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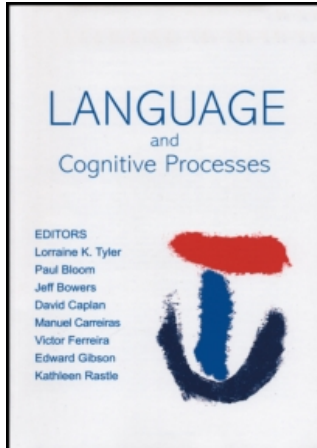
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## What are implicit causality and consequentiality?

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Much work in psycholinguistics and social psychology has investigated the notion of implicit causality associated with verbs. Crinean and Garnham (2006) relate implicit causality to another phenomenon, implicit consequentiality. We argue that they and other researchers have confused the meanings of events and the reasons for those events, so that particular thematic roles (e.g., Agent, Patient) are taken to be causes or consequences of those events by definition. In accord with Garvey and Caramazza (1974), we propose that implicit causality and consequentiality are probabilistic notions that are straightforwardly related to the explicit causes and consequences of events and are analogous to other biases investigated in psycholinguistics.

There is a long tradition of looking at systematic inferences that people make from verbs, which do not seem to be captured in linguistic theory or semantic analyses (e.g., Kanouse, 1972; Semin & Fiedler, 1988). In the last 30 years, there have been a great many studies in psycholinguistics and social psychology concerned with another type of inference that people make from verbs, called ‘implicit causality’. If people are presented with a sentence like *John questioned Mary* and asked to provide a cause, they tend to produce a cause associated with John, such as *because he wanted to know the truth*; whereas if they are presented with a sentence like *John praised Mary*, they tend to produce a cause associated with Mary, such as *because she was responsible for the successful campaign* (Garvey & Caramazza, 1974). Hence, we call *questioned* an NP1-biasing verb (i.e., biased to the first noun phrase)

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and *praised* an NP2-biasing verb (i.e., biased to the second noun phrase). Following Au (1986) and Stewart, Pickering, and Sanford (1998), Crinean and Garnham (2006) suggest yet another inference associated with verbs, termed ‘implicit consequentiality’, which is concerned with whether people tend to produce consequences associated with the first or second noun phrase, and argue for a systematic relationship between the two notions.

As well as pointing out a new inference, Crinean and Garnham (2006) propose an explanation of what gives rise to the implicit causality and consequentiality bias, namely that it is a product of the thematic roles of the verb. Indeed, some of the earliest work on implicit causality provides related accounts (e.g., Au, 1986; Brown & Fish, 1983; Hoffman & Tchir, 1990). In doing so, they assume that implicit causality and consequentiality capture aspects of the *meaning* of events described by verbs, rather than potential *reasons* for those events. This is not compatible with Garvey and Caramazza (1974) nor with psycholinguistic research over the last 30 years.

To see this, consider (1):

1. John broke the window because it was offensive.

In the event described by *John broke the window*, John intentionally performed the act of breaking. In other words, he *caused* the window to break. It is part of the meaning of *break* that its subject caused the breaking-event (when the verb is in the active voice). In a semantic account using thematic roles, John is the Agent of the breaking-event (though see McKoon & Ratcliff, 2003, for a non-thematic approach to causality). But the cause provided by the *because*-clause concerns the window, not John. This cause is not part of the meaning of the event described by *John broke the window*, but rather the *reason* for this event. So there appear to be two distinct notions of causality in play. This has led to great confusion in the implicit causality literature, which is reflected in Crinean and Garnham (2006). We believe that the original and most useful notion of implicit causality refers to reasons for events not meanings of events, and now explain why.

## IMPLICIT CAUSES AS REASONS FOR EVENTS

The implicit causality (and consequentiality) literature has been plagued by a confounding of distinct notions, so we first need to clarify terminology. The *explicit cause* is the cause that is provided for a target event. In (2), the explicit cause of John questioning Mary is John’s wanting to know the truth:

2. John questioned Mary because he wanted to know the truth.

This explicit cause is about (the referent of) NP1, because it refers to John with *he*. Importantly, it does not provide a redescription of the meaning of the main clause, which would occur if it was *because he asked her something*. Any such (tautological) redescription must be about John, because John is the Agent and therefore the person who causes (or produces) the action. Whereas *because*-clauses occasionally provide such redescriptions, they do not usually do so, and psycholinguistic experiments do not tend to study such cases. Similarly, in (3), the explicit consequence of John questioning Mary is Mary's confession:

3. John questioned Mary so she confessed everything.

Sentence (3) therefore has an NP2 explicit consequence, which describes what happened as a result of the event. It does not describe the event itself, as it would in the tautological *so she was asked a question*.

In accord with this definition, the *implicit-causality bias* of an event described by a transitive clause such as *John questioned Mary* corresponds to the likelihood of providing an NP1 or an NP2 explicit cause for that event. More precisely, there is a probability of providing an NP1 explicit cause and a probability of providing an NP2 explicit cause. So we can determine whether a transitive event is NP1- or NP2-biased, and the extent of its bias. *John questioned Mary* would be 80% NP1-biased if people provide NP1 explicit causes (i.e., referring to *John*) 80% of the time and NP2 explicit causes (i.e., referring to *Mary*) 20% of the time. Put another way, if you provided a reason for the event described by *John questioned Mary*, 80% of the time you would say something about John. The notion of *implicit-consequentiality bias* is similar.

Much research is interested in the implicit-causality bias associated with particular verbs, rather than with described events. It is generally assumed that the *verb implicit-causality bias* can be determined by assessing the explicit cause provided for events employing those verbs, so long as the NPs are 'neutral'. This requires that they have no 'content' that could have any relationship to the verb, and that they are equally salient (e.g., one could not be a definite and the other an indefinite NP). So many studies have paired verbs with two 'neutral' first names (e.g., *John, Mary*) to determine the verb implicit-causality bias (e.g., Au, 1986; Brown & Fish, 1983; Hoffman & Tchir, 1990). However, it is important to note that it is only possible to identify the verb implicit-causality bias when used in a particular construction; for example, causal attribution differs when a verb is used in an active versus a passive construction (Au, 1986; Garvey, Caramazza, & Yates, 1976; Kasof & Lee, 1994).

Clearly there is an important question of how implicit causality (and hence the verb implicit-causality bias) should be assessed. In an experimental elicitation, participants are provided with the relevant description of an event such as *John questioned Mary* and are prompted to produce a cause. This can be done by having them complete *John questioned Mary because ...* (e.g., Garvey et al., 1976; Guerry, Gimenes, Caplan, & Rigalleau, 2006) or by answering *John questioned Mary. Why?* (e.g., Brown & Fish, 1983). It is also possible to analyse explicit causality in corpora (e.g., Long & De Ley, 2000). Although biases may be (somewhat) affected by the assessment technique, a specific bias can be identified for any particular verb. In our example, *questioned* would be 80% NP1-biased; other verbs will be more or less strongly NP1- or NP2-biased.

Sentences are *congruent* if the explicit cause matches the implicit-causality bias. Our example (1) is congruent because *John questioned Mary* is 80% NP1-biased, and the sentence has an NP1 explicit cause (*he wanted to know the truth*). Some research suggests that congruent sentences are easier to process than incongruent sentences (e.g., Garnham, Oakhill, & Cruttenden, 1992; Koorneef & van Berkum, 2006; Stewart, Pickering, & Sanford, 2000); data about the time-course of these effects helps answer such questions as whether people initially adopt an analysis in accord with the implicit-causality bias (a *focusing* account) or whether they wait until they know the explicit cause before attempting to integrate the clauses (an *integration* account). Clearly, congruency only makes sense if implicit causality and explicit causality both refer to the same notion of causality. It is possible to define and assess verb explicit consequentiality similarly.

Note that there is now a straightforward analogy between implicit causality and parsing. Just as verbs can be NP1- or NP2-biased, they can be transitive- or intransitive-biased. *Rolled* is transitively biased, but is actually intransitive in (4).

#### 4. When the boy rolled the ball hit him.

So *rolled* is implicitly transitive, the sentence is explicitly intransitive, and the sentence is incongruent (in this sense). Syntactic incongruency generally causes processing difficulty (e.g., Mitchell & Holmes, 1985), just as causal incongruency does, and again there are debates about when the relevant information is used (e.g., Pickering, Traxler, & Crocker, 2000; Trueswell, Tanenhaus, & Kello, 1993). Most studies use 'neutral' subjects so that the syntactic bias associated with the verb is reflected in the sentence fragment as a whole, just as most work on implicit causality uses 'neutral' noun phrases. However, some studies draw a distinction between the bias associated with the verb and the bias associated with the sentence fragment (e.g., *rolled* is typically intransitive when *the ball* is its subject; Stowe, 1989), in a way that

corresponds to the distinction between the verb implicit-causality bias and the implicit-causality bias for the event. So defining implicit causality in this way allows a straightforward account of processing behaviour, which is directly comparable with other work in language comprehension.

### WHY IMPLICIT CAUSES (AND CONSEQUENCES) ARE NOT MEANINGS

On our account, there is a close link between implicit cause and explicit cause, because the implicit-causality bias constitutes the likely reasons given for an event, and the explicit cause provides those reasons in a given instance. In contrast, Crinean and Garnham (2006) interpret implicit causality in terms of the verb's thematic roles, and state that the Agent in an Agent-Patient verb (or the Stimulus in a Stimulus-Experiencer or Experiencer-Stimulus verb) simply *is* the cause. Related accounts differ in details, but also define the cause thematically, in terms of the meaning of the event (Au, 1986; Brown & Fish, 1983; Stevenson, Crawley, & Kleinman, 1994). But we have noted that explicit causes almost always provide reasons for the event. Such accounts therefore use implicit cause in a way that is unrelated to the explicit cause. This is problematic, because the notion of implicit cause exists to explain the distribution, production, and comprehension of explicit causes, just as the purpose of having a notion of syntactic bias is to explain the distribution, production, and comprehension of syntactic forms.

Because Crinean and Garnham (2006) claim that implicit causality (and consequentiality) is simply part of the definition of (a particular sense of) the verb, it follows that it is 'all or none'. This conflicts with Garvey and Caramazza (1974), who said that each type of verb (i.e., NP1- or NP2-biased) 'carries with it a *weighting* toward one or the other direction of attribution of cause' (p. 462, emphasis added). In accord with them, we assume that *questioned* has an 80% NP1-bias if 80% of explicit causes refer to NP1. In contrast, Crinean and Garnham claim that *questioned* has a 100% NP1-bias because it is an Agent-Patient verb. But incongruent sentences are common, comprising between a third and a half of responses for some verbs (see the Appendix to Crinean & Garnham, 2006) and are clearly acceptable (e.g., Stewart et al., 2000, generated highly plausible incongruent sentences), so the account leads to a large gulf between implicit and explicit cause. In fact, many Agent-Patient verbs show weak biases or indeed no discernable bias at all. For instance, Rudolph and Försterling's (1997) meta-analysis found that descriptions of events using Agent-Patient verbs received NP1 attributions only 64% of the time. More importantly, *Descriptive Action Verbs* (e.g., *kick*) show no clear bias to the Agent (Mannetti & De Grada, 1991; Semin & Fiedler, 1988). These verbs make reference to a concrete

action, have at least one invariant feature (e.g., *kick* always involves a foot), have a clear beginning and end, and do not have a strong evaluative component.

However, the most serious problem comes from so-called Agent-Evocator verbs. Crinean and Garnham (2006) propose that Agent-Patient verbs have NP1 implicit causality, except when the Patient is actually an Evocator, which is defined loosely as the entity initiating the event or the indirect cause. For instance, Mary is the Evocator in *John complimented Mary*, because Mary must have done something to lead to John's compliment. It is clear, however, that such an Evocator is the Patient in the event (here, the event of complimenting) and is only called the Evocator because people tend to provide a reason for the event that is framed in terms of it rather than in terms of the Agent. Perhaps because this reason does not form part of the meaning of the event, linguistic semantics does not recognise an Evocator thematic role (e.g., Dowty, 1991; Jackendoff, 1987). Indeed, the semantic basis for Crinean and Garnham's specific classifications is not clear, with *apologized* and *flattered* being classified as Agent-Patient verbs but *complimented* as an Agent-Evocator verb. In fact, their classification reflects the explicit causes provided for these verbs: 'We suggest that one semantic criterion for membership of this group of verbs is that, unlike the other semantic types, they have both their cause and consequences associated with the same individual' (p. 644). Thus, their classification is circular.

## CONCLUSIONS

If implicit causality is not the cause of the event described by the verb, what is it? We claim that it provides an abstraction of the type of reason that is most likely to be provided for the event, and indicates which entity the reason tends to be about. Hence, it is an inference from a description of an event. When that event is 'neutral', we can determine the way in which the verb itself directs that inference (hence the verb implicit-causality bias). Implicit consequentiality is similar, except that it provides an abstraction of the type of consequence that is most likely to be provided for the event.

How then do people compute the inference of implicit causality? Various components of the verb's meaning are of course important. One relevant component is provided by its thematic roles, but other relevant factors include how enduring the event is, how concrete it is, whether it is telic or not (Semin & Fiedler, 1988; Rudolph & Försterling, 1997), and how negative its connotative meaning is (Semin & Marsman, 1994). In addition, properties of the participants affect implicit causality. Changing the gender (Lafrance, Brownell, & Hahn, 1997), animacy (Corrigan, 1988, 1992), or typicality (Corrigan, 1992; Garvey et al., 1976) of the participants changes the implicit-

causality bias, as do contextual factors that affect focus (Majid, Sanford, & Pickering, 2006). Finally, syntactic form is important, with causal attribution differing for active versus passive constructions (Au, 1986; Garvey et al., 1976; Kasof & Lee, 1994). Much less is known about how people compute the inference of implicit consequentiality, but it is presumably determined by a similar range of factors. All of these factors affect the construction of the event representation, and it is this event representation that is used to *infer* the cause or consequence.

Notice that some manipulations may change thematic role assignment. For example, an animate subject of *amused* may be agentive on one reading (e.g., *John amused Mary*) but an inanimate subject of *amused* cannot be agentive (e.g., *the picture amused Mary*). But such effects depend on particular verb ambiguities and do not hold for most verbs or most manipulations. More importantly, they do not co-occur with effects on implicit causality. Whereas *The father praised the son* has a stronger NP2-bias than *The son praised the father* (Garvey & Caramazza, 1974), both *the father* and *the son* are the Agents of their respective events. Manipulations of thematic roles merely constitute one factor that affects implicit causality. Finally, animacy and typicality can affect misassignment of thematic roles in the interpretation of passives (Ferreira, 2003), but this finding does not explain the difference between implicit causality and correct thematic role assignment in actives or passives.

Crinean and Garnham (2006) pointed out that there is a systematic relationship between implicit causality and implicit consequentiality. Their observation is likely to lead to a programme of research concerned with explicating people's grounds for attributing reasons to events and determining the likely consequences of events. But it is not right to equate implicit causes and consequences with thematic roles, as they suggest. Implicit causality and consequentiality do not constitute parts of the meaning of events, but rather are abstractions over the likely reasons for the event and consequences of the event.

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