

## Introduction

A boy throws a ball, which hits a window and breaks it. This scene can be described using either sentence in (1), the first with *break* and the second with *hit*.

- (1) a. The boy broke the window with a ball.  
 b. The boy hit the window with a ball.

The participants in this scene – the boy, the window, and the ball – are expressed in a parallel fashion in both sentences: *the boy* is the subject, *the window* is the object, and *the ball* is the object of the preposition *with*. However, *break* can be used to describe a part of the same scene in another way, an option not available to *hit*.

- (2) a. The window broke.  
 b. \*The window hit.

Such puzzles are at the heart of the area of linguistics called ARGUMENT REALIZATION: the study of the possible syntactic expressions of the arguments of a verb. In the *hit/break* example, the challenge is to explain why two verbs show divergent behavior and why the divergences take the forms that they do. This example, drawn from Fillmore's well-known study, "The Grammar of *Hitting* and *Breaking*" (1970), is particularly apt because both verbs in their basic, nonidiomatic uses are commonly characterized as "agent-act-on-patient" verbs, and linguists often assume that much of what needs to be said about argument realization can be summarized with a simple statement correlating agents with subjects and patients – roughly, affected entities – with objects. Needless to say, such simple statements do not go far in helping to understand the basis for the difference between these two verbs.

It has long been known that verbs fall into semantically identifiable classes, which are the basis for generalizations concerning argument realization. Fillmore (1970) points out that in terms of their linguistic behavior, *break*

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and *hit* are each representative of a larger set of verbs, including those listed in (3). Each set shows semantic coherence: verbs patterning like *break* involve a change of state in an entity, while those patterning like *hit* involve contact, often forceful, with an entity, without entailing any change of state in that entity (e.g., *The rocks hit the window, but luckily it wasn't damaged*).

- (3) a. *Break* verbs: bend, fold, shatter, crack (Fillmore 1970: 125, (15))  
 b. *Hit* verbs: slap, strike, bump, stroke (Fillmore 1970: 125, (16))

All verbs in the *break* class – and none in the *hit* class – show the two argument realization options in (1) and (2), which together constitute the CAUSATIVE ALTERNATION (also known as the “anticausative” or “causative/inchoative” alternation). This alternation is characterized by verbs with transitive and intransitive uses, such that the transitive use of a verb *V* means roughly ‘cause to *V*-intransitive’; see B. Levin (1993) for discussion and references. More generally, both the *break* verbs and the *hit* verbs show a range of characteristic argument realization possibilities, going well beyond those just illustrated. As Fillmore (1970: 126) discusses, *The window was broken* allows both eventive and stative readings, while the comparable *The window was hit* allows only a stative reading. He also points out that *hit* permits alternate expressions of the possessor of a body part, while *break* does not.

- (4) a. I broke his leg./\*I broke him on the leg.  
 b. I hit his leg./I hit him on the leg. (Fillmore 1970: 126, (23)–(26))

Furthermore, in a later paper, Fillmore (1977a: 74–78) points out that the sentences in the pair in (5) are not paraphrases, though those in (6) are.

- (5) a. Perry broke the fence with the stick.  
 b. Perry broke the stick against the fence.  
 (6) a. Perry hit the fence with the stick.  
 b. Perry hit the stick against the fence.

The fact that classes of verbs with similar meanings show characteristic argument realization patterns suggests that these patterns can be attributed to the semantic properties of each class. In fact, two comparable classes of verbs, again with distinct behavioral patterns, can be identified in other languages, such as Lhasa Tibetan (DeLancey 1995), Berber, Warlpiri, and Winnebago (Guerssel et al. 1985).

One goal of a theory of argument realization is the isolation of the relevant components of meaning and the explication of their connection to the range of argument realization options. Groundbreaking studies exploring such regularities in the realization of arguments within the framework of generative grammar include Carter (1976, 1977, 1988 [1976]), Fillmore (1968, 1971b), and Ostler (1979). Over the years many argument realization regularities have

been uncovered, and recently several general theories of argument realization have been developed (Ackerman and Moore 2001; Baker 1996a, 1997, 2001; Croft 1991, 1998; Davis 2001; Davis and Koenig 2000; Dowty 1991; Hale and Keyser 1992, 1993, 1994, 1996, 1997a, 1997b, 1998, 1999, 2002; Jackendoff 1987, 1990b; Joppen and Wunderlich 1995; Rappaport Hovav and B. Levin 1998a; Schlesinger 1995; Van Valin 1993b; Van Valin and LaPolla 1997; Wechsler 1995; Wunderlich 1997a, 1997b, 2000; among others). This book aims to provide an overview and synthesis of the results of current research on argument realization, to highlight questions which remain open, and to lay out the challenges such phenomena present for linguistic theory.

Throughout this book we illustrate the richness and complexity of the phenomena falling under the rubric “argument realization.” As we use it, this term encompasses all facets of the syntactic expression of arguments of verbs, including the entire range of options for the grammatical relation they may bear, their syntactic category, and their surface morphosyntactic expression. The term “linking” has also been used in this connection. This term appears to have originated in Richard Carter’s unpublished 1976 paper, “Some Linking Regularities” (eventually published in 1988), where he uses the phrase “linking regularities” (1988: 3) for the regularities in the syntactic realization – i.e., the syntactic category and grammatical relation – of a verb’s arguments. Since the term “linking” does not transparently reflect the full range of phenomena we are concerned with and has other uses in other areas of linguistics, we adopt the term “argument realization” instead.

A complete theory of argument realization has to address five major questions: (i) Which facets of the meanings of verbs are relevant for the mapping from lexical semantics to syntax? (ii) What is the nature of a lexical semantic representation that encompasses these components of meaning? That is, what are the primitives of this representation and the principles for combining these primitives into representations of specific verb meanings? (iii) What is the nature of the algorithm which derives the syntactic expression of arguments? (iv) To what extent do nonsemantic factors such as information structure and heaviness govern argument realization? (v) To what extent are the semantic determinants of argument realization lexical and to what extent can some of them be shown to be nonlexical? This book is devoted to an exploration of these issues, laying out and comparing different theories which address them.

These issues have become important to linguistic theory because many current theories of grammar assume that the syntactic realization of arguments is predictable to a large extent from the meaning of their verbs. Our goal in this book is to provide a bridge between the line of syntactic research that presupposes a tight connection between verb meaning and syntactic structure and lexical semantic research into verb meanings. Syntacticians are most often interested in sweeping generalizations concerning argument realization and formulate theories without sufficiently delving into the lexical semantic notions

that enter into argument realization. On the other hand, lexical semanticists – including formal semanticists dealing with lexical semantic questions – facing the task of articulating lexical semantic representations of verbs are not always adequately versed in the syntactic issues impinging on the choice of representation. Furthermore, the lexical semantics of verbs has been explored from a wide range of theoretical perspectives, a fact which hinders the pooling of important insights. In this book we attempt to provide a synthesis and evaluation of these strands of work, placing them in a unified perspective. Our goal is not to develop a comprehensive theory, but rather to present research results which must be taken into consideration within any theoretical framework.

In the first part of the book we investigate the nature of a lexical semantic representation that can encode the grammatically relevant facets of verb meaning and, thus, can serve as a foundation for a theory of argument realization. We review various forms of lexical semantic representation and explore how each fulfills the basic requirements of a theory of argument realization. We focus both on the nature of the representation itself and on the appropriate characterization of the relevant components of meaning, since existing discussions present overlapping, but distinct characterizations. We begin in chapter 2 with SEMANTIC ROLE LISTS, one of the simplest – and, possibly, most commonly adopted – forms of lexical semantic representation, although, as we review, a form that also suffers from severe drawbacks. In chapter 3 we look at a more sophisticated version of semantic roles, GENERALIZED SEMANTIC ROLES, which overcomes some, but not all, of these drawbacks. In this chapter we also introduce a second form of lexical semantic representation, PREDICATE DECOMPOSITION, in which the meaning of a verb is represented in terms of some of its basic grammatically relevant elements of meaning. These representations are often called EVENT STRUCTURES, as they represent the linguistically relevant event types. Event structures have two properties that make them particularly effective: they encode a distinction between simple and complex events – a distinction which has repercussions for argument realization – and they make a distinction between the core meaning of a verb – its root – and the components of meaning that identify the verb's event type.

Since verbs are predicates of events, a characterization of the components of verb meaning relevant to argument realization must be couched within a theory of EVENT CONCEPTUALIZATION – a theory about which facets of events are encoded in event structures. In chapter 4 we review three approaches to event conceptualization; they differ as to whether they take events to be conceptualized in terms of notions of motion and location, in terms of their causal structure, or in terms of their aspectual structure. Each one, then, takes a different cognitively salient facet of events as relevant to argument realization. We focus on the last two approaches, as they have the most significant contributions to make to the understanding of argument realization. We conclude that it is not possible to isolate a single semantic factor which determines either subject or object selection, and attempt to tease apart and assess the relative contribution

of both causal and aspectual notions. We further show that sentence, which cannot always be subsumed under causal notions and lacks a natural place in the aspectual approach, is sometimes implicated in argument realization.

With this background, we turn in two subsequent chapters to questions of argument realization. In chapter 5 we address general properties of theories of the mapping from lexical semantics to syntax. The various accounts of this mapping which we review take as one of their goals the preservation of facets of the event structure in the syntax. We identify two hypotheses about which facets of event structure are preserved: some approaches assume that the mapping to syntax preserves equivalence classes of arguments or predicates, while others assume that the mapping preserves prominence relations in the event structure. Concomitantly, we show that the actual mapping algorithms are designed to be consistent with these hypotheses.

In chapter 6 we explore the use of a theoretical construct, a hierarchy of semantic roles or **THEMATIC HIERARCHY**, that has figured prominently in a wide range of approaches to argument realization. We underscore one reason for its prevalence: a thematic hierarchy facilitates the formulation of a mapping algorithm that ensures that prominence relations in the event structure are preserved in the syntax. Not all researchers, however, share this conception of the thematic hierarchy. We also identify a second conception: the thematic hierarchy provides a way of recognizing priorities among meaning components relevant to argument realization that fall outside the structure of event structure. Thus, the exploration of thematic hierarchies allows us to further weigh the ways in which different facets of a lexical semantic representation contribute to argument realization, buttressing the results in chapter 4. We also extensively consider the question of why there are so many different formulations of the thematic hierarchy in the literature.

As the discussion of *break* and *hit* revealed, verbs may show **ARGUMENT ALTERNATIONS** – alternate expressions of their arguments – as illustrated with the causative alternation. Argument alternations represent one instantiation of the larger phenomenon of **MULTIPLE ARGUMENT REALIZATION** – the ability of most verbs to appear in a variety of syntactic contexts. We devote chapter 7 to this phenomenon, though many of the issues discussed are touched on in earlier chapters as well. We review various treatments of multiple argument realization, showing that some alternations appear to be meaning driven (i.e., are a by-product of verbal polysemy), while others are not. We show that when two alternate argument realizations are truth-conditionally equivalent, the choice between them is governed by nonsemantic factors, such as the information status and heaviness of a verb's arguments. Perhaps one of the most vexed issues is the distribution of verbs across alternations. Verbs that are similar in meaning do not always show the same alternations, yet despite this apparent idiosyncrasy, argument alternations can be extended to new verbs. We conclude that a verb's root has a major part to play in determining which forms of multiple argument realization it might show.

Finally, chapter 8 offers a brief conclusion, summarizing the results of our study in the context of the five questions about argument realization we laid out above and pulling together the insights emerging in earlier chapters.

Although this book focuses on the relationship between verb meaning and argument realization, it is important to acknowledge right at its outset that some researchers (Borer 1994, 1998, 2003a, 2003b, in press a, in press b; Erteschik-Shir and Rapoport 1996; Ghomeshi and Massam 1995; Goldberg 1995; Hoekstra 1992; Jackendoff 1997; Kay 2000; Ritter and S. T. Rosen 1996, 1998) have recently espoused the position that most of the determinants of argument realization are not strictly lexical; rather, they suggest that certain syntactic configurations are themselves the bearers and determiners of certain meaning components; see section 7.1 for discussion. Nevertheless, the basic point still holds: the semantic determinants of argument realization – be they lexical or not – need to be studied seriously in order for a theory of argument realization to be firmly grounded. Therefore, the issues we deal with and the results we report are relevant even if the semantic determinants of argument realization turn out to be extralexical. Although at several points in the book we argue that there is much to be learned from paying attention to the lexical core of verb meaning, we do not take an explicit position on the larger question of how much is lexical and how much is extralexical. We usually refer to lexical semantic properties and lexical semantic representations, but most of the discussion can be recast in terms which are not strictly lexical.

# 1

## Challenges for theories of argument realization

In this chapter we set out the broad descriptive generalizations which emerge from investigations of argument realization and its lexical semantic underpinnings, as well as the methodological issues which a comprehensive theory of argument realization must address. These constitute the major challenges for a theory of lexical semantic representation and a theory of argument realization that dovetails with it.

### 1.1 Taking lexical semantic representations seriously

Since the 1980s, many theories of grammar have been built on the assumption that the syntactic realization of arguments – their category type and their grammatical function – is largely predictable from the meaning of their verbs. Such theories take many facets of the syntactic structure of a sentence to be projections of the lexical properties of its predicator – its verb or argument-taking lexical item;<sup>1</sup> see Wasow (1985) for discussion. To ensure this, these theories incorporate conditions requiring that the arguments of the verb are appropriately represented in the syntactic representation of its clause.<sup>2</sup> Such principles include the Principles and Parameters framework's Projection Principle (Chomsky 1981: 29, 38), Lexical-Functional Grammar's Completeness and Coherence Conditions (Kaplan and Bresnan 1982: 211–12), and Role and Reference Grammar's (RRG's) Completeness Constraint (Foley and Van Valin 1984: 183; Van Valin 1993b: 74–75; Van Valin and LaPolla 1997: 325–26).<sup>3</sup> The successful implementation of the program of deriving the syntactic properties of verbs from facets of their meaning depends on the existence of both an articulated theory of the lexical semantic representation of verbs and a theory of the mapping between this representation and the relevant syntactic representation. Syntacticians often appeal to principles such as the Projection Principle, which presuppose a lexical semantic representation, without seriously considering the

nature of the lexical semantic representations on which they are meant to operate and without taking into account the full range of empirical generalizations concerning argument realizations which these representations are meant to help account for. We illustrate these shortcomings through a review of some relevant discussions, devoting the rest of this chapter to setting out the generalizations that need to be taken into account.

In the past two decades, claims have often been made to the effect that a lexical entry needs to register s(ematic)-selection, the semantic selectional properties of verbs, and not c(onstituent)-selection, the morphosyntactic properties of the arguments of verbs (Chomsky 1986; Pesetsky 1982; Stowell 1981). Implicit in this line of work seems to be the assumption that s-selection takes the form of a list of arguments, identified by their semantic roles. Chomsky (1986: 86), for example, suggests that part of the semantic description of the verb *hit* is a specification that it selects arguments bearing the semantic roles agent and patient. He suggests that the syntactic type and grammatical relation of each argument (c-selection) can be derived from s-selection via general principles, so that subcategorization frames can be dispensed with altogether. In particular, the fact that this verb is transitive, taking an NP subject and an NP direct object, follows from the fact that the verb selects two “things” as arguments (rather than, for example, a “thing” and a “proposition”), and “things” are realized syntactically as NPs (cf. Grimshaw’s [1981] notion of canonical structural realization). The fact that the NP denoting the hitter is the subject and the NP denoting the contacted object is the direct object follows from the classification of the former as agent and the latter as patient, and the fact that universally agents and patients are realized, respectively, as subjects and direct objects.<sup>4</sup>

As already mentioned, lexical entries with agent and patient arguments have been attributed to *break* and *hit*. A similar entry is also proposed for *eat* (Pesetsky 1995: 4) and even for *see* (Rothstein 1983: 23). Again, this lexical entry is supposed to explain these verbs’ choice of subject and object. However, *break*, *hit*, *eat*, and *see* turn out to diverge in systematic and fundamental ways when their argument realization options are examined more fully. As already shown, *hit* differs from *break* in English. Moreover, although verbs like *break* are consistently transitive across languages, verbs like *hit* are not, but rather in some languages they are intransitives with an oblique complement; see section 1.6. The verb *eat* differs from *break* in still other ways. Like *hit*, it does not show an intransitive use whose subject is the transitive use’s object (\**The cookie ate*), but it does allow the omission of its object (*The boy ate*), unlike *break* and other change-of-state verbs (Rappaport Hovav and B. Levin 2002) and *hit*. Furthermore, *eat* and other verbs of consumption show some unique properties in other languages. For instance, they may causativize differently from other transitive verbs in certain languages, including Amharic (Amberber 2002a, 2002b: 37–38), Berber (Alalou and Farrell 1993: 165–66; Guerssel 1986: 36ff), Kannada (Fried 1992: 175–78), Tariana (Aikhenvald



## 1.2 Identifying grammatically relevant facets of meaning

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2000: 157–58), and various Indo-Aryan languages (Alsina and Joshi 1991: 6–7, 12–13; Masica 1976: 46; Ramchand 1997: 182–87). The perception verb *see* shows yet another pattern: it can appear without an object, although this use receives a definite interpretation, contrasting with the comparable use of *eat*, which receives an indefinite interpretation (Fillmore 1986). Such examples show that the program of deriving a verb's argument realization options from its meaning must be firmly grounded in the relevant empirical facts, and the range of facts goes well beyond those that syntacticians usually cite.

A basic understanding of what is involved in formulating a lexical semantic representation is also a prerequisite for the application of certain principles often invoked by syntacticians. For example, many syntactic analyses are motivated using Baker's (1988: 46, 1997) Uniformity of Theta Assignment Hypothesis, which states that NPs bearing identical semantic roles to a verb have to be realized in the same syntactic relation to that verb. Invoking this hypothesis without an understanding of when two NPs bear the same semantic relation to a verb deprives it of much of its power, since it is never clear whether it is being applied appropriately. As we discuss in chapter 7, this question surfaces in the analysis of the dative alternation, exemplified by near-paraphrase sentence pairs, such as *Terry gave a watch to Sam/Terry gave Sam a watch*. The question of whether the two VP-internal arguments bear the same semantic roles in both sentences is crucial to this hypothesis and, hence, to the larger analysis of the alternation. Most of the recent well-articulated theories of argument realization take semantic roles to be convenient labels for referring to arguments, derived from more basic components of lexical semantic representations, as we discuss extensively in chapter 2. Although lip service is usually paid to the nonprimitive status of semantic roles, most syntacticians still ignore the complicated issues involved in determining a comprehensive analysis of particular roles, and, hence, rarely adequately motivate particular semantic analyses, including those apparently dictated by Baker's hypothesis.

## 1.2 Identifying grammatically relevant facets of meaning

Given the complex and multifaceted nature of word meaning (Aitchison 1994; Bolinger 1965; Ullmann 1962), it is no small task to provide words with a structured lexical semantic representation which provides a basis for argument realization. Two methodological choices have facilitated this task. The first involves the nature of the evidence used to posit a lexical semantic representation and the second involves the types of semantic elements relevant to the lexical semantic representation.

Lexical semantic representations have been proposed on the basis of various types of evidence. Some evidence is purely linguistic in nature, while other evidence reflects language acquisition, cognitive, and philosophical considerations. As our focus is on the mapping from lexical semantics to syntax, we follow Dowty (1991: 560–62) and take as our primary criterion for developing

a lexical semantic representation the ability to formulate a perspicuous theory of argument realization. Any semantic distinction that affects argument realization is relevant to the design of a lexical semantic representation, while any others are to be ignored. This methodological choice is prompted by a lack of certainty that the lexical semantic elements relevant to argument realization are also relevant to other linguistic or nonlinguistic concerns. However, as B. Levin and Pinker (1991: 3–4) note, there is considerable convergence in the facets of meaning that various types of evidence home in on, so that the use of one type of evidence is likely to lead to a representation pertinent to other concerns.

Having discussed acceptable forms of evidence, we devote the remainder of this section to the second methodological choice pertinent to choosing the elements of a lexical semantic representation.

It is commonly assumed that only certain facets of word meaning are relevant to argument realization (Davis 2001; Grimshaw 1993; Jackendoff 1990b; B. Levin 1999; Pinker 1989; T. Mohanan and K. P. Mohanan 1999; Rappaport Hovav and B. Levin 1998a; among others).<sup>5</sup> One of the most explicit statements of this hypothesis is made by Pinker: “Perhaps there is a set of semantic elements and relations that is much smaller than the set of cognitively available and culturally salient distinctions, and verb meanings are organized around them” (1989: 166). These grammatically relevant components of verb meaning are usually isolated through an examination of the common semantic denominator of verbs exhibiting the same range of argument realization options.

A few examples will help clarify what is meant by grammatically relevant. Although the notion of color may be cognitively salient, Grimshaw (1993: 3) points out that there are no grammatical processes or generalizations about the morphosyntactic realization of arguments which are restricted to verbs having to do with color (e.g., *paint*, *color*, *bleach*, *redden*, *stain*). Similarly, Pesetsky (1995: 14) writes that the distinction between verbs of loud speech (e.g., *bel-low*, *holler*, *shout*) and verbs of soft speech (e.g., *murmur*, *whisper*) is not relevant to the syntax. Such observations should not be taken as denying the importance of these particular meaning elements; they simply do not figure in linguistic generalizations. In contrast, as Pesetsky (1995: 14) points out, the distinction between verbs of manner of speaking, such as *holler* and *whisper*, and verbs of content of speaking, such as *say* and *propose*, is grammatically relevant. Pesetsky supports this point by making reference to particular grammatical properties of these classes of verbs. We do not present his examples as they involve sentential complements, which we do not discuss in this book, but instead present comparable examples involving verbs of sound emission, drawing on the discussions in B. Levin, Song, and Atkins (1997) and Song (1996).

English has a large class of verbs of emission, which can be subdivided according to the nature of the emitted element: light, sound, smell, or substance (B. Levin 1993). Verbs of sound emission display a wide range of argument realization options, some of which are apparently restricted to a subset of these