

Expressing Causation

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Force Creation and Possible Causers across Languages

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People have strong expectations about the kinds of entities that can serve as causers. These expectations are a matter of psychology and philosophy but also, perhaps, a matter of linguistics. Consider, for example, the sentences in (1). In English, both (1a) and (1b) are acceptable descriptions of causal events, but (1c) is not. From the point of view of many current theories of causation, this is hard to explain. The problem is that many theories of causation define causers as a relation in which the presence of the causing entity increases the likelihood of an effect (e.g., Cheng & Novick, 1992; Woodward, 2007), and all of the causers specified in (1) meet this criterion.

- (1) a. The boy broke the window.
 b. The knife cut the bread.
 c. #The fork lifted the potato.

The problem becomes more complex when we look across languages. As we will see, in many languages, only (1a) is acceptable and (1b) is as bad as (1c) (Alexiadou & Schäfer, 2006; Folli & Harley, 2007; Guilfoyle, 2000; Levin & Rappaport-Hovav, 2005; van Voorst, 1996). In

other words, in some languages, simple objects such as “knives” and “forks” cannot be viewed as causers. If you ask a German speaker, for example, whether a knife can cut bread, they might point out that knives do not have “arms and hands that would enable them to do this,” as one of our language consultants informed us.

In this chapter, we attempt to identify the semantic constraints on causers, first within English, and then across languages. We seek to show how causal expressions in English and other languages reveal an interaction between grammatical structure and word meaning and how this interaction may provide insights into the representation of causation in the mind. We view this kind of research as part of a broader attempt to understand the language–thought interface.

The chapter is structured as follows. Focusing on English, we identify the range of possible entities that can appear as the external argument of a causal sentence, which, in English, is coextensive with the subject of the sentence. We propose that the range of possible causers in English and in other languages can be understood in terms of a continuum of force creation, with languages differing on this continuum with respect to the kinds of causers that can appear as external arguments. We further show that where a language divides the continuum can be predicted by whether the language uses morphological case. Finally, we describe empirical evidence in support of our proposals in three lines of research. In Experiment 1, we demonstrate systematic differences across languages with respect to the range of acceptable causers, specifically, English and Chinese allow a greater range of causers than Korean. In Experiment 2, we demonstrate that constraints on causer external arguments in English, Mandarin Chinese, and Korean affect judgments of sentence acceptability in one-clause and two-clause descriptions of causal events. In Experiment 3, we show that such constraints also affect the selection of causal

verbs by speakers of English, Russian, and German. We conclude with a discussion of the implications of these findings for the language–thought interface.

External Arguments and Causers in English

We are interested in the characteristics of entities that make good external arguments, or causers, in sentences that describe causal relationships. External arguments are typically associated with the semantic roles of “agent,” “instrument,” or “theme” (Radford, 1988). The concept of an external argument is defined in various approaches to grammars in configurational terms. For example, in the sentences *Alison petted the guinea pig* the second argument of the verb, *guinea pig*, is positioned inside the verb phrase, whereas the first argument, *Alison*, is positioned outside the verb phrase, and hence is referred to as an external argument (Radford, 1997). In generative grammar, the external arguments are effectively coextensive with the grammatical relation subject (Van Valin & LaPolla, 1997). In this chapter, however, we focus on external arguments rather than subjects because the behavioral and coding properties of “subjects” vary considerably across languages (Van Valin & LaPolla, 1997). Indeed, as argued by LaPolla (1993, 2009), Mandarin Chinese may completely lack the grammatical category of subject. We focus on the notion of external argument because it offers a more universal, language-neutral category of analysis, and we are especially interested in the range of possible causers across languages. Our claim will be that languages differ in the range of types of semantic roles that can appear in the external argument position. It is important to emphasize that the criteria that license external arguments in causal sentences may differ from the criteria that license external arguments in sentences describing noncausal relationships (Grimm, 2007). For example, whereas the sentence

The fork moved the potato sounds odd, the sentence *The fork stabbed the potato* sounds fine; the first sentence describes a causal relationship and the latter does not.

English allows for a wide variety of entities in the external argument position of causal expressions. Although causer external arguments are often animate entities, animacy is not required (Fillmore, 1968), as shown in (2).

- (2) a. Lightning killed the guard.
 b. The wind opened the door.
 c. The sun melted the ice.
 d. The wave capsized the boat.

Though they lack intentionality, natural forces, like intentional agents, can initiate their own actions and generate their own energy (Cruse, 1973; Grimm, 2007; Alexiadou & Schäfer, 2006; Schlesinger, 1989). Consistent with this characterization, natural forces, unlike instruments (e.g., *keys, knives, drills*), sound odd in *with* phrases, for example, *The janitor opened the door with the wind*. *With* phrases imply human control, and natural forces, by definition, cannot be controlled by human agents (Nilsen, 1973).

Projectiles are another type of inanimate entity that can readily appear as the external argument of a causal sentence (Cruse, 1973; Grimm, 2007; Kearns, 2000), as exemplified in (3).

- (3) a. The stone broke the window. (Kearns, 2000)
 b. The bullet killed the president. (Schlesinger, 1989)
 c. The cannon ball sank the ship.
 d. The falling branch broke the car window.

Projectiles acquire their energy from an external rather than internal force, but that energy seems to be construed of as their own (Cruse, 1973; Grimm, 2007; Kearns, 2000; Alexiadou &

Schaffer, 2006). It is interesting to note that when these kinds of entities appear as external arguments, the presence of an external, initiating agent is deemphasized (see Schlesinger, 1989); indeed, in the case of entities like branches (e.g., 3d), an external (sentient) agent may not exist. But even when an external agent is present, projectiles sound somewhat odd expressed as instruments in a *with* phrase, as in the sentence *The assassin killed the president with a bullet*, which suggests that they are more similar to animate entities and natural forces than to instruments (see Alexiadou & Schaffer, 2006).

Other kinds of entities that can serve as a causer external argument are entities that are often referred to as “instruments,” that is, entities that are used by a sentient entity to accomplish a task (Delancey, 1984; Schlesinger, 1989). In the lexical semantics literature, instruments have been divided into two types, *intermediary* and *facilitating*. Intermediary instruments are entities that can act in a manner that is at least partially independent of an agent’s controlling influence (Alexiadou & Schaffer, 2006; Kamp & Rossdeutscher, 1994). As such, they can be viewed as acting as an “intermediary” in the causal chain (Levin & Rappaport, 1988; Marantz, 1984). As shown in (4), some intermediary instruments, although controlled by human agents, have their own power source, which makes them, as described by Grimm (2007), “semiautonomous.”

- (4)
- a. The forklift killed the construction worker.
 - b. The remote control opened the door.
 - c. The crane sank the boat.
 - d. The bomb shook the ground.

Other intermediary instruments do not generate their own energy, but can nevertheless appear in the external argument position, as shown in (5).

- (5) a. The key opened the door.

- b. The knife cut the bread. (Levin, 1994)
- c. The axe split the log.
- d. The diamond scratched the glass.
- e. The wrench tightened three out of four bolts without incident.

Based on the discussion thus far, it might appear that the range of possible entities that can appear as an external argument is unconstrained. Importantly, however, there are certain entities that cannot appear as external arguments, despite their having an important role in the causal chain (as indicated by their acceptability in “with” phrases).

- (6) a. #The snow shovel moved the snow. (adapted from Grimm, 2007)
- b. #The fork lifted the potato.
- c. #The spatula flipped the pancake.
- d. #The chisel carved the statue. (Schlesinger, 1979)
- e. #The razor shaved Max. (Reinhart, 2002)
- f. #The broom cleaned the room.

The external arguments in (6) exemplify facilitating instruments (also referred to as “enabling” or “accessory” instruments). According to Kamp and Rossdeutscher (1994), a facilitating instrument is an entity that is not easily separated from the agent that handles it: there is no “causal complex” that includes the instrument that does not also include an external agent.

Given the high degree of similarity between the instruments in (5) and (6), an important question that arises is how to distinguish between intermediary and facilitating instruments. If an entity is able to generate its own energy or is able to transport externally acquired energy, it is likely that it can appear as an external argument in English. However, given that entities such as knives and keys can serve as external arguments, as shown in (5), the ability to generate or carry

energy does not appear to be necessary. In the next section, we propose that the key difference between intermediary and facilitating instruments is the ability to create force. As discussed in the following, the notion of force creation offers not only distinctions that can account for the difference between different kinds of instruments but also a continuum that can account for the difference in the semantics of external arguments across languages.

Force Creation

We propose that an entity can appear in the external argument position in English and other languages if it acts as a *force creator*. We further suggest that the relatively wide range of entities that can serve as causers in English follows from the relatively wide range of ways in which forces can be created. In this section, we describe three broad categories of force creation: energy conversion, physical contact, and force redirection.

First, a force can be created through energy conversion, that is, when energy is transformed from one form to another (Young & Freedman, 1999). For example, the forces involved in running, sneezing, and walking begin with a transformation of potential energy, in the form of chemical potential, to motion, kinetic energy. In internal combustion engines, energy conversion occurs when chemical potential energy in gasoline is transformed into kinetic energy. Many of the entities that make good causer external arguments (intentional agents, natural forces, power devices) generate their own kinetic force by converting energy. The creation of energy from potential energy seems to capture the notion of internal causation, which has been cited as playing an important role in distinguishing different classes of verbs (Levin & Rappaport-Hovav, 1995). According to Levin and Rappaport-Hovav (2005), internal causation arises from properties that are inherent to an entity. They note that although internal causation is prototypically associated with agentive entities (e.g., humans), it is also characteristic of

nonagentive entities such as natural forces and complex machines, and that it is this property that allows an entity to be viewed as a causer, or “responsible” for the event.

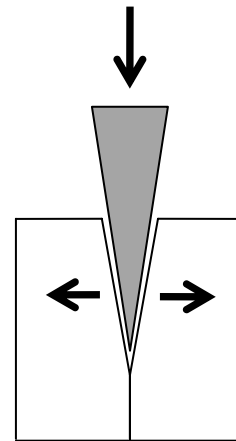
Another way in which a force can be created is through physical contact. When an object approaches and hits another object, it imparts a force on the hit object. Importantly, the imparted force does not exist until the moment of the collision. We know that the force does not exist prior to the impact because the properties of a force depend on the object that is hit. For example, a bullet that hits and tears through a piece of tissue will impart less force on the contacted entity than a bullet that hits and is stopped by a lead block. In this way, force is a quantity that is created by the interaction of two entities.

Finally, a force can be created through force redirection, which occurs when the direction or magnitude of an applied force is changed. Mechanical devices that produce a change in direction or magnitude in a single motion are known as simple machines (Asimov, 1988; Cotterell & Kamminga, 1990). There are six classic simple machines: levers, pulleys, inclined planes, wedges, screws, and wheel and axles. Many everyday objects operate as simple machines (or combinations of these machines), including hammers, axes, bottle openers, shovels, crowbars, see-saws, wrenches, pliers, and scissors, among others. The notion of force modification offers an account of why instruments such as hammers and knives can appear as external arguments. It is important to keep in mind that a force is a vector, meaning it has only one direction and magnitude. As a consequence, a change in the direction of a force implies the creation of a new force.

To see how a simple machine creates new forces, consider the case of a knife. A knife is a wedge, that is, a triangular object that operates by converting a force applied in the direction of one edge into forces that are perpendicular to the applied force, as shown in Figure 5.1. Thus,

when someone cuts a loaf of bread, the knife, in effect, creates two new forces perpendicular to the direction of the force from the agent. When the operations of two or more simple machines are combined, the result is a complex or compound machine. One such machine is the shovel, which combines the operations of a wedge and a lever. The wedge part helps push the scoop of the shovel into the ground by pushing the soil open (like a knife). The lever part changes the direction of the applied force at the point at which the shovel pivots in the dirt.

<Insert Figure 5.1 about here.>



According to our proposal, in English, entities can serve as causers when they create forces through energy conversion, physical contact, or force redirection. Thus, instruments such as knives, keys, and shovels, which can redirect forces, creating new forces, can appear as external arguments (see 5). Importantly, while instruments like forks, shovels, chisels, and sticks can be used as simple machines, they can also be used in manner in which they do not create new forces. On our account, when instruments are used in a manner that does not create a new force, they will not make acceptable external arguments. For example, *the shovel* can appear as an external argument when the verb implies that it is used to redirect forces (see 7a). In contrast, when it is clear that *the shovel* does not redirect forces, or the effect is not due to the force

created by the shovel coming into contact with the effected entity, it should sound odd as an external argument (7b).

- (7) a. ...the shovel overturned clumps of soil... (Etzioni-Halevy, 2006)
 b. #The snow shovel moved the snow. adapted from Grimm, 2007)

In general, we suggest that the reason why instruments sometimes do not make good external arguments is because they do not act as force creators. When instruments do not create forces, all that can be said of them is that they are “controlled” by the initiating agent and they fall into the category of “facilitating instruments.” However, when the instrument is not only controlled, but also creates force, whether through physical contact or force redirection, the instrument falls into the category of “intermediary instruments.”

Cross-Linguistic Differences in the Appearance of Nonagentive Entities in the External Argument Position

It has long been observed that languages differ in the kinds of entities that can serve as external arguments (Comrie, 1989; Craig, 1977; DeLancey, 1984; Folli & Harley, 2009; Guilfoyle, 2000; Hawkins, 1985; Wolff & Ventura, 2009). In particular, it has been suggested that English may allow a much broader range of external arguments than Irish, Dutch, German, Russian, Jacaltec, Cora, Spanish, or Korean (Comrie, 1981; Craig, 1977; Fausey & Boroditsky, 2008; Guilfoyle, 2000; Hawkins, 1985; Soto, 2001; van Voorst, 1988; Wolff & Ventura, 2009), and probably also Japanese, French, Italian, and Hare (Achard, 2001; DeLancey, 1984; Folli & Harley, 2007;).

In a discussion of the difference between English and German, Hawkins (1985) suggests how such differences might arise.¹ Hawkins notes that one prominent difference between German and English is the way in which grammatical relations are marked. In English, the

grammatical function of a noun within a phrase or clause is indicated by relatively fixed word order and prepositions. German, in contrast, marks grammatical relations with morphological case, that is, morphological attachments or modifications to the noun. Common cases include nominative case, which indicates the subject of a finite verb; accusative case, which indicates the direct object of a verb; dative case, which indicates the indirect object of a verb; and instrumental case, which indicates the object used to perform an action. Like other languages with case systems, German has a relatively free word order (Hawkins, 1985).

Hawkins (1985) hypothesized that word order rules interacting with certain pragmatic principles constrain the ranges of possible external arguments in German and English. For example, on the discourse level, it is preferable to position “given” information before “new” information (Lambrecht, 1994). This principle is easy to realize in German: Whether the given information is found in the direct object or the subject, either can occur initially. However, this option is not as simply realized in English because its word order is relatively fixed. Because English is less flexible with respect to word order, Hawkins (1985) suggests that English might satisfy pragmatic constraints, such as the given-new principle, by allowing for a wider range of entities in the subject position, including instrumental subjects. By doing so, English can position the given information first regardless of the entity’s ability to self-energize.

We suggest that Hawkins’ proposals be extended to other languages. In languages in which word order is relatively fixed, due to its role in indicating grammatical relations, the range of entities that can appear in the external argument position is likely to be greater than in languages with more flexible word order, due to their use of a morphological case system to indicate grammatical relations. Our proposal is consistent with Guilfoyle’s (2000) division of languages into two types: Type A languages (e.g., Dutch, Irish), which restrict the subject position to

entities that can initiate events, that is, mostly intentional agents or natural forces, and Type B languages (e.g., English), which allow for a wider range of entities as long as they participate in the causal chain.² We will refer to Guilfoyle's Type A languages as initiator languages and Type B languages as participant languages. Interestingly, the initiator languages cited by Guilfoyle have morphological case whereas the one language that she cites as an example of a participant language, English, does not. We suggest, then, that Hawkins' and Guilfoyle's proposals can be aligned with each other. According to what we call the *initiator hypothesis*, the kinds of entities that make good external arguments depend on the flexibility of a language's word order, which in turn depends on the presence of morphological case. Languages with morphological case (e.g., Dutch, Irish) will tend to be less restrictive in word order and hence more selective about the kinds of entities that can appear as external arguments; in particular, in initiator languages, external arguments must be able to initiate the causal chain. Languages without morphological case (e.g., English) will tend to be more restrictive about word order and less selective about the kinds of entities that can appear as external arguments; in participant languages, all that may be required is that the entity be an intermediary in the causal chain leading up to the result.

We further propose that the semantics of external arguments in the kinds of languages identified by Guilfoyle and Hawkins can be characterized in terms of force creation. In initiator languages, external arguments may be restricted to entities that can create force only through energy conversion, which is most clearly realized when an entity initiates an event. In contrast, in participant languages, the external argument can be realized by entities that create forces by other means, including physical contact and force redirection.

An analysis of this type offers several theoretical advantages over past accounts of the semantic of external arguments. First, as discussed previously, it offers a more unified account of

the difference between intermediary and facilitating instruments in English than previous accounts. Second, the distinctions offered in this account can be extended to explain differences in external argument selection across languages. A third benefit of such a reexpression is that it integrates well with current theories of argument realization; in particular, it complements the notion of a *force recipient* as proposed by Levin (2007), which applies to the direct object of a sentence. As described by Levin (2007), a force recipient is the target of a transmitted force and can be used to distinguish several classes of transitive verbs (e.g., verbs of change of state, surface contact, and perception). Finally, such an account is highly compatible with a relatively well-developed approach to the representation of causation, force dynamics, which has received significant support in the linguistic and psychological literatures (see Copley, 2005; Jackendoff, 2002; Pinker, 2007; Talmy, 1988; Wolff, 2007; Wolff & Song, 2003).

The initiator hypothesis is supported by the acceptability judgments reported in the literature and by our consultants. As predicted, the sentences in (8) and (9), which describe simple instruments, are acceptable in English, a language without morphological case, but unacceptable in languages such as Dutch, German, and (perhaps) Russian, languages that do mark for morphological case.

(8) The rock broke the windshield.

#Het steentje heft de voorruit gebroken. (Dutch; Alexiadou & Schaffer, 2006;
van Voorst, 1996)

#Der Stein zerbrach die Windschutzscheibe. (German)

?Kamen' razbil lobovoe steklo. (Russian)

(9) The key opened the door.

#D'oscail an eochair an doras.	(Irish; Alexiadou & Schaffer, 2006; Guilfoyle, 2000)
#Desleutel opende de deur.	(Dutch; Alexiadou & Schaffer, 2006; Guilfoyle, 2000)
#Kliuch otkryl dver'.	(Russian; Wolff & Ventura, 2009)
?Der Schlüssel öffnete die Tür.	(German)

A much stronger test of this hypothesis would be to examine external arguments in languages that have not yet been studied in this respect. In the following section, we examine the predictions of the initiator hypothesis for two such languages, Korean, which has a case system (Song, 1988), and Mandarin Chinese, which does not (LaPolla, 1993). Wolff, Jeon, Klettke, and Li (2009) describe the semantics of and causatives in these languages.

Experimental Evidence

External Arguments in English, Chinese, and Korean

According to our proposal, the range of entities that can appear in the external argument position should be wider for languages without morphological case than for languages with morphological case. We would expect, then, that English and Chinese should have comparable restrictions on what can appear in the external argument position and that both languages should differ from Korean. Furthermore, external arguments in Korean, but not English and Chinese, should be able to generate their own energy. We tested these predictions by having speakers of English, Mandarin Chinese, and Korean rate the acceptability of 30 sentences containing nonagentive external arguments that were either high or low in their ability to generate their own energy (for details, see Wolff et al., 2009). A sample of these sentences is shown in (10).

- (10) a. The sunlight dried the towel.
b. The wave flipped the boat.
c. The microwave defrosted the meat.
d. The air conditioner cooled the room.
e. The knife cut the bread.
f. The chopsticks squashed the noodle.
g. The bullet killed the president.
h. The spoon moved the ice cream.

The sentences were developed in consultation with native speakers of Mandarin Chinese and Korean to ensure that the words used had relatively direct translations in each language. All of the sentences described a causal interaction, broadly construed, between the external argument and the object of the sentence; in every sentence, the object underwent a change of state or location as a result of the actions of the external argument. The sentences were divided into two groups. Half of the sentences named external arguments that were able to generate their own energy and the remaining sentences contained external arguments that were unable to generate their own energy. Assignment to these two groups was based on the results from a separate rating task in which English speakers judged “the degree to which the affectors in the sentences were able to generate their own energy/force on a scale of 0 to 100.” In the high-energy generation group, roughly half of the external arguments were natural forces and the remaining entities were energy-transforming devices (e.g., microwaves). Of the external arguments naming entities without power sources, the majority were what would be construed of as instruments in the linguistics literature. The English versions of these sentences and associated instructions were translated into Mandarin Chinese and Korean; the translations were then checked by

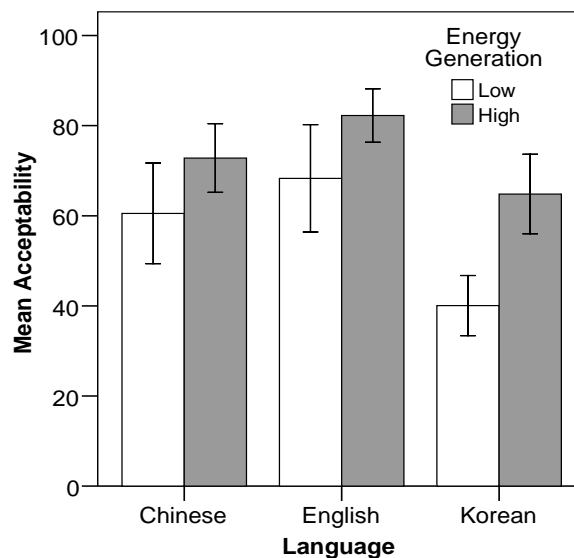
additional native speakers in each of these languages. In the rating task, participants were instructed to “rate how acceptable the sentences are on a scale of 0 to 100 (0 = is completely not acceptable; 100 = is perfectly acceptable).”

The participants were native speakers of English (Atlanta), Mandarin Chinese (Taitung), and Korean (Seoul), with 18 from each language. The Chinese and Korean speakers were tested in their own countries. The English speakers were undergraduates at Emory University.

There were three main results. First, as shown in Figure 5.2, there was an overall effect of language: acceptability ratings were highest for the English speakers, followed by the Chinese speakers, and finally followed by the Korean speakers. Statistical analyses indicated that English and Chinese differed significantly from Korean, but not from each other (see Wolff et al., 2009). Second, there was an overall effect of energy generation. Sentences with external arguments that could generate their own energy had higher acceptability ratings than sentences with external arguments that could not generate energy. The difference between high- and low-energy generation was significant for the English and Korean speakers, and there was a tendency toward significance with the Chinese speakers. The most important finding was a significant interaction between language and energy generation: the difference between high- and low-energy generation for the Korean speakers was greater than the difference between high- and low-energy generation for the Chinese and English speakers. This interaction is consistent with the prediction that external arguments should be acceptable in languages such as Korean only if they are capable of generating their own energy. The ability to self-energize is also important in languages such as Chinese and English, but to a lesser extent. The results from this study support the proposal that external argument selection should be more restricted in languages that have morphological case than in languages that do not. Furthermore, the results suggest that a large

proportion of the difference between languages can be attributed to whether the external argument is able to self-energize.

<Insert Figure 5.2 about here.>



To the extent that the results reflect constraints on external arguments in general, the effects should apply not only to the main external argument of a sentence, but also to the external argument of embedded clauses within a sentence. According to the initiator hypothesis, speakers of English and Chinese should be willing to use causal chains with periphrastic causative (biclausal) expressions regardless of whether the external argument of the embedded clause is able to self-energize; in contrast, Korean speakers should be willing to use biclausal expressions only if the external argument of the embedded clause is able to self-energize. These predictions were tested in two experiments. In the first, we examined the kinds of scenarios that we expected would be described in essentially the same way by speakers of English, Chinese, and Korean. The point of this experiment was to show that the kinds of constructions being compared across languages have essentially the same meaning for certain kinds of occurrences. In the second experiment, we examined the kinds of scenarios that, according to the initiator hypothesis, should lead to differences in linguistic coding across the languages.

<2>Selection Restrictions on Causees</2>

Causation can be expressed in various ways in English and in other languages (for a review, see Wolff et al., 2005). One such way is by means of a lexical causative. A lexical causative (e.g., *open, break, melt*) expresses a causal relation in a single clause that includes a causer, a causee, and a change of state. In the lexical causative in (11a), Alison (the causer) causes the door (the causee) to become open (change of state).

- (11) a. Alison opened the door. (lexical causative)
 b. Alison caused Nathaniel to open the door. (periphrastic causative)
 c. Alison caused the key to open the door. (periphrastic causative)

Another way to describe causal relationships is with a periphrastic causative. Periphrastic causatives express causal relationships (broadly construed) with two or more verbs, one associated with the cause and one associated with the result (Baron, 1977; Radford, 1988; Shibatani, 1976; Wolff, 2003; Wolff et al., 2005). For example, in the sentences in (4b) and (4c) the matrix verb, *caused*, expresses the notion of CAUSE and the embedded verb, *open*, expresses a particular endstate or result. Periphrastic causatives are typically analyzed as composed of two clauses, a main clause and an embedded clause (Radford, 1988). Such an analysis is not straightforward since it may initially appear as if the embedded clauses in (11b) and (11c) lack external arguments. Indeed, in most syntactic analyses of the sentences in (11b) and (11c), the noun phrases (NPs) immediately following the matrix verb (*Nathaniel, the key*) function as the objects of the matrix verbs, and there exists a covert “empty” external argument in the embedded clause (Jackendoff & Culicover, 2003; Polinsky & Potsdam, 2003; Radford, 1988). In periphrastic causatives, the referential properties of this covert external argument, represented atheoretically by the symbol Δ , can be represented using shared subscripts, as in (12).

(12) Alison caused Nathaniel_i [Δ_i to open the door]

Based on such an analysis, we can say, somewhat inaccurately, that the NP that follows the matrix verb in periphrastic causative structures serves two roles: It functions directly as the object of the matrix verb, and indirectly, through indexing, as the external argument of the embedded verb (Radford, 1988, 1997).

In addition to differing in syntax, lexical and periphrastic causatives differ in their semantics. Whereas periphrastic causatives can express either direct or indirect causation, lexical causatives imply direct causation (e.g., Levin & Rappaport-Hovav, 1995; Pinker, 1989; Shibatani, 1976; Song & Wolff, 2005; Wierzbicka, 1988; Wolff, 2003; among others). For example, the lexical causative in (11a) implies a situation in which Alison made direct physical contact with the door, for example, by turning the doorknob and pushing the door open. The periphrastic causative in (11c) implies a situation in which Alison did something, such as starting to smoke, that indirectly prompted the causee, Nathaniel, to open the door to get fresh air.

The cross-linguistic differences in the selection restrictions on external arguments discussed earlier should have consequences for the way periphrastic causatives are used and understood across languages. In initiator languages, such as Korean, the causee of a periphrastic causative should be restricted to entities that can self-energize. This is predicted because the causee of a periphrastic causative is (via indexing) the external argument of the embedded clause, and just like the external argument in the matrix clause, should be limited to entities that generate their own energy. In effect, then, in initiator languages, both the causer and the causee will tend to be agentive entities, as exemplified in (11b). In participant languages, the causee may also be either agentive or nonagentive, as exemplified in (11b) and (11c).

We tested these predictions by examining how the speakers of English, Chinese, and Korean would rate the acceptability of lexical and periphrastic causative descriptions of causal events (Wolff, Jeon, & Yeh, 2006; Wolff et al., 2009). The study had two parts. In the first, participants were shown animations of causal chains in which a human interacted either directly with an inanimate object or indirectly with another human. Figure 5.3A shows a single frame from one of the animations that depicted the first type of scenario. Here a woman closes a door by pushing on it. There is only one agent (the woman), who is able to initiate her own energy, and the causation is direct. We predicted that the speakers of all three languages would give relatively high ratings to single clause, lexical causative descriptions of this event, as in (13).

- (13) a. The mother closed the door. (English)
 b. māma guān shang le mén. (Mandarin Chinese)
 Mom closed up door.
 c. Umma-ga mun-eul dat-atda. (Korean)
 Mom-NOM door-ACC close-PST.

<Insert Figure 5.3 about here.>



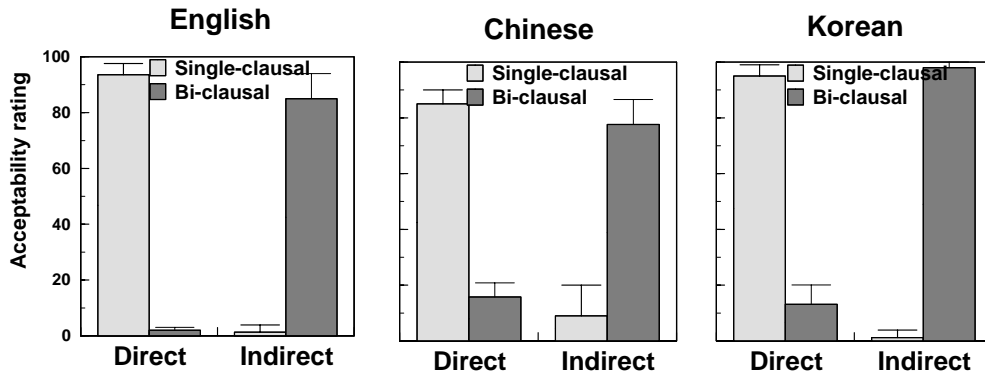
Figure 5.3b shows a single frame from an animation that depicted the second type of situation. In these scenarios a human tells another human to do something, that is, these causal chains consisted of two agents, each capable of initiating its own energy. Because the causation in these chains is indirect, we predicted that all three languages would give high ratings to biclausal, periphrastic descriptions of these events, as in (14).

- (14) a. The mother caused the son to close the door.
 b. māma shǐdé érzi guān shang le mén.
 Mom cause son closed door.
 c. Umma-ga aadeul-ege mun-eul dat-key haetda.
 Mom-NOM son-DAT door-ACC close-ADV CAUSE-PST.

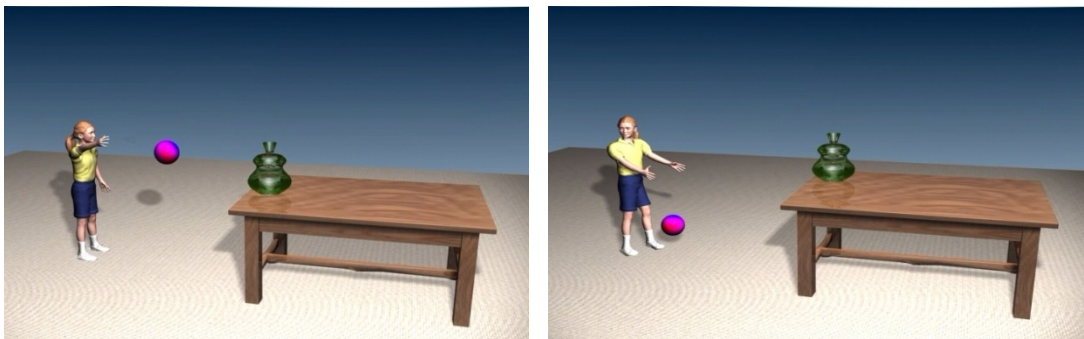
The participants were 48 native speakers of English (Atlanta), Mandarin Chinese (Taitung), and Korean (Seoul), with 16 from each language. The participants were tested in their home countries. Ten pairs of animations were constructed like the one in Figure 5.3, with one member of each pair depicting direct causation and the other depicting indirect causation. For each animation, participants rated the acceptability of single- and biclausal descriptions on a scale of 0 to 100 (0 = not acceptable; 100 = completely acceptable).

As predicted, all language groups gave high ratings to single-clause, lexical causative descriptions when the animations depicted direct causation and high ratings to biclausal, periphrastic causative descriptions when the animations depicted indirect causation (see Fig. 5.4). The results support the hypothesis that self-initiating agents can serve as external arguments of both main and embedded clauses in English, Chinese, and Korean.

<Insert Figure 5.4 about here.>



<Insert Figure 5.5 about here.>



In the second part of the study, we examined scenarios for which we predicted the acceptability ratings would differ. In these scenarios, the causal chains included intermediate entities that were inanimate. The animations were again constructed in pairs, this time differing with respect to whether the intermediate entity was fully under the control of the initial human agent. For example, in Figure 5.5A, a girl throws a ball at a vase and breaks it. Because the ball's motion is controlled by the girl, we predicted that the participants, regardless of their language, would view the causation as direct, and hence would give high ratings to single-clause descriptions of the event, as in (15).

- (15) a. The girl broke the vase.
 b. nǚhái dǎpò le huāping. (Mandarin Chinese)
 Girl broke vase.
 c. Sonyeo-ga ggotbyoung-eul ggaetda. (Korean)
 Girl-NOM vase-ACC broke-PAST.

In Figure 5.5B, in contrast, the girl accidentally bounces a ball off her foot and the ball hits the vase, breaking it. Because the ball's actions are not controlled, the causal chain should be viewed as indirect and so bias speakers to prefer biclausal causal descriptions of the event. For the English and Chinese speakers, this is straightforward: The ball acts as a simple machine by redirecting the force acting on it, and hence it should qualify as an external argument in the embedded clause. However, for the Korean speakers, a biclausal expression should not be acceptable since, in Korean an external argument must do more than redirect force, it must be able to generate force. As a consequence, Koreans should find it unacceptable to use the ball as

an external argument of the embedded clause in a periphrastic causative, and hence should give the biclausal descriptions low ratings, even though the causation is indirect. In sum, we predicted that English and Chinese but not Korean speakers would give relatively high ratings to periphrastic causative descriptions (e.g., 16b) of the animations associated with the kinds of scenes depicted in Figure 5.5B.

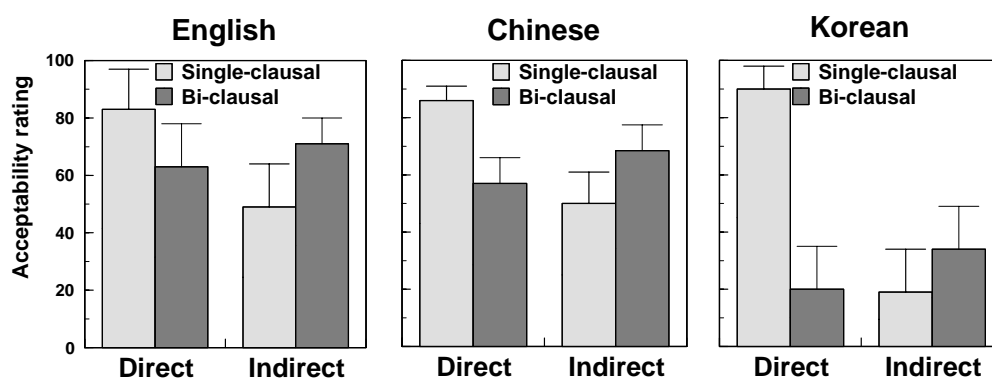
- (16) a. The girl caused the ball to break the vase.
 b. nǚhái shǐdé qiú dǎpò le huāpíng.
 Girl caused ball broke vase.
 c. *Sonyeo-ga gong-ege ggotbyoung-eul ggae-ge haetda.
 Girl-NOM ball-DAT vase-ACC break-CAUSE do-PST-DEC.

The participants in this part of the study were the same as those in the first part. As in the first part, 10 pairs of animations were constructed like the ones shown in Figure 5.5. All of the animations depicted a causal chain that began with a person and was mediated by a nonagentive entity (e.g., ball, stick, wind, remote control). As in the first part, participants rated the acceptability of single- and biclausal descriptions for each animation on a scale of 0 to 100 (0 = not acceptable; 100 = completely acceptable).

As shown in Figure 5.6, all language groups gave high ratings to single-clause descriptions of animations depicting direct causation. However, only the English and Chinese speakers gave high ratings for the biclausal sentences in the case of the indirect causal chains. For Korean speakers, the biclausal expressions, in which the nonagentive entity served as the external argument of the embedded clause, were completely unacceptable. The results from this second study provide further evidence for the proposal that the kinds of entities that can serve as external

arguments of causal sentences differ across languages, and that the constraint is specifically associated with external arguments (not simply initial causer in the causal chain).

<Insert Figure 5.6 about here.>






Cross-Linguistic Differences in the Application of Causal Verbs

In addition to restricting the use of periphrastic causatives to interactions between people (as in Korean), language-specific constraints on possible external arguments might lead the speakers of different languages to describe the same event using different verbs. Such differences might occur because constraints on external arguments might affect which aspects of an event speakers use to establish the presence of certain grammatically relevant properties in a scene, which, in turn, would affect verb preferences. As discussed, for speakers of initiator languages, the choice of a causal description will depend on internally generated forces, including intentions, whereas for speakers of participant languages, that choice will depend on both internal and external forces, that is, on both intentions and externally generated physical forces (e.g., friction). For certain events, these two aspects of an event might give rise to conflicting conclusions about the

presence of a particular grammatically relevant property. When use of a particular verb depends on such a property, speakers of initiator languages might reach a different conclusion about how to describe an event than speakers of participant languages. To explain exactly how these conclusions might differ, we need to be more specific about the semantics of causal verbs.

According to the force dynamic approach to causal representation (Wolff, 2007; Wolff & Song, 2003; based on Talmy, 1988 and extended in Pinker, 1989), descriptions of causation may be based on one of three major types of periphrastic verbs: CAUSE verbs (*cause, make, force, get*), PREVENT verbs (*prevent, block, keep, protect*), and ENABLE verbs (*enable, allow, permit, help*) (Wolff & Song, 2003; Wolff, Klettke, Ventura, & Song, 2005). In force dynamics, the concept of CAUSE differs from the concept of ENABLE primarily in terms of the causee's inherent tendency for a particular endstate, that is, the causee's physical or intentional inclination for a particular state of affairs. In CAUSE scenarios, the causee does not have a tendency toward a particular state, but is pushed to that state, in opposition to its tendency, by the force associated with the causer. In ENABLE scenarios, the causee does have a tendency for a particular state and reaches that endstate via the force of the causer, which is concordant with the tendency of the causee. The difference between these two concepts, and their associated verbs, can be exemplified by the continuum of scenarios shown in Figure 5.7.

<Insert Figure 5.7 about here.>

	Causee (man on dolly) opposes the causer	Causee (man on dolly) does nothing	Causee pushes along with the causer
			
English	CAUSE	CAUSE	ENABLE

Each panel in Figure 5.7 shows a frame from three different animations. In each of these animations, a man, the causer, holds a rope and pulls another man on a dolly, the causee, across a line. In the panel on the far left, the causee resists by pushing the dolly backward. According to force dynamics, such a situation should be construed as one of causation because the causee does not have a tendency for the result (crossing the line), but is opposed by the causer and ultimately crosses the line. In the panel on the far right, the causee pushes himself toward the line, but with some difficulty, leading the causer to help pull the causee over the line. In force dynamics, such a situation should be construed as one of enablement because the causee has a tendency for the result, and the causer assists the causee in achieving the result. Given that the scenarios on the far left and right represent clear cases of causal and enabling relations, we should expect a high degree of cross-linguistic agreement in how these situations are described: The situation on the far left should be described with CAUSE verbs and the situation on the far right with ENABLE verbs.

Where we should expect disagreement across languages is for animations such as the one referred to in the middle panel of Figure 5.7. In Wolff and Ventura (2009) and Klettke and Wolff (2003), such animations were used in a series of experiments to investigate the potential impact

of grammatical constraints on verb preference, in particular, the use of CAUSE and ENABLE type periphrastic verbs in English, Russian, and German. As discussed earlier, it is expected that English speakers may look for, and take into account, not only the causee's intentions, but also the forces external to the causee, such as resistance to motion due to friction. With respect to the middle panel in Figure 5.7, in particular, because the causee is facing the line, it might appear as if the causee's intention is to cross the line. However, in terms of external forces, the dolly is physically difficult to pull, so there is no physical tendency to cross the line. The apparent intention of the causee and the physical difficulty of pulling him may lead to conflict in terms of the tendency of the causee. This conflict might lead English speakers to describe the scenes with either CAUSE or ENABLE type verbs.

For speakers of German and Russian, in contrast, it is expected that the tendency of the man in the middle panel of Figure 5.7 should be less ambiguous. Both German and Russian have rich case systems, so it is expected that in languages such as these, the external argument will often be agentive or at least self-energetic. As a consequence, the speakers of these languages should focus on the kinds of forces that are self-generated in the causer and causee, including intentions. In the middle scene in Figure 5.7, for example, the causee appears to want to cross the line. As a consequence, Russian and German speakers should prefer descriptions of this scene based on ENABLE type verbs.

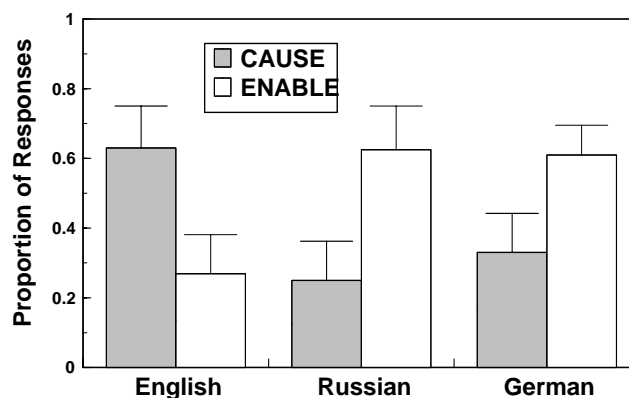
These predictions were tested in studies involving 48 native speakers of English (Memphis), Russian (Moscow), and German (Hamburg), with 16 from each language (Wolff & Ventura, 2009; Klettke & Wolff, 2003). Twelve animations were used to create four CAUSE–ENABLE continuums. After watching an animation, participants chose which of two possible periphrastic causative sentences (e.g., *The man in red caused the man in green to cross the line*; *The man in*

red enabled the man in green to cross the line), (or none of the above) best described the occurrence. The verbs in the sentences were based on one of several possible CAUSE (*cause, make, or force*) or ENABLE type verbs (*enable, let, or help*). The English versions of these sentences were translated into German and Russian for the German and Russian versions of this task.

The results supported our predictions. First, English, German, and Russian speakers preferred sentences with CAUSE verbs (88%, 81%, and 89%) over ENABLE verbs (12%, 3%, and 11%) for the animations that depicted clear cases of causation (e.g., far left panel of Fig. 5.7). Second, English, German, and Russian speakers preferred sentences with ENABLE verbs (81%, 81%, and 92%) over CAUSE verbs (14%, 15%, and 5%) for the animations that depicted clear cases of enablement (e.g., the animation on the far right in Fig. 5.7). The responses to the two far ends of the CAUSE–ENABLE continuum indicate that the languages share the same basic framework for distinguishing CAUSE and ENABLE interactions and that the animations depicted relatively clear examples of these types of causation in each language.

Of primary interest was how the speakers of each group would describe the intermediate situations. As shown in Figure 5.8, English speakers preferred CAUSE verbs whereas the Russian and German speakers preferred ENABLE verbs. The results demonstrate how grammatical constraints on external arguments may have an impact on the range of situations described by a verb, and furthermore, how the range of situations described by rough translations across languages can vary across languages.

<Insert Figure 5.8 about here.>



It is worth emphasizing that according to our account, these cross-linguistic differences are not due to differences in the meaning of CAUSE and ENABLE verbs in the different languages; rather, these cross-linguistic differences might be due to the semantics governing possible external arguments. Specifically, in languages that restrict the external argument position to entities that are self-energetic (as in German and, arguably, Russian), there may be a tendency to evaluate a situation only with respect to internally generated forces, such as intentions, which may lead the speakers to choose ENABLE verbs. When the entities in the external argument position are not so restricted (as in English) speakers may look for, and take into account, not only forces internal to the patient, but also external forces (e.g., gravity, friction), which may lead speakers to choose CAUSE verbs. In sum, differences at the grammatical level are likely to produce wide-ranging differences in the way verbs are used in two languages.

Summary

In this chapter we investigated the semantic criteria that determine the range of possible causers in English and other languages, including Mandarin Chinese, Korean, Russian, and German. We first proposed that Hawkins' ideas regarding the relationship between morphological case marking and the range of possible external arguments in English and German be extended: In

particular, we proposed that languages with case systems (and relatively free word order) allow for a smaller range of external arguments than languages without case systems (and more fixed word order). Then, for each of these language types, the kinds of external arguments that are acceptable can be characterized in terms of the notion of force creation and the different ways in which force can be created (i.e., through energy conversion, physical contact, and force redirection). So, in languages that are more restrictive, external arguments must be capable of generating their own energy. In less restrictive languages, the external argument position is open to entities that use other methods of force creation, including physical contact and force redirection. Based on this proposal, we predicted that Korean, Russian, and German—because they have case systems—would require self-energetic entities as external arguments. In contrast, we predicted that in English and Chinese—lacking case systems and having relatively fixed word order— external arguments could be entities that create force through means other than strictly generating their own energy, resulting in a wider range of available external arguments.

We then reported three lines of research that provided evidence for the initiator hypothesis and force creation. In the first, we showed that the range of possible external arguments in English and Chinese was greater than in Korean. We further showed that external arguments in Korean had to be capable of generating their own energy, that is, capable of creating their own force through energy conversion. In the second line of research, we showed that when these differences in external arguments were realized in embedded clauses, they resulted in cross-linguistic differences in periphrastic causal expressions. Specifically, we showed that in English and Chinese, intermediary causees can be animate or inanimate, but in Korean, they can only be animate (reflecting the requirement that they be self-energetic). In the third line of research, we examined how the range of acceptable external arguments in a language could affect the kinds of

verbs speakers preferred to describe causal situations. This time, English was contrasted with German and Russian. As predicted, we found that because external arguments in German and Russian are typically animate, speakers of these languages tend to focus on internal properties, such as an entity's intentions. As a consequence, for certain kinds of causal situations, speakers of German and Russian may prefer descriptions based on ENABLE rather than CAUSE verbs.

The Language–Thought Interface

In a recent typological study of 408 languages, Song (1996) observed that all had productive methods for the linguistic expression of causation. In a far more modest study, Wolff et al. (2005) observed that several languages (German, Spanish, Russian, and Arabic) have near translations of many of the periphrastic causative verbs in English (e.g., *cause, make, force, get, allow, enable*), implying that these languages make many of the same fine-level semantic distinctions, or at the very least, that they distinguish the causal concepts of CAUSE, ALLOW, and PREVENT. We conclude from these results, and from other evidence, that some form of the concept of CAUSE is universally shared by the speakers of all languages.

According to the dynamics model (Wolff, 2007; Wolff & Song, 2003), as discussed earlier, people may represent causal relations in an analog fashion, namely, in terms of configurations or chains of forces. We propose that such an account suggests how causal relations might be represented on the “thought” side of the language–thought interface. On the language side, word meanings might specify features for determining which linguistic labels can be applied to the analog representations on the thought side. For example, assuming that causal relations are represented in terms of configurations of force, the label “cause” might be licensed when the configurations of forces have the following properties: (1) forces associated with the causer and causee are in opposition, (2) the force associated with the causee is directed away from the

endstate, and (3) the causee progresses toward the endstate (see Wolff, 2007). Such criteria might be represented in the brain in the form of lists of features, or otherwise discrete symbols. Hence, the language–thought interface might involve an alignment between discrete, digital units in language with analog structures in thought.

It is possible that the criteria for individual verbs might be much the same across languages, and languages could still clearly differ in how such verbs are used. Our explanation for this variation is that it is caused by differences across languages in the semantics of external arguments. According to the dynamics model, the distinction between CAUSE and ALLOW/ENABLE depends on the tendency of the causee. In this chapter we have proposed that the speakers of different languages may draw on different aspects of a situation in determining the tendency of the causee, with speakers of initiator languages focusing on forces that are produced from energy conversion and speakers of participant languages factoring in a wider range of ways to produce force. One question to be addressed in future research is whether these differences in the determination of tendency are manifested in nonlinguistic activities, such as in the perception of events or in causal reasoning.³

<1>Conclusions</1>

We began this chapter by noting that people have strong expectations about possible causers. We argued that an explanation of this phenomenon was not only a matter of psychology and philosophy, but also a matter of linguistics. As discussed in this chapter, the selection of possible causers depends on the semantics associated with grammatical structures, which appear to differ across languages. These results emphasize how even the most fundamental of concepts, such as CAUSE, are likely to be expressed differently across languages as a consequence of the interaction between word meanings and the rest of the language system.

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^a Cite Song & Wolff (2005) in text.

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<FGN>Figure 5.1.</FGN><FGC> The downward force acting on the wedge is redirected to the sides of the material.</FGC>

<FGN>Figure 5.2. </FGN><FGC> Acceptability ratings to sentences containing external arguments that were either high or low in their ability to generate their own energy; the error bars indicate 95% confidence intervals. </FGC>

<FGN>Figure 5.3. </FGN><FGC> Frames from animations depicting (A) direct and (B) indirect causal chains used in part 1 of Wolff, Geon, and Yeh (2006). </FGC>

<FGN>Figure 5.4. </FGN><FGC> Acceptability ratings with 95% confidence intervals.</FGC>

<FGN>Figure 5.5. </FGN><FGC> Frames from two animations depicting direct (A) and indirect (B) causal chains used in part 2 of Wolff, Jeon, and Yeh (2006). </FGC>

<FGN>Figure 5.6. </FGN><FGC> Acceptability ratings with 95% confidence intervals.</FGC>

<FGN>Figure 5.7. </FGN><FGC> Frames from animations depicting three different kinds of events forming a CAUSE–ENABLE continuum and the types of descriptions English, German, and Russian speakers would likely use to describe them. </FGC>

<FGN>Figure 5.8. </FGN><FGC> Proportion of times that English, Russian, and German speakers chose the CAUSE and ENABLE sentences for the intermediate animations in the CAUSE–ENABLE continuum, with associated 95% confidence intervals. </FGC>

<1>Notes</1>

<N>¹We thank Beth Levin for making us aware of this idea and pointing us to Hawkins' (1985) work.

²In Guilfoyle's (2000) account, the two types of languages reflect a syntactic parameter on subjects. She suggests that in Type A languages, subjects raise to the specifier of TP (Tense Phrase) in the underlying syntactic structure, where they can be checked for time (i.e., whether they were the initiator of the event), whereas in Type B languages, the subject raises to the specifier of AgrS (Subject Agreement), where it is checked only for being a participant in the event.

³See Wolff, Jeon, and Yu (2009) for an initial investigation into this possibility.</N>