Semantic Transformations

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Abstract

Many words are polysemous. There are two ways of handling this phenomenon in a semantic theory: One is full specification, where each meaning of a word is represented separately in the lexicon. The other is minimal specification, where one meaning of a word is considered to be central, and other meanings are derived from the central one. The article defends minimal specification by presenting a number of semantic transformations that can be used to generate new meanings. Firstly, parallels between the visual process and changes of meaning are outlined. It is argued that many types of semantic transformations can be analyzed as different forms of focusing. For example, metonymical transformations are parallel to zooming out (*totem pro part*) or zooming in (*pars pro toto*). The notion of a domain is discussed in relation to the theory of conceptual spaces. It is argued that metaphorical meaning changes can be analyzed as mappings between domains. The notion of a mapping becomes more precise when the geometric structures of the domains are considered. As a case study, some of the many meanings of "over" are analyzed in terms of focusing or domain mappings. Finally, the productive functions of iterated semantic transformations are discussed.

Keywords: semantic transformation, minimal specification, metonymy, metaphor, domain, conceptual spaces

1. Minimal Versus Full Specification of Meaning

Saussure (1984) is famous for his dictum that the linguistic sign is arbitrary. But he complements this as follows: "Some signs are absolutely arbitrary: in others we note, not its complete absence, but the presences of degrees of arbitrariness: *the sign may be relatively motivated*. … [This] is true of *poirier* 'pear-tree', which recalls the simple word *poire* 'pear' and, through its suffix, *cerisier* 'cherry-tree', *pommier* 'apple-tree' etc" (Saussure, 1966, p. 131). In this article I argue that meanings of words are often

systematically related and that different meanings can be connected via a rather limited set of *semantic transformations*.[1]

Most of the analyses within cognitive linguistics concern relations between words and representations of concepts. Central concepts are the *image schemas* developed by Langacker (1987), Lakoff (1987), Talmy (1988), and others. Researchers in this tradition have to some extent analyzed how the semantic contents of different image schemas are related to each other, but there have been few systematic accounts of how such relations can be described (Dewell 1994 is an exception). In this article, I build on the theory of semantics based on conceptual spaces (Gärdenfors, 2000, 2014) to provide a first approximation of how relations between meanings can be modeled.

Many words seem to be polysemous; that is, they appear to have a number of different meanings that are only distantly related. There are two basic ways of handling this phenomenon in a semantic theory (Lakoff, 1987, p. 420; Tyler & Evans, 2001, pp. 727–733; Van der Gucht et al., 2007). One is *full specification*, where each meaning of a word is represented separately in the lexicon, but semantic relations between the different meanings can also be specified. The other is *minimal specification*, where one meaning of a word is considered to be central, and other meanings are derived from the central one by additional information from the context or by semantic transformations.

Lakoff (1987, p. 422) argues in favor of the full specification interpretation, and Tyler and Evans (2001, pp. 731–737) argue for a weaker form they call *principled polysemy*, the main difference being that Tyler and Evans provide criteria for identifying separate meanings. Principles of cognitive economy, however, provide strong arguments against the full specification position. Jackendoff (1983, pp. 118–189) writes: "The mind does not manufacture abstract concepts out of thin air. … It adapts machinery that is already available, both in the development of the individual organism and in the evolutionary development of the species." Our semantic memory would be strained if we were to have separate encodings of all the twenty-four meanings of "over" that Lakoff (1987) identifies and of corresponding meaning networks for other words. In contrast, remembering a prototypical meaning and then using some general semantic principles for creating other meanings would be more economical for our memory.

For this reason, I endorse the minimal specification approach. The burden on me will be to specify what ways exist to create new meanings from a central element. My primary tool for this is what I call semantic transformations.

2. Parallels Between Word Meanings and Visual Processes

The aim of this section is to point out some parallels between semantics, on the one hand, and ordinary visual processes and visualization, on the other. I want to demonstrate that the two kinds of processes share many more similarities than we are normally aware of (also cf. Chafe, 1995; Gärdenfors, 2004). My objective is to show that semantics and perception, in particular vision, cannot be separated. As a consequence, the structure of

visual processes will *constrain* semantic representations.

According to Langacker (1987, p. 311), the image schema for the verb "climb" can be turned into a schema for "climber" by using the same dimensions, objects, and relations. Only the *focus* of the schema is shifted from the time dimension to the trajectory. This is an example of *refocusing*, that is, a shift of attention from certain aspects of the schema to others. In cognitive semantics, such attention shifts are described under the name of "reprofiling" (Langacker, 1987; Holmqvist, 1993). I submit that this involves essentially the same process as attention shifts in ordinary vision.[2] The difference is that in the case of image schemas used in language understanding (as well as in inner visualization), the attention changes over an inner image, while in regular vision it moves over the scene presented by the external world.

An interesting case of inner attention is *fictive motion*, which shows up in many linguistic constructions (Talmy, 1996, p. 211; Jackendoff, 2012, p. 1147):

(1) This fence goes from the plateau to the valley.
(2) I looked out past the steeple.
(3) I aimed my camera into the living room.

These constructions do not describe processes that occur in the real world. Instead they represent our understanding of how we "perceive" in our inner world: you follow the fence with your gaze, your gaze moves along the landscape, and the "vision" of the camera is directed to a particular area.

Fictive motion is also involved in the kind of refocusing that Lakoff (1987) calls "path-process interchange." In a sentence such as "The power line stretches over the yard," the power line does not literally stretch itself. However, if the power line is seen as a path that one follows with one's attention, one's mental gaze can be described as "stretching" over the yard. In brief, the path is transformed into a visual process.

A related notion is discussed by Langacker (1987, sec. 3.1.2), who argues that we can perform a *mental scanning* of various forms of mental structures. For example, the following two sentences describe the same scene (Langacker, 2008, p. 82):

(4) The hill gently rises from the bank of the river.
(5) The hill gently falls to the bank of the river.

The difference between (4) and (5) is the direction of the mental scanning.

He distinguishes between two forms of mental scanning: *sequential scanning*, where one mentally traverses the objects (or path), having only one element active at a time; and *summary scanning*, where the elements are accumulated as we traverse them.

Two other visual processes are *zooming* in and *zooming* out. These processes have clear parallels also in semantics. For example, the location of an object can be described as zooming in (Langacker, 2008, p. 81):

(6) Your camera is in the study, in the closet, on the top shelf, behind some boxes.

The same task can also be achieved by zooming out:

(7) Your camera is behind some boxes, on the top shelf, in the closet, in the study.

However, a mixture of the processes does not work:

(8) *Your camera is on the top shelf, in the study, in the closet, behind some boxes.

Another kind of reprofiling is called *multiplex-mass interchange*. In Lakoff's example

(9) There were soldiers posted all over the hill.

the soldiers are seen not as a multiplex of individual soldiers but as a mass in analogy with

(10) He spilled wine all over the tablecloth.

Visually this corresponds to changing the *scale of resolution*. It can be described as a squinting with your inner eye. The process is not just zooming out; the reprofiling also involves a change in the perception of the soldiers: they are seen as a continuous substance that can be spread over the hill.

One of the most general types of refocusing in semantics is *metonymy*. In analogy with the characterization of metaphor in cognitive linguistics (e.g., Lakoff & Johnson, 1980; Lakoff, 1987; Croft, 2002), I regard metonymy as a primarily semantic operation that is expressed in different ways. Classical types of metonymy include *pars pro toto*, where a part of an object is focused instead of a whole object ("there are three sails on the lake," i.e., sails instead of boats), and *totum pro parte*, where the focus is put on something that contains the object as a part ("Paris announces shorter skirts this season," i.e., the city instead of the fashion designers in it). These processes correspond to the process of zooming in (on the sails) and zooming out (to the city of Paris) in visual attention.

A special case of *pars pro toto* is what cognitive linguists call "endpoint focus" (see also Dewell, 1994). For example, Lakoff (1987), in his study of different uses of "over", has looked at cases such as "Sausalito is over the bridge" (from the point of view of San Francisco). Here Sausalito is not literally "over" the Golden Gate Bridge; it is the *path* one travels from San Francisco to Sausalito that goes "over" the bridge (this path is only a visualized one, if we perform a mental scanning of the trip from San Francisco to Sausalito). However, by focusing one's attention on the endpoint of this path, which is Sausalito, one creates a *pars pro toto* metonymy.

These examples suggest that many of the transformations that have been described by cognitive linguists have close analogues in visual processing, in particular focusing of attention, visual scanning, and change of resolution. Nevertheless the analogies require careful experimental testing to determine their validity.

3. Metaphors and Metonymies Modeled in Conceptual Spaces

Cognitive linguistics has brought forward the importance of metaphors and metonymies as strong tools for expanding the meanings of words. I submit that these mechanisms are indeed the most important forms of meaning transformations.

Linguists and philosophers disagree, however, on how to characterize metaphors and metonymies. As an indication, Broström (1994, pp. 27–28) provides the following example of how the notion of domain as it has been used in cognitive linguistics leads to problems concerning how metaphors are to be identified:

> If when looking at a dog, I think of his *face*, is that the result of metaphorical categorization? When looking at a caterpillar? Or, to recast the question in domain terms, does the concept of a face belong to the domain of the human body, to the more general domain of animate bodies or to a domain of intermediate scope, say mammalian bodies?

She analyzes the problem as follows:

> Now, even if the concept of a domain may be a useful approximation, as is the term "metaphor" itself, it does not provide us with an explanation of the difference between litera [literal meaning] and metaphor. The reason why is that it is not possible to individuate domains, to tell one domain from another, independently of establishing which expressions are literal and which metaphorical. Domain boundaries are not clearer than the boundary between litera and metaphor. (Broström, 1994, p. 26)

This diagnosis indicates that the use of the notion of domain in cognitive linguistics is too lax. Given Broström's analysis, I propose that "face" is better analyzed in meronomic, that is, part-whole, terms. Given this distinction, the boundary between literal meaning and metaphor will become sharper.

Using conceptual spaces to model meanings (Gärdenfors, 2000, 2014), it is natural to say that a metaphor expresses an identity in structure between different domains. A word representing a particular pattern in one domain can be used as a metaphor to express the same pattern in another domain. In his *invariance principle*, Lakoff (1993, p. 215) formulates a closely related position: "Metaphorical mappings preserve the cognitive topology (that is, the image-schema structure) of the source domain, in a way consistent with the inherent structure of the target domain." In this way one can account for how a metaphor transfers information from one conceptual domain to another; what is

transferred is a pattern rather than domain-specific information. A metaphor can thus be used to identify a structure in a domain that would not have been discovered otherwise. This is how metaphors create new knowledge. By exploiting geometric and topological invariances, the theory of conceptual spaces provides a principled way of describing the mappings.

The role of metonymy is primarily referential. By picking out one specific aspect of an entity, metonymy focuses attention on something salient to the situation, thereby helping one's understanding of it. The relevant parts and wholes in *pars pro toto* and *totum pro parte* metonymies need not just be spatial but can be temporal as well. More abstract meronomic relations of a functional or causal nature also generate metonymies: for example, in the sentence "Proust is tough to read," the author stands for the book he wrote; while in "Napoleon attacked Russia," the highlight is Napoleon's function as leader of the army.[3] (For an extensive list of different types of metonymies, see Peirsman & Geeraerts, 2006, sec. 2.)

Metonymic concepts make it possible to conceptualize something by its relation to something else to which it is connected. In contrast to metaphor, metonymy is based not on the similarity between two domains but on meronomic (and other) relations *within* the same domain. Here I agree with Lakoff and Turner (1989, p. 103), who argue that—unlike metaphor—metonymy "involves only one conceptual domain. A metonymic mapping occurs within a single domain, not across domains" (see also Peirsman & Geeraerts, 2006, p. 271). Langacker (2008, p. 69) goes along the same lines: "In a narrow sense, we can characterize metonymy as a shift in profile" (of an image schema).

Therefore, I propose the following thesis, on the basis of the notion of domains presented in Gärdenfors and Löhndorf (2013) and Gärdenfors (2014):

> *Thesis about metaphors and metonymies*: Metaphors refer to mappings *between* domains; metonymies refer to meronomic and other relations *within* domains.

The upshot is that by narrowing the use of the notion of a domain, one obtains a sharper division between metaphors and metonymies. One theory that comes close—in content if not in terminology—is Croft's (2003). He starts out from the broad notion of domain in the Langacker tradition; but then, following Langacker (1987, p. 152), he introduces a distinction between (base) domain and domain matrix. Croft writes: "The combination of domains simultaneously presupposed by a concept such as [HUMAN BEING] [is] called a *domain matrix*" (2003, p. 168). In line with the proposed thesis, Croft describes metaphors as domain mappings (p. 177). He then argues that metonymy is based on what he calls *domain highlighting*, involving a shift from the foregrounding or highlighting of something in the primary domain of a concept to the foregrounding or highlighting of it in a secondary domain within the same domain matrix (p. 179). On the surface, this characterization differs from my notion of metonymy, but the result of Croft's analysis is basically the same as mine. That said, I believe that the contrast between dimensional

domain mappings and meronomic relations makes the difference between the functions of metaphors and metonymies clearer.

4. Main Transformations

I will use the preposition "over" to illustrate some of the main transformations of semantic content that are needed to defend a minimal specification position. My position is that there are only a few basic transformational mechanisms. In the previous part, I identified two main categories of transformations: *metonymy* as a (re)focusing of attention (within a semantic domain) and *metaphorical mapping* (between domains). Note that I use both metonymy and metaphor in a broader way than is usual within linguistic theory.

At the end of his paper, Dewell (1994, pp. 375–376) presents a list of the semantic transformations that he finds necessary for the analysis of "over". Many of them—*segment profiling*, *trajector-part profiling*, *extending-path*, and their subcategories—can be seen as special cases of a*ttention focusing* and thus they fall under my broad characterization of metonymy. The *multiplex-mass* transformation was also presented there as a case of zooming out. As a variation of this, Dewell also considers *multiplex path*, where a pointlike trajector moves in a variety of directions that can be construed as a mass. His *resulting state* is what is here called endpoint focus.

In addition to the transformations generated by the attentional changes and other metonymical operations, I discuss in Gärdenfors (2014, ch. 11) several examples of *metaphorical* transformations in the example of how "over" is used, for example, by mapping from the force to the time domain. What Dewell (1994, p. 361) calls *shifting perspectives* are the dimensional changes from vertical to horizontal (or reversing the directions of the vertical) that I classify as a form of metaphorical transformation. A full analysis of the different submechanisms is, however, beyond the scope of this article. Such an analysis would be useful not only for lexical research but also for communication modeling.

5. Iterated Transformations

Semantic transformations operate on several levels in language use: they are partly lexicalized, partly introduced by coordination in communication, and partly by context. As an example of the role of context, consider Lakoff's (1987, pp. 429–439) analysis of "rotated" schemas for "over".

(11) Superman flew all over downtown Metropolis.
(12) Harry climbed all over the canyon walls.
(13) *Superman flew all over the canyon wall.

Lakoff considers (11) and (12) to be acceptable sentences, but not (13). He thinks that

the rotational transformation involved in using "over" with a vertical landmark requires contact between the trajector and the landmark. However, this conclusion depends on the salience of direction of the landmark in the context. If Harry has been climbing all over the canyon wall the whole day looking for an edelweiss flower, the verticality of the world has become extremely salient. He may then sigh and say, "I wish I were Superman. Then I could fly all over the canyon wall." Once the rotational transformation has been established, it becomes easier to add another transformation and still be understood.

Here I will focus on the lexicalization of transformations rather than on their dependence on the context. Let me begin with the example "topless district" (Fillmore, 1978). Here it is not the district that is topless, or the bars in the district, or the waitresses who work in the bars, but the dresses that the waitresses wear. What has happened in this lexicalization process is a series of three *totum pro parte* transformations. First, the waitresses are taken to stand for the dresses they wear; second, the bars stand for the waitresses who work in them; and third, the district stands for the bars in it. The lexicalization must occur in a stepwise fashion: one cannot go directly from "topless dress" to "topless district" without the intermediary metonymies.

One can also find iterations of metaphors and combinations of metaphors and metonymies. Consider the French "avoir la tête en feu" (have one's head on fire). Here the head is a *pars pro toto* metonymy for a person combined with the fire as a metaphor for the person being excited or agitated (see De Lucs, 1993).

In general, applying transformations to a prototypical meaning of a word will generate a graph structure of meanings that are connected to each other via various transformations. As a matter of fact, I believe that the twenty-four meanings that Lakoff (1987) and the fourteen meanings that Tyler and Evans (2001) present can all be analyzed as combinations of shifts in attentional foci, metaphorical transformations, and elaborations (superimpositions). Furthermore, the graph structure generated by the combinations can also be interpreted as a semantic map that can be used to investigate the differences between how different languages partition meaning structures. As is well known, although two languages may have the same central meaning of a word, the set of transformations that are lexicalized may vary considerably, and thus the extended meanings of the word will be different. As Langacker (1991, p. 3) writes: "There is no way to predict precisely which array of extensions and elaborations—out of all those that are conceivable and linguistically plausible—have in fact achieved conventional status."

Meaning transformations come at different *cognitive costs*. Some metaphorical mappings, for example, may be more difficult to understand than other more conventional ones.[4] Psycholinguistics uses a number of methods—for example, measuring reaction times and error frequencies—to compare the cognitive efforts of comprehension or production tasks.

Considerations of cognitive costs motivate the general constraint on iterated semantic transformations that the set of lexicalized meanings of an expression should be *connected*. This means that if word *w* originally has a meaning m_1 and this meaning has been

extended by a series of transformations to meaning m_n through meanings m_2, m_3, … , and meaning m_n also falls under the word w, then all meanings m_2, m_3, … , also fall under w.

6. Conclusion

In this article, I have built on the theory of conceptual spaces (Gärdenfors 2000, 2014) and the notion of a domain as a collection of dimensions with a geometric structure to provide a first approximation of how relations between meanings can be modeled. By analyzing metaphors as mappings between domains and metonymies as relations within domains, I have argued that these operations are the most central semantic transformations.

Acknowledgements
I want to thank the Swedish Research Council for its support to the Linneaus environment *Cognition*, *Communication and Learning*.

Notes

1 This article builds on some material from my book *The Geometry of Meaning: Semantics Based on Coanceptual Spaces* (Gärdenfors 2014).

2 In making this analogy, it is important to distinguish between *automatic* attention, where an external event or object attracts your attention, and *voluntary* attention, where you choose to direct your attention to something. The analogy is that language triggers automatic attention shifts in the inner world.

3 This process is called "relation linking" by Wisniewski (1996).

4 When the poet and Nobel laureate Tomas Tranströmer writes about a house in a storm that it "feels its own constellation of nails holding the walls together," the first metaphor of the house feeling is fairly standard, but seeing the nails of the house as a constellation of stars involves a cognitively much less accessible mapping (which, of course, is part of its beauty).

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