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Simulation Semantics and the Linguistics of Time. Commentary on Zwaan

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Recent work addressing the phenomenon of perceptual simulation offers new and exciting avenues of investigating how to model knowledge representation (e.g., Barsalou 1999, 2003; Barsalou & Wiemer-Hastings, 2005). From the perspective of language, the simulation approach has given rise to new impetus to work on models of language understanding (e.g., Zwaan, 2004, and references therein), and provides a way of recasting recent work in the psychology of language on *situation models* (Zwaan, this volume). Carried out by Zwaan and others, I refer to this work as *simulation semantics*. Simulation semantics is concerned with modeling the mechanisms involved in language understanding. More specifically, a fundamental claim of this approach is that semantic representation in language prompts for *simulations*: a rehearsal of a previously stored perceptual experience. Zwaan refers to such sense-perceptory experiences as *motor resonances*. The development of a simulation semantics offers the potential for understanding part of the interaction between language and conceptual structure in meaning-construction.

Here, I respond to Zwaan's article in this volume, in which he provides preliminary proposals for how a simulation semantics might address the relationship between aspects of temporal representation in language, and how such are interpreted in language understanding. In particular, he focuses on the way in which a simulation semantics might account for the semantic representation of the distribution of action through time: the assortment of grammatical and lexical means of encoding what is known as aspect.

In general terms, my point is as follows. Before we can speculate on the relationship between the role of visuo-motor simulations in language understanding in the domain of time, we must first get some basic issues straight with

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respect to (a) language, (b) the relationship between language and temporality, and (c) the role of language in meaning-construction. My overall purpose is to highlight some constraints on the nature and extent of the applicability of a simulation semantics, as it applies to temporal representation in language and to semantic representation in language more generally. Nevertheless, my comments are meant to facilitate the simulation semantics agenda, by placing it on a firmer footing.

There are a number of prerequisites for a simulation semantics: (a) We need to understand the ways in which time is encoded in language; (b) we need to understand how language is organized, in terms of the nature of meaning types that it encodes, and how these *lexical concepts* (Evans, 2006) relate to nonlinguistic aspects of knowledge (e.g., perceptual knowledge); (c) we need to know how the process of meaning-construction takes place, as mediated by language, and, crucially, the way it interfaces with nonlinguistic (e.g., perceptual) knowledge; and (d) we need to understand the nature of temporal experience.

The Expression of Time in Language

There is a wide range of ways in which language encodes temporal representation (see Klein, this volume). A simulation semantics must be clear on the complexity involved in the temporal representation of time in language.

One way in which language encodes time relates to the range of linguistic phenomena often referred to, variously, as aspect. This is the focus in Zwaan's article. In general terms, aspect relates to the way in which action is distributed through time, as encoded by language. Nevertheless, aspect is not a homogenous category, and even an individual language (such as English, for instance) has a range of ways of encoding the distribution of action through time. By way of illustration, I identify three distinct sorts of ways in which the distribution of action through time is encoded in English.

First, there is what we might refer to as *grammatical aspect*. This is illustrated by (1a) and (b):

(1) a. He is drinking the beer [progressive]
b. He has drunk the beer [bounded]

These examples relate respectively to what is traditionally referred to as imperfective aspect (1a) and perfective aspect (1b). Imperfective aspect encodes a schematic progressive (or continuous) reading: The event in question was in progress at the time-reference indicated by the tense system. Perfective aspect encodes a schematic bounded reading: The event in question occurred (or was

initiated) at an earlier point and is complete, but still relevant, at the more recent time-reference, as indicated by the tense system. Hence, the meaning of the utterance in (1a) is that the drinking of the beer is ongoing at the time of speaking; that is, progressive aspect reveals that, in terms of the time period covered by the utterance, the drinking event is unbounded. The meaning of the utterance in (1b) is that the drinking of the beer was initiated at an earlier point in time and was completed prior to or at the moment of speaking; that is, perfective aspect reveals that, in terms of the time period covered by the utterance, the drinking event is bounded (see Comrie, 1979; Langacker, 1987).

Second, in addition to grammatical aspect, aspectual meaning is also "bundled" with verbal meaning. We might refer to this phenomenon as *lexical aspect*. For example, consider (2a)–(2e), and corresponding terminology, drawn from Talmy (2000):

(2) a. (to) die [One-way nonresettable]
b. (to) fall [One-way resettable]
c. (to) flash [Full cycle]
d. (to) breathe [Multiplex]
e. (to) sleep [Steady state]

The verbs represented in (2) encode, in part, different sorts of distribution of action through time.

Third, Vendler (1957) proposed a highly influential taxonomy of the distribution of action through time. Vendler's taxonomy relates to verb phrases and, hence, might be referred to as *utterance-level aspect*. Vendler distinguished between what he referred to as *activities*, *accomplishments*, *achievements*, and *states*, as illustrated in (3a)–(3d):

(3) a. He was pushing a cart [Activity]
b. He ran a mile [Accomplishment]
c. He reached the top [Achievement]
d. I love her [State]

Whereas an activity involves an event without a specific end point, an accomplishment does feature an inherent end point. An achievement represents a punctual event, whereas a state does not involve an event at all.

Aspect is a complex and multifaceted phenomenon. A simulation semantics must be clear on which sort of aspectual phenomenon it is addressing, and which part of a given utterance is encoding the aspectual phenomenon under investigation.

How Meaning Is Organized in Language

Semantic representation in language is encoded by two systems: a *lexical system* and a *grammatical system* (Talmy, 2000; see also Evans, in press; Evans & Green, 2006). Whereas the meaning encoded by the lexical system is (perceptually) rich in nature, the meaning associated with the grammatical system is more schematic in nature. The point, for a simulation semantics, is as follows. The grammatical system is unlikely to afford access to rich, perceptual rehearsals of experience ("simulations"). This follows as the grammatical system encodes schematized parameterizations abstracted away from rich, perceptual experience. As such, a simulation semantics must carefully select the sorts of temporal linguistic phenomena for which it seeks to account. The schematic meanings associated with grammatical phenomena such as grammatical aspect are unlikely to be tractable (in their own right) from the perspective of a simulation semantics.

Recent research in cognitive linguistics reveals that a speaker's knowledge of language is represented as a structured inventory of conventional symbolic units that subsumes both open-class and closed-class symbolic units (Croft, 2001; Langacker, 1987; Talmy, 2000). These represent qualitatively distinct end points on a *lexicon-grammar continuum* between specific (content) meaning and schematic (grammatical) meaning. Talmy modeled this distinction in terms of bifurcation between distinct lexical and grammatical systems that contribute to meaning in distinct, albeit complementary, ways (although, see Croft, 2007). On this account, schematic meaning is encoded by closed-class elements and has a structuring function. In contrast, content meaning is a function of open-class symbolic units, which are "draped," so to speak, across the "scaffolding" provided by the grammatical elements of language. To illustrate, consider (4):

(4) **These** cowboy**s are** ruin**ing my** flowerbed**s**. (Evans & Green, 2006, p. 503)

In (4), the closed-class elements are highlighted in bold. For instance, the meaning of the closed-class elements can be glossed as "These somethings are somethinging my somethings," which can be paraphrased as "more than one entity close to the speaker is presently in the process of doing something to more than one entity belonging to the speaker." The point is that although the meaning encoded by these closed-class elements is highly schematic, it is meaning nonetheless.

In summary, the meaning associated with closed-class forms (the grammatical system) (a) encodes highly schematic aspects of experience and (b) provides a means for encoding recurrent "digitized" parameters of humanly relevant

experience in an efficient way, and, as such, (c) may not, of themselves, give rise to simulations: perceptually rich experience. In contrast, meaning elements associated with open-class forms (a) encode rich aspects of experience, including visuo-motor information, and, as such, (b) are likely to give rise to simulations.

In essence, it is not clear that closed-class forms, such as grammatical aspect, are likely to relate to specific and/or discrete simulations. Rather, their contribution is likely to facilitate a structuring function, and thus the construction of a situation model, in the sense of Zwaan (this volume). Hence, some types of aspect (or tense) may not be amenable to a simulation semantics at the level of the individual morpheme or word.

Lexical Semantics Versus Utterance/Discourse-Level Meaning

In this section I argue that word meaning is, crucially, a function of the utterance context in which a word is embedded. Hence, meaning is constructed: the result of integration with the closed-class schematic system at the utterance and discourse levels. Put another way, words do not "mean" in their own right but rely on the conceptual "scaffolding," the schematic meaning, afforded by the closed-class elements associated with the grammatical system. From the perspective of a simulation semantics, the simulation that an open-class element gives rise to is likely to be a function of the utterance and discourse context in which it is embedded, rather than being due to a context-independent semantic representation. To illustrate, consider the various meanings of *open* in (5a)–(5h):

(5) a. John opened the window
b. John opened his mouth
c. John opened the book
d. John opened his briefcase
e. John opened the curtains
f. The carpenter opened the wall
g. The surgeon opened the wound
h. The sapper opened the dam

In these examples the semantic contribution of *open* is slightly different. This follows as the nature of the event associated with *open* involves, in each case, different means, including different tools, differences in the nature of the aperture, and differences in the purpose of the opening event in each case. The meaning of *open* then, is, in a nontrivial sense, created, in part, by the utterance

context in which *open* is embedded and the discourse event in which the utterance is embedded. Hence, the motor resonances (i.e., simulations) associated with *open* in each example will be different.

In essence, simulations are likely to arise due to integration at (or above) the level of the utterance. Moreover, closed-class elements contribute to the structuring of parameters, which serve to facilitate the precise specification of the simulation semantics associated with open-class meaning elements. Finally, aspect, insofar as it can be identified as being associated with distinct forms (e.g., grammatical aspect), contributes to the structuring function of language, rather than being relatable to distinct simulations.

The Nature of Temporal Experience

Recent research has revealed that temporal experiences are complex, multifaceted, and subjectively real, which is to say directly experienced (see Evans, 2004, for a review, and references therein). Indeed, types of temporal experience include the experience of duration (e.g., protracted duration and temporal compression), instantaneity, synchronicity, sequentiality, and so on. Moreover, temporal experience is neurologically instantiated (e.g., Mauk & Buonomano, 2004; Walsh, 2003). In short, whereas temporal experiences do not have a veridical sensory-motor dimension in the same way that, say, a motion event has, they are nevertheless phenomenologically real. As temporal experiences (and hence representations) appear to be of a distinct kind from visuo-motor experience, it is not clear that these can be fully captured in terms of a simulation semantics that is based on motor resonances alone.

Summary

A simulation semantics approach to language understanding (simulation semantics) represents an exciting and promising area of enquiry. However, a simulation semantics needs (a) to pay attention to the differential semantic contribution of grammatical and lexical subsystems of language and (b) to take account of the fact that meaning is a function not of monotonic composition but of situated language use. Hence, meaning arises from integration at, or above, the level of the utterance. As such, simulations are always contextualized. In terms of aspect, which is the specific focus of Zwaan's article, it is clear that this constitutes a complex phenomenon, which is encoded by virtue of both the grammatical and lexical (sub)systems. Hence, some aspectual phenomena may not be directly relevant, in the sense of not being tractable from the perspective

of a simulation semantics. Moreover, the neural implementation of time, in language, relates to perceptual experience, which is not limited to visuo-motor experience. Hence, a simulation semantics, which encompasses time, needs to include those aspects of phenomenological experience uniquely relevant for time.

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