



Choosing anaphoric expressions: Do people take into account likelihood of reference?

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ABSTRACT

Research has shown that following a sentence fragment such as *John impressed Mary because...*, people are most likely to refer to *John*, whereas following *John admired Mary because...*, *Mary* is the preferred referent. Two written completion experiments investigated whether such semantic biases affect the choice of anaphor (pronouns vs. names). Experiment 1 investigated biases due to verb semantics, and Experiment 2 contrasted biases due to different connectives (*because* vs. *so*). Frequency-based accounts such as proposed by Arnold (2001) and functional linguists (e.g., Givón, 1988, 1989) suggest that the likelihood of reference to a particular discourse entity should affect the choice of anaphor: more pronouns (relative to names) for the bias-consistent entity than the bias-inconsistent entity. Although the semantics of the verb and connective had strong effects on the choice of referent, neither experiment showed any effect of semantic bias on the choice of anaphoric form. In contrast, structural factors did affect anaphoric choice.

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Introduction

When people refer to a previously mentioned discourse entity, they can use various types of anaphoric expressions such as pronouns, proper names, or definite descriptions. An important question for models of language production is how people choose among different expressions. A general assumption is that the choice of anaphor depends on the referent's accessibility or how activated it is in the discourse representation. When the referent is highly accessible in the discourse, reduced anaphoric expressions such as pronouns tend to be used, whereas when it is less accessible, more explicit expressions such as proper names and definite descriptions are used (Ariel, 1990; Chafe, 1976; Chafe, 1994; Givón, 1983; Grosz, Joshi, & Weinstein, 1995; Gundel, Hedberg, & Zacharski, 1993).

Several factors have been identified to affect accessibility and hence the choice of anaphoric expressions. For

example, a referent is more accessible when it has been mentioned more recently or more frequently in the preceding discourse, so more reduced anaphoric expressions such as pronouns tend to be used under such conditions (Ariel, 1990; Givón, 1983). Other research has shown that people use more pronouns when the referent is the grammatical subject in sentence-initial position rather than a later-mentioned object in the immediately preceding clause (Arnold, 2001; Brennan, 1995; Fletcher, 1984; Stevenson, Crawley, & Kleinman, 1994), consistent with theoretical accounts that claim that the referent's accessibility is affected by structural properties of the preceding sentence such as the antecedent's grammatical role (e.g., Brennan, Friedman, & Pollard, 1987; Frederiksen, 1981; Gordon, Grosz, & Gilliom, 1993; Grosz et al., 1995) or surface sentence position (Gernsbacher & Hargreaves, 1988; Gordon et al., 1993).

In this article, we investigate whether the likelihood of referring to an entity, which has been argued to influence the activation of discourse entities, also constrains the form of anaphoric expressions. Many studies have shown that verb semantics influences which entity people are

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most likely to refer to next (Au, 1986; Brown & Fish, 1983; Caramazza, Grober, Garvey, & Yates, 1977; Garvey & Caramazza, 1974; Garvey, Caramazza, & Yates, 1975; Stevenson et al., 1994). When completing sentence fragments such as (1a), people tend to start their completion by referring to *John* as the subject of the subsequent clause (e.g., *because he/John was very clever*), whereas when completing sentence fragments such as (1b), they tend to refer to *Mary* (e.g., *because she/Mary was very clever*).

1a John impressed Mary because...

1b John admired Mary because...

Such completion preferences have been assumed to occur because verbs such as *impress* have a semantic bias that attributes causality to the first mentioned noun phrase (NP1), whereas verbs such as *admire* have a bias that assigns causality to the second mentioned noun phrase (NP2) (often referred to as *implicit causality biases*). Some researchers have argued that this is because certain semantic roles are more likely to be seen as the cause of the event denoted by the verb (Au, 1986; Brown & Fish, 1983; Crinean & Garnham, 2006; Stevenson et al., 1994). For instance, *impress* is a stimulus-experiencer verb because NP1 has the semantic role of stimulus and NP2 the role of experiencer, whereas *admire* is an experiencer-stimulus verb because NP1 is the experiencer and NP2 the stimulus. When these verbs are combined with the causal connective *because*, people tend to associate causality with the stimulus rather than the experiencer. Other researchers have argued that completion preferences cannot always be predicted from the verb's semantic roles and that the effects are due to more subtle properties of the event that is described by the sentence (Garvey & Caramazza, 1974; Garvey et al., 1975; Pickering & Majid, 2007). For example, modal verbs (e.g., *may*) (Grober, Beardsley, & Caramazza, 1978) and verb tense (Rohde, Kehler, & Elman, 2006) have been shown to affect completion preferences. In the following, we will refer to completion preferences determined by the meaning of the verb (including its modality and tense) and the connective as *semantic biases*.

Of interest is whether the choice of anaphor is affected by such semantic biases. Many researchers have assumed that semantic biases modulate accessibility in the discourse, so that entities congruent with the semantic bias are more accessible than those that are not. That is, following (1a), NP1 (*John*) is more accessible than NP2, whereas following (1b), NP2 (*Mary*) is assumed to be more accessible (e.g., Garvey & Caramazza, 1974; Greene & McKoon, 1995; Long & De Ley, 2000; McDonald & MacWhinney, 1995; Stevenson et al., 1994). Consistent with this, probe recognition studies have shown that names denoting bias-consistent entities are recognised more quickly than those denoting bias-inconsistent entities (e.g., Long & De Ley, 2000; McKoon, Greene, & Ratcliff, 1993). Similarly, people preferentially interpret ambiguous pronouns as co-referent with entities that are consistent with the semantic bias (Kehler, Kertz, Rohde, & Elman, 2008; Stevenson et al., 1994), and unambiguous pronouns are comprehended faster when they refer to the bias-consistent

entity (e.g., *he* in (1a) and *she* in (1b)) than the bias-inconsistent entity (e.g., Koornneef & Van Berkum, 2006; Van Berkum, Koornneef, Otten, & Neuwland, 2007; Vonk, 1985).

Given the general assumption that choice of anaphor is affected by referents' accessibility in the discourse, it seems plausible that anaphoric forms for bias-consistent entities are more reduced than for bias-inconsistent entities. Such an account has been proposed by Arnold (2001, 2008) who argued that an entity's level of activation is affected by how likely it is to be referred to in the subsequent discourse. Arnold (2001) argued that: "in cases in which speakers are more likely to refer to entities that have played certain thematic roles, both speakers and comprehenders should find pronouns more natural than fuller forms of reference to refer to these entities" (p. 158).

Arnold's frequency-based account is in line with functional linguists who have equated predictability with givenness (Kuno, 1972, 1978; Prince, 1981) and accessibility (Givón, 1988, 1989). For example, Givón (1989) argued that predictable information is "more readily available (...) or (...) more vividly activated in the memory, thus more strongly attended to", so "It does not – unlike new unpredictable information – require strong activation by massive coding" (p. 218). Thus, according to Givón, reduced referring expressions such as pronouns should occur in more predictable contexts than more explicit expressions. Importantly, he assumes that predictability is determined by various types of contextual information, including the semantics of the discourse.

Similarly, some probabilistic models of human language processing also assume a link between the predictability of a word and its form reduction (Bell et al., 2003; Gregory, Raymond, Bell, Fosler-Lussier, & Jurafsky, 1999; Jurafsky, Bell, Gregory, & Raymond, 2001). These models claim that the more predictable or probable a word is because of its neighbouring words, syntactic and lexical structure, semantic expectations and discourse factors, the more phonologically reduced the word is. Indeed, words tend to be shorter in duration when their neighbouring words make them statistically predictable than otherwise (Bell et al., 2003; Gregory et al., 1999; Jurafsky et al., 2001). Importantly, several researchers, including Arnold (2008) and Givón (1988, 1989), assume that predictability affects not only acoustic reduction but also reduction of lexical form (e.g., a pronoun rather than name). For example, Fowler, Levy, and Brown (1997) argued that referring expressions for highly predictable entities are not only acoustically reduced but also lexically reduced, so more reduced referring expressions such as pronouns should be used for more predictable entities. Consistent with this, factors that have been argued to influence predictability and acoustic reduction, such as prior mention and frequency of mention (Bard & Aylett, 1999; Fowler & Housum, 1987; Fowler et al., 1997), have also been shown to influence anaphoric form (Ariel, 1990; Givón, 1983; Levy & McNeill, 1992).

According to frequency-based accounts, semantic biases should affect the choice of anaphor because *what* people refer to and *how* they refer are determined by the same constraints. Evidence that supports this claim comes

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