

General Article

TELLING SOMETHING WE CAN'T KNOW: Experimental Approaches to Verbs Exhibiting Implicit Causality

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An interpersonal verb such as annoy or admire can be categorized according to whether its grammatical subject or grammatical object initiates the interaction described by the verb. Such a verb can also be categorized according to whether a derived adjective describes its grammatical subject (e.g., annoying) or its grammatical object (e.g., admirable). Although there has been much speculation (e.g., Brown & Fish, 1983) that these and other characteristics of these verbs shed light on basic principles of human social interaction, we argue that research to date has failed to demonstrate directly any real-time consequences of these verbs during language comprehension. We present evidence that the initiating-reacting distinction predicts on-line changes in the accessibility of these verbs' arguments, but that the existence of a derived adjective does not. We conclude that tasks that question subjects explicitly about language may fail to reflect the ordinary processes of language comprehension.

Trust Envy Praise Detest Apologize

Each of these verbs can be used to describe a relationship or an interaction between two people. In fact, the relationships these verbs describe are among the most basic of human relationships, and it is not surprising that psychologists are interested in situations in which people trust, envy, praise, detest, or apologize. But what is surprising is the attention that has been paid to the words themselves. Both social and cognitive psychologists have classified each of these verbs as belonging to the set of verbs exhibiting "implicit causality." One or the other of their arguments "is implicated as the assumed locus of the underlying cause of the action or attitude" (Garvey &

Caramazza, 1974, p. 460). These verbs have been studied by social and developmental psychologists in North America (Au, 1986; Brown & Fish, 1983; Brown & Van Kleek, 1989; Hoffman & Tchir, 1990; LaFrance & Hahn, 1993; Van Kleek, Hillger, & Brown, 1988) and in Europe (Edwards & Potter, 1993; Fiedler & Semin, 1988; Manetti & De Grada, 1991), by cognitive psychologists in North America (Caramazza, Grober, Garvey, & Yates, 1977; Caramazza & Gupta, 1979; Garvey & Caramazza, 1974; Garvey, Caramazza, & Yates, 1975; Grober, Beardsley, & Caramazza, 1978; Hudson, Tanenhaus, & Dell, 1986; McKoon, Greene, & Ratcliff, 1993) and in Europe (Ehrlich, 1980; Garnham, Oakhill, & Cruttenden, 1992; Vonk, 1985a, 1985b), and by linguists (Grimshaw, 1990; Levin, 1993).

Although there is little agreement among researchers concerning the proper analysis of verbs exhibiting implicit causality, all agree that some such verbs attribute causality to the person who is the grammatical subject of the verb and some attribute causality to the person who is the grammatical object. The verb *annoy*, for example, attributes causality to the argument in the subject position. When one hears that John annoys Mary, one normally assumes that the cause of the annoyance is some property or action of John's. In contrast, *admire* attributes causality to the argument in object position. When one learns that Bill admires Nancy, one normally assumes that the reason for the admiration is to be found in some property or action of Nancy's.

Social psychologists have often claimed that the property of implicit causality derives from basic principles of human cognition that determine mental representations of the events described by these verbs and their arguments (see Brown & Fish, 1983; Fiedler & Semin, 1988; Gilovich & Regan, 1986; Hoffman & Tchir, 1990; Kasof & Lee, 1993). Brown and Fish (1983), for example, based

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their account of implicit causality on a principle of human thought "Humans generally think in terms of" (p. 271) people whose actions affect other people or people who have some characteristic that elicits a reaction in others.

Social psychological accounts of implicit causality and cognition have all been supported by the same kind of empirical reasoning. Judgments subjects make about the causality of a verb in a simple sentence are taken to reflect properties of the verb. These properties, in turn, are assumed to illuminate the basic principles of human cognition that govern how people perceive and interpret interactions between people. But this reasoning is faulty. Subjects' judgments about verbs in simple sentences cannot be used to infer fundamental principles of human interaction. As Edwards and Potter (1993) have pointed out, a sentence like *Bill admired Nancy* is an extremely impoverished stimulus from which to draw inferences about fundamental principles of human cognition. Even within the domain of single sentences, a verb's implicit causality can be overridden, as in the sentence *Bill admired Nancy because he had been deprived of role models*.

More important, language is a tool at the service of a speaker, who can choose to package the same information in a variety of ways (Austin, 1962; Chafe, 1974; Clark & Carlson, 1982; Edwards, 1991; Edwards & Potter, 1993; Wilson & Sperber, 1979). Speakers' choices about how to convey information are not random, but are determined in a context of other persons and events. A speaker may choose to use a verb exhibiting implicit causality in a situation in which he or she intends the "causal" argument to be taken as the person responsible for the action, in a situation in which he or she intends the other argument to be taken as the person responsible, or in a situation in which he or she intends responsibility to be multiply assigned in different ways to different people (See Edwards & Potter's, 1993, discussion of *telephone*, p. 26, and of *kick*, pp. 27-28; see also Corrigan, 1988).

Although the study of verbs in simple sentences cannot give a complete picture of the human interactions represented by the verbs, such study has provided a cohort of properties of these verbs' meanings that are highly correlated with attributions of causality. We take this cohort as a partial description of the meanings of the verbs. These properties include which argument is named as the actor in an antecedent inference (Fiedler & Semin, 1988), which argument is more salient (Kasof & Lee, 1993), which argument exercised choice in the interaction (Gilovich & Regan, 1986), which argument's role is more distinctive (Brown & Fish, 1983), which argument can be described by an adjective derived from the verb (Brown & Fish, 1983; Hoffman & Tchir, 1990), which argument is judged to be more causal (Brown & Fish, 1983; Hoffman & Tchir, 1990; Van Kleeck et al., 1988), and which ar-

gument is more likely to be identified as the referent of an ambiguous pronoun that could refer to either argument (Caramazza et al., 1977; Caramazza & Gupta, 1979; Ehrlich, 1980; Mannetti & De Grada, 1991; Vonk, 1985a). The evidence is clear that all of these properties are understood by speakers of the language, they are part of speakers' competence. Any or all of these may be central properties of the meaning of a verb exhibiting implicit causality, or any or all of them may be only peripheral or incidental.

Reasoning from a psycholinguistic perspective leads to an experimental approach different from that pursued by social psychologists. One goal of psycholinguistic experiments is to distinguish those variables that are involved in the processes of comprehension from those that may be available to a competent speaker upon reflection but not ordinarily used in on-line comprehension. Potentially, any of the properties just mentioned could play a role in comprehension. For example, comprehenders could draw an inference about which argument was causal, or they could somehow encode that one argument could be described by an adjective related to the verb. If any of the properties does play a role in on-line comprehension, one could infer that it is a directly accessible part of the meaning of these verbs and, therefore, that it may have consequences for understanding social situations described by these verbs.

It is important, therefore, to determine whether any of the properties correlated with implicit causality can be shown to have consequences for real-time comprehension of language. One potential processing consequence of a verb exhibiting implicit causality might be that one of the verb's arguments becomes more accessible than the other (McKoon et al., 1993). For example, the argument that is more distinctive (cf. Brown & Fish, 1983) might become more accessible. To examine possible processing consequences, it is critical to find a task that taps not what a subject can do if asked explicitly but what a subject does do when not asked explicitly. All of the tasks that have been used in previous research (e.g., causal ratings tasks used by Brown & Fish, 1983; Hoffman & Tchir, 1990; Van Kleeck et al., 1988; sentence completion or generation tasks used by Au, 1986; Brown & Fish, 1983; Garvey & Caramazza, 1974; Garvey et al., 1975; Grober et al., 1978; pronoun disambiguation tasks used by Caramazza et al., 1977; Caramazza & Gupta, 1979; Ehrlich, 1980; Mannetti & De Grada, 1991; Vonk, 1985a; and listings of antecedents and consequences used by Fiedler & Semin, 1988) have relied upon subjects' implicit or explicit knowledge about the language.

The common difficulty with all of these tasks, as Edwards and Potter (1993) have argued, is that they may lead subjects to make judgments of causality based on information that is not available to ordinary comprehen-

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sion processes. Any task that asks subjects to make judgments about language may reveal different aspects of linguistic knowledge than are ordinarily used by language comprehension processes. For example, subjects can reliably distinguish four-letter from five-letter words, but that does not mean that this distinction results in interesting processing differences during comprehension. What researchers need instead is a task that measures the results of comprehension as it is proceeding. With such a task, they can investigate which aspects of the meanings of verbs exhibiting implicit causality play a role in real-time comprehension. For our experiments, we chose recognition as the on-line task, and we selected for investigation two components of the meanings of the verbs whether the grammatical subject or object is the argument that initiates the interaction described by the verb, and whether an adjective derived from the verb describes the subject or the object. First, we review existing research on these two variables.

IMPLICIT CAUSALITY AND INITIATING-REACTING ROLES

The set of interpersonal verbs exhibiting implicit causality has never been well defined. Brown and Fish (1983) suggested that verbs that exhibit implicit causality are "state" verbs whose arguments fill the semantic roles of stimulus and experiencer and "action" verbs whose arguments fill the semantic roles of agent and patient. Brown and Fish's characterization of these verbs fits with their explanation of the nature of implicit causality. They hypothesized that state verbs exhibit implicit causality toward their stimulus and action verbs toward their agent because stimuli and actors are more distinctive¹ than experiencers and patients. Although these regularities appeared in Brown and Fish's data, the state-action classification failed to explain subsequent data (Au, 1986, Van Kleek et al., 1988). Some action verbs exhibit implicit causality toward their agent, some toward their patient, and some apparently not at all (Au, 1986). Furthermore, the classification of a verb as a state verb is not sufficient to predict the direction of its implicit causality. One still must analyze its semantics to determine which argument is the stimulus and which is the experiencer to identify which argument is the causal one. Taken together, these observations lead to the conclusion that the state-action distinction is not useful in predicting implicit causality.

We argue that verbs exhibiting implicit causality should be analyzed in terms of which of their arguments

initiates the interaction and which responds to it (McKoon et al., 1993, following Au, 1986, also Osgood, 1970). The implicit causality of a verb is said to be toward the argument that initiates an action or evokes a response. For example, the subject of *confess* initiates the action. People confess for things they themselves have done. In contrast, the subject of *thank* is reacting to a state of affairs brought about by the object. A person thanks others for things they have done. In one case, the grammatical subject is the initiator, and the object is the reactor; in the other, the object is the initiator, and the subject is the reactor. The reactor may very well carry out some action, as in *congratulate*, the key is that the action is necessarily in response to an initiating state or action of someone else.

Analyzing these verbs in terms of initiating and reacting roles focuses attention on whose behavior requires explanation. The initiation of a state of affairs typically demands an explanation, the reaction is explained by the state of affairs itself. From a processing point of view, this focus is useful because the person whose behavior requires explanation is likely to be the topic of a subsequent *because* clause. Thus, if verbs exhibiting implicit causality make the initiator more accessible in a comprehender's discourse model, they are, in effect, helping prepare comprehenders for information that is likely to be forthcoming.

The present experiments tested the usefulness of the initiating-reacting distinction in predicting the on-line processing consequences of verbs exhibiting implicit causality. If characters in initiating roles really are made more accessible than characters in reacting roles during the routine processes of comprehension, then an on-line task should be able to detect evidence of this change.

IMPLICIT CAUSALITY AND DERIVED ADJECTIVES

The direction of the causality of a verb exhibiting implicit causality has usually been determined by means of a simple rating task. Subjects are presented simple sentences, such as *Ted likes Paul*, and asked to rate how likely it is that this state of affairs has come about because of something about Ted and how likely it is that this has come about because of something about Paul (Brown & Fish, 1983, Hoffman & Tchir, 1990, Van Kleek et al., 1988). If subjects assign higher ratings to one argument than the other, that argument is taken to be causal.

In 1983, Brown and Fish reported a "remarkable" discovery (p. 239). The argument of a verb that can be described by an adjective derived from that verb is most likely also the argument favored by the implicit causality. For example, in *Lucas loathed Emily*, the implicit causality of *loathe* is toward Emily, and the only adjective

¹ Brown and Fish used the term *distinctive* with its meaning within attribution theory (Kelley, 1967). A characteristic that a small number of people share is said to be more distinctive than one that is shared by a larger number of people.

Table 1 Verbs used in the experiments and their derived adjectives

Object-initiating verbs with object adjectives		Object-initiating verbs with subject adjectives		Subject-initiating verbs
Verb	Adjective	Verb	Adjective	
abhor	abhorrent	accuse	accusatory	aggravate
admire	admirable	appreciate	appreciative	agitate
adore	adorable	compliment	complimentary	amaze
commend	commendable	congratulate	congratulatory	amuse
deplore	deplorable	console ^a	consoling	anger
despise	despicable	criticize	critical	annoy
detest	detestable	dende	derisive	bore
dread	dreadful	disdain	disdainful	concern
esteem	estimable	mourn	mournful	disappoint
honor	honorable	reassure	reassuring	dumbfound
like	likable	reproach ^b	reproachful	fascinate
loathe	loathsome	resent	resentful	flabbergast
notice	noticeable	revere	reverential	infuriate
praise	praiseworthy	scorn	scornful	inspire
ridicule	ridiculous	soothe	soothing	intimidate
value	valuable	thank	thankful	peeve

^a Console also has the object adjectives *inconsolable* and *disconsolate*

^b Reproach also has the object adjective *irreproachable*

that can be derived from *loathe*, *loathsome*, applies to Emily. This discovery suggested to Brown and Fish a Whorfian hypothesis according to which the existence of such an adjective in one's mental lexicon affects one's understanding of the verb from which it is derived. Brown and Fish ultimately rejected this explanation, but it was later revived by Hoffman and Tchr (1990), who found that the existence of a derived adjective predicts subjects' ratings of the relative causality of a verb's arguments.

The goal of our experiments was not to reopen the debate on the Whorfian hypothesis. Instead, our goal was to determine whether the existence of a derived adjective describing one of the verb's arguments affects on-line comprehension, in particular, whether the argument described by the derived adjective is made more accessible during comprehension. We knew from Hoffman and Tchr's (1990) work that the argument that can be described by a derived adjective does receive higher ratings of causality, the question we asked was whether higher ratings of causality translate into on-line effects on the relative accessibility of the argument during comprehension.

SELECTION OF EXPERIMENTAL MATERIALS

Our first task was to establish that our categorization of verbs as subject initiating or object initiating predicts the difference in ratings of causality that has been the defining feature of the class of verbs exhibiting implicit

causality. This step was necessary to establish that our on-line recognition experiments would study the same group of verbs that previous research had investigated.

Because we selected two groups of object-initiating verbs—those that have a derived adjective describing their subject and those that have a derived adjective describing their object—we were able to replicate the essential finding of Hoffman and Tchr (1990). We did not select a similarly balanced group of subject-initiating verbs because an extensive search of published sources failed to turn up a sufficiently large number of subject-initiating verbs that have a derived adjective describing their object.

Sixteen verbs were selected from each of the three categories of interest: object-initiating verbs with object adjectives, object-initiating verbs with subject adjectives, and subject-initiating verbs. The verbs in each category and their derived adjectives are shown in Table 1. Verbs were categorized as subject or object initiating on a theoretical basis (as outlined in McKoon et al., 1993). The implicit causality of these verbs was confirmed by asking 30 participants² at Northwestern University to generate continuations of sentence fragments that presented each verb in the frame "name, verb (tense), name, because" (e.g., James infuriated Debbie because __). Overall, the mean percentage of participants continuing a

2 To avoid confusion between the use of *subject* in its grammatical sense and in its sense meaning an experimental participant, we refer to the people who participated in our experiments as *participants*.

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Table 2 Mean causality ratings for subjects and objects by verb type and gender

Gender	Object-initiating verbs with object adjectives			Object-initiating verbs with subject adjectives			Subject-initiating verbs		
	Subject	Object	Subject — object	Subject	Object	Subject — object	Subject	Object	Subject — object
Male	6.06	6.64	-0.58	6.41	6.00	0.41	6.98	5.89	1.09
Female	5.86	6.59	-0.73	6.31	5.80	0.51	6.76	5.56	1.20
Mean	5.96	6.62	-0.66	6.36	5.90	0.46	6.87	5.73	1.14

Note The category of object-initiating verbs with subject adjectives excludes the verbs *console* and *reproach*. The standard error of the mean for all verbs is 0.04 in the items analysis.

sentence fragment with a pronoun referring to the character consistent with the causality of the verb (i.e., the character classified theoretically as the initiator) was 91 for the object-initiating verbs with object adjectives, 87 for the object-initiating verbs with subject adjectives, and 89 for the subject-initiating verbs.

Ratings of the relative causal role played by the verbs' subjects and objects were obtained by means of a causal attribution questionnaire modeled on that used by Hoffman and Tchr (1990). Each verb appeared in the past tense in a sentence frame of the form *Gregory — Lucy* (e.g., *Gregory admired Lucy*). The proper names were always unambiguously of different genders and were roughly matched for popularity on the basis of rankings in Lansky (1991). Participants used a 9-point scale to rate "to what extent was this because of some characteristic of Gregory's" and "to what extent was this because of some characteristic of Lucy's".

Mean causality ratings for the subjects and objects of each of the three types of verbs are shown in Table 2.³ Planned contrasts with participants (F_1) and items (F_2) as random variables confirmed that subjects of subject-initiating verbs were rated as more causal than were subjects of object-initiating verbs, whereas objects of subject-initiating verbs were rated as less causal than were objects of object-initiating verbs, $F_1(1, 136) = 23.51$, $F_2(1, 43) = 15.27$, $p < .001$. A second set of orthogonal planned contrasts supported Hoffman and Tchr's hypothesis that the nature of the adjective derived from a verb also influences the perceived causality of the verb's subject and object. Within the category of object-

initiating verbs, causality ratings for the subjects of verbs with subject adjectives were higher than those for the subjects of verbs with object adjectives, and vice versa for causality ratings of the objects, $F_1(1, 136) = 50.51$, $F_2(1, 43) = 8.91$, $p < .005$.

EXPERIMENTS 1, 2, AND 3

The results of the causal attribution questionnaire show that someone who initiates an interaction is judged to be more responsible for the interaction than is someone who merely reacts to it. They also show that someone who possesses a characteristic for which there is a lexicalized term in English (e.g., *detestable*, *disdainful*) is attributed additional responsibility for a situation in which he or she displays that characteristic. In Experiments 1, 2, and 3, we asked whether these properties of verbs exhibiting implicit causality play a role in on-line comprehension. If so, we could conclude that they are a directly accessible part of the meanings of the verbs.

Our experiments, therefore, used an on-line recognition task to determine what consequences verbs exhibiting implicit causality have during the routine course of comprehension. Participants read stories such as those shown in Table 3. At either Test Point 1 (after the second sentence) or Test Point 2 (after the prepositional phrase in the third sentence), participants were presented the name of one of the story characters and asked to verify that that name had appeared in the story. If some property of the verb in the third sentence makes one argument more accessible than the other, then we expected the reaction times to that argument would show a relative speedup from Test Point 1 to Test Point 2.

Method

Materials

Three sets of 16 experimental items were constructed using the verbs listed in Table 1. One set contained object-initiating verbs with object adjectives, another con-

3 After conducting the experiments reported here, we realized that two of the verbs—*console* and *reproach*—that we had classified as having only subject adjectives also have object adjectives—*inconsolable*, *disconsolate*, and *irreproachable*. Therefore, we conducted all of the analyses reported in this section both including and excluding those two verbs, all results that were significant in one set of analyses were also significant in the other. Only analyses excluding those verbs are reported for the ratings data.

Table 3 Examples of the experimental materials (with two continuations for each story)

Experiment 1 (object-initiating verbs with object adjectives)

Michael and Jessica spent hours in the greenhouse
They were trying to breed a new hybrid rose;
Michael valued Jessica because in an often hectic
environment;

she always kept a steady course
he had a tendency to get distracted

Experiment 2 (object-initiating verbs with subject adjectives)

Judah and Alexis went out to dinner and a show
They had been seeing a lot of each other for six months now;
Judah thanked Alexis because for the past month,
she had been especially kind and considerate

he had needed a lot of extra support

Experiment 3 (subject-initiating verbs)

Preston and Deborah were teaching a sociology course
together

They practiced their lectures together in advance;

Preston bored Deborah because after all the preparation,

he had taken out all the jokes

she had heard everything too many times

One quarter of the test words were positive (i.e., had appeared in the text). Each filler text also had associated with it one true and one false test statement, as with the experimental texts, these sentences were written to test a variety of kinds of information from the texts.

Procedure

All of the texts and test items were presented on a computer screen, and responses were collected on the keyboard. Each participant took part in one 50-min session.

Each experiment began with 30 lexical decision test items to give participants practice with the response keys on the computer keyboard. After this practice, 20 filler texts were presented, and then the 16 items from one experimental set and the remaining 40 fillers were presented in random order.

Each text began with the instruction to press the space bar on the keyboard. The screen was then cleared for 1 s, and then the text was presented, one word at a time. Each word was displayed in the same location on the screen, for 170 ms plus 17 ms multiplied by the number of letters in the word. There was no pause between words. The last word of a sentence was displayed for an extra 200 ms unless it was immediately followed by a test word. When a test word was presented, it appeared in the same location as the text words, its letters were all in upper case (unlike the words of the text), and two asterisks were displayed immediately to its left and to its right. The test word remained on the screen until a response key was pressed (? for "yes" the word had appeared in the text, and z for "no" the word had not appeared in the text). After the response and a pause of 170 ms, the text continued or the "press space bar" message appeared. Each text was followed by a true/false test statement, if the response was incorrect, the word "ERROR" appeared for 1,500 ms. For each filler text, one of the two test sentences was selected randomly to be presented. For the test words, participants were instructed to respond as quickly and accurately as possible. For the true/false test statements, they were told to aim for 100% accuracy.

Design and subjects

The items containing object-initiating verbs with object adjectives were used in Experiment 1, those containing object-initiating verbs with subject adjectives were used in Experiment 2, and those containing subject-initiating verbs were used in Experiment 3. For all three experiments, there were two variables for the 16 experimental texts. The test word was the name of either the initiating or the reacting character, and the test position occurred either after the second sentence of the story or

tained object-initiating verbs with subject adjectives, a final set contained subject-initiating verbs. In all of the experimental items, a verb of the appropriate type was used in the final sentence of a three-sentence text. The first sentence of each text introduced two characters using proper names, one male and the other female. For half of the texts, the first-mentioned character was male and for the other half, it was female. The second sentence contained a joint anaphoric reference to both of the characters (usually, *they*). The first clause of the third sentence consisted of the proper names and one of the critical verbs in the same frame that was used in the causal attribution questionnaire (e.g., *Gregory congratulated Lucy*). The proper names appeared in the same order as they appeared in the first sentence. The third sentence continued with the conjunction *because*, followed by a prepositional phrase, which was included to increase the distance between the proper names and the pronoun that followed in the second clause. There were two versions of the remainder of the second clause of the third sentence. One version began with a pronoun matching the gender of the character in the initiating role in the first clause and continued with information that made sense for that character, the second version began with a pronoun matching the gender of the reacting character and continued with information that made sense for that character.

There were two test words for each text, the two character names. There was also a true/false test sentence for each text; these sentences tested a variety of kinds of information from the texts.

We used 60 filler texts to provide test words different from the kinds of test words for the experimental texts.

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immediately before the pronoun in the second clause of the final sentence. To which character the second clause of the final sentence referred was not part of the experimental design, instead, it was counterbalanced across the conditions of interest. The four conditions formed by crossing the two variables were combined in a Latin square design with four sets of texts (four per set) and four groups of participants (10 in each group in Experiment 1, 9 in Experiment 2, and 8 in Experiment 3). The participants took part in the experiments for credit in an introductory psychology course at Northwestern University.

Results and Discussion

For each experiment, means for the correct responses in each condition are shown in Table 4. Outliers consisting of about 2% of the data were trimmed in each experiment; these were reaction times longer than 2,000 ms in Experiments 1 and 2, and 2,300 ms in Experiment 3 (Experiment 3 had larger variance before trimming than did Experiments 1 and 2). Reaction times and error rates for filler items and test sentences appear in Table 5.

Analyses of variance of the reaction time data from Experiments 1 and 2 showed that the object-initiating verbs followed by the connective *because* increased the accessibility of the verbs' objects (initiators) relative to that of their subjects (reactors). Correct responses to the names of the initiators were significantly faster following this construction than they had been before it, but responses to the names of the reactors were not signifi-

cantly faster after the construction than before it. This interaction was significant both for verbs with derived adjectives that refer to their object and for verbs with derived adjectives that refer to their subject (Experiment 1 $F_1[1, 39] = 5.8$, $F_2[1, 12] = 5.0$, Experiment 2 $F_1[1, 35] = 4.5$, $F_2[1, 12] = 4.8$, all $p < .05$). Separate analyses of the Experiment 2 data that replaced the response times to either the verb *console* or the verb *reproach* with the means of the remaining 15 verbs showed the same pattern of results, although the significance level of the items analysis dropped to $p < .06$ when *console* was removed. No other effects of reaction time or error rates reached significance in any of the analyses ($F_s < 3.3$).

The pattern of results was strikingly different for the subject-initiating verbs in Experiment 3. In contrast to the pattern in Experiments 1 and 2 with the object-initiating verbs, responses to subjects and objects were not differentially affected by a causal construction using a subject-initiating verb. The lack of a difference between subjects and objects in Experiment 3 may be attributable to a countervailing recency effect, because the object always occurred after the subject in the final sentence, reaction times to objects would have been somewhat speeded.

GENERAL DISCUSSION

Our (McKoon et al., 1993) analysis of verbs exhibiting implicit causality led us to conclude that the causal ratings participants assigned to the verbs' arguments were determined by which argument of the verb initiated the

Table 4 Results of Experiments 1 through 3. Response times (in milliseconds) and error rates (in percentages)

Character tested	After second sentence		Before pronoun	
	Response time	Error rate	Response time	Error rate
Experiment 1 (object-initiating verbs with object adjectives)				
Subject (reactor)	1,015	7	968	2
Object (initiator)	1,069	7	939	2
Experiment 2 (object-initiating verbs with subject adjectives)				
Subject (reactor)	985	6	968	3
Object (initiator)	1,034	6	945	2
Experiment 3 (subject-initiating verbs)				
Subject (initiator)	1,030	6	982	2
Object (reactor)	1,035	9	970	1

Note. In the participants analysis of Experiments 1, 2, and 3, the standard errors of the reaction time means are 17 ms, 22 ms, and 18 ms, respectively; the standard errors of the error rates are 1.4%, 1.9%, and 2.4%, respectively.

Table 5 Response times (in milliseconds) and error rates (in percentages) for filler test words and test sentences

Experiment	Positive test words		Negative test words		True test sentences		False test sentences	
	Response time	Error rate	Response time	Error rate	Response time	Error rate	Response time	Error rate
1	1,080	7	1,038	2	2,193	9	2,169	11
2	1,088	12	1,125	4	2,295	6	2,145	9
3	1,071	9	990	3	2,214	6	2,155	8

situation described by the verb. The present experiments investigated the role in on-line comprehension of that property and of another property which argument of the verb can be described by a derived adjective.

The results of Experiments 1 through 3 revealed that only the initiating-reacting role of the verbs' arguments had an effect on on-line comprehension of a subsequent *because* clause. The objects of object-initiating verbs increased in relative accessibility. This effect was identical, regardless of whether a derived adjective described that argument or not. The relative accessibilities of the arguments of subject-initiating verbs were not differentially affected.

The experimental approach we employed does not follow the logical structure of earlier social psychological research on verbs exhibiting implicit causality. Our goal was not to discover general principles about social interaction that might be responsible for the causality implicit in these verbs. The relationship between verbs exhibiting implicit causality and social interaction is indirect, in that the effects of these verbs can be relevant only to social interactions that we learn about through language. It is quite a different thing to comprehend *John admires Mary because she is a hard worker* than it is to observe John admiring Mary while they work together. In the former case, the semantic properties of *admire* are immediately relevant to—in fact, determine—one's understanding of the situation. In the latter, these properties become relevant only when a person describes that observation to someone else or, perhaps, reflects on the situation himself or herself.

Of course, it is possible that there are some properties of verbs exhibiting implicit causality that do not play a role in on-line comprehension but nonetheless become important in later reflection about a situation described by one of these verbs. However, the onus is properly upon investigators who claim such a role for a specific property to demonstrate some effect of the property, beyond its mere existence.

As we suggested at the beginning of this article, verbs exhibiting implicit causality describe some of the most basic human relationships. Perhaps for this reason, re-

searchers have been tempted to treat these verbs as an opportunity to find evidence that bears on a Whorfian hypothesis. Does the language people use affect the way they perceive simple, but basic, human interactions? We offer two points in response to this question—one theoretical and one empirical. The theoretical point is that, to date, all of the research that has been intended to study the influence of verbs exhibiting implicit causality on interpersonal perceptions has been carried out entirely within the realm of language. The stimuli and the responses are linguistic. The most one can hope to learn from this approach is whether one aspect of language use influences another aspect of language use (e.g., whether knowledge of a derived adjective affects a verbal response about causality).

The empirical point, based on the results of Experiments 1 through 3, is that the case for even a severely attenuated Whorfian claim—that the existence of an adjective in the lexicon affects comprehension of the verb from which it is derived—is hard to maintain. Although we replicated Hoffman and Tchir's (1990) finding that the existence of a derived adjective is associated with higher causal ratings for the argument described by that adjective, the results of these experiments suggest that this association does not have any effect on on-line comprehension of the verbs. In the experiments, only a verb's status as subject or object initiating predicted the on-line effects of the verb on its arguments' relative accessibility. We suspect that some aspect of a verb's meaning, perhaps related to whether its subject or object is the initiator, differentially affects the likelihood that, over time, language users will derive an adjective from that verb to describe the subject or to describe the object. The meaning of a verb determines what adjectives can be derived from it, not vice versa.

The present experiments highlight the difference between comprehending language and reflecting on language. On close analysis, people may notice things that are not a part of everyday comprehension. This does not make those things any less real or important. It just makes them a phenomenon different from the real-time use of language.

Implicit Causality

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