Implicit Causality Can Affect Pronoun Use in Fragment Completion Tasks

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An unresolved debate surrounds the question of whether speakers pay attention to predictability when choosing referential expressions. Every act of referring requires speakers to choose between explicit expressions (e.g., the *professor*) or attenuated ones (e.g., *she*). Several production theories suggest that less-explicit forms are used when a word conveys information that is already predictable from the context (e.g., Aylett & Turk, 2004; Tily & Piantadosi, 2009). Yet there is mixed evidence about whether this generalization applies to pronoun production.

Most of this work examines pronoun use in contexts where semantic constraints make one character more predictable – that is, more likely to be re-mentioned in the discourse. For example, in *Amanda amazed John because…*, Amanda is predictable because she is considered the likely cause of John's amazement, and "because" signals an upcoming explanation (e.g., Kehler et al., 2008). By contrast, for verbs like "admire" (e.g., *Amanda admired John because…*), the object (*John*) is the implicit cause. Numerous studies have examined these contexts with a fragment completion task. Results show that people tend to re-mention the implicit cause (i.e., it is predictable), but do not use pronouns more frequently to refer to the implicit cause (Fukumura & Van Gompel, 2010; Kaiser et al., 201; Kehler et al., 2008; Rohde & Kehler, 2014). Rather, pronoun use is driven by a syntactic bias, where pronouns are used more for the subject than the object.

By contrast, implicit causality did affect pronoun use in a recent study using a different task, where participants memorized facts about different characters, and then filled in the more plausible fact to finish the sentence (Weatherford & Arnold, 2019). This study provided a richer context by introducing a set of characters appearing in all the stories, and with a context sentence for each story, e.g. *The maid and the cook put away the dishes on the top shelves. The cook appreciated the maid because {the maid/she} was tall.* In this task, people did use more pronouns for the implicit cause. This finding is consistent with evidence that semantic biases also guide pronoun use for a different verbtype (Arnold, 2001; Rosa & Arnold, 2017). The conflict between the above findings is critical to resolve, because it bears on a fundamental question about whether predictability affects referential form choices. This raises a question: for fragment-completion task, would adding a richer context be enough to observe an implicit causality effect on pronoun use?

We test this question using Weatherford & Arnold's stories, but in a fragment-completion task. Participants (24 for Exp. 1, 24 for Exp. 2) were introduced to the story setting and 6 characters (3 male, 3 female) with pictures. Then they read fragments (see Fig. 1) and provided a natural ending. Each story included a context sentence and a fragment with an implicit causality verb. For the 12 critical items, we manipulated verbs so that half the time the implicit cause was in subject position, and half in object position. As a control, the subject was first-mentioned in the context sentence half the time. Participants were instructed to begin their continuation with the character we underlined. The target was manipulated within each item, such that each of the two lists had 3 items in each of the four conditions resulting from the 2 (subject vs. non-subject) by 2 (implicit cause vs. non-cause) design. In Exp. 1 the critical stimuli had two same-gendered characters; in Exp. 2 the two characters had different gender. We examined pronoun use for the targets and expected more pronouns when the pronoun was unambiguous in Exp. 2. The critical question is whether implicit causality would increase pronoun use.

Results critically showed that subjects used more pronouns for the implicit cause, but only when the pronoun was ambiguous (Exp. 1) and not in Exp. 2. In both experiments people used pronouns more for the subject. This shows that the predictability effect of implicit causes can be observed in sentence-completion task. However, this effect is fragile. We speculate that our context-rich stimuli encouraged speakers to make inferences about referential predictability, supporting this effect. But even so, when gender made pronouns unambiguous, pronouns became more attractive, which wiped out the subtle effect of semantic bias. Furthermore, participants showed strong individual biases, raising concerns about how the fragment completion task relates to natural language performance.

Exp.1 (Gender-Ambiguous)	Exp.2 (Gender-Unambiguous)
Context: 1. Non-subject & cause continuation: The duke and the butler played pool. 2. Subject & Non-cause continuation: The duke and the butler played pool.	**Context:** 1. Non-subject & cause continuation: The maid and the duke played pool. 2. Subject & non-cause continuation: The maid and the duke played pool.
Prompt: The butler admired the duke because…	**Prompt:** The maid admired the duke because…
Sample Response: 1. He/the duke played well. 2. He/the butler could never beat the duke.	**Sample Response:** 1. He/the duke played well. 2. She/the maid was impressed by the duke.

Figure 1. Examples of experimental stimuli in Exp.1 (left) and Exp.2 (right).
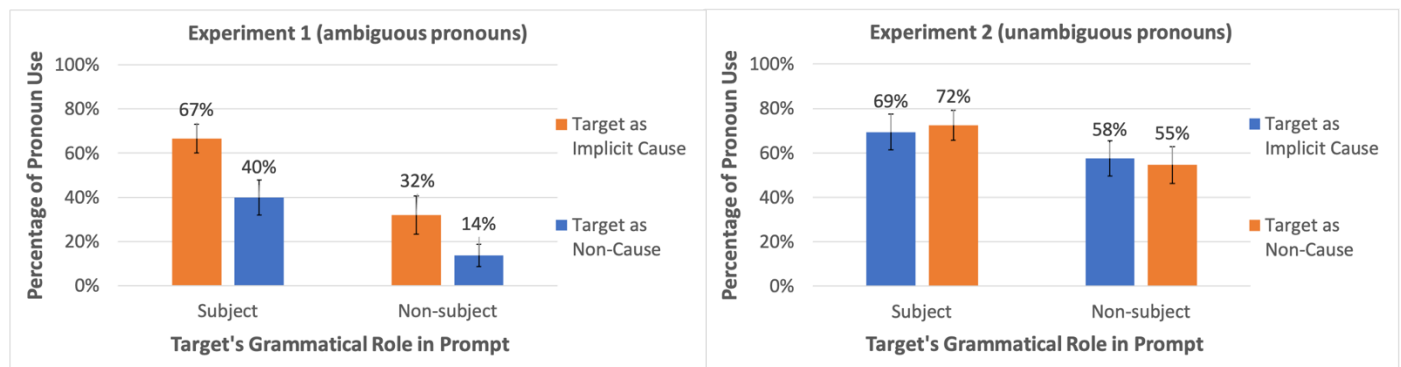

Figure 2. Percentage of pronoun use for the underlined character (target) in prompt as subject vs. non-subject and implicit cause vs. non-cause.

Experiment 1 Solutions for Fixed Effects				
Effect	**Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	-0.4795	0.3088	-1.55	0.1385
Implicit Causality	0.9161	0.3300	2.78	0.0060
Subjecthood	1.4149	0.3261	4.34	<.0001
Implicit Causality*Subjecthood	-0.08386	0.8479	-0.10	0.9232

Experiment 2 Solutions for Fixed Effects				
Effect	**Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	0.7664	0.3217	2.38	0.0258
Implicit Causality	-0.2510	0.3327	-0.75	0.4513
Subjecthood	0.8493	0.3731	2.28	0.0314
Implicit Causality*Subjecthood	-0.1073	0.6594	-0.16	0.8709

Figure 3. Summary of effects of implicit causality and subjecthood on pronoun production.

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