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19. Lexical conceptual structure

The term "lexical conceptual structure" was introduced in the 1980s to refer to a structured lexical representation of verb meaning designed to capture those meaning components which determine grammatical behavior, particularly with respect to argument realization. Although the term is no longer much used, representations of verb meaning which share many of the properties of LCSs are still proposed in theories which maintain many of the aims and assumptions associated with the original work on LCSs. As LCSs and the representations that are their descendants take the form of predicate decompositions, the article reviews criteria for positing the primitive predicates that make up LCSs. Following an overview of the original work on LCS, the article traces the developments in the representation of verb meaning that characterize the descendants of the early LCSs. The more recent work exploits the distinction between root and event structure implicit in even the earliest LCS in the determination of grammatical behavior. This work also capitalizes on the assumption that predicate decompositions incorporate a subeventual analysis which defines hierarchical relations among arguments, allowing argument realization rules to be formulated in terms of the geometry of the decomposition.

1. Introduction

Lexical conceptual structure (LCS) is a term that was used in the 1980s and 1990s to refer to a structured lexical representation of verb meaning. Although the term "LCS" is no longer widely used, structured representations of verb meaning which share many of the properties of LCSs are still often proposed, in theories which maintain many of the aims and assumptions associated with those originally involving an LCS. These descendants of the original LCSs go by various names, including lexical relational structures (Hale & Keyser 1992, 1993), event structures (Rappaport Hovav & Levin 1998a, Levin & Rappaport Hovav 2005), semantic structures (Pinker 1989), L-syntax (Mateu 2001a, Travis 2000), l-structure (Zubizarreta & Oh 2007) and first phase syntax (Ramchand 2008); representations called semantic forms (Wunderlich 1997a, 1997b) and semantic representations (Van Valin 1993, 2005, Van Valin & LaPolla 1997) are also close in spirit to LCSs. Here we provide an overview of work that uses a construct called LCS, and we then trace the developments which have taken place in the representation of verb meaning in descendants of this work. We stress, however, that we are not presenting a single coherent or unified theory, but rather a synthetic perspective on a collection of related theories.

2. The introduction of LCSs into linguistic theory

In the early 1980s, the idea emerged that major facets of the syntax of a sentence are projected from the lexical properties of the words in it (e.g. Chomsky 1981, Farmer 1984, Pesetsky 1982, Stowell 1981; see Fillmore 1968 for an earlier proposal of this sort), and over the course of that decade its consequences were explored. Much of this work assumes that verbs are associated with predicate-argument structures (e.g. Bresnan 1982, Grimshaw 1990), often called theta-grids (Stowell 1981, Williams 1981). The central idea is that the syntactic structure that a verb appears in is projected from its predicate-argument structure, which indicates the number of syntactic arguments a verb has, and some information about how the arguments are projected onto syntax, for example, as internal or external arguments (Marantz 1984, Williams 1981). One insight arising from the closer scrutiny of the relationship between the lexical properties of verbs and the syntactic environments in which they appear is that a great many verbs display a range of what have been called argument—or diathesis—alternations, in which the same verb appears with more than one set of morphosyntactic realization options for its arguments, as in the causative and dative alternations, in (1) and (2), respectively.

(1) a. Pat dried the clothes.
b. The clothes dried.

(2) a. Pat sold the rare book to Terry.
b. Pat sold Terry the rare book.

Some argument alternations seem to involve two alternate realizations of the same set of arguments (e.g. the dative alternation), while others seem to involve real changes in the meaning of the verb (e.g. the causative alternation) (Rappaport Hovav & Levin 1998b). Researchers who developed theories of LCS assumed that in addition to a verb's argument structure, it is possible to isolate a small set of recurring meaning components which determine the range of argument alternations a particular verb can participate in. These meaning components are embodied in the primitive predicates of predicate decompositions such as LCSs. Thus, LCSs are used both to represent systematic alternations in a verb's meaning and to define the set of verbs which undergo alternate mappings to syntax, as we now illustrate.

A case study which illustrates this line of investigation is presented by Guerssel et al. (1985). Their study attempts to isolate those facets of meaning which determine a verb's participation in several transitivity alternations in four languages: Berber, English, Warlpiri, and Winnebago. Guerssel et al. compare the behavior of verbs corresponding to English *break* (as a representative of the class of change of state verbs) and *cut* (as a representative of the class of motion-contact-effect verbs) in several alternations, including the causative and conative alternations in these languages (cf. Fillmore 1970). They suggest that participation in the causative alternation is contingent on the LCS of a verb containing a constituent of the form '[come to be STATE]' (represented via the predicate BECOME or CHANGE in some other work), while participation in the conative alternation requires an LCS with components of contact and effect.

The LCSs suggested for the intransitive and transitive uses of *break*, which together make up the causative alternation, are given in (3), and the LCSs for the transitive and intransitive uses of *cut*, which together make up the conative alternation, illustrated in (4), are presented in (5).

(3) a. *break*: y come to be BROKEN (Guerssel et al. 1985: 54, ex. (19))

b. *break*: x cause (y come to be BROKEN) (Guerssel et al. 1985: 55, ex. (21))

(4) a. I cut the rope around his wrists.

b. I cut at the rope around his wrists.

(5) a. *cut*: x produce CUT in y, by sharp edge coming into contact with y (Guerssel et al. 1985: 51, (11))

b. *cut* Conative LCS: x causes sharp edge to move along path toward y, in order to produce CUT on y, by sharp edge coming into contact with y (Guerssel et al. 1985: 59, (34))

We cite semantic representations in the forms given in the source, even though this leads to inconsistencies in notation; where we formulate representations for the purposes of this article, we adopt the representations used by Rappaport Hovav & Levin (1998a) and subsequent work. Although the LCSs for *cut* in (5) include semantic notions not usually encountered in predicate decompositions, central to them are the notions 'move' and 'produce', which have more common analogues: GO and the combination of CAUSE and BECOME, respectively.

The verb *cut* does not have an intransitive noncausative use, as in (6), since its LCS does not have an isolatable constituent of the form '[come to be in STATE]', while the verb *break* lacks a conative variant, as in (7), because its LCS does not include a contact component. Finally, verbs like *touch*, whose meaning does not involve a change of state and simply involves contact with no necessary effect, display neither alternation, as in (8).

(6) *The bread cut.

(7) *We broke at the box.

(8) a. We touched the wall.

b. *The wall touched.

c. *We touched at the wall.

For other studies along these lines, see Hale & Keyser (1987), Laughren (1988), and Rappaport, Levin & Laughren (1988).

Clearly, the noncausative and causative uses of a verb satisfy different truth conditions, as do the conative and nonconative uses of a verb. As we have just illustrated, LCSs can capture these modulations in the meaning of a verb which, in turn, have an effect on the way a verb's arguments are morphosyntactically realized. As we discuss in sections 5 and 6, subsequent work tries to derive a verb's argument realization properties in a principled way from the structure of its LCS.

However, as mentioned above, verbs with certain LCSs may also simply allow more than one syntactic realization of their arguments without any change in meaning. Rappaport Hovav & Levin (2008) argue that this possibility is instantiated by the English dative alternation as manifested by verbs that inherently lexicalize caused possession such as *give*, *rent*, and *sell*. They propose that these verbs have a single LCS representing the causation of possession, as in (9), but differ from each other with respect to the specific type of possession involved. The verb *give* lexicalizes nothing more than caused possession, while other verbs add further details about the event: it involves the exchange of money for *sell* and is temporary and contractual for *rent*.

(9) Caused possession LCS: [x CAUSE [y HAVE z]]

According to Rappaport Hovav & Levin (2008), the dative alternation arises with these verbs because the caused possession LCS has two syntactic realizations. (See Harley (2003) and Goldberg (1995) for an alternative view which takes the dative alternation to be a consequence of attributing both caused motion and caused possession LCSs to all alternating verbs; Rappaport Hovav & Levin only attribute both LCSs to verbs such as *send* and *throw*, which are not inherently caused possession verbs.)

As these case studies illustrate, the predicate decompositions that fall under the rubric "LCS" are primarily designed to capture those facets of meaning which determine grammatical facets of behavior, including argument alternations. This motivation sets LCSs apart from other predicate decompositions, which are primarily posited on the basis of other forms of evidence, such as the ability to capture various entailment relations between sets of sentences containing morphologically related words and the ability to account for interactions between event types and various tense operators and temporal adverbials; cf. article 17 *Lexical decomposition*. To give one example, it has been suggested that verbs which pass tests for telicity all have a state predicate in their predicate decomposition (Dowty 1979, Parsons 1990). Nevertheless, LCS representations share many of the properties of other predicate decompositions used as explications of lexical meaning, including those proposed by Dowty (1979), Jackendoff (1976, 1983, 1990), and more recently in Role and Reference Grammar, especially, in Van Valin & LaPolla (1997), based in large part on the work of generative semanticists such as Lakoff (1968, 1970), McCawley (1968, 1971), and Ross (1972). These similarities, of course, raise the question of whether the same representation can be the basis for capturing both kinds of generalizations.

LCSs, however, are not intended to provide an exhaustive representation of a verb's meaning, as mentioned above. Positing an LCS presupposes that it is possible to distinguish those facets of meaning that are grammatically relevant from those which are not; this assumption is not uncontroversial, see, for example, the debate between Taylor (1996) and Jackendoff (1996a). In addition, the methodology and aims of this form of "componential" analysis of verb meaning differs in fundamental ways from the type of componential analysis proposed by the structuralists (e.g. Nida 1975). For the structuralists, meaning components were isolatable insofar as they were implicated in semantic contrasts within a lexical field (e.g. "adult" to distinguish *parent* from *child*); the aim of a componential analysis, then, was to provide a feature analysis of the words in a particular semantic field that distinguishes every word in that field from every other. In contrast, the goal of the work assuming LCS is not to provide an exhaustive semantic analysis, but rather to isolate

only those facets of meaning which recur in significant classes of verbs and determine key facets of the linguistic behavior of verbs. This approach makes the crucial assumption that verbs may be different in significant respects, while still having almost identical LCSs; for example, *freeze* and *melt* denote "inverse" changes of state, yet they would both share the LCS of change of state verbs.

Although all these works assume the value of positing predicate decompositions (thus differing radically from the work of Fodor & Lepore 1999), the nature of the predicate decomposition and its place in grammar and syntactic structure varies quite radically from theory to theory. Here we review the work which takes the structured lexical representation to be a specifically linguistic representation and, thus, to be distinct from a general conceptual structure which interfaces with other cognitive domains. Furthermore, this work assumes that the information encoded in the LCSs is a small subset of the information encoded in a fully articulated explication of lexical meaning. In this respect, this work is different from the work of Jackendoff (1983, 1990), who assumes that there is a single conceptual representation, used for linguistic and nonlinguistic purposes; cf. article 31 *Conceptual semantics*.

3. Components of LCSs

Since verbs individuate and name events, LCS-style representations are taken to specify the limited inventory of basic event types made available by language for describing happenings in the world. Thus, our use of the term "event" includes all situation types, including states, similar to the notion of "eventuality" in some work on event semantics (Bach 1986). For this reason, such representations are often currently referred to as "event structures". In this section, we provide an overview of the representations of the lexical meaning of verbs which are collectively called event structures and identify the properties which are common to the various instantiations of these representations. In section 6, we review theories which differ in terms of how these representations are related to syntactic structures.

All theories of event structure, either implicitly or explicitly, recognize a distinction between the primitive predicates which define the range of event types available and a component which represents what is idiosyncratic in a verb's meaning. For example, all noncausative verbs of change of state have a predicate decomposition including a predicate representing the notion of change of state, as in (10); however, these verbs differ from one another with respect to an attribute of an entity whose value is specified as changing: the attribute relevant to *cool* involves temperature, while that relevant to *widen* involves a dimension. One way to represent these components of meaning is to allow the predicate representing the change to take an argument which represents the attribute, and this argument position can then be associated with distinct attributes. This idea is instantiated in the representations for the three change of state verbs in (11) by indicating the attribute relevant to each verb in capital italics placed within angle brackets.

(10) [BECOME [y <*RES-STATE*>]]

(11) a. *dry*: [BECOME [y <*DRY*>]]
b. *widen*: [BECOME [y <*WIDE*>]]
c. *dim*: [BECOME [y <*DIM*>]]

As this example shows, LCSs are constructed so that common substructures in the representations of verb meanings can be taken to define grammatically relevant classes of verbs, such as those associated with particular argument alternations. Thus, the structure in (10), which is shared by all change of state verbs, can then be associated with displaying the causative alternation. Being associated with this LCS substructure is a necessary, but not sufficient, condition for participating in the causative alternation, since only some change of state verbs alternate in English. The precise conditions for licensing the alternation require further investigation, as does the question of why languages vary somewhat in their alternating verbs; see Alexiadou, Anagnostopoulou & Schäfer (2006), Doron (2003), Haspelmath (1993), Koontz-Garboden (2007), and Levin & Rappaport Hovav (2005) for discussion.

The idiosyncratic component of a verb's meaning has received several names, including "constant", "root", and even "verb". We use the term "root" (Pesetsky 1995) in the remainder of this article, although we stress that it should be kept distinct from the notion of root used in morphology (e.g. Aronoff 1993). Roots may be integrated into LCSs in two ways: a root may fill an argument position of a primitive predicate, as in the change of state example (10), or it may serve as a modifier of a predicate, as with various types of activity verbs, as in (12) and (13). (Modifier status is indicated by subscripting the root to the predicate being modified.)

(12) Casey ran.
[x ACT$_{<RUN>}$]

(13) Tracy wiped the table.
[x ACT$_{<WIPE>}$ y]

Although early work on the structured representation of verb meaning paid little attention to the nature and contribution of the root (the exception being Grimshaw 2005), more recent work has taken seriously the idea that the elements of meaning lexicalized in the root determine the range of event structures that a root can be associated with (e.g. Erteschik-Shir & Rapoport 2004, 2005, Harley 2005, Ramchand 2008, Rappaport Hovav 2008, Rappaport Hovav & Levin 1998a, Zubizarreta & Oh 2007).

Thus, Rappaport Hovav & Levin (1998a) propose that roots are of different ontological types, with the type determining the associated event structures. Two of the major ontological types of roots are manner and result (Levin & Rappaport Hovav 1991, 1995, Rappaport Hovav & Levin 2009; see also Talmy 1975, 1985, 2000). These two types of roots are best introduced through an examination of verbs apparently in the same semantic field which differ as to nature of their root: the causative change of state verb *clean*, for example, has a result root that specifies a state that often results from some activity, as in (14), while the verb *scrub* has a manner root that specifies an activity, as in (15); in this and many other instances, the activity is one conventionally carried out to achieve a particular result. With *scrub* the result is "cleanness", which explains the intuition of relatedness between the manner verb *scrub* and the result verb *clean*.

(14) [[x ACT$_{<MANNER>}$] CAUSE [BECOME [y <*CLEAN*>]]]

(15) [x ACT$_{<SCRUB>}$]

Result verbs specify the bringing about of a result state—a state that is the result of some sort of activity; it is this state which is lexicalized in the root. Thus, the verbs *clean* and *empty* describe two different result states that are often brought about by removing material from a place; neither verb is specific about how the relevant result state comes about. Result verbs denote externally caused eventualities in the sense of Levin & Rappaport Hovav (1995). Thus, while a cave can be empty without having been emptied, something usually becomes empty as a result of some causing event. Result verbs, then, are associated with a causative change of state LCS; see also Hale & Keyser (2002) and Koontz-Garboden (2007) and for slightly different views Alexiadou, Anagnostopoulou & Schäfer (2006) and Doron (2003).

A manner root is associated with an activity LCS; such roots describe actions, which are identified by some sort of means, manner, or instrument. Thus, the manner verbs *scrub* and *wipe* both describe actions that involve making contact with a surface, but differ in the way the hand or some implement is moved against the surface and the degree of force and intensity of this movement. Often such activities are characterized by the instrument used in performing them and the verbs themselves take their names from the instruments. Again among verbs describing making contact with a surface, there are the verbs *rake* and *shovel*, which involve different instruments, designed for different purposes and, thus, manipulated in somewhat different ways. Despite the differences in the way the instruments are used, linguistically all these verbs have a basic activity LCS. In fact, all instrument verbs have this LCS even though there is apparent diversity among them: thus, the verb *sponge* might be used in the description of removing events (e.g. *Tyler sponged the stain off the fabric*) and the verb *whisk* in the description of adding events (e.g. *Cameron whisked the sugar into the eggs*), while the verbs *rake* and *shovel* might be used for either (e.g. *Kelly shoveled the snow into the truck*, *Kelly shoveled the snow off the drive*). According to Rappaport Hovav & Levin (1998b), this diversity has a unified source: English allows the LCSs of all activity verbs to be "augmented" by the addition of a result state, giving rise to causative LCSs, such as those involved in the description of adding and removing events, via a process they call Template Augmentation. This process resembles Wunderlich's (1997a, 2000) notion of argument extension; cf. article 95 *Operations on argument structure*; see also Rothstein (2003) and Ramchand (2008). Whether an augmented instrument verb receives an adding or removing interpretation depends on whether the instrument involved is typically used to add or remove stuff.

In recent work, Rappaport Hovav & Levin (2009) suggest an independent characterization of manner and result roots by appealing to the notions of scalar and nonscalar change—notions which have their origins in Dowty (1979, 1991) and McClure (1994), as well as the considerable work on the role of scales in determining telicity (e.g. Beavers 2008, Borer 2005, Hay, Kennedy & Levin 1999, Jackendoff 1996b, Kennedy & Levin 2008, Krifka 1998, Ramchand 1997, Tenny 1994). As dynamic verbs, manner and result verbs all involve change, though crucially not the same type of change: result roots specify scalar changes, while manner roots do not. Verbs denoting events of scalar change in one argument lexically entail a scale: a set of degrees—points or intervals indicating measurement values—ordered on a particular dimension representing an attribute of an argument (e.g. height, temperature, cost) (Bartsch & Vennemann 1972, Kennedy 1999, 2001); the degrees indicate the possible values of this attribute. A scalar change in an entity involves a change

in the value of the relevant attribute in a particular direction along the associated scale. The change of state verb *widen* is associated with a scale of increasing values on a dimension of width; and a widening event necessarily involves an entity showing an increase in the value along this dimension. A nonscalar change is any change that cannot be characterized in terms of a scale; such changes are typically complex, involving a combination of many changes at once. They are characteristic of manner verbs. For example, the verb *sweep* involves a specific movement of a broom against a surface that is repeated an indefinite number of times. See Rappaport Hovav (2008) for extensive illustration of the grammatical reflexes of the scalar/nonscalar change distinction.

As this section makes clear, roots indirectly influence argument realization as their ontological type determines their association with a particular event structure. We leave open the question of whether roots can more directly influence argument realization. For example, the LCS proposed for *cut* in (5) includes elements of meaning which are normally associated with the root since "contact" or a similar concept has not figured among proposals for the set of primitive predicates constituting an LCS. Yet, this element of meaning is implicated by Guerssel et al. in the conative alternation. (In contrast, the notion "effect" more or less reduces to a change of state of some type.)

4. Choosing primitive predicates

LCSs share with other forms of predicate decomposition the properties that are said to make such representations an improvement over lists of semantic roles, whether Fillmore's (1968) cases or Gruber (1965/1976) and Jackendoff's (1972) thematic relations, as structured representations of verb meaning. There is considerable discussion of the problems with providing independent, necessary and sufficient definitions of semantic roles (see e.g. Dowty 1991 and article 18 *Thematic roles*), and one suggestion for dealing with this problem is the suggestion first found in Jackendoff (1972) that semantic roles can be identified with particular open positions in predicate decompositions. For example, the semantic role "agent" might be identified with the first argument of a primitive predicate CAUSE. There is a perception that the set of primitive predicates used in a verb's LCS or event structure is better motivated than the set of semantic role labels for its arguments, and for this reason predicate decompositions might appear to be superior to a list of semantic role labels as a structured representation of a verb's meaning. However, there is surprisingly little discussion of the explicit criteria for positing a particular primitive predicate, although see the discussion in Carter (1978), Jackendoff (1983: 203–204), and Joshi (1974).

The primitive predicates which surface repeatedly in studies using LCSs or other forms of predicate decomposition are ACT or DO, BE, BECOME or CHANGE, CAUSE, and GO, although the predicates HAVE, MOVE, STAY, and, more recently, RESULT are also proposed. Jackendoff (1990) posits a significantly greater number of predicates than in his previous work, introducing the predicates CONFIGURE, EXTEND, EXCHANGE, FORM, INCH(OATIVE), ORIENT, and REACT. Article 33 *Word meaning and world knowledge* discusses how some of these predicates may be grounded in an axiomatic semantics.

Once predicates begin to proliferate, theories of predicate decomposition face many of the well-known problems facing theories of semantic roles (cf. Dowty 1991). The question is whether it is possible to identify a small, comprehensive, universal, and well-motivated

set of predicates accepted by all. It is worthwhile, therefore, to scrutinize the motivation for proposing a predicate in the first place and to try to make explicit when the introduction of a new predicate is justified.

In positing a set of predicates, researchers have tried to identify recurring elements of verb meaning that figure in generalizations holding across the set of verbs within (and, ultimately, across) languages. Often these generalizations involve common entailments or common grammatical properties. Wilks (1987) sets out general desiderata for a set of primitive predicates that are implicit in other work. For instance, the set of predicates should be finite in size and each predicate in the set should indeed be "primitive" in that it should not be reducible to other predicates in the set, nor should it even be partially definable in terms of another predicate. Thus, in positing a new predicate, it is important to consider its effect on the overall set of predicates. Wilks also proposes that the set of predicates should be able to exhaustively describe and distinguish the verbs of each language, but LCS-style representations, by adopting the root–event structure distinction, simply require that the set of primitives should be able to describe all the grammatically relevant event types. It is the role of the root to distinguish between specific verbs of the same event type, and there is a general, but implicit assumption that the roots themselves cannot be reduced to a set of primitive elements. As Wilks (1987: 760) concludes, the ultimate justification for a set of primitive is in their "special organizing role in a language system". We now briefly present several case studies chosen to illustrate the type of reasoning used in positing a predicate.

One way of arriving at a set of primitive predicates is to adopt a hypothesis that circumscribes the basic inventory of event types, while allowing for all events to be analyzed in terms of these types. This approach is showcased in the work of Jackendoff (1972, 1976, 1983, 1987, 1990b), who develops ideas proposed by Gruber (1965/1976). Jackendoff adopts the localist hypothesis: motion and location events are basic and all other events should be construed as such events. There is one basic type of motion event, represented by the primitive predicate GO, which takes as arguments a theme and the path (e.g. *The cart went from the farm to the market*). There are two basic types of locational events, represented by the predicate BE (for stative events) and STAY (for non-stative events); these predicates also take a theme and a location as arguments (e.g. *The coat was/stayed in the closet*). In addition, Jackendoff introduces the predicates CAUSE and LET, which are used to form complex events taking as arguments a causer and a motion or location event.

Events that are not obviously events of motion or location are construed in terms of some abstract form of motion or location. For example, with events of possession, possessums can be taken as themes and possessors as locations in an abstract possessional "field" or domain. The verb *give* is analyzed as describing a causative motion event in the possessional field in which a possessum is transferred from one possessor to another. Physical and mental states and changes of state can be seen as involving an entity being "located" in a state or "moving" from one state to a second state in an identificational field; the verb *break*, for instance, describes an entity moving from a state of being whole to a state of being broken. Generalizing, correspondences are set up between the components of motion and location events and the components of other event domains or "semantic fields" in Jackendoff's terms; this is what Jackendoff (1983: 188) calls the Thematic Relations Hypothesis; cf. article 31 *Conceptual semantics*. In general on this view, predicates are most strongly motivated when they figure prominently in lexical organization and in cross-field

generalizations.

This kind of cross-field organization can be illustrated in a number of ways. First, many English verbs have uses based on the same predicate in more than one field (Jackendoff 1983: 203–204). Thus, the predicate STAY receives support from the English verb *keep*, whose meaning presumably involves the predicates CAUSE and STAY, combined in a representation as in (16), because it shows uses involving the three fields just introduced.

(16) [CAUSE (x, (STAY y, z))]

(17) a. Terry kept the bike in the shed. (Positional)

b. Terry kept the bike basket. (Possessional)

c. Terry kept the bike clean. (Identificational)

Without the notion of semantic field, there would be no reason to expect English to have verbs which can be used to describe events which on the surface seem quite different from each another, as in (17). Second, rules of inference hold of shared predicates across fields Jackendoff (1976). One example is that "if an event is caused, it takes place" (Jackendoff 1976: 110), so that the entailment *The bike stayed in the shed* can be derived from (17a), the entailment *The bike basket stayed with Terry* to be derived from (17b), and the entailment *The bike stayed clean* to be derived from (17c). This supports the use of the predicate CAUSE across fields. Finally, predicates are justified when they explain cross-field generalizations in the use of prepositions. The use of the allative preposition *to* is taken to support the analysis of *give* as a causative verb of motion.

These very considerations lead Carter (1978: 70–74) to argue against the primitive predicate STAY. Carter points out that few English words have meanings that include the notion captured by STAY, yet if STAY were to number among the primitive predicates, such words would be expected to be quite prevalent. So, while the primitives CAUSE and BECOME are motivated because languages often contain a multitude of lexical items differentiated by just these predicates (e.g. the various uses of *cool* in *The cook cooled the cake*, *The cake cooled*, *The cake was cool*), there is no minimal pair differentiated by the existence of STAY, for example, the verb *cool* cannot also mean 'stay cool'. Carter also notes that if NOT is included in the set of predicates, then the predicate STAY becomes superfluous, as it could be replaced by NOT plus CHANGE, a predicate which is roughly an analogue to Jackendoff's GO. Carter further notes that as a result simpler statements of certain inference rules and other generalizations might be possible.

However, the primitive predicates which serve best as the basis for cross-field generalizations are not necessarily the ones that emerge from efforts to account for argument alternations—the efforts that lead to LCS-style representations and their descendants. This point can be illustrated by examining another predicate whose existence has been controversial, HAVE. Jackendoff posits a possessional field that is modeled on the locational field: being possessed is taken to be similar to being at a location—existing at that location (see also Lyons 1967, 1968:391–395). This approach receives support since many entailments involving location also apply to possession, such as the entailment described for STAY. Furthermore, in some languages, including Hindi-Urdu, the same verb is used in basic locational and possessive sentences, suggesting that possession can be reduced to location (though the facts are often more complicated than they appear on the surface; see Harley

2003). Nevertheless, Pinker (1989: 189–190) and Tham (2004: 62–63, 74–85, 100-104) argue that an independent predicate HAVE is necessary; see also Harley (2003). Pinker points out that in terms of the expression of its arguments, it is *belong* and not *have* which resembles locational predicates. The verb *belong* takes the possessum, which would be analyzed as a theme (i.e. located entity), as its subject and the possessor, which would be analyzed as a location, as an oblique. Its argument realization, then, parallels that of a locational predicate; compare (18a) and (18b). In contrast, *have* takes the possessor as subject and the possessum as object, as in (19), so its arguments show the reverse syntactic prominence relations—a "marked" argument realization, which would need an explanation, on the localist analysis.

(18) a. One of the books belongs to me.
b. One of the books is on the table.

(19) I have one of the books.

Pinker points out that an analysis which takes *have* to be a marked possessive predicate is incompatible with the observations that it is a high-frequency verb, which is acquired early and unproblematically by children. Tham (2004: 100–104) further points out that it is *belong* that is actually the "marked" verb from other perspectives: it imposes a referentiality condition on its possessum and it is used in a restricted set of information structure contents—all restrictions that *have* does not share. Taking all these observations together, Tham concludes that *have* shows the unmarked realization of arguments for possessive predicates, while *belong* shows a marked realization of arguments. Thus, she argues that the semantic prominence relations in unmarked possessive and locative sentences are quite different and, therefore, warrant positing a predicate HAVE.

5. Subeventual analysis

One way in which more recent work on event structure departs from earlier work on LCSs is that it begins to use the structure of the semantic representation itself, rather than reference to particular predicates in this representation, in formulating generalizations about argument realization. In so doing, this work capitalizes on the assumption, present in some form since the generative semantics era, that predicate decompositions may have a subeventual analysis. Thus, it recognizes a distinction between two types of event structures: simple event structures and complex event structures, which themselves are constituted of simple event structures. The prototypical complex event structure is a causative event structure, in which an entity or event causes another event, though Ramchand (2008) takes some causative events to be constituted of three subevents, an initiating event, a process, and a result.

Beginning with the work of the generative semanticists, the positing of a complex event structure was supported using evidence from scope ambiguities involving various adverbial phrases (McCawley 1968, 1971, Morgan 1969, von Stechow 1995, 1996). Specifically, a complex event structure may afford certain adverbials, such as *again*, more scope-taking options than a simple event structure, and thus adverbials may show interpretations in sentences denoting complex events that are unavailable in those denoting simple events. Thus,

(20) shows both so-called "restitutive" and "repetitive" readings, while (21) has only a "repetitive" reading.

(20) Dale closed the door again.
Repetitive: the action of closing the door was performed before.
Restitutive: the door was previously in the state of being closed, but there is no presupposition that someone had previously closed the door.

(21) John kicked the door again.
Repetitive: the action of kicking the door was performed before.

The availability of two readings in (20) and one reading in (21) is explained by attributing a complex event structure to (20) and a simple event structure to (21).

A recent line of research argues that the architecture of event structure also matters to argument realization, thus motivating complex event structures based on argument realization considerations. This idea is proposed by Grimshaw & Vikner (1993), who appeal to it to explain certain restrictions on the passivization of verbs of creation (though the pattern of acceptability that they are trying to explain turns out to have been mischaracterized; see Macfarland 1995). This idea is further exploited by Rappaport Hovav & Levin (1998a) and Levin & Rappaport Hovav (1999) to explain a variety of facts related to objecthood.

In this work, the notion of event complexity gains explanatory power via the assumption that there must be an argument in the syntax for each subevent in an event structure (Rappaport Hovav & Levin 1998a, 2001; see also Grimshaw & Vikner 1993 and van Hout 1996 for similar conditions). Given this assumption, a verb with a simple event structure may be transitive or intransitive, while a verb with a complex event structure, say a causative verb, must necessarily be transitive. Rappaport Hovav & Levin (1998a) attribute the necessary transitivity of *break* and *melt*, which contrasts with the "optional" transitivity of *sweep* and *wipe*, to this constraint; the former, as causative verbs, have a complex event structure.

(22) a. *Blair broke/melted.
b. Blair wiped and swept.

Levin & Rappaport Hovav (1999) use the same assumption to explain why a resultative based on an unergative verb can only predicate its result state of the subject via a "fake" reflexive object.

(23) My neighbor talked *(herself) hoarse.

Resultatives have a complex, causative event structure, so there must be a syntactically realized argument representing the argument of the result state subevent; in (23) it is a reflexive pronoun as it is the subject which ends up in the result state. Levin (1999) uses the same idea to explain why agent-act-on-patient verbs are transitive across languages, while other two-argument verbs vary in their transitivity: only the former are required to be transitive. As in other work on LCSs and event structure, the use of subeventual structure is motivated by argument realization considerations.

Pustejovsky (1995) and van Hout (1996) propose an alternative perspective on event complexity: they take telic events, rather than causative events, to be complex events. Since most causative events are telic events, the two views of event complexity assign complex

event structures in many of the same instances. A major difference is in the treatment of telic uses of manner of motion verbs such as *Terry ran to the library* and telic uses of consumption verbs such as *Kerry ate the peach*; these are considered complex predicates on the telicity approach, but not on the causative approach. See Levin (2000) for some discussion.

The subeventual analysis also defines hierarchical relations among arguments, allowing rules of argument realization to be formulated in terms of the geometry of the LCS. We now discuss advantages of such a formulation over direct reference to semantic roles.

6. LCSs and syntax

LCSs, as predicate decompositions, include the embedding of constituents, giving rise to a hierarchical structure. This hierarchical structure, which includes the subeventual structure discussed in section 5, allows a notion of semantic prominence to be defined, which mirrors the notion of syntactic prominence. For instance, Wunderlich (1997a, 1997b, 2006) introduces a notion of a-command defined over predicate decompositions, which is an analogue of syntactic c-command. By taking advantage of the hierarchical structure of LCSs, it becomes possible to formulate argument realization rules in terms of the geometry of LCSs and, more importantly, to posit natural constraints on the nature of the mapping between LCS and syntax. As discussed at length in Levin & Rappaport Hovav (2005: chapter 5), many researchers assume that the mapping between lexical semantics and syntax obeys a constraint of prominence preservation: relations of semantic prominence in a semantic representation are preserved in the corresponding syntactic representation, so that prominence in the syntax reflects prominence in semantics (Bouchard 1995). This idea is implicit in the many studies that use a thematic hierarchy—a ranking of semantic roles—to guide the semantics-syntax mapping and explain various other facets of grammatical behavior; however, most work adopting a thematic hierarchy does not provide independent motivation for the posited role ranking. Predicate decompositions can provide some substance to the notion of a thematic hierarchy by correlating the position of a role in the hierarchy with the position of the argument bearing that role in a predicate decomposition (Baker 1997, Croft 1998, Kiparsky 1997, Wunderlich 1997a, 1997b, 2000). (There are other ways to ground the thematic hierarchy; see article 18 *Thematic roles*.)

Researchers such as Bouchard (1995), Kiparsky (1997), and Wunderlich (1997a, 1997b) assume that predicate decompositions constitute a lexical semantic representation, but many other researchers now assume that predicate decompositions are syntactic representations, built from syntactic primitives and constrained by principles of syntax. This move obviates the need for prominence preservation in the semantics-syntax mapping since the lexical semantic representation and the syntactic representation are one. The idea that predicate decompositions motivated by semantic considerations are remarkably similar to syntactic structures, and thus should be taken to be syntactic structures has previously been made explicit in the generative semantics literature (e.g. Morgan 1969). Hale & Keyser were the first to articulate this position in the context of current syntactic theory; their LCS-style syntactic structures are called "lexical relational structures" in some of their work (1992, 1993, 1997). The proposal that predicate decompositions should be syntactically instantiated has gained currency recently and is defended or assumed in a range of work, including

Erteschik-Shir & Rapoport (2004), Mateu (2001a, 2001b), Travis (2000), and Zubizaretta & Oh (2007), who all build directly on Hale & Keyser's work, as well as Alexiadou, Anagnostopoulou & Schäfer (2006), Harley (2003, 2005), Pylkkänen (2008), and Ramchand (2008), who calls the "lexical" part of syntax "first phase syntax". We now review the types of arguments adduced in support of this view.

Hale & Keyser (1993) claim that their approach explains why there are few semantic role types (although this claim is not entirely uncontroversial; see Dowty 1991 and Kiparsky 1997). For them, the argument structure of a verb is syntactically defined and represented. Furthermore, individual lexical categories (V, in particular) are constrained so as to project syntactic structures using just the syntactic notions of specifier and complement. These syntactic structures are associated with coarse-grained semantic notions, often corresponding to the predicates typical in standard predicate decompositions; the positions in these structures correspond to semantic roles, just as the argument positions in a standard predicate decomposition are said to correspond to semantic roles; see section 4. For example, the patient of a change of state verb is the specifier of a verbal projection in which a verb takes an adjective complement (i.e. the N position in '[$_{\mathrm{V}}$ N [$_{\mathrm{V}}$ V A]]'). Since the number of possible structural relations in syntax is limited, the number of expressible semantic roles is also limited. Furthermore, Hale & Keyser suggest that the nature of these syntactic representations of argument structure also provide insight into Baker's (1988: 46, 1997) Uniformity of Theta Role Assignment, which requires that identical semantic relationships between items be represented by identical structural relations between those items at d-structure. On Hale & Keyser's approach, this principle must follow since semantic roles are defined over a hierarchical syntactic structure, with a particular role always having the same instantiation. These ideas are developed further in Ramchand (2008), who assumes a slightly more articulated lexical syntactic structure than Hale & Keyser do.

Hale & Keyser provide support for their proposal that verb meanings have internal syntactic structure from the syntax of denominal verbs. They observe that certain impossible types of denominal verbs parallel impossible types of noun-incorporation. In particular, they argue that just as there is no noun incorporation of either agents or recipients in languages with noun-incorporation (Baker 1988: 453–454, n. 13, 1996: 291–295), so there is no productive denominal verb formation where the base noun is interpreted as an agent or a recipient (e.g. **I churched the money*, where *church*$_{\mathrm{N}}$ is understood as a recipient; **It cowed a calf*, where *cow*$_{\mathrm{N}}$ is understood as the agent). However, denominal verbs are productively formed from nouns analyzed as patients (e.g. *I buttered the pan*) and containers or locations (e.g. *I bottled the wine*). Hale & Keyser argue that the possible denominal verb types follow on the assumption that these putative verbs are derived from syntactic structures in which the base noun occupies a position which reflects its semantic role. This point is illustrated using their representations for the verbs *paint* and *shelve* given in (24) and (25), respectively, which are presented in the linearized form given in Wechsler (2006: 651, (17)–(18)) rather than in Hale & Keyser's (1993) tree representations.

(24) a. We painted the house.

b. We [$_{\mathrm{V'}}$ V1 [$_{\mathrm{VP}}$ house [$_{\mathrm{V'}}$ V2 [$_{\mathrm{PP}}$ P$_{\mathrm{with}}$ paint]]]].

(25) a. We shelved the books.

b. We [$_{\mathrm{V'}}$ V1 [$_{\mathrm{VP}}$ books [$_{\mathrm{V'}}$ V2 [$_{\mathrm{PP}}$ P$_{\mathrm{on}}$ shelf]]]].

The verbs *paint* and *shelf* are derived through the movement of the base noun—the verb's root—into the empty V1 position in the structures in (b), after first merging it with the preposition P_{with} or P_{on} and then with V2. Hale & Keyser argue that the movement of the root is subject to a general constraint on the movement of heads (Baker 1988; Travis 1984). Likewise, putative verbs such as *bush* or *house*, used in sentences such as *I bushed a trim* (with the intended interpretation 'I gave the bush a trim') or *I housed a coat of paint* (with the intended interpretation 'I gave the house a coat of paint') are also excluded by the same constraint.

Hale & Keyser's approach is sharply criticized by Kiparsky (1997). He points out that the syntax alone will not prevent the derivation of sentences such as *I bushed some fertilizer* from a putative source corresponding to *I put some fertilizer on the bush* (cf. the source for *I bottled the wine* or *I corralled the horse*). The association of a particular root with a specific lexical syntactic structure is governed by conceptual principles such as "If an action refers to a thing, it involves a canonical use of the thing" (1997: 482). Such principles ensure that *bush* will not be inserted into a structure as a location, since unlike a bottle, its canonical use is not as a container or place.

Denominal verbs in English, although they do not involve any explicit verb-forming morphology, have been said, then, to parallel constructions in other languages which do involve overt morphological or syntactic derivation (e.g. noun incorporation), and this parallel has been taken to support the syntactic derivation of these words. Comparable arguments can be made in other areas of the English lexicon. For example, in most languages of the world, manner of motion verbs cannot on their own license a directional phrase, though in English all manner of motion verbs can. Specifically, sentences parallel to the English *Tracy ambled into the room* are derived through a variety of morphosyntactic means in other languages, including the use of directional suffixes or applicative morphemes on manner of motion verbs and the combination of manner and directed motion verbs in compounds or serial verb constructions (Schaefer 1985, Slobin 2004, Talmy 1991). Japanese, for example, must compound a manner of motion verb with a directed motion verb in order to express manner of motion to a goal, as the contrast in (26) shows.

(26) a. ?John-wa kishi-e oyoida.
John-TOP shore-to swam
'John swam to the shore.' (intended; Yoneyama 1986: 1, (1b))

b. John-wa kishi-e oyoide-itta.
John-TOP shore-to swimming-went
'John swam to the shore.' (Yoneyama 1986: 2, (3b))

The association of manner of motion roots with a direction motion event type is accomplished in theories such as Rappaport Hovav & Levin (1998b, 2001) and Levin & Rappaport Hovav (1999) by processes which augment the event structure associated with the manner of motion verbs. But such theories never make explicit exactly where the derivation of these extended structures takes place. Ramchand (2008) and Zubizarreta & Oh (2007) argue that since these processes are productive and their outputs are to a large extent compositional, they should be assigned to the "generative computational" module of the grammar, namely, syntax. Finally, as Ramchand explicitly argues, this syntacticized approach suggests that languages that might appear quite different, are in fact, underlyingly quite similar, once

lexical syntactic structures are considered.

Finally, we comment on the relation between structured event representations and the lexical entries of verbs. Recognizing that many roots in English can appear as words belonging to several lexical categories and that verbs themselves can be associated with various event structures, Borer (2005) articulates a radically nonlexical position: she proposes that roots are category neutral. That is, there is no association specified in the lexicon between roots and the event structures they appear with. Erteschik-Shir & Rapoport (2004, 2005), Levin & Rappaport Hovav (2005), Ramchand (2008), and Rappaport Hovav & Levin (2004) all point out that even in English the flexibility of this association is still limited by the semantics of the root. Ramchand includes in the lexical entries of verbs the parts of the event structure that a verbal root can be associated with, while Levin & Rappaport Hovav make use of "canonical realization rules", which pair roots with event structures based on their ontological types, as discussed in section 3.

7. Conclusion

LCSs are a form of predicate decomposition intended to capture those facets of verb meaning which determine grammatical behavior, particularly in the realm of argument realization. Research on LCSs and the structured representations that are their descendants has contributed to our understanding of the nature of verb meaning and the relation between verb syntax and semantics. This research has shown the importance of semantic representations that distinguish between root and event structure, as well as the importance of the architecture of the event structure to the determination of grammatical behavior. Furthermore, such developments have led some researchers to propose that representations of verb meaning should be syntactically instantiated.

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