



THE UNIVERSITY *of* EDINBURGH

Edinburgh Research Explorer

Effects of priming and audience design on the explicitness of referring expressions

Citation for published version:

Loy, J, Bloomfield, S & Smith, K 2020, 'Effects of priming and audience design on the explicitness of referring expressions: Evidence from a confederate priming paradigm', *Discourse Processes*, vol. 57, no. 9, pp. 808-821. <https://doi.org/10.1080/0163853X.2020.1802192>

Digital Object Identifier (DOI):

[10.1080/0163853X.2020.1802192](https://doi.org/10.1080/0163853X.2020.1802192)

Link:

[Link to publication record in Edinburgh Research Explorer](#)

Document Version:

Peer reviewed version

Published In:

Discourse Processes

Publisher Rights Statement:

This is an Accepted Manuscript of an article published by Taylor & Francis in Discourse Processes on 28 August 2020, available online: <http://www.tandfonline.com/10.1080/0163853X.2020.1802192>

General rights

Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact openaccess@ed.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.



ABSTRACT

In formulating a referring expression, speakers may choose between an explicit expression (such as a proper name or a noun phrase), or a reduced form such as a pronoun. We investigated whether speakers are influenced by their conversation partner to produce full noun phrases instead of pronouns, and whether this differs depending on whether their partner was a native and a nonnative partner. Participants took turns to describe and match cartoons with a (confederate) partner, who used either full noun phrases or pronouns when referring to discourse entities. We found that participants were more explicit or less explicit in their own referring expressions depending on their partner's behavior on the turn before, and adapted to the same extent with native and nonnative partners. We conclude that speakers adapt their production of referring expressions based on what their partners say, but do not make strategic adjustments based on who their partner is.

KEYWORDS

dialogue; referring expressions; priming; audience design; native–nonnative interaction

1. Introduction

In formulating a referring expression, speakers typically have a choice between various forms. A speaker may use an explicit referring expression such as a proper name or a noun phrase (e.g. ‘Jenny’, ‘the blue ball’), or a reduced form such as a pronoun. While pronouns may be easier and more economical to produce (Hendriks, Englert, Wubs, & Hoeks, 2008; Koster, Hoeks, & Hendriks, 2011), using a pronoun over a more explicit expression may result in ambiguity for the listener. The form that speakers choose is influenced by various factors: for example, speakers prefer to use pronouns for grammatical subjects (Gordon, Grosz, & Gilliom, 1993) or to refer back to animate compared to inanimate referents (Fukumura & Van Gompel, 2011), while they are more likely to use names or full noun phrases (NPs) for referents that are new

to a discourse (Chafe, 1976) or when multiple characters are present in the discourse (Arnold & Griffin, 2007; Serratrice, 2013). In addition, speakers may adapt their choice of referring expression with respect to their interlocutor. Hendriks et al. (2008) demonstrated that adult speakers prefer pronouns over full NPs, but may opt for a full NP if a pronoun's antecedent would be unrecoverable for the listener (cf. Hendriks, Koster, & Hoeks, 2014). Studies on infant- and child-directed speech also frequently note the substitution of first and second person pronouns with proper names by mothers (e.g. Hyams, 2008; Snow et al., 1976); Snow and Ferguson (1977) term this the 'Proper Name strategy', adopted by mothers of children whose language use may reflect difficulty with pronoun acquisition. In the current study, we investigate whether we see a similar phenomenon in native–nonnative interaction. Specifically, we test whether native speakers of English increase their use of full NPs when their partner exhibits pronoun difficulty by overusing full NPs, and whether this behavior is more prevalent with a nonnative compared to a native interlocutor.

There are two (non-mutually exclusive) explanations for why speakers may adapt their production of referring expressions in dialogue. The first is *priming*. This refers to a speaker's tendency to repeat recently-encountered forms or structures (Bock, 1986). Pickering and Garrod's (2004) interactive alignment model offers a priming-based account of adaptation between speakers. The model outlines an automatic, implicit process that arises as a by-product of speakers perceiving another's behavior, leading to higher activation of the relevant forms, which are in turn selected during production. Priming effects have been shown across multiple levels of representation, including the lexical (Cleland & Pickering, 2003), syntactic (Levelt & Kelter, 1982; Pickering & Branigan, 1998), and conceptual (Garrod & Anderson, 1987) levels, and notably, are known to occur in dialogue, where a speaker's choice of expression is influenced by their

conversation partner's prior productions (e.g. Branigan, Pickering, & Cleland, 2000; Cleland & Pickering, 2003). Branigan et al. (2000) showed, for example, that speakers describing ditransitive events were primed to produce either Prepositional Object (e.g. 'The pirate giving the banana to the sailor') or Double Object (e.g. 'The pirate giving the sailor the banana') constructions depending on which form a confederate used on the turn before.

There is evidence that speakers' choice of referring expressions for discourse entities is sensitive to priming. Research on the expression of subject personal pronouns in Spanish suggests that the form produced by speakers depends on what form was previously used: Analysis of various corpora of sociolinguistic interviews shows that overt expressions (e.g. 'Yo canto' *I sing*) favour subsequent overt expressions, while the null alternative (e.g. 'Canto' (*I sing*)) favours subsequent null expressions (Abreu, 2012; Flores-Ferrán, 2002; Torres Cacoullós & Travis, 2011; Travis, 2007). Although existing studies have mainly examined priming within individuals, showing a tendency for speakers to prefer the same form that they themselves used previously, Abreu (2012) observed a similar, albeit nonsignificant, trend for participants to produce more overt or more null subject pronouns depending on which form the interviewer used on a previous turn. These studies have to date been limited to the investigation of pronoun use in Spanish; nevertheless, they provide converging evidence that speakers can be primed to be more or less explicit (by way of using an optional pronoun or not) when formulating a referring expression. It is worth noting that these results can to an extent be explained by a lexical enhancement effect via repetition of the expressed subject (e.g. 'yo' *I*; cf. Pickering & Branigan, 1998). However, lexical repetition does not appear to provide the full picture. As Travis (2007) noted, a lexical explanation would predict a stronger effect with the priming of overt subject expressions compared

to the priming of null expressions (where there is no lexical material to be repeated); however this was not observed in their study. [Travis](#) thus suggests that the priming of subject expressions is a structural phenomenon, influencing speakers' productions via an implicit learning mechanism rather than simply increased activation of a specific lexical item (cf. [Bock & Griffin, 2000](#); [Chang, Dell, Bock, & Griffin, 2000](#)).

If speakers are similarly primed in English to be more or less explicit in their production of referring expressions, we might expect them to produce sentences containing more full NPs after hearing a prime in which discourse entities are consistently referred to via full NPs; conversely, we might expect them to produce more pronouns following a prime featuring typical, unmarked pronoun use. However, inasmuch as adaptation is driven by priming, this suggests that it is largely mechanistic and encapsulated from higher-level pragmatic factors such as partner-specific considerations. Thus, whether speakers are interacting with a native or a nonnative partner should not affect their adaptation of referring expressions following their partner's behavior.

There are other routes to adaptation, however, which take such factors into account. One example is *audience design*. This refers to a process whereby speakers tailor their utterances to the specific needs or characteristics of their interlocutor ([Clark, 1996](#); [Clark & Murphy, 1983](#)). Theories of reference production have proposed an addressee-oriented account by which speakers choose the degree of specificity needed to successfully communicate an intended referent based on pragmatic assumptions about their partner's knowledge and attention state ([Ariel, 1990](#); [Chafe, 1976](#); [Givón, 1992](#)). Under this account, speakers' choose their form of referring expression by way of signaling to their addressee how accessible or salient the referent is within the current discourse. Consequently, pronouns are more likely to be used for subjects that for example have been topicalized in the discourse ([Hendriks et al., 2014](#)), have given status (i.e. has

been previously referenced; [Chafe, 1976](#); [Prince, 1981](#)), or have occurred more recently in the linguistic context ([Ariel, 1990](#)). It should be noted that these factors may also be listener-independent, in that speakers may rely on their own discourse model when making assumptions about how accessible a referent is for their addressee (see e.g. [Fukumura & van Gompel, 2012](#)). Nevertheless, an addressee-oriented account makes predictions in line with findings from referential communication tasks, which demonstrate the role of audience design in speakers' lexical choice in referring expressions. In [Brennan and Clark \(1996\)](#), for instance, speakers who had aligned with a partner on an over-specific referring expression (e.g. 'the pennyloafer' for a shoe) reverted to the simpler term 'shoe' when interacting with a new partner. In a similar vein, [Bard and Aylett \(2004\)](#) found that speakers produced simpler, more reduced forms (e.g. 'it' rather than 'the mountain') across repeated mentions of a referent to a partner, but stopped simplifying with a new partner, suggesting that referential form was adapted to the addressee's needs based on what the addressee could be assumed to know.

Notably, adaptation via audience design can result from a speaker's inferences about their partner's linguistic capabilities (e.g. [Bortfeld & Brennan, 1997](#); [Branigan, Pickering, Pearson, McLean, & Brown, 2011](#)). One factor which may influence such an inference is whether or not their partner is a native speaker of the language. For example, participants in [Bortfeld and Brennan \(1997\)](#) were observed to adopt idiosyncratic expressions (e.g. 'you can shake your body' to describe a rocking chair) that their nonnative partners showed a preference for, suggesting that native English speakers sacrificed idiomaticity and naturalness in favor of comprehensibility for their nonnative partners. Such adjustments may be reinforced by native speakers' sociolinguistic expectations about a nonnative interlocutor: For instance, expectations about a nonnative speaker's reduced proficiency leads to less detailed processing of nonnative

speech and thus an increased reliance on top-down information, in turn shaping the interaction to be more in line with prior expectations (Lev-Ari, Ho, & Keysar, 2018).

The use of full NPs as a communicative strategy to facilitate nonnative comprehension has not been tested empirically. However, research on the features of speech typically directed at nonnative speakers reflects a metalinguistic awareness of pronoun ambiguity. Ferguson's (1975) questionnaire on linguistic modification in nonnative-directed speech highlights a number of pronoun-related modifications cited by respondents with the aim of reducing ambiguity. These include adding of the subject *you* to imperatives (e.g. 'you come'), paraphrasing of possessives (e.g. 'brother of me' for *my brother*), and the use of gestures or pointing alongside pronouns. The adaptation of pronoun use, such as by substitution with a different pronoun form by Welsh speakers (James, 1986), or by using pronouns in addition to standard subject marking via verb inflection by Polish speakers (Krakowian & Corder, 1980), has also been observed in other studies. James (1986) additionally notes a strategy he terms 'concretisation', in which speakers 'recourse to concrete instances of an entity and the avoidance of abstraction ... [by] use of a proper noun rather than a pronoun' (p. 49). Although the abovementioned studies highlight a range of distinct strategies adopted by native speakers, they collectively point towards a perceived need to modify pronoun use with nonnative interlocutors, likely arising from inferences about a link between linguistic proficiency and the ability to interpret pronouns. Such strategies are also in line with findings from a comprehension perspective, which demonstrate a pronoun resolution disadvantage in nonnative compared to native comprehenders during both online and off-line processing (Cheng & Almor, 2017; Felser & Cunnings, 2012; Paterson, Trompelt, & Felser, 2014; Roberts, 2008; Sorace & Filiaci, 2006). Together, these studies support the notion that native speakers hold assumptions about a non-

native interlocutor's (decreased) ability to comprehend pronouns. However, findings from production that speakers adapt their use of pronouns have mainly relied on questionnaire-based methods to elicit utterances directed at hypothetical speakers. Thus, it remains unclear whether such interlocutor-based assumptions would result in an increased use of full NPs during communicatively authentic situations.

It should also be noted that the degree of consciousness or explicit negotiation between interlocutors that arises through audience design is unclear. [Branigan et al. \(2011\)](#) note that adaptation can be influenced by peoples' beliefs about their interlocutor even without explicit awareness of those beliefs. [Horton and Gerrig \(2005\)](#) similarly argue that the process of deriving beliefs based on common ground between interlocutors can be made in an automatic fashion. More recently, research has addressed the question of the extent to which such effects are strategic and open to introspection: [Rogers, Fay, and Maybery \(2013\)](#) make a distinction between strategic and non-strategic audience design; although their non-strategic account has its basis in priming, it is susceptible to pragmatic influences such as beliefs about one's conversation partner (cf. [Branigan et al., 2011](#)) or situational factors like group size (cf. [Fay, Garrod, & Carletta, 2000](#)), which can mediate the degree of adaptation observed. Here, we adopt a broad definition of audience design to encompass adaptation that is influenced by interlocutor-specific information, such as knowledge about a partner's linguistic background or their communicative needs; while the degree of awareness underlying such adaptation lies beyond the scope of the study, we note that the precise nature of the mechanism may lie on a continuum that ranges from more automatic to more deliberate.

The two mechanisms—priming and audience design—are also not necessarily independent, and may act in tandem to shape adaptation in dialogue. One possibility,

for instance, is for priming to be mediated by audience design, such as in [Rogers et al.'s \(2013\)](#) account of non-strategic audience design, which assumes a default priming mechanism that is influenced by pragmatic factors. In a similar vein, [Costa, Pickering, and Sorace \(2008\)](#) modify the interactive alignment model to account for differential adaptation with native and nonnative interlocutors, citing explanations that a native speaker may be less susceptible to automatic priming from a nonnative partner, or may more deliberately adopt a nonnative partner's lexical choices. While [Costa et al.](#) do not make specific predictions about speakers' production of referring expressions, specifically their use of full NPs vs. pronouns, they nevertheless provide a basis to expect different patterns of adaptation during native–native and native–nonnative interaction.

We report an experiment investigating whether speakers adapt their form of referring expressions in response to their partner's behavior during face-to-face interaction, and whether this differs during interaction with a native compared to a nonnative partner. The experiment used a confederate priming paradigm ([Branigan et al., 2000](#)) where a naive participant takes turns to describe pictures with a confederate, who produces prime descriptions according to a script. We manipulated the form of confederates' prime descriptions within-subjects such that half the confederate's descriptions made use of full NPs to refer to all discourse entities and objects, while the other half made use of pronouns for all references past the first mention. We also manipulated confederate nativeness between-subjects; half of participants interacted with a nonnative speaker of English while the other half interacted with another native speaker. If speakers adapt their degree of explicitness in referring expressions based on their interlocutor's behavior, we can expect more full NPs following full NP primes and fewer full NPs following pronoun primes; additionally, if this priming effect is mediated

by audience design in which speakers consider whether their partner is a nonnative speaker, we can expect to see different levels of priming from nonnative compared to native confederates. Alternatively, if speakers' adaptation of referring expressions is driven by audience design outwith the influence of priming, we might expect more full NPs during interaction with nonnative compared to native confederates regardless of prime type.

2. Method

2.1. *Participants*

Forty self-reported native speakers of English (7 male; 33 female) were recruited via the University of Edinburgh careers service website. Participants were paid £5 each to take part in the experiment. Each session lasted 25–30 minutes.

Participants (20 each) were randomly paired with a confederate who was either a native speaker ($n = 2$ confederates) or a nonnative speaker of English ($n = 2$ confederates). The confederates were students from the University of Edinburgh recruited via word-of-mouth. The nonnative confederates spoke Italian (1) and Mandarin Chinese (1) as their native language. Confederates were paid at the same rate as participants.

2.2. *Materials and design*

The experiment comprised 30 items, each consisting of a prime trial on which the confederate described a cartoon strip (a series of four panels), followed by a target trial on which the participant described a different cartoon strip. Two unique sets of 30 strips were prepared—a *participant set* and a *confederate set*. Each strip featured 1–4 characters within an event that unfolded across four panels (see Figs. [1](#) and [2](#) for

examples).

[Figure 1 about here.]

[Figure 2 about here.]

In the participant set, each character’s name was printed below the character every time they appeared in the strip (see Fig. 1). In the confederate set, a full description was printed below each panel, which served as the confederate’s script on the trial (see Fig. 2). Two versions of each confederate strip were created to serve as different prime types: For *full noun phrase (NP) primes*, characters and objects were always unambiguously referenced by a proper name or full NP (e.g. ‘Tim’, ‘the ball’; see Fig. 2a); for *pronoun primes*, subsequent references of a character or an object once it had been established made use of pronouns instead (e.g. ‘he’, ‘it’, ‘they’; see Fig. 2b). Both the participant and confederate sets included a range of events such that strips varied in terms of number of characters featured, the inclusion of inanimate objects or not, and whether pronoun use could lead to gender ambiguity (e.g. more than one male character present). The materials included variation to prevent participants from picking up on the pronoun/full NP manipulation. This meant that the opportunity for priming was not equal for each cartoon strip. However, as all participants saw the same set of cartoons, the overall opportunity for priming across participants was the same.

The experiment was presented as a cartoon description and matching game in which interlocutors alternated between describing cartoons for their partner and matching cartoons based on their partner’s description. Prime type was manipulated within-subjects; half of the confederate’s cartoon descriptions were full NP primes and the other half pronoun primes. The assignment of prime type to cartoon strip was random-

ized for each run of the experiment. Match screens presented the target strip alongside three distractors in a 2 x 2 grid array. Two possible array types were used, each featuring minor variations to the characters or event in the three distractor strips. The variations were designed to ensure interlocutors had to attend to their partner’s full description in order to select the correct strip. Table 1 outlines the two array types for the cartoon strip in Fig. 1. The relative positions of target and distractors within the array were randomized on each trial. None of the distractors served as target cartoons on any of the trials.

[Table 1 about here.]

2.3. Procedure

Throughout the experiment up until debrief, the confederate assumed the role of a naive participant. Confederates and participants were seated facing each other across a desk in a quiet room. Prior to beginning, both interlocutors (starting with the confederate) were asked to report whether they were a native speaker of English.

The experiment was presented to each interlocutor on a 13” Apple Macintosh laptop. The instructions screen introduced characters in the cartoons by name to encourage participants to use these over common nouns such as ‘the man’. The session then began with the first item; each item consisted of a prime followed by a target trial, ensuring that sessions always began with the confederate describing and the participant matching. Thus, the confederate would first describe a cartoon according to the script on their screen (see e.g. fig. 2), which the participant matched by clicking on one of four cartoons, after which the participant would see a single cartoon (e.g. fig. 1) which they had to describe for the confederate to match. The order of presentation

of items was randomized for each experimental run. Trial progression on both laptops was triggered when the matcher clicked on a cartoon, with no feedback provided on match accuracy. Participant and confederate descriptions were recorded on each trial via the laptops' internal microphones.

After the experiment the participant was debriefed, during which the priming manipulation and confederate's role were revealed. Participants were asked if they were aware of either during the experiment, with a positive response to either used as a basis for excluding their data from analysis.

2.4. Transcription and coding

Participants' descriptions on each trial were transcribed, and transcripts annotated for character/object reference. The following scheme was used to determine and code opportunities for reference in each cartoon description produced by participants:

- (1) The first instance of each character/object mention in a description was marked as a *reference establishment*
- (2) All subsequent instances were marked as a *reference opportunity*
- (3) Each opportunity was coded as one of three possible types of referring expressions produced by participants:¹
 - *full NP* — proper name reference to a character; noun phrase reference to an inanimate object (e.g. Tim buys the hat)
 - *pronoun* — overt pronoun reference to a character or object (e.g. He buys it)
 - *omission* — pronoun omission for a character or object in subject position

¹Participants occasionally dropped subject pronouns as an alternative to using a pronoun or full NP, hence coding took into account all three categories of reference.

(e.g. Tim buys a hat, \emptyset puts it on)

Thus, the total number of opportunities for a given cartoon varied depending on the participant’s conceptualization of the event; for example, ‘*Jenny* says thank you’ was coded as one opportunity (full NP), ‘*Jenny* thanks *Henry*’ was coded as two opportunities (full NP, full NP), and ‘*Jenny* thanks *him*’ was coded as two opportunities (full NP, pronoun). Table 2 provides some example descriptions and the corresponding coding for the cartoon in Fig. 1.

[Table 2 about here.]

All transcripts were checked against the recordings and subsequently coded by an independent second coder. Both coders were blind to the prime type and confederate’s nativeness on each trial. Krippendorff’s alpha (α ; Krippendorff, 2004), a chance-corrected estimate of interrater reliability that takes into account the degree of disagreement between raters, was computed for the count of each of the three reference types as well as the number of opportunities calculated by each coder for each trial. Table 3 presents the α statistics for interrater agreement; all α values indicated good reliability between the two coders (≥ 0.8 ; Krippendorff, 1980).

[Table 3 about here.]

3. Results

Participants produced 1,200 cartoon descriptions in total, across which 5,085 reference opportunities were recorded. Of these, 3,387 (66.6%) were coded as full NPs, 1,345 (26.5%) were coded as pronouns, and 353 (6.9%) were coded as omissions.² Fig. 3

²Participants’ preference for full NPs over pronouns may seem surprising given they are somewhat unnatural for given/repeated entities, which feature heavily in the materials. One possibility is that the participant cartoon

shows the mean percentage of each of the three referring expression types produced and individual participant means in each condition.

[Figure 3 about here.]

Data were analyzed in R Version 3.5.0 (R Core Team, 2018) via logistic mixed effects regression using the lme4 package (Bates, Maechler, Bolker, & Walker, 2014). We were primarily interested in whether speakers could be primed to produce full NPs by their partner, and whether this effect would differ between interacting with a native and a nonnative confederate. Hence we modeled the binary outcome of whether or not participants produced a full NP for each reference opportunity, collapsing across pronouns and omissions to form a single *reduced* category. The model included prime type (pronoun vs. full NP) and confederate nativeness (native vs. nonnative) as fixed effects (both predictors mean centered), as well as random intercepts for participant, cartoon strip, and confederate ID, and by-participant random slopes for prime type³

[Table 4 about here.]

Table 4 shows the model results for the effects of prime type and confederate nativeness on participants' adaptation of referring expressions. The model showed a main set, which always displayed the character's name under each character's appearance, may have encouraged participants to use proper names. Importantly, however, this property of the stimuli was consistent across conditions, and hence would not have influenced participants' pattern of adaptation in the experiment.

³As the experiment utilized multiple confederates, we first ran a preliminary analysis to check whether participants' behavior differed significantly across confederates. We modeled the outcome variable on the sole predictor of confederate ID (sum-coded), separately for the native partner and nonnative partner confederate conditions. Models included by-participant random intercepts but no random slopes since confederate was manipulated between-subjects. Neither model showed an effect of confederate ID on participants' reference productions (all $p > .2$), confirming that participants behaved similarly across the two confederates in both partner conditions.

effect of prime type: Participants were more likely to produce full NPs following a full NP prime compared to a pronoun prime, $\beta = 0.46$, $SE = 0.08$, $p < .001$. There was no effect of confederate nativeness nor an interaction between prime type and confederate nativeness (all $p > .1$), suggesting that the priming effect did not differ between native and nonnative confederates.⁴

3.1. Controlling for lexical overlap

A common finding within the literature is that priming effects are enhanced by lexical repetition across prime and target trials (cf. Pickering & Branigan, 1998). In order to check for possible lexical effects, we conducted a secondary analysis where we split the dataset according to whether any overlap occurred in the characters or objects that appeared across prime and target cartoon strips in each item. We conducted the same analysis on each of the two datasets (overlap set: 319 trials; no overlap set: 881 trials).

We observed the same pattern of results for both datasets. There was a main effect of prime type with participants producing more full NPs following a full NP prime compared to a pronoun prime, $\beta = 0.43$, $SE = 0.10$, $p < .001$ for items with no lexical overlap, and $\beta = 0.49$, $SE = 0.18$, $p = .005$ for items with lexical overlap. There was no effect of confederate nativeness nor an interaction between prime type and

⁴Our analysis collapses pronouns and omissions into a single category; however we note that an ordinal regression taking into account all three referring expression types as separate categories produces the same pattern of results.

⁵Based on a reviewer's suggestion that the influence of priming and/or audience design may have varied over the course of the interaction (e.g. strategic audience design effects may have been more prevalent at the start of the interaction), we conducted an additional analysis including experimental phase (first half of trials vs. second half of trials; sum-coded) as a predictor. This model indicated no effect of phase nor its interaction with either prime type or confederate (all $p > .1$), suggesting that any effects of priming and audience design remained stable over time.

confederate nativeness in either dataset (smallest $p = .1$).

4. Discussion

We investigated how speakers' production of referring expressions is influenced by their conversation partner. Using a confederate scripting paradigm, we tested whether native speakers of English are primed by their partner to produce full NPs in place of pronouns, and whether this differs during interaction with native and nonnative partners. Our main result demonstrates that speakers' form of referring expressions can be primed in dialogue: Speakers produced more explicit referring expressions, either in the form of proper names (for animate characters) or noun phrases (for inanimate objects), following descriptions in which their partner consistently overused full NPs instead of pronouns. Extending previous work investigating reference priming for objects in a static display (e.g. [Branigan et al., 2011](#); [Cleland & Pickering, 2003](#); [Fukumura, 2018](#); [Goudbeek & Krahmer, 2012](#)), here we demonstrate priming effects on speakers' choice of referring expressions for discourse entities in a story-telling context.

As in [Travis \(2007\)](#), the priming we observed is unlikely simply due to a lexical enhancement effect, since the names of characters and objects differed across prime and target trials in most items. Moreover, we found a priming effect in both the subset of items that featured character/object repetition and those that did not. This is in line with findings that indicate a similar degree of priming for overt and null subject pronoun references in Colombian Spanish ([Travis, 2007](#)) and Puerto Rican Spanish ([Abreu, 2012](#); [Flores-Ferrán, 2002](#)), suggesting that such priming cannot be attributed merely to repetition of an explicit subject that is mentioned. However, we note that our data cannot entirely rule out a lexical explanation, since characters and objects frequently appeared more than once across panels within a strip; hence, a full

NP reference in an earlier panel could have primed subsequent full NP references to the same character or object via increased activation of the lexical item. Such an effect would be similar to a finding by Scherre and Naro (1991) for the explicit marking or non-marking of subject/verb agreement in Brazilian Portuguese across sequences of adjoining clauses, and supports the idea that priming can occur with multi-sentence constructions at the level of the discourse.

In contrast to the robust priming effect, our results provide little evidence for an effect of audience design on speakers' production of referring expressions. Although speakers produced numerically more full NPs with a nonnative than a native confederate (71% vs. 62%), this difference was not significant, nor was there an interaction between prime type and confederate nativeness to suggest that the priming effect differed between native and nonnative confederates. These results seem surprising given existing evidence that speakers' production of referring expressions is influenced by partner-specific considerations, and moreover, that one such consideration seems to be a nonnative interlocutor's diminished ability to comprehend pronouns (e.g. Ferguson, 1975). Studies examining priming and audience design simultaneously in referential communication tasks have also reported evidence for independent effects of both: Haywood, Pickering, and Branigan (2003) found that whether participants produced an adjective in a modified NP or a relative clause (e.g. 'the blue triangle' vs. 'the triangle that's blue') depended both on the form a confederate used in the turn before as well as the form that would facilitate the confederate's accurate selection (whether the target was in a box that sorted by color or shape). However, Haywood et al. noted that the priming effects they observed were statistically more robust than the audience design, citing the automaticity of priming as a potential explanation, in contrast to the strategic nature of audience design which is likely more resource-intensive on a

speaker. It is plausible that tailoring the degree of explicitness of a referring expression to one's partner places a similar, if not greater, cognitive demand on speakers as choosing between two syntactic structures like in Haywood et al.'s task. Additionally, Haywood et al. found that the extent to which speakers engaged in audience design depended on their partner's behavior: Confederates who behaved in a linguistically cooperative manner elicited more descriptions whose word order facilitated the search task than confederates who behaved uncooperatively. While we did not manipulate our confederates' linguistic behavior between-participants, their overuse of full NPs half the time might have been similarly viewed as uncooperative due to its unnaturalness (cf. Gordon et al., 1993; Hendriks et al., 2008), reducing the overall likelihood of participants engaging in audience design. Such an explanation is broadly in line with other work on referential production which demonstrates a range of factors constraining whether or not audience design occurs, such as time pressure (Horton & Keysar, 1996) or memory load on the speaker (Horton & Gerrig, 2005; Roxβnagel, 2000).

It is also worth noting that although we found no statistical evidence for audience design in our results, the effect size of our confederate manipulation is comparable to that of prime type (see table 4).⁶ The lack of significance is likely due to the relatively large standard error for confederate nativeness, indicating that variation between subjects was high compared to that within. This is further reflected in the considerable spread of individual participant means in the degree of adaptation we observed (see fig. 3). In other words, while the likelihood of adapting to the confederate varied widely across participants, individual participants were likely fairly consistent in whether or not they adapted. Indeed, previous research on adaptation has highlighted the role of individual differences, resulting in considerable variation in speakers' propensity to

⁶We thank two anonymous reviewers for their comments on this point.

adapt (Gill, Harrison, & Oberlander, 2004; Kidd, 2012). Thus, although we did not find an overall significant effect of audience design, our pattern of results suggests that some participants did adapt their referring expressions based on their interlocutor's nativeness.

Finally, recent research on nonnative-directed speech supports the notion of individual tendencies to adapt. Results from a questionnaire by Margić (2017) suggests that not all native English speakers view audience design as a helpful communicative strategy. In her study, a fifth of respondents indicated reluctance to modify their language use with nonnative speakers, citing reasons such as a concern that it could be perceived as patronizing or reduce the overall quality of conversation. The latter point may be particularly relevant in the case of referring expressions, since the use of full NPs over pronouns can both aid or impede comprehension: While full NPs reduce ambiguity and support accurate reference resolution (Sekerina, Stromswold, & Hestvik, 2004), comprehension studies indicate that their repeated use over pronouns can incur processing costs by interrupting the local discourse coherence (Cloitrew & Bever, 1988; Gordon et al., 1993). It is possible that native speakers may engage in audience design with nonnative interlocutors by employing other linguistic devices, such as replacing expressions or enunciating more clearly (Snow, Eeden, & Muysken, 1981; Uther, Knoll, & Burnham, 2007). In contrast, although speakers may have a metalinguistic awareness of the potential ambiguity of pronouns (Ferguson, 1975), this may not necessarily give rise to an increase in full NP production during actual discourse. Thus, we see in the formulation of referring expressions in dialogue that priming—an automatic, subconscious process—exerts an influence on speakers' productions, while the strategic nature of audience design may play a less prominent role in shaping what they say.

Data availability

The datasets analysed for the study along with the analysis script can be found in the Open Science Framework repository <https://osf.io/ekm8a/>.

Acknowledgement(s)

This research received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement 681942), held by KS. The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript. The authors would like to thank Steve Pitcher-Cumming for designing the stimuli used in the experiment.

References

- Abreu, L. (2012). Subject pronoun expression and priming effects among bilingual speakers of Puerto Rican Spanish. In K. Geeslin & M. Diaz-Campos (Eds.), *Selected Proceedings of the 14th Hispanic Linguistics Symposium* (pp. 1–8). Somerville, MA: Cascadilla Proceedings Project.
- Ariel, M. (1990). *Assessing noun-phrase antecedents*. London: Routledge.
- Arnold, J. E., & Griffin, Z. M. (2007). The effect of additional characters on choice of referring expression: Everyone counts. *Journal of Memory and Language*, *56*(4), 521–536.
- Bard, E. G., & Aylett, M. P. (2004). Referential form, word duration, and modeling the listener in spoken dialogue. In J. T. . M. Tanenhaus (Ed.), *Approaches to studying world-situated language use: Bridging the language-as-product and language-as-action traditions* (pp. 173–191). Cambridge, MA: MIT Press.
- Bates, D., Maechler, M., Bolker, B., & Walker, S. (2014). lme4: Linear mixed-effects models using Eigen and S4 [Computer software manual]. Retrieved from <http://CRAN.R-project>

`.org/package=lme4` (R package version 1.1-6)

- Bock, K. (1986). Syntactic persistence in language production. *Cognitive Psychology*, *18*(3), 355–387.
- Bock, K., & Griffin, Z. M. (2000). The persistence of structural priming: Transient activation or implicit learning? *Journal of Experimental Psychology: General*, *129*(2), 177–192.
- Bortfeld, H., & Brennan, S. E. (1997). Use and acquisition of idiomatic expressions in referring by native and non-native speakers. *Discourse Processes*, *23*(2), 119–147.
- Branigan, H. P., Pickering, M. J., & Cleland, A. A. (2000). Syntactic co-ordination in dialogue. *Cognition*, *75*(2), B13–B25.
- Branigan, H. P., Pickering, M. J., Pearson, J., McLean, J. F., & Brown, A. (2011). The role of beliefs in lexical alignment: Evidence from dialogs with humans and computers. *Cognition*, *121*(1), 41–57.
- Brennan, S. E., & Clark, H. H. (1996). Conceptual pacts and lexical choice in conversation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *22*(6), 1482–1493.
- Chafe, W. (1976). Givenness, contrastiveness, definiteness, subjects, topics and point of view. In C. N. Li (Ed.), *Subject and topic* (pp. 25–56). New York: Academic Press.
- Chang, F., Dell, G. S., Bock, K., & Griffin, Z. M. (2000). Structural priming as implicit learning: A comparison of models of sentence production. *Journal of Psycholinguistic Research*, *29*(2), 217–230.
- Cheng, W., & Almor, A. (2017). The effect of implicit causality and consequentiality on nonnative pronoun resolution. *Applied Psycholinguistics*, *38*(1), 1–26.
- Clark, H. H. (1996). *Using language*. Cambridge University Press.
- Clark, H. H., & Murphy, G. L. (1983). Audience design in meaning and reference. In J. F. LeNy & W. Kintsch (Eds.), *Language and comprehension* (pp. 287–299). Amsterdam: North-Holland Publishing Co.
- Cleland, A. A., & Pickering, M. J. (2003). The use of lexical and syntactic information in language production: Evidence from the priming of noun-phrase structure. *Journal of*

- Memory and Language*, 49(2), 214–230.
- Cloitrew, M., & Bever, T. G. (1988). Linguistic anaphors, levels of representation, and discourse. *Language and Cognitive Processes*, 3(4), 293–322.
- Costa, A., Pickering, M. J., & Sorace, A. (2008). Alignment in second language dialogue. *Language and Cognitive Processes*, 23(4), 528–556.
- Fay, N., Garrod, S., & Carletta, J. (2000). Group discussion as interactive dialogue or as serial monologue: The influence of group size. *Psychological Science*, 11(6), 481–486.
- Felser, C., & Cunnings, I. (2012). Processing reflexives in a second language: The timing of structural and discourse-level constraints. *Applied Psycholinguistics*, 33(3), 571–603.
- Ferguson, C. A. (1975). Toward a characterization of English foreigner talk. *Anthropological Linguistics*, 1–14.
- Flores-Ferrán, N. (2002). *Subject personal pronouns in Spanish narratives of Puerto Ricans in New York City: A sociolinguistic perspective* (Vol. 2). Lincom Europa.
- Fukumura, K. (2018). Ordering adjectives in referential communication. *Journal of Memory and Language*, 101, 37–50.
- Fukumura, K., & Van Gompel, R. P. (2011). The effect of animacy on the choice of referring expression. *Language and Cognitive Processes*, 26(10), 1472–1504.
- Fukumura, K., & van Gompel, R. P. (2012). Producing pronouns and definite noun phrases: Do speakers use the addressee's discourse model? *Cognitive Science*, 36(7), 1289–1311.
- Garrod, S., & Anderson, A. (1987). Saying what you mean in dialogue: A study in conceptual and semantic co-ordination. *Cognition*, 27, 181–218.
- Gill, A. J., Harrison, A. J., & Oberlander, J. (2004). Interpersonality: Individual differences and interpersonal priming. In K. Forbus, D. Gentner, & T. Reiger (Eds.), *Proceedings of the 26th annual meeting of the cognitive science society* (Vol. 26). Chicago, Illinois.
- Givón, T. (1992). The grammar of referential coherence as mental processing instructions. *Linguistics*, 30(1), 5–56.
- Gordon, P. C., Grosz, B. J., & Gilliom, L. A. (1993). Pronouns, names, and the centering of

- attention in discourse. *Cognitive Science*, 17(3), 311–347.
- Goudbeek, M., & Kraemer, E. (2012). Alignment in interactive reference production: Content planning, modifier ordering, and referential overspecification. *Topics in Cognitive Science*, 4(2), 269–289.
- Haywood, S., Pickering, M. J., & Branigan, H. P. (2003). Co-operation and co-ordination in the production of noun phrases. In R. Alterman & D. Kirsh (Eds.), *Proceedings of the 25th Annual Meeting of the Cognitive Science Society* (Vol. 25, pp. 533–538). Boston, MA.
- Hendriks, P., Englert, C., Wubs, E., & Hoeks, J. (2008). Age differences in adults' use of referring expressions. *Journal of Logic, Language and Information*, 17(4), 443–466.
- Hendriks, P., Koster, C., & Hoeks, J. C. (2014). Referential choice across the lifespan: why children and elderly adults produce ambiguous pronouns. *Language, Cognition and Neuroscience*, 29(4), 391–407.
- Horton, W. S., & Gerrig, R. J. (2005). The impact of memory demands on audience design during language production. *Cognition*, 96(2), 127–142.
- Horton, W. S., & Keysar, B. (1996). When do speakers take into account common ground? *Cognition*, 59(1), 91–117.
- Hyams, N. (2008). Reflections on motherese. In T. Sano, M. Endo, M. Isobe, K. Otaki, K. Sugisaki, & T. Suzuki (Eds.), *An enterprise in the cognitive science of language* (pp. 1–12). Tokyo: Hituzu Syobo Publishing.
- James, C. (1986). Welsh foreigner talk: Breaking new ground. *Journal of Multilingual & Multicultural Development*, 7, 41–54.
- Kidd, E. (2012). Individual differences in syntactic priming in language acquisition. *Applied Psycholinguistics*, 33(2), 393–418.
- Koster, C., Hoeks, J., & Hendriks, P. (2011). Comprehension and production of subject pronouns: Evidence for the asymmetry of grammar. In A. Grimm, A. Müller, C. Hamann, & E. Ruigendijk (Eds.), *Production-comprehension asymmetries in child language* (pp. 99–122). Berlin: De GruyterMouton.

- Krakowian, B., & Corder, P. S. (1980). Polish foreigner talk. *Studia Anglica Posnaniensia*, 12.
- Krippendorff, K. (1980). *Content Analysis: An Introduction to its Methodology*. SAGE Publications.
- Krippendorff, K. (2004). Reliability in content analysis. *Human Communication Research*, 30(3), 411–433.
- Lev-Ari, S., Ho, E., & Keysar, B. (2018). The unforeseen consequences of interacting with non-native speakers. *Topics in Cognitive Science*, 10(4), 835–849.
- Levelt, W. J. M., & Kelter, S. (1982). Surface form and memory in question answering. *Cognitive Psychology*, 14, 78–106.
- Margić, B. D. (2017). Communication courtesy or condescension? Linguistic accommodation of native to non-native speakers of English. *Journal of English as a Lingua Franca*, 6(1), 29–55.
- Patterson, C., Trompelt, H., & Felser, C. (2014). The online application of binding condition B in native and non-native pronoun resolution. *Frontiers in Psychology*, 5, 147.
- Pickering, M. J., & Branigan, H. P. (1998). The representation of verbs: Evidence from syntactic priming in language production. *Journal of Memory and Language*, 39(4), 633–651.
- Pickering, M. J., & Garrod, S. (2004). Toward a mechanistic psychology of dialogue. *Behavioral and Brain Sciences*, 27(2), 169–190.
- Prince, E. F. (1981). Towards a taxonomy of given-new information. In P. Cole (Ed.), *Radical pragmatics* (pp. 235–255). New York: Academic Press.
- R Core Team. (2018). R: A language and environment for statistical computing [Computer software manual]. Vienna, Austria. Retrieved from <https://www.R-project.org/>
- Roberts, L. (2008). Online pronoun resolution in L2 discourse: L1 influence and general learner effects. *Studies in Second Language Acquisition*, 30, 333–357.
- Rogers, S. L., Fay, N., & Maybery, M. (2013). Audience design through social interaction

- during group discussion. *PloS one*, 8(2), 1–7.
- Roxβnagel, C. (2000). Cognitive load and perspective-taking: applying the automatic-controlled distinction to verbal communication. *European Journal of Social Psychology*, 30(3), 429–445.
- Scherre, M. M. P., & Naro, A. J. (1991). Marking in discourse: “birds of a feather”. *Language Variation and Change*, 3(1), 23–32.
- Sekerina, I. A., Stromswold, K., & Hestvik, A. (2004). How do adults and children process referentially ambiguous pronouns? *Journal of Child Language*, 31(1), 123–152.
- Serratrice, L. (2013). The role of number of referents and animacy in children’s use of pronouns. *Journal of Pragmatics*, 56, 31–42.
- Snow, C. E., Arlman-Rupp, A., Hassing, Y., Jobse, J., Joosten, J., & Vorster, J. (1976). Mothers’ speech in three social classes. *Journal of Psycholinguistic Research*, 5(1), 1–20.
- Snow, C. E., Eeden, R., & Muysken, P. (1981). The interactional origins of foreigner talk: Municipal employees and foreign workers. *International Journal of the Sociology of Language*, 1981(28), 81–92.
- Snow, C. E., & Ferguson, C. A. (1977). Talking to children: Language input and acquisition.
- Sorace, A., & Filiaci, F. (2006). Anaphora resolution in near-native speakers of Italian. *Second Language Research*, 22(3), 339–368.
- Torres Cacoullos, R., & Travis, C. E. (2011). Testing convergence via code-switching: Priming and the structure of variable subject expression. *International Journal of Bilingualism*, 15(3), 241–267.
- Travis, C. E. (2007). Genre effects on subject expression in Spanish: Priming in narrative and conversation. *Language Variation and Change*, 19(2), 101–135.
- Uther, M., Knoll, M. A., & Burnham, D. (2007). Do you speak E-NG-LI-SH? A comparison of foreigner-and infant-directed speech. *Speech Communication*, 49(1), 2–7.

Table 1.: Match array distractors for the cartoon strip in Fig. 1. Changes to the strip are in italics.

Target event: Henry is fishing, Henry catches a fish, Henry gives the fish to Jenny, Jenny says thank you

Array type	Distractor manipulation	Event depicted
1	first panel altered	<i>Henry and Jenny are driving</i> Henry catches a fish Henry gives the fish to Jenny Jenny says thank you
	second or third panel altered	Henry is fishing <i>Henry eats an apple</i> Henry gives a fish to Jenny Jenny says thank you
	fourth panel altered	Henry is fishing Henry catches a fish Henry gives the fish to Jenny <i>Jenny pays Henry</i>
2	character name changed	<i>Jeremy</i> is fishing <i>Jeremy</i> catches a fish <i>Jeremy</i> gives the fish to Jenny Jenny says thank you
	one panel altered	Henry is fishing Henry catches a fish Henry gives the fish to Jenny <i>Jenny pays Henry</i>
	character name changed + one panel altered	<i>Jeremy</i> is fishing <i>Jeremy</i> catches a fish <i>Jeremy</i> gives the fish to Jenny <i>Jenny pays Jeremy</i>

Table 2.: Coding of example descriptions produced for the cartoon in Fig. 1

Ex.	Description ^a	Full NPs	Pronouns	Omissions	Total opp. ^b
(1)	<p><u>Henry</u> <i><est></i> goes fishing.</p> <p><u>Henry</u> <i><full></i> catches a <u>fish</u> <i><est></i>.</p> <p><u>He</u> <i><pro></i> gives <u>it</u> <i><pro></i> to <u>Jenny</u> <i><est></i>.</p> <p><u>Jenny</u> <i><full></i> says thank you.</p>	2	2	0	4
(2)	<p><u>Henry</u> <i><est></i> goes fishing,</p> <p>\emptyset catches a <u>fish</u> <i><est></i>,</p> <p>and \emptyset gives <u>it</u> <i><pro></i> to <u>Jenny</u> <i><est></i>,</p> <p>and <u>she</u> <i><pro></i> says thank you.</p>	0	2	2	4
(3)	<p><u>Henry</u> <i><est></i> goes fishing.</p> <p><u>Henry</u> <i><full></i> catches a <u>fish</u> <i><est></i>.</p> <p><u>Henry</u> <i><full></i> gives <u>the fish</u> <i><full></i> to <u>Jenny</u> <i><est></i>.</p> <p><u>Jenny</u> <i><full></i> thanks <u>him</u> <i><pro></i>.</p>	4	1	0	5

^a *est* = establishment, *full* = full NP, *pro* = pronoun, \emptyset = omission

^b figures represent counts per cartoon description

Table 3.: Krippendorff's α and 95% bootstrap confidence intervals (in brackets) for the three reference types and the total number of opportunities

Measure	α (95% CI)
Full NPs	0.93 (0.92, 0.95)
Pronouns	0.93 (0.91, 0.95)
Omissions	0.92 (0.90, 0.95)
Total opp.	0.90 (0.87, 0.93)

Table 4.: Model results for full NP production with prime type and confederate nativeness as fixed effects.

	β	SE	z	p
(Intercept)	0.98	0.26	3.81	< .001
Prime type	0.46	0.08	5.66	< .001
Confederate nativeness	0.51	0.32	1.55	0.12
Prime type * Confederate nativeness	-0.18	0.16	-1.14	0.25

List of Figures

1	Example cartoon strip from the participant set.	32
2	Example cartoon strip from the confederate set as (a) a full NP prime and (b) a pronoun prime.	33
3	Mean percentages of full NPs, pronouns, and omissions produced by participants in each condition. Percentages were calculated out of the total number of reference opportunities produced in each condition. Error bars represent ± 1 standard error of by-participant means. Dots represent individual participant means.	34

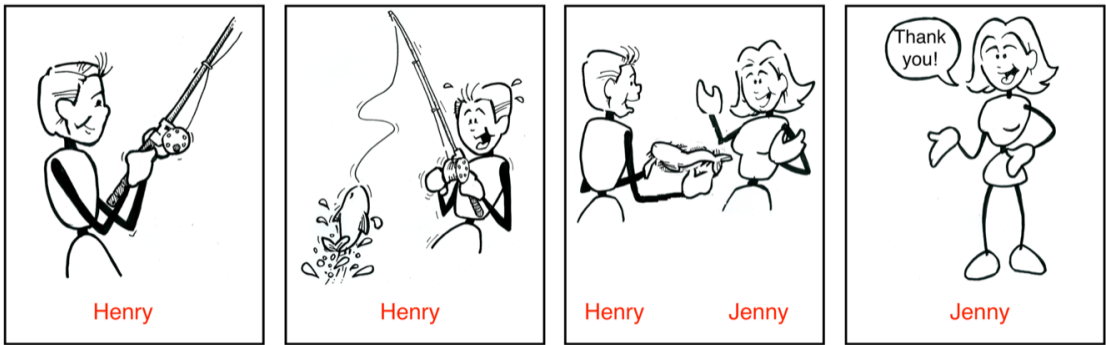
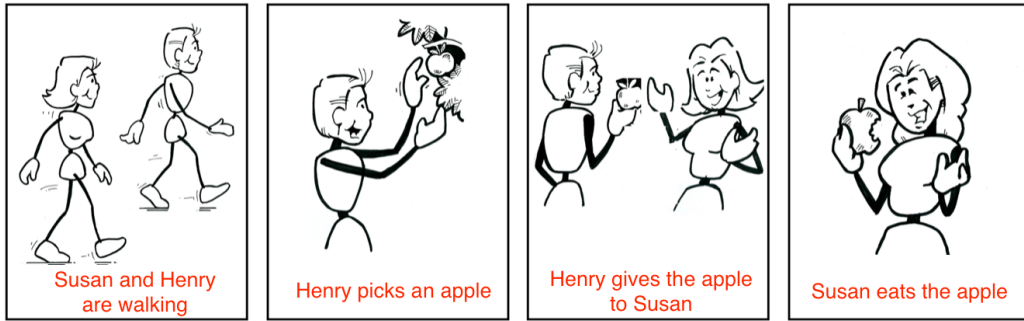


Figure 1.: Example cartoon strip from the participant set.

(a)



(b)

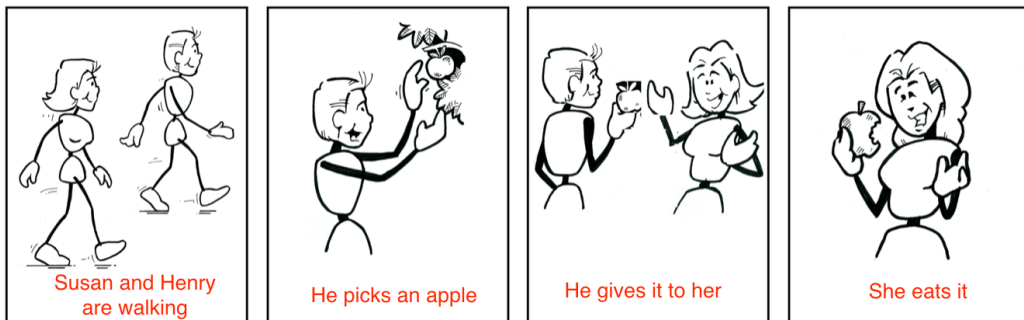


Figure 2.: Example cartoon strip from the confederate set as (a) a full NP prime and (b) a pronoun prime.

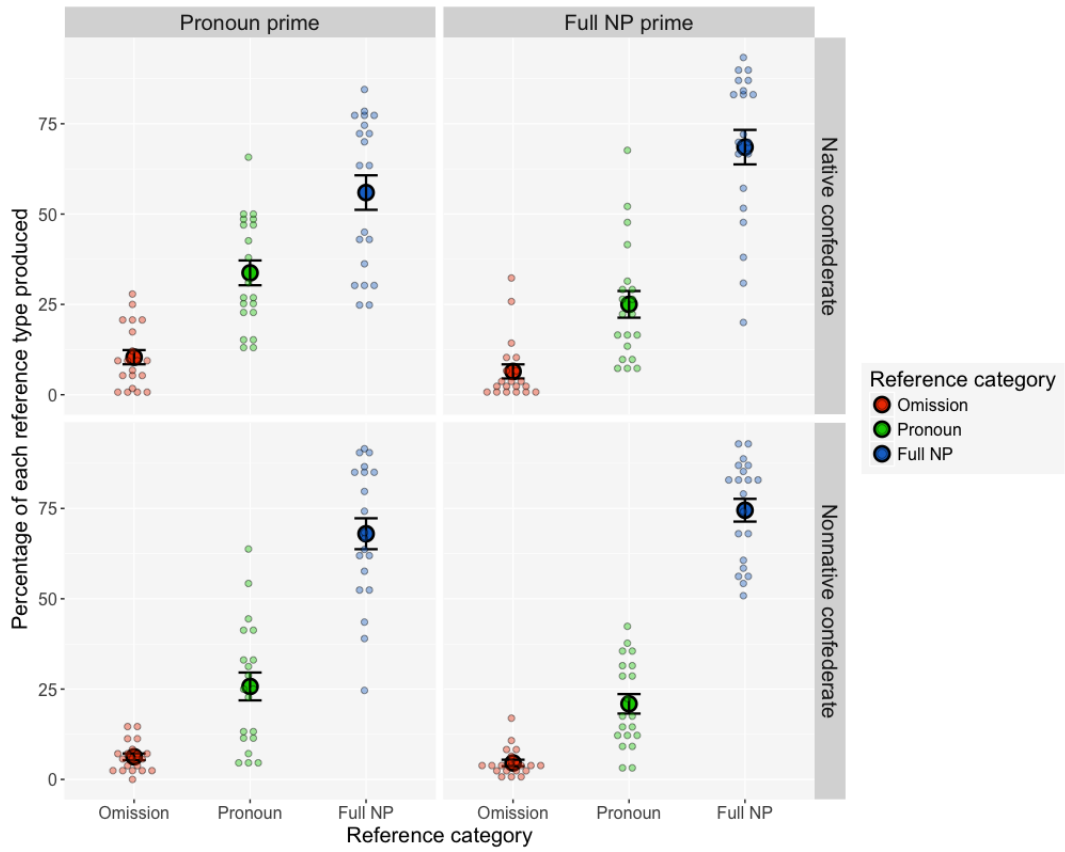


Figure 3.: Mean percentages of full NPs, pronouns, and omissions produced by participants in each condition. Percentages were calculated out of the total number of reference opportunities produced in each condition. Error bars represent ± 1 standard error of by-participant means. Dots represent individual participant means.