

Transitivity and Change of State Verbs

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0. Overview

It has long been established that there is an important relationship between syntax and semantics in verb classification. In Fillmore's 1970 paper "The Grammar of *Hitting* and *Breaking*," he demonstrates that a verb's syntactic behavior can be predicted by its semantic meaning; crucially, verbs can be grouped together into semantically identifiable classes. This approach to verb classification is thoroughly explored in Levin's 1993 seminal work on English verb classes where she classifies over 3,000 verbs into almost 50 separate semantic classes.

In this paper, I focus on a specific class of verbs known as *change of state verbs*. These are verbs that involve a change in the internal composition of an entity undergoing a particular event. However, in recent work, change of state verbs have been subdivided into two different groups: *externally caused change of state verbs* include members such as *break*, *cool*, and *freeze*; *internally caused change of state verbs* include members such as *bloom*, *decay*, and *erode* (Levin 1993, Levin and Rappaport Hovav 1995). Further examples are given in (1):

- (1) a. Externally Caused Change of State Verbs: *bake, boil, break, cool, crack, dry, freeze, lengthen, melt, open, shatter, straighten, widen, . . .*
- b. Internally Caused Change of State Verbs: *bloom, blossom, corrode, decay, erode, ferment, germinate, molt, rot, rust, sprout, stagnate, wilt, wither, . . .*

Externally and internally caused change of state verbs can be distinguished in both a semantic and a syntactic sense. Semantically, they differ in that the externally caused change of state verbs imply the existence of an external causer with immediate control over the eventuality; meanwhile, internally caused change of state events involve properties inherent to the entities undergoing the events that are responsible for bringing about the eventuality. Syntactically, these verbs show differences in terms of their argument expression options. Externally caused change of state verbs participate in the causative/inchoative alternation. This is a

transitivity alternation where a verb can be used both intransitively and in a related transitive variant, as shown in (2):

- (2) a. The window broke.
 b. Bill broke the window.

However, it has been shown that while the internally caused change of state verbs occur in the intransitive variant, they fail to occur in related transitive forms (Levin and Rappaport Hovav 1995). An example is given in (3):

- (3) a. The roses bloomed.
 b. *John bloomed the roses.

Nonetheless, it is apparent that some internally caused change of state verbs are found in transitive causative constructions, as demonstrated by examples like those in (4):

- (4) a. Salt air rusted the metal pipes.
 b. Early summer heat wilted the petunias.

These examples raise an important question about the distribution of internally caused change of state verbs in transitive constructions: How can this variation be accounted for? In other words, why do we see examples like those in (4) but fail to see examples like (3b)? In this paper I propose an answer to that question. I argue that semantic and pragmatic properties—as opposed to syntactic properties—are responsible for the variability found with transitive uses of change of state verbs. In particular, a variety of factors combine together to determine the argument expression options associated with an individual verb. These factors include *controllability* (the degree to which an event can be externally manipulated), *causer type* (whether the event is human driven or nonhuman driven), and *subject-modification* (whether the causer is in a modified or unmodified form). Finally, I argue that it is possible to predict how acceptable a verb sounds in a transitive construction by a statistical model that combines and weights these different factors.

1. Transitive Uses of Change of State Verbs

The causative/inchoative alternation has often been used to characterize change of state verbs (Fillmore 1970). As I discuss above, externally caused change of state verbs clearly participate in this alternation (5a), but according to Levin and Rappaport Hovav (1995), internally caused change of state verbs do not (5b):

- (5) a. The vase shattered. / Lynn shattered the vase.
 b. The cactus bloomed. / *The gardener bloomed the cactus.

Nonetheless, recent work by McKoon and Macfarland (2000) and Wright (2001) show that internally caused change of state verbs do occur in transitive constructions, as indicated by a number of attested corpus examples:

- (6) a. Early summer heat blossomed fruit trees across the valley. (LN 1999)
b. Salt air and other pollutants can decay prints. (LN 1982)
c. Raindrops selectively erode clay particles. (BNC B1E)
d. The onset of temperatures of 100 degrees or more, on top of the drought, has withered crops. (NYT 1986)

However, even though these verbs are found in transitive constructions, it is clear that they do not pattern identically with the externally caused change of state verbs and in fact differ from these verbs in a number of important ways.

As I discuss in detail in Wright (2001), internally caused change of state verbs differ from externally caused change of state verbs in four main respects—frequency, causer type, verbal interpretation, and acceptability ratings. First, random searches of corpus data indicate that internally caused change of state verbs occur significantly less often in transitive constructions than externally caused change of state verbs ($t = 8.18$, $df = 26$, $p < .01$). Secondly, when internally caused change of state verbs are used transitively, they are more likely to involve a nature-related causer; meanwhile externally caused change of state verbs are more likely to involve a human causer (Chi-square = 340, $df = 2$, $p = 0$). Third, transitive uses of internally caused change of state verbs are more likely to involve a metaphorical interpretation than those with externally caused change of state verbs (Chi-square = 50.51, $df = 1$, $p = 0$). Finally, results from survey data show that internally caused change of state verbs are rated as less acceptable than externally caused change of state verbs in transitive constructions ($t = 9.41$, $df = 83$, $p < .0001$). These findings clearly demonstrate important distinctions between internally and externally caused change of state verbs and again raise questions about the behavior of change of state verbs with regard to transitivity: How can differences in transitivity be explained?

2. Analysis

In this paper I argue that semantic and pragmatic properties are responsible for the frequency and range of acceptability ratings associated with transitive uses of change of state verbs. In particular, I look at three factors that play a role in predicting transitive behavior: (1) causer type, (2) controllability, and (3) selectional restrictions/subject-modification. Finally, I show that these factors interact together to predict the acceptability scores associated with transitive uses of change of state verbs. Specifically, I demonstrate that a multiple regression model, incorporating these three factors, can predict acceptability ratings of transitive constructions remarkably well.

2.1 Causer Type

Causer type is one factor that can help to account for differences in transitive behavior across change of state verbs. There is a fairly extensive literature investigating what comprises the “prototypical” transitive event, and it has consistently been noted that the prototypical transitive event involves a human causer deliberately performing an action that brings about a change of state. This is in contrast to less prototypical transitive events, which are those that typically involve nonhuman causers. (See Lakoff (1977), Hopper & Thompson (1980), DeLancey (1984, 1985, 1987), and Croft (1991), among others, for further discussion.)

In general, human-driven events are judged as more acceptable than nonhuman-driven events in transitive constructions. For example, sentences like those in (7), containing human causers, are rated by subjects as being completely acceptable—regardless if they are presented within or outside of any particular context:

- (7) a. Nick broke the plate.
b. Jody cracked the teacup.

These high acceptability scores are related to the fact that these constructions have properties that correlate well with prototypical transitivity; in other words, they involve a human causer deliberately performing an action on an inanimate entity.

In English, however, it has often been noted that it is possible to have a nonhuman causer in subject position. Examples are given in (8):

- (8) a. The bat broke the window.
b. The wind cracked the teacup.

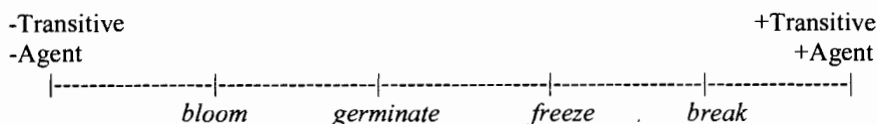
While sentences like those in (8) are generally considered to be grammatical, they tend to be judged as sounding somewhat unnatural and especially bizarre when presented out of any discourse context. In large part, this is due to the fact that these sentences do not correlate well with prototypical transitivity. In fact, causative verbs generally sound peculiar with nonhuman subjects because we typically try to associate transitive constructions with some notion of agentivity.

In these respects, we see a clear difference between externally and internally caused change of state verbs. Externally caused change of state events correlate well with the properties associated with prototypical transitive events. They often involve some notion of agentivity and involve human-driven events that bring about a change of state in some inanimate entity. However, internally caused change of state events are not typically associated with agentivity; in fact, they tend to involve nature-driven events that bring about a change of state in some biological entity. I suggest that these differences account in part for the distinctions between externally and internally caused change of state verbs that are found in transitive constructions. Change of state verbs that are more likely to

occur transitively are those that are more likely to occur with human causers (i.e., the externally caused change of state verbs). Meanwhile, change of state verbs that are less likely to occur transitively are those that are less likely to occur with human causers (i.e., the internally caused change of state verbs). Moreover, differences in causer type can also help to account for the variation found within the change of state class, as well as across the change of state classes.

This link between agentivity and transitivity can be represented according to a continuum of event types, where potential agentivity corresponds positively with transitivity use. As depicted in Figure 1, events like *break* are often human driven; correspondingly, they often occur in transitive constructions. Events like *freeze* are somewhat less likely to be human driven, and they are somewhat less likely to occur in transitive constructions, and so on.

Figure 1 Transitivity and Agentivity with Change of State Events



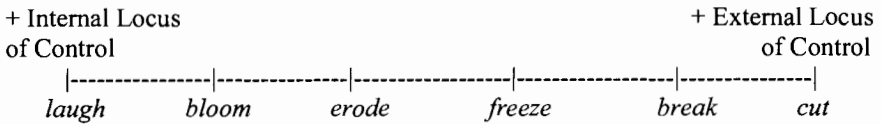
Thus, I'd argue that an important difference between internally and externally caused change of state verbs has to do with agentivity and prototypical transitivity. Externally caused change of state verbs are more likely to occur transitively because they contain properties (i.e., human causers) that tend to be associated with prototypical transitive events.

2.2 Controllability

A second factor to consider is controllability. In a more general discussion of event types, Smith (1970) notes that events that must be externally manipulated by an external causer must occur transitively (e.g., *cut*), while events that cannot be externally manipulated by an external causer must occur intransitively (e.g., *laugh*). This distinction seems to be especially relevant for change of state verbs and might again best be represented in terms of a continuum of event types. In particular, I suggest that change of state verbs occur along a scale of controllability where their position on the scale is dependent upon the degree to which they can be manipulated by an outside source. Most externally caused change of state verbs can clearly be manipulated by an external causer; these events involve animate beings acting upon inanimate objects and involve events which can be manipulated externally. However, most internally caused change of state verbs are more questionable with regard to control; in fact, they can only questionably be manipulated by an external causer. Essentially, these events lead to some cognitive confusion. Again, they involve nature-related causers acting upon biological entities. They do involve external factors; in a blooming-event,

for example, external factors such as sun, water, and soil nutrients are present in bringing about the event. However, the real question is to what extent do these external factors control the event and to what extent do they serve to facilitate an event which is largely under its own control? The answer to this question is a bit uncertain, and I'd argue that this type of vagueness accounts for the degraded acceptability ratings found with these verbs in transitive constructions. Externally caused change of state events can clearly be manipulated by an outside source; thus, they occur toward the *cut*-end of the scale of controllability. Internally caused change of state verbs are less clear in this respect; minimally, they occur closer toward the internal locus of control. This scale is depicted in Figure 2:

Figure 2 Locus of Control with Verbal Events



Thus, controllability also appears to play an important role in accounting for differences in transitive behavior across change of state verbs: externally caused change of state verbs are more likely to occur transitively because they tend to involve an external locus of control.

2.3 Selectional Restrictions/Subject-Modification

One last factor that I'd like to address is the role that selectional restrictions and subject-modification play in predicting verb behavior. Internally and externally caused change of state verbs also differ in the types and range of causers that tend to be associated with their events. Specifically, I suggest that internally caused change of state verbs select for a narrow range of causer types—so narrow, in fact, that causer type is actually inherent to the meaning associated with the verbs themselves and, therefore, doesn't need to be overtly specified to be understood as playing a role in the event. Meanwhile, externally caused change of state verbs select for a wider range of causer types; causer type is not inherent to the meaning associated with these verbs and, thus, must be overtly specified to be understood as being part of the actual event.

Evidence for these claims comes from further empirical results. In a survey task, I asked ten subjects to list three typical causers associated with a variety of different internally caused change of state verbs. For example, they received a verb like *bloom* and were asked to list three typical causers associated with a blooming-event. Overall, I found that there was considerable agreement in the listing of causer type where on average 8.5 distinct causers were listed across all subjects for each verb. This suggests that the range of causer types truly is restricted for verbs in this class. In fact, as shown by the data in (9), we have an

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expectation that these “prototypical” causers play a role in these events: if they are excluded or denied, the sentences really take on a somewhat surprising or unexpected interpretation:

- (9) a. The roses bloomed, but the warm weather didn't cause it.
b. The plants wilted, but the heat didn't cause it.
c. The vegetables rotted, but the moisture didn't cause it.

For the externally caused change of state verbs, meanwhile, we see something quite different. In a similar survey task, subjects were asked to list three typical causers associated with a variety of different externally caused change of state verbs. For example, they received a verb like *break* and were asked to list three typical causers associated with a breaking-event. Here I found there was much greater variation in the listing of causer type; on average, 14.8 typical causers were listed for each verb. Moreover, even if the most typical causers are excluded from the event, as shown in (10), the sentences don't take on that same element of surprise:

- (10) a. The car window broke, but I didn't cause it.
b. The car window broke, but the hail didn't cause it.
c. The car window broke, but the collision didn't cause it.

Furthermore, these verbs exhibit differences in acceptability ratings depending on their subject type. Specifically, sentences with internally caused change of state verbs are rated higher when the causer in subject position is “modified”—that is, being emphasized as playing a stronger than normal role in the event ($t = 2.54$, $df = 26$, $p < .01$). For example, sentences like (11a) and (12a) sounded worse to subjects than sentences like (11b) and (12b):

- (11) a. ?Last July, sunlight wilted the begonias.
b. Last July, the intense sunlight wilted the begonias.
(12) a. ?This past summer, moisture rotted the tomatoes.
b. This past summer, extremely moist conditions rotted the tomatoes.

I argue that these differences in acceptability scores are related to selectional restrictions. For the internally caused change of state verbs, causer type is largely inherent to the meaning associated with the verbs themselves; thus, overtly specifying these causers is unnecessary—if not completely redundant—unless they are being highlighted (i.e., modified) as playing a stronger than normal role in the event.

However, for the externally caused change of state verbs, I did not find the same differences in judgments. Externally caused change of state verbs did not sound any better to subjects when the causer in subject position was in its bare

form or when it was being modified ($t = .27$, $df = 26$, $p = .78$). Examples are given below:

- (13) a. Over time, pressure shattered the rock.
 b. Over time, intense pressure shattered the rock.
- (14) a. This morning, the sun melted the ice.
 b. This morning, the intensely hot sun melted the ice.

These facts are supported by the hypothesis that externally caused change of state verbs do not select for any particular causer type; the subjects sound equally as good in their modified and unmodified forms. Thus, I suggest that another distinction between externally and internally caused change of state verbs is causer type and, specifically, the degree to which causer type is selected for by the verb.

2.4 Multiple Regression Model

As I have demonstrated, a variety of factors contribute to predicting transitive behavior across change of state verbs. I conclude by showing that it is possible to predict how good a verb sounds in a transitive construction by a formula that weights these different types of factors. Interaction among different factors in predicting acceptability ratings can be demonstrated statistically as input into a multiple regression model, where the model can predict actual acceptability ratings remarkably well.

To carry out this examination, I presented subjects with a variety of transitive sentences involving change of state verbs and then asked them to judge the acceptability of these sentences on a five-point scale, where a rating of “1” indicated the sentence was not acceptable and a rating of “5” indicated that the sentence was completely acceptable. The sentences for this task were manipulated according to the factors discussed above (i.e., agentivity, controllability, and subject-modification).

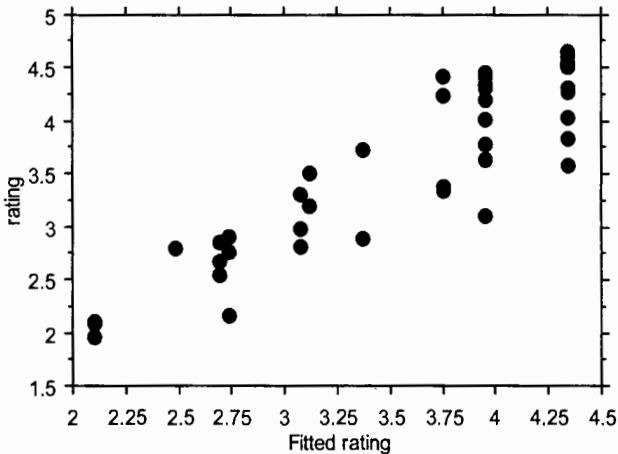
Each sentence was then assigned values for the contribution of these factors to determining its acceptability. The sentences were coded in the following way. Agentivity received a binary assignment; I assigned “1” to sentences containing human subjects and “0” to those with nonhuman subjects. Subject-modification also received a binary assignment; here I assigned “1” for modified subjects and “0” for unmodified subjects. For controllability, I assigned one of five possible values to each sentence; this was based on the notion discussed earlier that controllability is a scalar property. Events that could not easily be externally controlled received a score of “1” for controllability; events that could easily be externally controlled received a score of “5” for controllability. Events that were more variable with regard to controllability received intermediate scores from “2” – “4”. These scores were assigned for each verbal token with the assistance of two independent raters.

Separate multiple regression models were fit to establish the contribution of these factors to the direction and strength of subjects’ acceptability ratings for

both the internally and externally caused change of state verbs. The results demonstrate that for the internally caused change of state verbs, all three factors significantly contribute to the model. A model incorporating these three factors returns $r^2 = .80$, $p < .0001$. This represents the proportion of variability (80%) in the dependent variable (acceptability ratings) that can be explained by the set of independent variables (agentivity, controllability, and subject-modification). Although all three factors contributed significantly to predicting acceptability ratings, the weightings of the factors did differ. Controllability was the strongest factor overall ($t = 10.7$, $p < .0001$). This suggests that locus of control played the strongest role in accounting for acceptability judgments, and according to this model, the likeliness that an event could be externally manipulated correlated positively with acceptability ratings. Subject-modification was the least significant factor ($t = 3.3$, $p < .01$), although it still played a strong role; subject-modification also corresponded positively with acceptability ratings. Finally, agentivity was a strong predictor as well ($t = -4.8$, $p < .0001$). However, agentivity was a negative contributor for internally caused change of state verbs; in other words, it predicted lower scores rather than higher scores.

By establishing a fitted line to the data, we can compare the predicted acceptability ratings with the actual acceptability ratings. Figure 3 shows a graphical display of this model.

Figure 3 Acceptability Ratings: Internally Caused Change of State Verbs



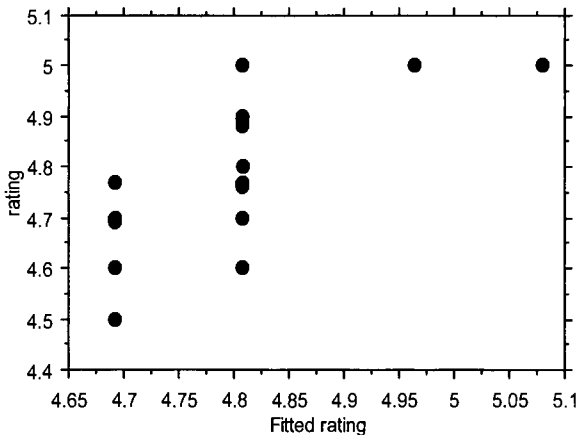
The actual acceptability ratings are given on the y-axis; the fitted ratings are given on the x-axis. Points toward the top of the graph indicate high acceptability scores; points toward the right of the graph indicate corresponding high predicted acceptability scores. Likewise, points toward the bottom of the graph indicate low

acceptability scores, and points toward the left of the graph indicate corresponding low predicted acceptability scores. The linear relationship shown in the graph demonstrates that a multiple regression model, incorporating agentivity, controllability, and subject-modification, predicts acceptability ratings remarkably well.

For the externally caused change of state verbs, only two of the factors significantly contributed to the model. A model incorporating these three factors returns $r^2 = .65$, $p < .0001$. Here agentivity was the strongest factor overall ($t = 8.4$, $p < .0001$) and made a positive contribution to the model; that is, sentences with agentive causers received higher acceptability ratings. Controllability was a slightly less significant predictor ($t = 3.6$, $p < .001$), and subject-modification was not a predictor at all ($t = .3$, $p = .77$). The fact that subject-modification failed to predict acceptability ratings for externally caused change of state verbs is not surprising, given the analysis discussed in Section 2.3. Since externally caused change of state verbs have a wider range of causer types (i.e., causers which aren't implicit in the actual events), the model correctly predicts that subject-modification should have no effect in judging acceptability scores.

By establishing a fitted line to the data, we can compare the predicted acceptability ratings with the actual acceptability ratings. Figure 4 shows a graphical display of this model:

Figure 4 Acceptability Ratings: Externally Caused Change of State Verbs



Again, the actual acceptability ratings are given on the y-axis, and the predicted ratings are given on the x-axis. The linear relationship shown in the graph demonstrates that a multiple regression model, incorporating agentivity and controllability, predicts acceptability ratings fairly well. (Subject-modification is included, although it makes no significant contribution to the model.) Notably, the

correlation between actual ratings and fitted ratings shown here is not as strong as the relationship depicted in the graph in Figure 3. This, however, is not surprising given the fact that there is far less variation in this data overall. (In fact, there was considerable overlap at many points in the graph.) Nonetheless, we now have clear evidence that these various semantic and pragmatic factors play an important role in accounting for the differences in acceptability ratings associated with internally and externally caused change of state verbs: when these factors are inputted into a multiple regression model, they can significantly predict the differences in acceptability rating scores.

3. Conclusion

Change of state verbs can be split into two main types. Internally caused change of state verbs include members such as *bloom*, *blossom*, and *wilt*; externally caused change of state verbs include members such as *break*, *cool*, and *crack*. In this paper I argue that both internally and externally caused change of state verbs are found in intransitive and related transitive constructions; in other words, all change of state verbs participate in the causative/inchoative alternation. However, these verbs differ in terms of the frequency and acceptability with which they are used transitively.

In this paper I show that a variety of semantic and pragmatic factors can help to account for the differences found across transitive uses of change of state verbs: causer type, controllability, and subject-modification. Finally, I demonstrate that the predictive power of these factors can be described statistically as input into a multiple regression model where the model predicts the actual acceptability ratings remarkably well.

References

- Croft, William. 1991. *Syntactic Categories and Grammatical Relations*. Chicago, IL: University of Chicago Press.
- DeLancey, Scott. 1984. Notes on Agentivity and Causation. *Studies in Language* 8: 181-213.
- DeLancey, Scott. 1985. Agentivity and Syntax. In *Papers from the Parasession on Causatives and Agentivity at the 21st Regional Meeting*, 1-12. Chicago Linguistics Society, Chicago, IL.
- DeLancey, Scott. 1987. Transitivity in Grammar and Cognition. In R. S. Tomlin (ed.) *Coherence and Grounding in Discourse*, 53-68. Philadelphia, PA: John Benjamins.
- Fillmore, Charles J. 1970. The Grammar of *Hitting* and *Breaking*. In R. Jacobs & P. Rosenbaum (eds.) *Readings in English Transformational Grammar*, 120-133. Waltham, MA: Ginn.
- Hopper, Paul and Sandra A. Thompson. 1980. Transitivity in Grammar and Discourse. *Language* 56: 251-299.

- Lakoff, George. 1977. Linguistic Gestalts. In *Papers from the 13th Regional Meeting* 225-235. Chicago Linguistics Society, Chicago, IL.
- Levin, Beth. 1993. *English Verb Classes and Alternations: A Preliminary Investigation*. Chicago, IL: The University of Chicago Press.
- Levin, Beth and Malka Rappaport Hovav. 1995. *Unaccusativity: At the Syntax-Lexical Semantics Interface*. Cambridge, MA: MIT Press.
- McKoon, Gail and Talke Macfarland. 2000. Externally and Internally Caused Change of State Verbs. *Language* 76: 833-858.
- Smith, Carlotta S. 1970. Jespersen's "Move and Change" Class and Causative Verbs in English. In M. A. Jazayery, E. C. Polomé, & W. Winter (eds.) *Linguistic and Literary Studies in Honor of Archibald A. Hill. Vol. 2: Descriptive Linguistics*, 101-109. The Hague: Mouton.
- Wright, Saundra K. 2001. Internally Caused and Externally Caused Change of State Verbs. PhD dissertation, Northwestern University, Evanston, IL.

Corpora

British National Corpus (BNC)	Lexis-Nexis, Academic Universe (LN)
Brown Corpus (Brown)	New York Times (NYT)
Collins Cobuild (Cobuild)	Oxford English Dictionary (OED)

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