

The Role of Attention in Choice of Referring Expression

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Abstract

Many models suggest that the use of pronouns and other underspecified forms of reference is supported when the referent is in the listener's focus of attention, but it is unclear whether the mechanisms of production are conditioned by psychological attention, independently from the discourse structure. To get at this question, we examined effects of speaker and listener distraction on choice of referring expression during a narrative task. In all conditions, we observed the expected effects of discourse status: pronouns and zeros were used recently-mentioned referents, especially those that were previously in subject position. On top of this, distracted speakers used more specific referring expressions, and in particular fewer zeros. When the listener was distracted, speakers used less specific referring expressions, i.e. more pronouns and zeros. These results suggest that psychological attention does affect reference form. However, speakers do not condition form choice on the listener's focus of attention, or at least not in the expected direction.

Keywords: attention; discourse; referring expression

Background and Research Objective

How do people choose referring expressions that are specific enough to be uniquely identifiable but not overly informative or lengthy? Traditional models of reference form suggest that attention is the critical constraint in speakers' calculations about what forms to use (Chafe, 1987, Gundel, Hedberg & Zacharski, 1993). Gundel et al. (1993) state "It is widely recognized that the form of referring expressions... depends on the assumed cognitive status of the referent, i.e. on assumptions that a cooperative speaker can reasonably make regarding the addressee's knowledge and attention state" (p. 275). Models such as these suggest that speakers use less-specified expressions, like pronouns, when the referent is already in the attention of the addressee. More specific expressions, like descriptions or names, are used when the referent is less accessible in the discourse, or when introducing new referents.

Gundel et al.'s Givenness Hierarchy (1993) proposes that referential forms are determined by the referent's cognitive status, which can range from "in-focus" to "type-identifiable". By choosing a specific expression, for example, *it*, the speaker signals to her listener that the cognitive status for that form (in this case, "in-focus") has been met. They analyzed corpora in several languages, documenting the relationship between linguistic forms and

cognitive statuses. The results indicated that the vast majority of referring expressions were restricted to a particular cognitive status, and in some cases used for lower cognitive statuses, supporting the prediction that the statuses are implicationally related (Gundel et al. 1993). This analysis confirms that referential forms are specialized for pragmatic roles (for related analyses, see Ariel, 1990; Arnold, 1998; Givón, 1983). But note that the cognitive statuses were judged by the experimenters, on the basis of the information in the corpus. While it is plausible that these categories are related to psychological mechanisms of attention, this study did not directly measure the role of attention per se, nor whether the speaker's choices were driven by her own attention or that of the addressee.

The idea that linguistic form is related to attention is more generally implicit in the use of terms like "discourse focus", or "center of attention" to describe the linguistic contexts that support pronoun use (e.g., Grosz, Joshi & Weinstein, 1995). For example, pronouns are known to be preferred when the referent was recently mentioned (Givón, 1983), or if it was last mentioned as the grammatical subject of the preceding utterance (e.g. Brennan, 1993; see Arnold, 2008 for review). While these categories may also attract the actual attention of discourse participants, their effect on reference form may be independent of actual attention, and instead rely on the linguistic category itself. Under this view, reference choice may be driven solely by linguistic constraints, e.g., rules like "use a pronoun for the backward-looking center" (Grosz et al., 1995).

The link between reference form and attention is typically assessed with respect to the linguistic context, thus intertwining or even conflating the roles of the linguistic constraints and speaker or listener attention. The goal of the current project is to understand the role of psychological attention on reference form choices, independent from the known effects of the linguistic context.

We report an experiment that examined the effect of distraction on reference form choices in production. Speakers told stories to listeners while the speaker was distracted, the listener was distracted, or neither was distracted. The effect of distraction is considered in the context of a detailed analysis of the linguistic discourse structure.

The first question we addressed is whether reference production is sensitive to the actual, psychological attention of discourse participants. If psychological attention matters

(and not just the linguistic context), the distraction conditions should differ from the control no-distraction conditions.

If psychological attention is a contributing factor in the choice of referring expression, a second question is whether it is the speaker's own attention that matters, or the speaker's assumptions about the listener's attention. It is generally assumed that conversation participants maintain mental representations of the discourse entities and events in situations models. In these models, attended information receives greater activation (e.g. Bower & Morrow, 1990; Kintsch, 1988). Some theories assume that these models favor shared information, i.e., information that is in common ground (e.g., Clark, 1996). Yet the speaker's own attentional resources should also affect their representations, and thus pronoun use (Arnold & Griffin, 2007). The effects of speaker vs. listener attention are assessed in this experiment by manipulating distraction for speaker and listener separately.

A third question is in what direction an effect might be found. We consider several alternate predictions for how speaker and listener distraction might relate to reference selection. In all cases, we assume that the distraction manipulation results in a reduction in attentional resources available for the primary narrative task.

When speakers experience reduced attentional resources, they might become more egocentric, increasing the number of pronouns used. Perhaps accessing and producing pronouns is less demanding than more specific referring expressions, so speakers might use pronouns/zeros when unwarranted by the linguistic constraints (cf. Almor et al., 1999). Alternatively, speakers may become more specific, and use more explicit referring expressions when they are distracted. This is predicted by the idea that attention underlies the accessibility of discourse entities. Several models of reference production link reference form to accessibility, or focus. If speakers are dividing their attention between multiple tasks, referents that might normally be accessible or "in-focus" are less activated, and may therefore merit less specific referring expressions. Arnold & Griffin (2007) found that speakers used fewer pronouns in stories with more than one character, even if the characters were of different genders, and therefore wouldn't be ambiguous. They suggested that stories with multiple characters required speakers to distribute their attention, lowering the individual activation for each character and thus pronoun usage (see also Fukumura & Hyönä, 2011; Fukumura et al., in press). Finally, distraction may result in speakers using referential forms less systematically overall. This might be the case if the attention load of the distraction task makes it more difficult for speakers to access the discourse status information, resulting in referring expressions that are less closely tied to the discourse context.

When listeners are distracted, some models predict that speakers should use more specific referring expressions, under the assumption listener attention is the critical

determinant of referring expression (e.g., Chafe, 1976; Gundel et al., 1993). This might reflect the speaker's assumption that a distracted speaker would have a harder time following the story without explicit referential expressions. Alternatively, other studies have found that speakers use less detail in stories when talking to inattentive listeners (Kuhlen & Brennan, 2010, Pasupathi, Stallworth, & Murdoch 1998), potentially because they feel less socially engaged. This predicts a greater proportion of pronouns and zeros for distracted listeners

The ultimate goal of this line of research is to better understand the mechanisms that control reference form choice. Our approach is to determine the factors that are involved in such choices, and how they interact. The confines of the linguistic context are strong and fairly well understood, but do allow, in some situations, for flexibility. By examining the effects of attention within the constraints of the linguistic context, we can observe the relative influence of speaker and listener attention, and determine in what situations they impact reference choices. These findings will allow us to develop a model of a reference production that accounts for the effects of the linguistic context, as well as how it relates to attention.

Method

Participants

18 (13 female) university undergraduates participated in the experiment for course credit.

Materials and Design

We examined how reference production in a narrative task was influenced by distraction of either the speaker or addressee. The distracted participant did a nonlinguistic shape-sorting task on a computer, working as quickly as possible throughout the narrative task. Speakers viewed graphic presentations of 9 stories (see Figure 1), and recounted them to a confederate addressee in three conditions: speaker distracted, listener distracted, and no distraction. Blocks of 3 stories were assigned to each condition, rotated across subjects in a factorial design. Condition order was counterbalanced, but the speaker distraction always immediately preceded the listener distraction so that the speaker would have concrete experience with the listener's secondary task; thus the control condition always occurred either first or last.

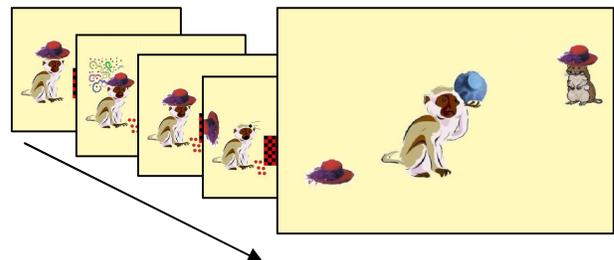


Figure 1: Story-telling task stimuli

The experiment was broken into 3 blocks, by condition, in which there were 3 stories. Each story involved two steps. During Step 1, speakers viewed the graphic stimuli of the story, at their own pace. During Step 2, the speaker recounted the story without viewing the story pictures. The distraction manipulation took place during this recounting – either the speaker or the listener completed the secondary task, or neither did. After Step 2 of each story was completed, the speaker moved on to Step 1 of the next story. Speakers were instructed to provide coherent, interesting stories. In order to motivate story accuracy, speakers were told that listeners would have to answer questions about the stories at the end of the task.

The distraction task was nonlinguistic, to provide a test of attention that cannot be explained as a discourse rule (see Figure 2). By contrast, evidence that linguistically prominent positions support pronoun use does not constitute proof for a role of attention. Linguistically “in focus” entities may attract attention, but this does not mean that attention is the critical cause of pronoun use.

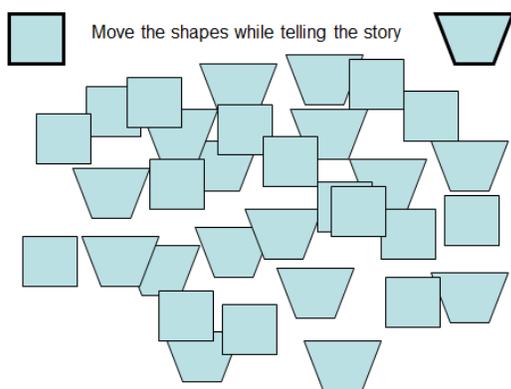


Figure 2: Secondary task stimuli

Analysis and Predictions

Importantly, the role of distraction was assessed against the backdrop of a fine-grained analysis of the linguistic context (Arnold, Bennetto & Diehl 2009). The stories were taped, transcribed, and separated into clauses. Clauses were defined as main or subordinate independent clauses, including all arguments. Within each clause, we examined all character references in grammatical subject position. These were coded as either a description (the mouse) or a pronoun (He/she/it) or zero (e.g., *The mouse sat down and Ø played checkers*). We analyzed reference form as two binary dependent variables: 1) all attenuated forms (pronouns and zeros) vs. descriptions/names forms, and 2) the most attenuated form (zeros) vs. pronouns and descriptions/names.

We examined the effects of distraction on reference form within four linguistic categories. These categories were determined by whether the referent of the expression had last been mentioned as 1) the subject of the previous clause, 2) a nonsubject of the previous clause, 3) two or more

clauses ago, or 4) was completely new. We also coded whether there was a competitor character in the previous clause or not.

The choice of reference form was analyzed with a multilevel logistic regression, using SAS proc glimmix. Continuous dependent variables (e.g., number of clauses) were analyzed in multilevel models, using SAS proc mixed. All models included random effects for both subjects and story. For each model, we first built a model with just the control variables: 1) List, 2) condition order, 3) whether the no distraction condition came first or last, and 4) number of words in the clause, not including those words in the referring expression. Only those with *t* values greater than 1.5 were entered into the model of interest. The effects of the control variables are not reported here.

If the relevant sort of attention for reference form is only the linguistic category of “discourse focus”, we should see strong effects of linguistic context, but no effects of distraction. If psychological attention is important, speakers’ referring expressions will differ between the two distraction conditions and the no-distraction condition. If speakers specifically monitor addressees’ attentional state, we should see a greater increase in explicit forms for distracted listeners than for distracted speakers.

Results

An example story corresponding to the visual stimuli presented in Figure 1 is displayed below.

“Okay in this story there is a monkey and a mouse playing checkers and um the um the monkey appears to beat the mouse in the game of checkers which angers the mouse so...so she uh throws a checker at the monkey removing her um large purple hat with red feathers and the um the checker not only removes the hat but it also hits the monkey in the head and the monkey is forced to try and heal herself with a uh one of those cold compresses.”

Story and clause length

We first examined the lengths of the stories and utterances. Speakers who were distracted told longer stories, i.e. with more clauses on average (9.15, SD=3.46) than in the distracted-listener (8.22, SD=2.87) or in the no distraction condition (7.98, SD=2.83). Multilevel models revealed a significant effect of speaker distraction ($p=0.004$), but no effect of listener distraction ($p=0.57$). By contrast, clauses in all conditions were about 9 words long, and the model revealed no effects of either listener ($p=0.90$) or speaker distraction ($p=0.41$).

Reference form

We examined the speaker’s choices in reference form (zero, pronoun, or description/name) as a function of the referent’s accessibility and the distraction condition. Table 1 shows the average proportion in each of these categories. For the purpose of modeling the speaker’s choices, we analyzed two dichotomies: 1) all attenuated forms, i.e. zeros and

pronouns, vs. descriptions (Figure 3), and 2) the most attenuated form, i.e. zeros, vs. pronouns/descriptions (Figure 4).

Of particular interest are cases where the speaker refers to characters who were mentioned in the previous clause, either as subject or nonsubject. These show the most variation among reference form types. Moreover, these categories highlight the importance of the grammatical role of the last mention of the referent (subject referents are more accessible), as well as the role of parallelism with the current clause (parallel reference supports the use of attenuated forms).

The following are some examples of reference in the first two accessibility categories, demonstrating how multiple forms of reference can be acceptable.

Pronoun reference to subject referent

Prior clause:

Okay so there's a dog uh who starts digging a hole

Current clause:

And he's got a bone in his mouth

Zero reference to a subject referent

Prior clause:

Alright so a penguin wearing a top hat uh was ice skating

Current clause:

And Ø fell through the ice

Pronoun reference to non-subject referent

Prior clauses:

The giraffe still has his kite though

And uh then it shows the lion

Current clause:

And he's all covered with paint [he=the lion]

Descriptive reference to non-subject referent

Prior clause:

And the koala bear returned the soccer ball to the kangaroo

Current clause:

And the kangaroo put it in its pouch

Table 1: Proportions of zeros, pronouns and noun phrases by discourse status of referent

		Subject-prior clause	Non-subject prior clause	2+ clauses ago	New
Speaker					
Distracted					
	Zero	0.266	0.000	0.027	0.000
	Pronoun	0.663	0.200	0.081	0.003
	Description	0.071	0.800	0.891	0.997
Listener					
Distracted					
	Zero	0.429	0.000	0.015	0.000
	Pronoun	0.509	0.440	0.061	0.010
	Description	0.061	0.560	0.923	0.990
No distraction					
	Zero	0.418	0.055	0.015	0.000
	Pronoun	0.442	0.278	0.094	0.000
	Description	0.140	0.667	0.890	1.000

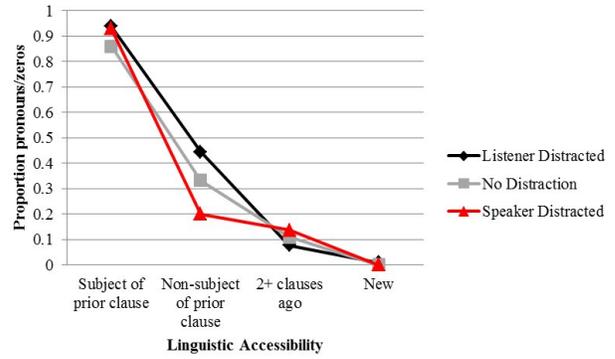


Figure 3: Proportion of pronouns/zeros by discourse status of referent

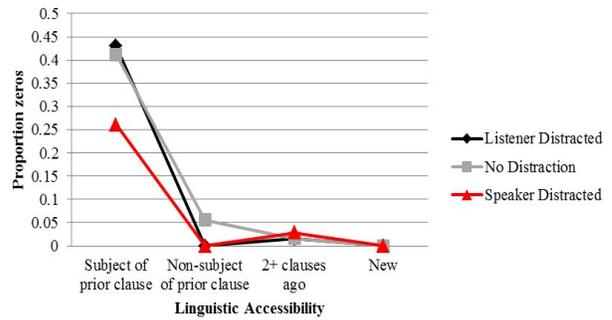


Figure 4: Proportion of zeros by discourse status of referent

As expected, there were large effects of discourse status. Pronouns and zeros were highly frequent for reference to the subject of the prior clause, and zeros occurred nearly exclusively in this context. Pronouns were used less frequently for a reference to the non-subject of the prior clause, and were very rare for less-recent references or for new items (see Figure 3). Speakers were also more likely to use a description/name when the prior clause mentioned a competitor character (avg. 87%) than when it did not (avg. 30%). Both accessibility and presence of competitor were included in all the models. Interactions between accessibility and distraction conditions were included when significant.

The critical question was how reference form choice would change under conditions of speaker and listener distraction. We first examined this question by analyzing all attenuated forms, i.e. pronouns and zeros categorized together. Figure 3 suggests that, compared with the control condition, speakers used slightly more zeros/pronouns for distracted listeners, and slightly fewer when they themselves were distracted.

In the multilevel model, however, there was only a significant main effect of listener distraction $F(1,1047)=4.07, p=0.04$. This effect occurred in addition to the main effect of accessibility, $F(1,1047)=84.36, p<.0001$, and main effect of presence of a competitor referent in the prior clause $F(1,1047)=29.86, p<.0001$. There was no effect of speaker distraction, and no interactions between accessibility and either listener or speaker distraction. The

effect of listener distraction held even in a restricted analysis just comparing listener distracted to the control condition, demonstrating that the effect was not due to any effects of speaker distraction.

In a second analysis, we examined the specific use of zeros, the most reduced referring expressions. As Figure 4 shows, zeros were most common when the referent was the subject of the prior clause. Critically, zero use was lower when the speaker was distracted. This was reflected in the model as a main effect of speaker distraction $F(1,1049)=7.31, p=0.0069$. There was also a main effect of accessibility $F(1,1049)=59.38, p<.0001$, but no effect of listener distraction and no interactions between accessibility and either distraction condition. The graph suggests that the effect of speaker distraction was carried by the reference-to-prior-subject context. This is not surprising, as zeros are generally unacceptable in other linguistic accessibility conditions, even though a few were attested in our sample. In a restricted analysis comparing speaker distraction to the control condition this effect remained, demonstrating that it was not due to any effects of the listener distraction condition.

In sum, we found that speakers used significantly more specific (less reduced) referring expressions when they were distracted. Speakers who were distracted used fewer zeros compared to pronouns or more descriptive phrases. Although there was an effect of listener distraction, it was in the opposite direction of what would be expected if speakers were aiding their listeners. The effect of listener distraction was in the direction of less specificity; that is, speakers used more pronouns/zeros when listeners were distracted, compared to when they were distracted or the no-distraction control condition.

Conclusions

Two main findings emerged from this study. First, we found direct evidence that psychological attention does matter for reference choice, consistent with claims of traditional models of reference form (e.g., Gundel et al., 1993). The predicted effect was for speakers to use more specific forms under conditions of distraction. Such an effect was observed, in that distracted speakers used fewer zeros than undistracted speakers (regardless of whether the listener was distracted). Thus, while linguistic constraints are very influential in the choice of referential form, they are not the sole determinants. This supports the idea that psychological attention is relevant beyond its association with particular discourse statuses.

Second, although we did find an effect of listener distraction, it was not in the same direction as the effects of speaker distraction. Speakers used less specific referring expressions when listeners were distracted, possibly suggesting disengagement. This contrasts with claims that listener attention is the primary determinant of referential form (Chafe, 1987; Gundel et al., 1993). However, effects of listener attention may show up in other tasks, as in another unpublished study in our lab (Rosa, Finch,

Bergeson, & Arnold, 2011). This study used an instruction-giving task to examine the effects of listener-distraction versus no distraction. In this case, speakers did modify their speech when their addressees were distracted by using longer pronunciations than for undistracted addressees. In addition, this effect was localized to the most task-relevant information, the object the addressee needed to move. The difference between studies is likely due to the different tasks used. The instruction-giving study provided considerable motivation for cooperation, as the results of insufficient instructions were immediately apparent. The current task was narrative, and while speakers were encouraged to provide detailed and cohesive stories, their only motivation to do so was so that the listener could complete a questionnaire after the task. The instruction-giving task was also highly constrained linguistically, and speakers gave instructions like *Put the teapot on the red circle* in a context where the teapot had not been mentioned before.

Although we found effects of listener distraction in the current study, they were in the opposite direction of the speaker distraction effects. If the production mechanism used calculations about addressee attention as the primary constraint on reference form, we would expect these two effects to be similar, yet the data do not support this. This suggests that speakers do not prioritize assumptions about the listener's attentional state when not necessitated by task demands.

The implications of these findings for a mechanism of reference production are as follows. First, the linguistic constraints on reference form are substantial, and any study of referring expression variation must carefully consider the data within an understanding of the discourse context. Variability of referring expressions is considerably more possible and appropriate in some discourse contexts than others, and an insufficient treatment of these real constraints can disguise the more subtle effects of other factors, like distraction. Second, speakers used significantly fewer zeros (compared to pronouns or noun phrases) when they were distracted. Thus, we found no support for the possibility that speakers would become more egocentric when distracted (and use more attenuated forms), nor the possibility that they might become less constrained by the discourse. This suggests a mechanism that allows for selection of a pronoun/zero when sufficient activation is allotted to a specific referent in the speaker's model of the discourse.

This study also raises a number of questions for future research. First, it is notable that the effect of speaker distraction emerged most strongly on the analysis of zeros. Since the use of zeros is highly constrained by the syntactic context, one question is whether the effect emerged because distracted speakers chose pronouns over zeros when both were possible, or because distracted speakers used a greater proportion of constructions that disallowed zeros. For example, a subordinate clause like *And when he/* \emptyset walked away* disallows a zero, whereas both are possible in clauses like *And he/ \emptyset ate the pie from the windowsill*.

Second, our results suggested that the increase in explicit references may not be limited to a reduction in zeros. When the referent was mentioned in the previous sentence, but as a nonsubject, distracted speakers used numerically (but not significantly) fewer pronouns. This distraction effect is most likely to surface in a context where pronouns are possible but not required, i.e. in the reference-to-nonsubject category. However, there were relatively few items in this category in our current sample. A larger sample may be necessary to detect this effect of speaker distraction.

Third, it is notable that subjects in our study occasionally used both zeros where they were unsupported by the discourse context. For example, the following excerpt (from the listener-distracted condition) contains a zero for reference to the beaver, who was not mentioned in the previous clause at all: *and the beaver wearing the top hat; the dog did not have a top hat he had a bow; um Ø [the beaver] leaves the scene with the bone.* Another subject used a pronoun to refer to the alligator, who had previously only been introduced with a compound NP *Alright so there was an alligator and a flamingo; And they had baseball caps on; And he [the alligator] was uh grilling some burgers on a propane grill anyway.* Whether the frequency of these ‘disallowed’ constructions varies by distraction condition is also being examined further.

A further question is whether the reduction of pronouns and zeros in the speaker-distracted condition hampered listeners’ comprehension. Perhaps the narratives in the no-distracted and listener-distraction conditions were more fluent and comprehensible than those in the speaker-distracted, and thus speakers were not, in fact, handicapping listeners by not altering their speech to be more like the speaker-distracted condition when listeners were distracted. The cohesiveness and interpretability of the stories in each of the conditions are dimensions to be explored in future analyses.

Our findings are consistent with traditional views of reference form: psychological attention is related to reference form choices. This emerged in the current task as an effect of the speaker’s own attentional load. Whether listener’s attention is incorporated as a partial constraint is a topic for further research.

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