

The micro-geography of verb meanings

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Much work on the lexical semantics of verbs over the past quarter century has focused on the general organization of the space of verb meanings, what Rappaport and Levin (1998) call the *structural aspect of verb meaning*. Much less is known about the micro-geography of this space. This paper addresses more directly the question of how the idiosyncratic and the structural components of verb meanings interact through a comprehensive study of a subclass of causal situations. We analyze the meaning of *all* English verbs which are typically known by adult, college educated speakers, and that describe situations where, informally, an agent uses an instrument to affect a patient.

In the first, quantitative, survey, two independent raters used the conjunction of two morphosyntactic tests of instrumentality to select verbs whose denotations allow or require an instrument (whether sentences of the form *X verbed (Z)* entailed or were semantically compatible with sentences of the form *X used Y to V* and *X V-ed (Z) with Y*). About 12% of verbs semantically required an Instrument role and about 30% allowed it. In the second, qualitative, survey, we analyzed the meaning of one lemma for each verb that required or allowed an Instrument role, using the traditional method of analyzing verb denotations into causal subeventualities (or temporally interpreted CAUSE/BECOME predicates, if one does not recognize eventualities), as in Carter (1976), Dowty (1979), and others. All in all, our qualitative survey isolated 15 semantic classes for verbs whose denotations require an instrument and 12 semantic classes for verbs whose denotations allow an instrument. For example, one class of verbs whose denotations require the presence of an instrument includes about 60 verbs. They all denote situations in which an agent *A* causes contact between an entity *I* and an entity *P*, possible motion of *I* while in contact with *P*, and, as a result, incision or severance of a portion of *P* (e.g., *amputate, bone, cut, dissect, guillotine, hack, incise, knife, core, castrate, gore, cleave, sever* and *eviscerate, ...*). (1) represents the common meaning of these verbs.

(1) **cause**(s_1, s_2) \wedge **act**(s_1, \mathbf{A}, I) \wedge **contact**($s_2, \mathbf{I}, \mathbf{P}$) \wedge **cause**(s_2, s_3) \wedge **incised**(s_3, \mathbf{P})

Our examination of all 27 semantic classes resulted in four major conclusions. Our first conclusion is that we must add to the set of structural templates for verb meanings proposed in Carter (1976), Dowty (1979), Rappaport Hovav and Levin (1998), and Van Valin and Lapolla (1997). (This conclusion assumes that an Instrument role is part of the meaning of verbs whose denotations *require* an instrument, see Koenig et al. (2003).) More specifically, we argue that the meaning of verbs that belong to 13 out of the 15 classes of verbs that require an instrument involves more than a single cause-effect pair. It involves a sequence of two such pairs (as suggested in Croft, 1991 or Talmy, 2000 and exemplified in (1)). Interestingly,

such meanings exceed the boundaries of structural semantic complexity assumed in Carter (1976) and Rappaport and Levin (1988). The two remaining classes of verbs, members of the **Hit** and **Cover** classes, cannot be analyzed as involving a sequence of two cause-effect pairs; they involve only the weaker notion of use of a tool to perform an action.

Second, not all portions of a verb's structural meaning seem as likely to be elaborated. Verbs are finicky about (i) the *effect* of the Agent's action on the instrument and (ii) the *effect* the instrument has on the patient (compare *paint* versus *mince* and *chop*), but they do not, typically, include much information about the *action itself* the agent performs on the instrument. We interpret this fact as a type-frequency reflex of the token-frequency bias towards goals and result states observed by Lakusta and Landau (2005). Lakusta and Landau showed that adults, children, and aphasics are more likely to include the goal of motion or other result states than the source of motion or other initial states in reporting events they see. Our survey indicates that, at a type-frequency level, individual verbs are, similarly, more likely to encode fine-grained distinctions about result states than initial states. Our analysis, thus, generalizes Slobin's (2004) observation that the higher token-frequency of manner of motion verbs in English discourse has led to a larger set of manner of motion verbs in the English lexicon.

Third, verbs that encode mediated causation seem to vary more in the exact nature of the causal relation involved than other verbs. The instrument phrase *with his binoculars* and *with butter* in (2), for example, does not strictly speaking cause the events of watching or cooking (and, thus, do not strictly abide by Croft or Talmy's definition of instruments). We argue that a weaker notion of causation, what we call helping (see (3)), is required to model the causal role of the instrument in these cases.

- (2) a. John watches birds all day with his binoculars.
- b. Bill cooks his steaks with butter.
- (3) An object x *helps* the occurrence of token e of the event category C iff (i) there is an ordering of tokens of C along a pragmatically defined scale (ease of performance, how good the resulting state is, fewer unwelcome "side-effects"); (ii) x caused the token e of C to be higher on that ordering than it would otherwise have been.

A final result of our survey is that the micro-geography of the meanings of verbs whose denotations require an instrument differs from that of verbs whose denotations merely allow an instrument. More specifically, the semantic space of verbs that semantically require an Instrument is more tightly organized than that of verbs that allow an instrument. For example, verbs in the **Cut** class are characterized by the common result state of the patient being incised. But there is no common result state for verbs whose denotations allow an instrument that merely helps in the performance of the action (e.g., *cook (with butter)*, *eat (with chopsticks)*, *look (with a telescope)*, *practice (with a metronome)*, ...). Similarly, verbs that require an Instrument role constrain properties of the instrument more than verbs that merely allow an Instrument role. For example, instruments of members of the **Cut** class must have the requisite sharpness, whereas the instruments that may, but need not, be used to *check* or *practice* something are much more varied.

Our study of the micro-geography of verb meanings is, naturally, preliminary, as we focused on one understudied portion of the causal portion of that space, that

of verbs whose denotations allow or require instruments. But, it suggests that there may be some structure and information of general linguistic relevance to subparts of the causal situations quadrant of meaning space. Once we leave structural aspects of verb meaning, it is not just all idiosyncratic information.