</th>
<th>Other spatial relations</th>
<th>Distance denoted in temporal terms</th>
<th>Other temporal relations</th>
</tr>
</thead>
<tbody>
<tr>
<td>apart</td>
<td>106</td>
<td>0</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>away</td>
<td>1655</td>
<td>0</td>
<td>92</td>
<td>35</td>
</tr>
<tr>
<td>between</td>
<td>53</td>
<td>0</td>
<td>0</td>
<td>69</td>
</tr>
<tr>
<td>from</td>
<td>1763</td>
<td>0</td>
<td>164</td>
<td>612</td>
</tr>
<tr>
<td>to</td>
<td>741</td>
<td>3</td>
<td>147</td>
<td>2510</td>
</tr>
<tr>
<td>Total</td>
<td>4318</td>
<td>3</td>
<td>404</td>
<td>3242</td>
</tr>
</tbody>
</table>

Table 1. Representations of distance in spatial and temporal terms found in the BNC for selected prepositions

Table 1 shows that 4,318 concordance lines retrieved from the BNC for spatial units were recognized as valid representations of spatial distance, but only 404 concordance lines retrieved from the corpus for temporal units were recognized as valid representations of spatial distance. Although it is impossible to discuss the living organism of language in absolute numbers, the proportion of spatial vs. temporal representations of distance found in the BNC is a significant indicator that generally English speakers tend to express distance in spatial terms. The result can be used to support claims (e.g. Casasanto et al., 2010) that spatial relations are relatively rarely expressed in terms of duration, which is congruent with observations on the nature of spatiotemporal relations in conceptual metaphors presented over 30 years ago by Lakoff and Johnson (1980).
However, taking a closer look at Table 1 reveals that one lexical item, namely *away*,\(^3\) stands out from the rest of analyzed prepositions in a particular manner. With temporal units it is used more frequently to specify distance in space (92 times) than to express temporal relations (35 times). No other preposition from the selection analyzed in this study manifests this kind of predisposition. The number of examples retrieved from the BNC is substantial enough to indicate that the difference does not arise from a coincidental occurrence in the corpus.

### 6. Representations of distance with *away* in the NCP

To attest validity of the above observation for another language, a similar search was executed for Polish using the NCP. Although Polish does not have an equivalent directly correspondent to *away* in the form of a single lexical item, it conveys the meaning of disconnection in space\(^4\) with a combination of set phrases expressing separation from/to a destination point. Hence, spatial and temporal representations of distance for the parallel semantic context were identified in Polish with a combination of set phrases: *drogi do* (Lit. “of way to”), *drogi z[e]/od[e]*) (Lit. “of way from”), and *drogi stąd* (Lit. “of way from here”). The following lexical

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\(^3\) Traditionally, *away* was regarded in descriptive grammars of English as an adverb. However, the latest comprehensive grammar of English (Huddleston & Pullum, 2002) puts it in the category of prepositions.

\(^4\) As noted in OED, although predominantly associated with removal in space due to motion, *away* is also used to speak of actions, positions, directions, and of states or conditions resulting from removal, deprivation, elimination, parting, loss or extinction. It can be used to express use of time, as well as to emphasize temporal continuity of action, e.g. “They danced the night away” or “He’s been painting away all morning”. 
pattern was used:

**Spatial or Temporal Unit + Set Phrase Correspondent To Away**

Units of time measurement selected for Polish include *minuta, godzina, dzień* [minute, hour, day] and units of space measurement *kilometr, metr, mila* [kilometer, meter, mile], which generally parallels the units used for English.5

Corpus queries based on the above pattern retrieved 137 concordance lines from the NCP, which were reviewed to exclude coincidental matches. Six examples were found to share the defined sequence of lexical items by coincidence.

<table>
<thead>
<tr>
<th>away in Polish</th>
<th>Distance denoted in spatial terms</th>
<th>Coincidental hits</th>
<th>Distance denoted in temporal terms</th>
<th>Coincidental hits</th>
</tr>
</thead>
<tbody>
<tr>
<td>drogi do</td>
<td>7</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>drogi z(e)/od(e)</td>
<td>10</td>
<td>2</td>
<td>91</td>
<td>2</td>
</tr>
<tr>
<td>drogi stąd</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>17</strong></td>
<td><strong>4</strong></td>
<td><strong>114</strong></td>
<td><strong>2</strong></td>
</tr>
</tbody>
</table>

Table 2. Representations of distance in spatial and temporal terms identified in the NCP for set phrases parallel semantically to away

As shown in Table 2, the gap between 17 spatial vs. 114 temporal representations of distance found in the NCP indicates that in the context of *ways from/to* a destination Polish speakers have a tendency to express spatial distance in temporal terms, too. The number of examples identified in the NCP is substantial enough to indicate that the difference does not arise from a coincidental occurrence in the corpus.

5 Although Polish speakers do not normally express spatial extents with imperial units, the [nautical] mile (mila [morska]) is used for denoting sea distance.
7. Motion as a modulator of distance expressions

The above-reported results suggest that in the context of *ways* separating spatial locations both English and Polish speakers have a tendency to express distance in temporal terms relatively more frequently than for other prepositions. A possible explanation for this phenomenon is that *ways* are inherently characterized by the semantic component of motion. This can be inferred from the etymology of *away*. As noted in OED, *away* in its origin was a phrase, **ON prep., and **weż, **WAY, i.e. on (his, one’s) way, ‘on’ of motion (as in ‘move on’), and thus also ‘from this (or that) place’ to a distance. Already in Old English reduced to *a-weż*.

Moreover, *way* in the sense of a path used for motion of objects in space is a basic component of the **SOURCE-PATH-GOAL** image schema of motion (Lakoff, 1987; Hampe, 2005). It is also an internal core component of *motion events* Talmy (2000b, Part 1). It must be emphasized that from Talmy’s (2000b, p. 25) outlook, the notion of *motion event* refers to translocation and the continuation of a stationary location alike, despite the fact that in the latter an object does not move in space from one point to another.6

Therefore, a plausible explanation for the outstanding temporality of prepositional expressions of distance including *away* is that the semantic component of motion acts as an underlying modulator that shifts conceptualizations of distance from spatial to temporal expressions.

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6 Levinson (2003, p. 97) notes that despite connections to the locative system, the description of motion is organized, at least to some extent, differently to the description of locations. Because translocation involves the extra temporal dimension, it is naturally more complex than location, and involves an additional set of parameters that denote not only change of location, but also manner of motion, instrument of motion, medium of motion, as well as other attributes.
terms. Such a hypothesis is by no means unusual. Earlier cognitive behavioral studies have found that spatiotemporal reasoning is affected by conceptualizations of real, imagined, and fictive motion in physical and non-physical domains (see Ramscar et al., 2010 for a review). Because spatial cognition is largely relativistic and approximate, rather than Euclidean and quantitative (Tversky, 2009; see also Talmy, 2000a, Ch. 1 & 3), it comes naturally to language users to specify the distance to Mars in months of space traveling or the distance to Mt. Everest peak in days of climbing, without even noticing the conceptual shift from the spatial to the temporal domain of representation.

8. Conclusions

An observation that emerges from this research is that the cognitive entanglement of space and time is not universally asymmetric. Instead, the relationship between space and time appears to hinge, at least to some extent, on the underlying semantic context in which a particular conceptualization takes place (see also Szwedek, 2009). As shown in this study, the semantic element of motion seems to act as a modulator that shifts conceptualizations of distance from spatial to temporal terms. Since the temporal dimension is the primary cognitive domain of instantiation for events (Langacker, 2008, Ch. 11; 2012), it appears that in the context of motion events temporal conceptualizations of distance take precedence over spatial ones. Observations of travel time as a popular metric of spatial distance have been made for years in studies on geographical cognition (e.g. MacEachren, 1980), especially in the context of urban environments, where reaching destination points depends not as much on the spatial separation as on the traffic intensity at different times of the day.
In more general terms, the results suggest that in motion-framed scenarios space and time can be viewed as elements of a unified conceptual frame, which dictates their reciprocal relations in a complementary fashion. Kövecses (2005, p. 53) discusses the Time-Motion schema, within which elements can stand for each other in the form of *metonymies*. He notes that in English one can say, for example, “I slept for *fifty miles* while she drove” (Distance For Time-Duration), as well as “San Francisco is *half an hour* from Berkeley” (Time-Duration For Distance). In the light of this research, in motion-mediated scenarios cognition of space and time is intertwined into a unified conceptual frame of Space-Time-Motion, within which the elements can stand metonymically for one another: time elapsed in motion can be used to express spatial distance and space traversed in motion can be used to specify duration.
Appendix

1. Explanations for query listings
All queries we implemented with the value of 0 for SLOP factor, and Preserve order option set to “yes”. A single asterisk (*) replaces any number of characters, e.g. [yard*] substitutes for “yard, yards, yardstick, etc.” A vertical bar or pipe ( | ) symbol stands for logical AND, which enables executing multiple queries with a single line, e.g. [way to|from] substitutes for “way to” and “way from”. The PELCRA concordancer offers an underlying Polish morphological dictionary, which allows for queries incorporating all Polish inflectional forms with the use of double asterisk (**) used as a wildcard.

2. Corpus queries used to examine representations of distance in spatial and temporal terms for selected prepositions in the BNC.

For spatial units:

- [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* apart]
- [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* away]
- [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* between]
- [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* from]
- [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* to]

For temporal units:

- [CRD>|a|an|few|many|several|some minute*|hour*|day|days apart]
- [CRD>|a|an|few|many|several|some minute*|hour*|day|days away]
- [CRD>|a|an|few|many|several|some minute*|hour*|day|days between]
- [CRD>|a|an|few|many|several|some minute*|hour*|day|days from]
- [CRD>|a|an|few|many|several|some minute*|hour*|day|days to]

3. Corpus queries used to examine representations of distance in spatial and temporal terms for set phrases parallel semantically to the preposition away in the NCP.

For spatial units:

- [metr**|kilometr**|mila** drogi do|z|ze|od|ode|stąd]; SLOP=1, Preserve order=YES

For temporal units:

- [minuta**|godzina**|dzień** drogi do|z|ze|od|stąd]
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NCP. *Narodowy Korpus Języka Polskiego* [The National Corpus of Polish] (2010). Available at: www.nkjp.pl


PELCRA web-based interface to the National Corpus of Polish (2010). A concordancer with support for proximity queries for the National Corpus of Polish. Lodz: University of Lodz. Available at: www.nkjp.uni.lodz.pl