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The Implicit Causality in Verbs

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Abstract: Natural languages display a great variety of devices that are used to speak of causal relations, ranging from prepositions, subordinating conjunctions and verbs. The present contribution provides a review of both theoretical and psycholinguistic approaches to causality in language. The focus will be causal relations expressed by verbs. Implicit causality refers to the observation that certain verbs tend to prefer statistically reliable causal antecedents (Garvey and Caramazza, 1974). These causal biases can affect the likelihood of remention in the subsequent discourse.

Keywords: Prominence, verbs, implicit causality, pronominalization, next mention.

1. Introduction

In discourse processing, interlocutors collaborate towards coherence, negotiating for a mutually shared mental discourse model. Coherence is achieved by means of lexical knowledge and different grammatical processing cues, as well as by the need to establish prominence relations between discourse referents. Most models put forth so far have looked at how referent tracking and reference resolution are used to achieve coherence. The general consensus is that in a given discourse segment referents are not equally prominent and that speakers explicitly or implicitly signal a referent's degree of prominence (Ariel, 1988; Gundel, Hedberg, & Zacharski 1993; Chiriacescu 2011a).

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One way to signal referential prominence is by using a particular type of referring expression. For example, it was shown that while pronouns tend to refer back to the most accessible referent previously mentioned, demonstratives are associated with less accessible or prominent referents (Hobbs, 1979; Grosz & Sidner, 1986; Kehler, Kertz, Rohde, & Elman, 2008). The common assumption is that the more elaborated a type of referring expression is, the less prominent its associated referent is (Ariel 1988; Gundel, Hedberg, & Zacharski 1993). Most studies focused on personal pronouns as a testing ground for highly prominent referents and investigated the factors that contribute to pronoun use and interpretation. Different syntactic, semantic and information structural factors have been shown to affect pronoun resolution and thus the prominence of referents.

The question of how information conveyed by the main verb of a sentence contributes to the sentence's grammatical structure has been investigated in recent years. Research has focused on the way in which the causality implicit in verbs impacts the prominence of referents (Au, 1986; Brown & Fish, 1983; Caramazza, Grober, Garvey, & Yates, 1977; Ehrlich, 1980; Hudson, Tanenhaus, & Dell, 1986). In pre-theoretical terms, this property defining some verbs is understood as the amount of knowledge that may be activated when comprehenders decide who did what. Upon hearing a transitive sentence with two human referents, it is this implicit knowledge shared by discourse participants that may guide the interpretation of the event described in the immediately following sentence. For example, when hearing a sentence like *Mary admires Rebecca*, comprehenders activate the background information that there must be a reason, or more generally a cause, that determines *Mary* to admire *Rebecca*. *Rebecca* must have some special property or trait that makes her admirable by others.

Moreover, the implicit causality interpretation generated by the verb used in one clause may influence the assignment of reference to the pronoun in the next sentence by singling out one of the two referents as the cause of the event described. Returning to the example introduced above, if we continue the sentence *Mary admires Rebecca* with a pronoun, this pronoun is more likely to co-refer with the causally implicated referent, in this case, *Rebecca*, than with *Mary*.

In this paper, we review work on the implicit causality of verbs, the way in which such verbs give structure to the discourse and how they affect the prominence of referents. The paper is structured as follows. Section 2 introduces implicit causality as a factor associated with prominent referents. Section 3 reviews some studies that tested the effects of different verbs in terms of likelihood of subsequent mention and linguistically triggered explanations in the following sentence. The last section concludes the paper.

2. Implicit causality

Causal relations such as explanations are considered to be crucial to our understanding of discourse, i.e. in texts spanning more than one sentence (Hobbs, 1979; Kehler, 2002; Asher and Lascarides, 2005). In discourse, we may find a number of different kinds of causal relations. They may be expressed by linguistic devices such as the connectives *because* and *therefore*, or they may be left implicit and hence must be inferred by the comprehender. One of the key findings in the literature on text processing is that causal relationships play a distinguished role in structuring the meaning of a text and its integration into a mental model of the discourse (van den Broek & Trabasso 1986).

The phenomenon of causality in language has been investigated from different perspectives, such as the computation of serial causal relations in a narrative (Fletcher & Bloom 1988, van den Broek & Trabasso 1986) and the processing of coherence chains. Central to the purpose of this paper is the investigation of the effects of implicit causality of verbs on reference tracking and reference resolution. It was shown that in a transitive event introducing two referents, implicit causality affects the process of interpretation of a subsequent pronoun towards the causally implicated antecedent (Chang, 1980; Corbett & Chang, 1983; Gernsbacher, 1989; MacDonald & MacWhinney, 1990; McKoon & Ratcliff, 1980, 1984). Moreover, the causally implicit argument has been shown to be more prone to be mentioned next. Accordingly, implicit causality has been associated with prominent referents. In the following we review several studies that investigated the causality implicit in verbs and the way in which they affect the prominence of referents. First, we discuss the implicit causality of verbs and its possible sources. Second, we review several ways in which verbs have been classified.

Following Heider (1958), who was the first to investigate the attributions triggered by different transitive verbs, Garvey & Caramazza (1974) empirically tested this property of verbs. They coined the term “implicit causality” to describe the property of interpersonal verbs that relate two human or animate entities in such a way that one of the entities is “implicated as the assumed locus of the underlying cause of the action or attitude (Garvey & Caramazza 1974: 460)”. The implicit cause of the event described in the main clause may influence the interpretation of the explicit statement of the cause in the subsequent clause. Consider example (1), which illustrates this point. This sentence gives rise to the implicit assumption, that there must be a reason, or cause, for why *Anna* admires *Rebecca*. In this particular case, it is most probable that *Rebecca* has either some particular traits or properties, or has done something so that she is admirable by others. So, although the clause says nothing explicit about the cause of the event it describes, it nevertheless indicates that the second referent, *Rebecca*, is the locus of the implicit cause.

(1) Anna admires Rebecca since high school.

Implicit causality is a highlighting mechanism as it makes one of several participants in an event the cause of that event. Furthermore, Garvey and Caramazza 1974 show that the property of implicit causality is triggered by the semantics of the verb root, but that the direction of causal assignment may vary. They distinguish between three verb types: some, such as *admire, telephone* or *approach* assign the cause of the event to the first noun phrase (NP), the subject, while other verbs, such as *fear, praise,* and *admire* attribute the cause to the second referent, the object. The third class, such as *babysit, see* or *hear*, are considered neutral towards the assignment of the cause. These theoretical considerations were then tested in a sentence completion study on English, in which participants were asked to continue sentences with an ambiguous pronoun prompt. Results showed reliable biases for some verbs to attribute the cause of the event to the first referent, and for other verbs to attribute the cause to the second referent. A third category of verbs did not preferentially attribute the cause to the first or second referent and remained neutral towards this attribution.

An additional study by Caramazza, Grober, Garvey, Yates (1977) showed that participants were faster to identify the antecedent of a pronoun after reading a sentence containing a verb exhibiting implicit causality if that pronoun was consistent with the causality implied by the verb than if it was not. For example, when asked to interpret the referent for *he*, participants responded Jimmy faster after reading sentence (2a) than they responded Michael after reading sentence (2b).

(2a) Jimmy confessed to Mary because he wanted forgiveness.
(2b) Cathy confessed to Michael because he offered forgiveness.

Heider (1958) classified verbs by dividing them into two major classes, namely actions (e.g. hit) and states or sentiments (e.g. admire). Action verbs are analysed as being attributed to the actor argument and subject of the sentence, while state verbs are generally attributed to the sentence object, who stimulates the state or sentiment in the actor.

The distinction proposed by Heider was later enriched by the classification of transitive verbs based on semantic roles. Interpersonal action verbs such as *cheat* or *help* were divided into agent-patient (e.g. hit, XX) and agent-evocator (e.g. criticize, praise) verbs (Rudolph & Försterling, 1997). The agent argument in both classes is an entity that causes or instigates an action, having its own motivational force. However, in the case of agent-evocator verbs, the action of the agent is a reaction to the behaviour of the other argument. The patient argument is described as an entity that suffers a change of state (Brown & Fish 1983).

This classification further divides state verbs, which describe experiences or feelings, into stimulus-experiencer verbs and experiencer-stimulus verbs (Brown & Fish, 1983; Greene & McKoon, 1995; Levin, 1994). In the case of stimulus-experiencer verbs such as *disappoint* or *fascinate*, the sentence subject takes the role of a stimulus that evokes a feeling or mental state in the sentence object, the experiencer. In the case of experiencer-stimulus verbs as *admire*, or *love*, the sentence

subject experiences a feeling or mental state triggered by the sentence object, the stimulus. Several empirical investigations have highlighted the importance in terms of assigned causal weight to the stimulus argument in both cases. For stimulus-experiencer verbs, the subject or the first mentioned referent is the causally implicated one, whereas for experiencer-stimulus verbs it is the object referent (Au, 1986; Brown & Fish, 1983). The effects of different verbs have been tested in several ways, as will be discussed in the next section.

3. Effects of implicit causality

Different aspects of implicit causality verbs have been extensively investigated. On the one hand, for the domain of social cognition it was particularly interesting to analyse how information about interpersonal exchanges encoded in different verbs relates to models of social cognition (Brown and Fish 1983, Rudolf & Försterling 1997). On the other hand, linguists and psycholinguists have been concerned with a more fine-grained classification of verbs based on their semantic characteristics and with the processing of implicit causality verbs in sentence or discourse. Results showed that verbs display effects in terms of next mention biases and preferential types of continuation (e.g. explanation continuation) in the subsequent discourse. We will elaborate upon these two findings in the following.

Recent investigations showed that the next-mention rates of referents in one clause can be systematically affected by the verb in the previous clause (Garvey, Caramazza, & Yates, 1974). Numerous verbs bias listeners to resolve the re-mentioned referent to the previous subject (e.g. amuse, delight), to the previous object (e.g. admire, criticize, love), or they remain neutral towards this preference, as discussed above. Accordingly, the pronoun in the second sentence of (3a) is preferably interpreted as co-referring with the initial subject argument, *Mary*, whereas the pronoun in (3b) is preferentially interpreted as referring back to the second argument, which is the object referent, *Jane*. Finally, the pronoun in the third sentence, (3c), is ambiguous as it can refer back to both the initial subject or object arguments. Based on the word order of subject and object, verbs like *amuse* are characterized as NP1-biased verbs, verbs such as *admire* are characterized as NP2-verbs, whereas verbs like *see* are considered neutral. The preference for one antecedent argument over the other cannot be reduced to the plausibility of the material in the second sentence. The proportion of continuations picking up the subject or the object referent is referred to in the literature as implicit causality bias (Crinean & Garnham, 2006, among many others).

The bias towards one of the two referents has generally been tested in production studies using a pronoun prompt in the second sentence, as illustrated in (3). In such experimental contexts, participants are given sentences like the ones in (3a) and (3b) and are asked to continue them by adding a continuation sentence to each of them, starting with the pronoun in the second conjunct.

(3) a. Mary$_1$ amuses Jane$_2$. She$_1$_____
b. Mary$_1$ admires Jane$_2$. She$_2$_____
c. Mary$_1$ saw Jane$_2$. She$_{1/2}$_____

These biases towards the subject or the object referent are manifestations of an expectation about who will be mentioned next in the discourse and can affect the resolution of a subsequent pronoun (Garvey et al., 1974; Kehler, Kertz, Rohde & Elman, 2008, Hartshorne, 2014).

Furthermore, it has been shown that implicit causality verbs not only display a particular bias towards who will be mentioned next, but they are also more likely to give rise to explanation continuations (60%), compared non-IC verbs (24%, Kehler et al., 2008), which prefer other types of continuations. For example, there is a reported strong preference to give an explanation about why *Mary* amuses *Jane* in (3a), or about the reason why *Mary* admires *Jane* in (3b). These expectations of continuation come about as a result of the fact that both verbs, *amuse* and *admire*, are implicit causality verbs. The two verbs differ in that there is a strong preference for providing an explanation referring primarily to the subject argument (3a). For *admire*, however, participants preferably produce continuations referring to the object argument (3b). On the contrary, other verbs such as *hear* or *see*, which are non-IC verbs, do not trigger such continuation expectancies. Neutral verbs do not trigger explanation continuations and may be continued with different types of continuations (e.g. elaboration, occasion, parallel).

Moreover, the bias to continue with explanation continuations is even stronger in "because" and full stop contexts. First, the preference to continue with an explanation that focuses on one of the two arguments is boosted when the first sentence containing a causally implicit verb is followed by a sentence that is introduced by the subordinate conjunction *because*, which explicitly triggers an explanation continuation. These preferences are standardly tested in production studies in which participants are asked to continue sequences ending in because-prompts, like those illustrated in (4), with sample continuations in parenthesis.

(4) a. Mary$_1$ amuses Jane$_2$. Because_____ (she was in control of the situation).
b. Mary$_1$ admires Jane$_2$. Because_____ (she was in control of the situation).

Second, implicit causality verbs trigger more explanation continuations when prompted for continuations by a full stop, compared to a pronoun prompt in the next sentence (e.g. Kehler et al. 2008). Accordingly, speakers of English are more prone to continue talking about the reasons why *Mary* amuses *Jane* in (4a), rather than e.g. talking about what happened next, as they are not restricted to use a pronoun in the next sentence.

In sum, previous experimental investigations showed that implicit causality verbs display effects in terms of next mention biases and preferential types of continuation (e.g. explanation continuation) in the subsequent discourse.

4. Conclusions

In discourse, language users build a discourse representation that contains the entities, times and events implicitly and explicitly introduced and the relations among these events (Grosz & Sidner, 1986; McKoon, Ratcliff, Ward, & Sproat, 1992; McKoon, Ward, Ratcliff, & Sproat, 1992; Webber, 1983, Chiriacescu 2011a, 2011b, Jasinskaja, Chiriacescu, Donazzan, von Heusinger, & Hinterwimmer 2015). In such constellations, entities are not equally prominent, but are ranked in relation to one another. Different syntactic, semantic and discourse-pragmatic factors contribute to the ranking of referents at each point in the discourse. In this paper we focused on the causality implicit in verbs as another factor that contributes to the ranking of referents with respect to their prominence. Recent investigations have demonstrated that verbs come in different flavours and that they impact the likelihood of a referent to be mentioned next and the type of continuation that will be used. With respect to the likelihood of subsequent mention of a particular referent, a threefold classification has been proposed, which distinguishes between NP1-biased, NP2-biased and neutral verbs. The proportion of continuations picking up the subject or the object referent is referred to in the literature as implicit causality bias (Crinean & Garnham, 2006, among many others).

An interesting observation is that since the first elaborated account of implicit causality proposed by Brown and Fish (1983), this phenomenon has been attested in a variety of different languages. A large number of researchers have translated some of the English verbs initially tested by Brown and Fish (1983) into Japanese and Cantonese (Brown 1986), Greek (Natsopoulos, Grouios, Bostantzopoulou, Mentenopoulos, Katsarou, & Logothetis, 1993), Spanish (Goikoetxea, Pascual, & Acha, 2008) and other languages and found equivalent biases. The general conclusion from these studies is that implicit causality constitutes a cognitive universal, such that the same verb translated in another language will trigger the same pronoun interpretation in discourse. However, disadvantages of previous translation studies are: determining what counts as the right translation in another target language, the limited number of verbs tested in one language, focusing on the same verbs that showed a strong bias towards one of the arguments. Despite generating strong predictions and being widely tested, the claim concerning the universality of verbal implicit causality has not been challenged (with few exceptions). Future investigations will show whether implicit causality is indeed a universal component of the verbal domain cross-linguistically. Moreover, future analyses will show what the underlying source of implicit causality is, whether it stems from the semantics of each verb, or whether it is triggered by the world knowledge associated with verbs.

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