

Differences in How English and German Speakers Talk and Reason about CAUSE

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Abstract

This research identifies how English and German speakers differ in the range of situations they describe as causal and how these difference may influence causal reasoning. In Experiments 1 and 2, English and German speakers described 3D animations of complex events using CAUSE verbs (*cause*, *get*) and ENABLE verbs (*let*, *enable*). As predicted, English speakers used CAUSE verbs to describe a wider range of events than German speakers. In Experiment 3, English and German speakers viewed 3D animations of CAUSE and ENABLE events and then estimated the likelihood of the effect (E) in the presence of the affector (A), $p(E|A)$, in hypothetical situations similar to the one they just saw. Given the results of Experiments 1 and 2, we predicted that German speakers' estimates of $p(E|A)$ would be higher than English speakers' estimates of $p(E|A)$ for ENABLE events, but not necessarily for CAUSE events. The results were as predicted. The findings suggest that English and German speakers differ in the range of situations they describe as causal and that these differences in linguistic coding may lead to differences in causal reasoning.

Introduction

Recent cross-linguistic research has found that languages can differ significantly, and systematically, with respect to the expression of some of the most fundamental categories of human experience, including the conceptualization of space (e.g., Bowerman, 1996; Levinson, 1996), time (e.g., Boroditsky, 2001; Scott, 1989), and objecthood (e.g., Imai & Gentner, 1997; Lucy & Gaskins, 2001). In this paper, we investigated the possibility that languages might also differ with respect to the expression of CAUSE, and the possibility that this difference in expression might have consequences for causal reasoning.

The concept of CAUSE has frequently been treated as a conceptual primitive in both the linguistic (Dowty, 1979; Jackendoff, 1990; Levin & Rappaport Hovav, 1995; Pinker, 1989; Pustejovsky, 1991) and psychological literatures (e.g., Miller & Johnson-Laird, 1976; Norman, Rumelhart, & the LNR Research Group, 1975; Schank, 1972). Given this assumption, we might expect that the meaning of words encoding the concept of CAUSE should be relatively consistent across languages. However, as argued by Gentner and Boroditsky (2001), concepts that are not closely tied to sensory experience lend themselves to cross-linguistic variation. Indeed, since causal relations cannot be directly observed (Hume, 1739/1978), they might be the very kind

of concept whose expression might vary across languages (see also Gentner, 1982; Gentner & Goldin-Meadow, 2003). Exactly how they might differ is suggested by a recent theory of causal meaning based on force dynamics (Wolff, 2003; Wolff & Song, in press).

The Force Dynamic Model

A theory of force dynamics was first proposed by Talmy (1988) and has been elaborated by other researchers, most notably Jackendoff (1990; Pinker, 1989). From a force dynamic perspective, the concept of CAUSE – as encoded in words like the verb *cause* – is one member of a family of concepts that includes the such concepts as ENABLE and PREVENT, among others. Each of these concepts represents an interaction between an affector and a patient. In an adaptation to Talmy's theory introduced in Wolff and Song (in press; Wolff, Song & Driscoll, 2002), we distinguish the concepts of CAUSE and ENABLE (as well as PREVENT) in terms of three main dimensions: 1) the tendency of the patient for a result, 2) the presence of opposition between the affector and patient, and 3) the occurrence of a result. The notion of tendency is defined as the patient's propensity for the result due to properties or activities that are internal to the patient (e.g., an object's thrust or tendency to move or resist motion due to friction or inertial forces). Opposition between the affector and patient is said to be present when the force exerted on the patient by the affector is not consistent with the patient's tendency. The notion of result is defined as a particular endstate that a patient could enter into. The way in which these dimensions define and differentiate the concepts of CAUSE, ENABLE, and PREVENT is specified in Table 1.

Table 1: The force dynamic model's representations of CAUSE, ENABLE, & PREVENT

	Patient Tendency for Result	Affector- Patient Opposition	Occurrence of Result
CAUSE	N	Y	Y
ENABLE	Y	N	Y
PREVENT	Y	Y	N

As shown in Table 1, the force dynamic model holds that CAUSE and ENABLE differ with respect to the patient's tendency for the result and the presence of opposition.


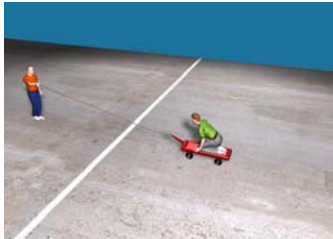

	CAUSE	INTERMEDIATE	ENABLE
	Patient opposes affector	Patient does nothing	Patient pushes along with affector
			
Tendency	No	?	Yes
Opposition	Yes	?	No
Result	Yes	Yes	Yes

Figure 1: Scenes in which the tendency of the patient is varied to produce different force dynamic interactions.

Consider an example of CAUSE as encoded in the sentence in (1a). In this sentence, the tendency of the patient (the boat) is not for the result (heeling), but because the tendency is opposed by the affector (the blast), the result occurs.

- (1) a. The blast caused the boat to heel.
b. Vitamin B enables the body to digest food.

In contrast, in the enabling situation described in (1b), the tendency of the patient (the body) is for the result (to digest food). This tendency is not opposed by the affector (vitamin B). Rather, vitamin B is facilitative, and the result occurs. The two concepts are not interchangeable. It would sound quite odd to say, for example, “The blast enabled the craft to heel” or “Vitamin B causes the body to digest food.” In specifying the dimensions along which these concepts differ, the force dynamic model suggests how their expression might vary across languages.

CAUSE-ENABLE series

The situations in Figure 1 depict the crucial way in which CAUSE and ENABLE situations might differ. In each panel, a man holding a rope pulls a man on a sled across a line. However, in the panel on the far left, the man on the sled resists by pushing backwards. According to the force dynamic model, people should describe this interaction with a CAUSE verb (*cause*, *get*). In the panel on the far right, the man on the sled pushes himself toward the line. The force model dynamic model predicts that people should describe this interaction with an ENABLE verb (*enable*, *let*). In the middle panel, the man simply sits on the sled. How might this scene be described? From a force dynamic perspective, it depends on how the notion of tendency is encoded in the meaning of causal verbs such as *cause* and *enable*. We conjectured that if languages differ in their meaning of causal verbs, such differences should be most clearly revealed by people’s descriptions of such borderline situations.

How CAUSE might differ across languages

In particular, we speculated that English speakers might be more likely than German speakers to describe force dynamic interactions with CAUSE verbs than with ENABLE verbs. This prediction was based, in part, on an intriguing pattern sometimes found in the linguistic literature in which German sentences containing ENABLE verbs are glossed in English with CAUSE verbs. For example, in Gunkel (1999, p. 134), the German sentence in (2a), which contains the ENABLE verb *lasse* (= *let*), is glossed in English with the CAUSE verb *cause*.

- (2) a. *Ich lasse den Motor aufheulen.*
‘I cause the motor to roar.’
b. *Der Priester liess mich [den Armen Geld geben].*
‘The priest had me give money to the poor.’

In the German sentence in (2b) (Wunderlich, 1997, p. 64), the ENABLE verb *liess* (= *let*), is glossed in English with the CAUSE verb *have*. Such examples suggest that the verb *cause* and related verbs in English have no direct translation in German. However, it also possible that such examples merely reflect less than perfect translations. To determine whether English and German speakers differ in the range of events they describe as causing versus enabling, the nature of the referent needs to be held constant. English and German speakers can be shown and asked to describe exactly the same event. If English and German differ systematically in the meaning of verbs such as *cause*, then English speakers may be more likely than German speakers to describe force dynamic interactions with CAUSE verbs rather than ENABLE verbs. This possibility was tested in the next experiment by having English and German speakers view and describe 3D animations of complex events.

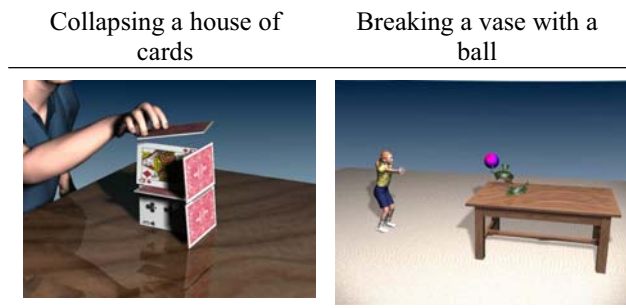


Figure 2: Two of the animations used in Experiment 1.

Experiment 1

Method

Participants The participants were 16 English monolinguals attending the University of Memphis and 16 German monolinguals living near Hamburg, Germany.

Materials Twelve 3D animations were made from an animation package called Discreet 3D Studio Max version 4. Each animation depicted a sequence of events initiated by a sentient affector. Two sample animations are shown in Figure 2. The remaining animations included situations such as extinguishing a flame, waving a flag, dimming a light, and popping a balloon. The average length of the animations was 5.6 seconds.

Procedure The animations were presented in random order on Windows-based computers. After each animation, participants chose which one of two sentences best described the animation. Specifically, English speakers chose from sentences such as “The woman got the house of cards to collapse” and “The woman let the house of cards collapse” while Germans chose from the near translations of these sentences, “Die Frau brachte die Karten zum Einstürzen” and “Die Frau ließ die Karten einstürzen.” If participants felt that neither sentence described the scene, they could choose the option “none of the above” (“Keine der Möglichkeiten”). Participants indicated their answers by clicking a radio button next to their choice.

Results and Discussion

The results were as predicted. As shown in Figure 3, English speakers ($M = .65$, $SEM = .042$) preferred to describe the animations with CAUSE sentences more often than did German speakers ($M = .42$, $SEM = .052$). This difference was confirmed by analyses across both participants, $t_p(30) = 3.44$, $p < .01$, and items $t_i(22) = 2.13$, $p < .05$.¹ The results suggest that English and German speakers differ in the range of situations they describe as causal (as opposed to enabling). However, the results leave

¹ The analyses in Experiments 1 and 2 are based only on people’s CAUSE sentence choices. To also include ENABLE choices would be partially redundant since their selection was not wholly independent of the CAUSE choices.

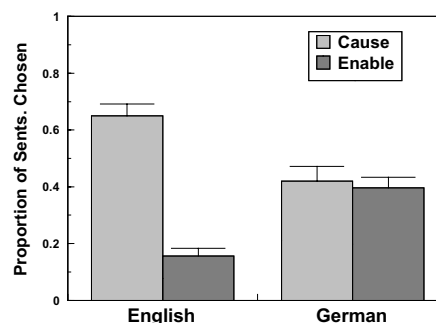


Figure 3: Responses to complex animations in Exp. 1.

open the possibility that German speakers differed from English speakers because they were, for some unknown reason, uncertain about the nature of the task, and so chose the CAUSE and ENABLE options at chance.

Another issue not addressed by these findings is precisely how the verbs encoding CAUSE and ENABLE might differ across languages. As discussed above, the force dynamic model proposes several dimensions along which the languages might differ. For example, if causal verbs in English and German differ in what they encode about the patient’s tendency, it should be possible to test for this difference using series of animations like the one in Figure 1. We would predict that English and German speakers should both prefer to use CAUSE verbs for the animation on the far left and ENABLE verbs for the animation on the far right. Their descriptions of the animations at opposite ends of the CAUSE-ENABLE series would provide a baseline for examining their responses to the intermediate animation. If English and German differ systematically in their meaning of CAUSE and ENABLE verbs, then, this difference should be greatest for the intermediate animation: English speakers should be more likely to use CAUSE verbs relative to German speakers, who should be more likely to use ENABLE verbs, as tested below.

Experiment 2

Method

Participants The participants were 16 English monolinguals attending the University of Memphis and 16 German monolinguals living near Hamburg, Germany.

Materials Fifteen animations were used to create five CAUSE-ENABLE series. One of the series is shown in Figure 1 and sample animations from the four remaining series are shown in Figure 4. The average length of the animations was 6 seconds.

Procedure Participants viewed twelve randomly ordered animations. After each animation, they chose which of two possible sentences (or “none of the above”) best described the occurrence. For CAUSE sentences, the matrix verb was either *cause* or *get* (= “verursachen” or “dazu bringen”) while for ENABLE sentences, the matrix verb was either *let* or *enable* (= “lassen” or “ermöglichen”).

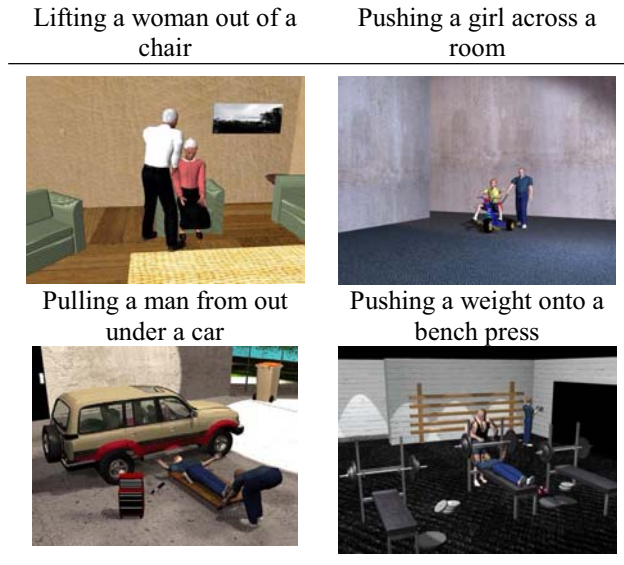


Figure 4: Scenes from four of the intermediate animations used in Experiment 2 and 3.

Results and Discussion

The results, again, were as predicted. Table 2 shows the percentage of times that English and German speakers chose the CAUSE and ENABLE sentences for animations at opposite ends of the CAUSE-ENABLE series.

Table 2: Proportion of CAUSE and ENABLE sentences for the two ends of the CAUSE-ENABLE series

		CAUSE END	ENABLE END
English	Cause	.83 (.044)	.09 (.041)
	Enable	.13 (.031)	.89 (.036)
German	Cause	.81 (.064)	.15 (.06)
	Enable	.03 (.017)	.81 (.06)

Both groups of speakers strongly preferred CAUSE sentences to describe animations in which the patient clearly opposed the affector and ENABLE sentences for animations in which the affector and the patient were clearly in concordance. The results support our prediction that German ENABLE verbs (*let* and *enable*) are used more broadly than English ENABLE verbs. Importantly, these results also indicate that German ENABLE verbs are not simply superordinate terms for the range of situations described by CAUSE and ENABLE verbs in English. If they were, then German speakers should have been more likely to describe the CAUSE end of series with ENABLE verbs, which they were not. The results indicate, then, that the categories of CAUSE and ENABLE are distinguished by two, relatively non-overlapping subcategories of verbs in both English and German.

The results also provide further support for the hypothesis that the CAUSE and ENABLE verbs in English and German differ systematically in their meaning. Figure 5

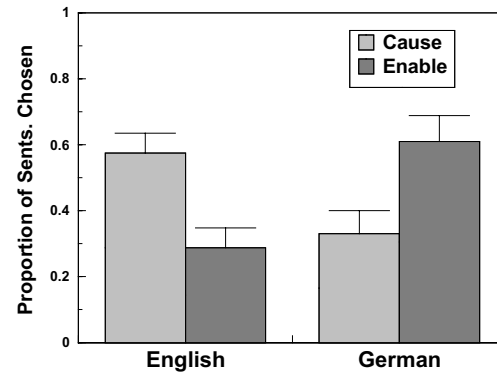


Figure 5: Responses to intermediate animations in Exp. 2.

shows the proportion of times that English and German speakers chose CAUSE and ENABLE sentences for the intermediate animations in the five CAUSE-ENABLE series. As shown in Figure 5, English speakers ($M = .58$, $SEM = .06$) described the intermediate animation with the CAUSE sentence more often than did German speakers ($M = .33$, $SEM = .10$), across participants, $t_p(30) = 2.70$, $p < .05$, and (marginally) across items, $t_i(4) = 2.48$, $p = .068$. Thus, the results indicate that English and German speakers differ in the range of situations that they classify as causal. In effect, the results indicate that the verb *cause* in English has no direct translation in German.

Might this difference in meaning have consequences for causal reasoning? One way to investigate this question is suggested by recent work by Goldvarg and Johnson-Laird (2001). Goldvarg and Johnson-Laird had participants read problems consisting of two premises followed by a question. For example, participants read statements such as “*Eating protein will cause her to gain weight*” and “*She will eat protein.*” They then answered the question “*Will she gain weight?*” Some of the sentences contained the verb *cause* (as above) while others contained the verb *allow*. In short, participants read a general causal claim, then thought hypothetically about the likelihood of the effect (E) given the affector (A) (i.e., $p(E|A)$). Interestingly, Goldvarg and Johnson-Laird found that the estimates of $p(E|A)$ were higher when the main verb was *cause* than when the verb was *allow* (an ENABLE verb). Since $p(E|A)$ plays a key role in covariational models of causation (e.g., Mandel & Lehman, 1998), these results show how the concepts of CAUSE and ENABLE can give rise to different patterns of causal inference.

If language plays a role in causal reasoning, then speakers of English and German might differ in their judgments of causation. We can examine this possibility by showing English and German speakers animations and then asking them to think hypothetically. What might happen in situations in which the affector’s actions are the same as those depicted in the animation, but the patient’s actions are unknown? That is, they could be asked to estimate the probability of the effect given knowledge of only the affector’s actions, $p(E|A)$. For CAUSE interactions, English

and German speakers should be fairly confident of the occurrence of the effect given knowledge of the affector's actions since, in these interactions, the affector brings about the result even though the patient does not have a tendency for that result; in other words, the effect occurs regardless of the patient's actions. Thus, estimates of $p(E|A)$ should be high. For ENABLE interactions, in contrast, there is less certainty about the occurrence of the effect since the effect may depend on contributions from both the affector and the patient. Recall that in ENABLE interactions, the patient has a tendency for the result. While the affector alone might be capable of bringing about the result, it is also possible that the result might not occur without the patient's help.

In estimating $p(E|A)$, people may be biased to imagine variants of the animations that accord with the typical way in which force dynamic situations are interpreted and expressed in their language. Thus, when thinking hypothetically, English speakers might be more likely to re-construe ENABLE scenarios as CAUSE interactions than German speakers, who, in contrast might be more likely to re-construe them as ENABLE interactions. Specifically, when thinking hypothetically about ENABLE interactions, English speakers might be more likely than German speakers to imagine the patient as not having a tendency for the effect (thus opposing the affector), while German speakers might be more likely to imagine the patient as having a tendency for the effect. As a consequence, in the case of ENABLE interactions, English speakers' estimates of $p(E|A)$ might be lower than German speakers' estimates. We don't expect the language groups would differ with respect to CAUSE interactions since, in such cases, it makes little difference whether the patient helps or resists the affector. To test these hypotheses, English and German speakers saw animations depicting clear cases of CAUSE and ENABLE from Experiment 2 then estimated $p(E|A)$.

Experiment 3

Method

Participants The participants were 16 English monolinguals attending the University of Memphis and 16 German monolinguals living in Hamburg, Germany.

Materials The materials were the animations at opposite ends of each series of animations used in Experiment 2, that is, the five clear cases of CAUSE and the five clear cases of ENABLE interactions.

Procedure Participants viewed the ten animations in random order. After each animation, they were told to imagine a situation that was very similar to the one that they just saw. In this imagined situation, participants were told that "the affector does exactly what he/she did in the animation while the patient may or may not do what he/she did in the animation." Participants were then asked to "estimate the likelihood of the result by choosing a number from 0% to 100%." In no part of this experiment were

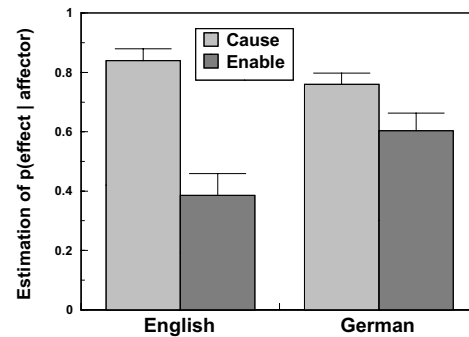


Figure 6: Estimates of $p(E|A)$ for clear cases of CAUSE and ENABLE

people asked to generate a linguistic description. Rather, all they did was type in a number.

Results and Discussion

The results were as predicted. Figure 6 shows the estimated probability that the result would occur given the presence of the affector based on CAUSE and ENABLE animations. As expected, both English and German speakers predicted that $p(E|A)$ should be higher for CAUSE animations than for ENABLE animations, $F_p(1,30) = 25.20$, $p < .001$, $F_i(1,4) = 43.76$, $p < .01$. Thus, our results replicate the difference between CAUSE and ENABLE found in Goldvarg and Johnston-Laird (2001), except with animations instead of sentences. Importantly, however, the difference between CAUSE and ENABLE was greater for English speakers than for German speakers, as confirmed by a significant interaction between language and animation type, $F_p(1, 30) = 6.34$, $p < .05$, $F_i(1,4) = 40.50$, $p < .01$. As predicted, German speakers were more likely than English speakers to imagine that the effect would occur in ENABLE situations, presumably because they were more likely to view the patient as having a tendency for the result, which would then increase the likelihood of the effect.

Conclusions

The results indicate that English and German speakers differ in their expression of causal interactions. Experiment 1 showed that English speakers described complex causal chains with CAUSE verbs more often than German speakers. In Experiment 2, this cross-linguistic difference was found to be greater when the tendency of the patient was ambiguous than when the tendency of the patient was clearly specified. In Experiment 3, German speakers' estimates of $p(E|A)$ were higher than those of English speakers in the case of ENABLE interactions, suggesting that differences in linguistic expression might lead to differences in causal reasoning.

It might be objected that if German and English speakers really did think differently about something as fundamental as causality, then the exercise of looking for any generalities across the human species would be ill-guided. Importantly, however, in this research we show how differences in the

expression of causal notions in English and German can be explained in terms of three underlying semantic parameters. We show, then, how differences between languages might occur with respect to underlying, cross-linguistic commonalities. In showing such commonalities, the current results support the possibility that the force dynamic account adopted in this research can be extended beyond English to the analysis of causatives in other languages.

Our findings suggest that causal verbs in English and German differ systematically in meaning and that these differences might have consequences for causal reasoning. However, the results leave open how these differences in language might affect thought. On the one hand, it may be that people often use language to help them to think hypothetically about a situation, and it is in these verbal representations that differences between languages have an effect. Alternatively, it may be that differences in language promote different habits of thought. In tending to use ENABLE verbs more often than CAUSE verbs, German speakers, for example, might be more likely than English speakers to view patients as having a tendency for a particular end state, especially when the patient's tendency is relatively ambiguous. Differentiating between these alternative explanations will be the focus of further research.

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