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Abstract

Two experiments investigated whether the choice of anaphoric expression is affected by the presence of an addressee. Following a context sentence and visual scene, participants described a target scene that required anaphoric reference. They described the scene either to an addressee (Experiment 1) or without an addressee (Experiment 2). When an addressee was present in the task, participants used more pronouns and fewer repeated noun phrases when the referent was the grammatical subject in the context sentence and no competitor was mentioned. They used fewer pronouns and more repeated noun phrases when a visual competitor was present on the scene than when there was no visual competitor. In the absence of an addressee, linguistic context effects were the same as when an addressee was present, but the visual effect of the competitor disappeared. We conclude that visual salience effects are due to adjustments that speakers make when they produce reference for an addressee, whereas linguistic salience effects appear whether or not speakers have addressees.

Is anaphoric reference cooperative?

One of the main concerns in discourse and dialogue studies has been speakers' level of cooperation with their addressees when referring to various discourse elements under discussion (e.g., Ariel, 1990; Bard et al., 2000; Brennan, 1995; Brennan & Clark, 1996; Clark & Murphy, 1982; Dell & Brown, 1991; Galati & Brennan, 2006; Horton & Gerrig, 2002; Horton & Keysar, 1996; Keysar et al., 2000). Speakers can use different referring expressions when they establish a link between different mentions of the same entity in the discourse. The linguistic form of these expressions varies with respect to how explicitly they are linked to their antecedents in the prior discourse (e.g., referring back to *a footballer* as 'the footballer', 'the player', 'Wayne Rooney' or 'he'). An ideal dialogue can be claimed to follow a cooperative principle (Grice, 1975) according to which speakers provide information that makes the interpretation of the utterances clear to their addressees. Whether the linguistic form that speakers choose for their referring expression can be seen to reflect this cooperative principle has been one of the central issues in studies of dialogue. In the present study, we focused on anaphoric expressions, that is, expressions (e.g., pronouns) that refer back to a recently mentioned constituent and investigated whether the form of these expressions differed when speakers completed a picture story to an addressee and when they completed the same picture story without an addressee being present.

The idea that speakers adapt to their addressees' needs and knowledge in their contributions to the on-going dialogue has been termed *audience design* (e.g., Clark & Murphy, 1982; Galati & Brennan, 2010; Horton & Gerrig, 2002). According to collaborative models of discourse (e.g., Brennan & Clark, 1996; Hanna & Tanenhaus, 2004; Heller, Gorman, & Tanenhaus, 2012; Horton & Gerrig, 2002, 2005; Lockridge & Brennan, 2002; Metzing & Brennan, 2003) the information that interlocutors share or do not share at a

particular point in the dialogue determines what kind of expressions speakers use for their addressees; that is, speakers are assumed to design their utterances with their addressees in mind and these partner-specific effects in communication emerge early in production processes (see Brennan & Hanna, 2009 for a review).

While some discourse theories assume audience design, others claim that speakers may not necessarily construct their utterances completely with their listeners in mind but might have a more self-centred point of departure and only later adjust to the needs of their listeners (e.g., Horton & Keysar, 1996; Keysar, Barr, & Horton, 1998). A number of studies (e.g., Brown & Dell, 1987; Ferreira & Dell, 2000; Horton & Keysar, 1996; Wardlow Lane & Ferreira, 2008; Wardlow Lane et al., 2006) suggest that speakers produce language highly automatically using a production system that is less sensitive to the communicative needs of the addressees than what is assumed by collaborative models. Considering the listeners' perspective by keeping track of what has been said in the preceding context and what is known to the listeners on the basis of their general knowledge might be a time-consuming process that places high demands on speakers' memory and attention (e.g., Pickering & Garrod, 2004). Also, in an on-going conversation speakers may have very little time to plan their utterances in advance because speaker-listener switches are often done with little or no time gap at all (e,g., Beattie, 1981; Clark, 1996; Jefferson, 1972). Horton and Keysar (1996), for example, showed that speakers did not consider listeners' perspective under time pressure as often as they did when there were no time constraints.

Most researchers agree that audience design occurs but disagree on when during the production process it occurs and under what circumstances. Most often, research in interactive dialogue has studied audience design in initial reference and in conditions in which speakers refer to the same object on different occasions or with different addressees. Studies have provided demonstrations of lexical entrainment; that is, when two interlocutors repeatedly

refer to the same object, they tend to start using the same terms (e.g., Brennan & Clark, 1996; Garrod & Anderson, 1987; Van Der Wege, 2009). In these experiments, participants referred to objects in a context with another object from the same category (e.g., Brennan & Clark, 1996) or referred to a similar object that differed in size or shape (e.g, Brown-Schmidt & Tanenhaus, 2006; Wardlow & Ferreira, 2008) or repeatedly referred to same objects when they interacted with new and old conversational partners (e.g., Brennan & Clark, 1996; Horton & Gerrig, 2005). In other studies, participants described routes on maps that differed for the speaker and the addressee or they were engaged in cooperative maze games (e.g., Garrod & Anderson, 1987) where they described their locations in the maze to each other.

What has not been systematically investigated in many of the studies is anaphoric reference. Anaphoric reference indicates that a noun phrase or a pronoun is referentially equivalent to a previously mentioned person or item (e.g., *A footballer hit a supporter$_i$. The supporter$_i$ fell.* or *The footballer$_i$ fell. He$_i$ was tackled from behind.*). A common assumption in theories of reference (e.g., Ariel, 1990, Chafe, 1994; Givón, 1983) is that the anaphoric expressions speakers choose when they refer to elements in the prior context signal how salient or accessible the referent is in its context. Language users produce reduced referring expressions such as pronouns when they refer to a highly accessible referent and use more explicit expressions such as names and noun phrases to refer to less salient referents; that is, the more accessible a referent is in the context the less information is needed in the anaphoric expression. When speakers use an unstressed pronoun (e.g., *he*) to refer to an individual (e.g., *a footballer*) they presumably refer to the most salient individual in the prior context whereas they use more elaborate expressions (e.g., *the footballer*) to refer to less accessible discourse entities. In fact, it has been shown that repeating explicit referring expressions for highly accessible referents can lead to processing difficulty (Gordon, Grosz, & Gilliom, 1993).

Research has shown that various discourse factors make referents salient for language users and affect language producers' choice of anaphoric expressions. For referents that are the grammatical subject or the first-mentioned entity, most often the topic in the preceding discourse, language producers tend to use more pronouns and fewer repeated names or definite noun phrases than for referents that are not subjects or first-mentioned entities in sentences (e.g., Arnold, 2001; Fletcher, 1984; Stevenson, Crawley, & Kleinman, 1994). They also tend to use more pronouns for animate than inanimate referents (Fukumura & Van Gompel, 2011) and they produce less elaborate expressions when only a single referent is present in the preceding context than when another referent is also mentioned (e.g., Arnold & Griffin, 2007; Fukumura, Van Gompel, & Pickering, 2010). Furthermore, corpus studies show that language producers use shorter expressions for entities that have been recently mentioned than for entities that were established earlier in the context (e.g., Ariel, 1990; Arnold, Bennetto, & Diehl, 2009; Givón, 1983).

However, most studies have not investigated to what extent speakers’ choice of anaphoric form is driven by the perceived needs of their addressee. Do speakers choose anaphoric expressions based on how accessible they believe that they are for their listeners or does the choice of the linguistic form merely reflect how available the referents are for the speakers themselves? Often, however, the speaker's point of departure does not differ from that of the adressees involved in the same conversation. If the speaker and the addressee share the same discourse context, referents that are highly accessible in the speakers' discourse representation are likely to be as accessible in the addressees' discourse representation. Therefore, when choosing referential expressions speakers might use the accessability of the referents that comes from their own internal representation of discourse and not necessarily from the perceived needs of the addressee. For example, Fukumura and Van Gompel (2012) manipulated whether speakers and their addressees shared the immediately preceding

linguistic context in which either a referent or a competing chararcter was mentioned. The study showed that speakers' choice of referring expressions was determined by how accessible the referent was for the speakers rather than how accessible it was for the addressees. In the present study, we examined whether and to what extent the anaphoric expressions that speakers produce differ depending on whether the speakers interact with an addressee or not.

Many linguistic models of discourse representation (e.g., Asher & Lascarides, 2003; Grosz, Joshi, & Weinstein, 1995; Hankamer & Sag, 1976; Heim, 1982; Kamp & Reyle, 1993; Webber, 1979) make the implicit assumption that speakers' discourse representations are primarily anchored to the preceding linguistic context; anaphoric expressions are syntactically and semantically controlled by their linguistic antecedents within the context. Although these models assume that a reference can also be pragmatically controlled without an explicitly expressed antecedent (e.g., derived from the context by lexical inference as in *Keith drove to London. The car was old and rusty* where the referent *the car* is inferred from the verb *drive*) and non-linguistic information can affect reference in discourse (e.g., Hankamer & Sag, 1976), their architectures generally only include elements that are linguistically mentioned. They do not capture non-linguistic elements that are part of external situations or need extensive inference.

One such external source of information that has received considerable attention in experimental research is the visual context. Several studies (e.g., Brown-Schmidt & Tanenhaus, 2006; Tanenhaus, Spivey Knowlton, Eberhard, & Sedivy 1995; Wardlow Lane & Ferreira, 2008) have shown that language processing in general is affected by what is visually present in the discourse context and that the linguistic forms speakers use are influenced by what they can see, even in cases in which the visual information is not shared by their addressees. Three studies (Arnold & Griffin, 2007; Fukumura, Van Gompel, & Pickering,

2010; Vogels, Krahmer, & Maes, 2012) have investigated whether speakers' choice of anaphoric expressions is also affected by visual context.

Arnold and Griffin (2007) investigated the use of pronouns and repeated names in a story-telling task. Participants first heard a context sentence that described a stimulus picture showing one or two characters (e.g., *Mickey went for a walk in the hills / Mickey went for a walk with Daisy in the hills*). Next, they described a target picture in which one of the characters (e.g., *Mickey*) was engaged in an action. In the single-character condition only one character was mentioned (e.g., *Mickey went for a walk in the hills*) and was present in both pictures. In the other conditions, a competing character of a different gender (*Daisy*) was mentioned in the context sentence and was present both in the stimulus picture and the target picture (the two-character condition), or the competitor (*Daisy*) was mentioned in the context sentence and was shown in the stimulus picture but was no longer present in the target picture (the two/one-character condition). Arnold and Griffin found a higher mean use of pronouns than repeated names in the single character condition whereas pronoun use was much lower in the other two conditions which did not differ. Pronoun use was significantly lower in the two/one-character conditions than in the single-character condition although the target picture was exactly the same in both conditions. According to Arnold and Griffin, the speakers' choice of referring expressions was affected by the presence of a competing character in the discourse representation rather than what was visually present in the target picture.

But Arnold and Griffin's (2007) results may suggest that the visual context *per se* did not affect the choice of referring expressions. Pronoun use was similar when the competitor was present in the target picture (the two-character condition) to when it was not (the two/one-character condition) suggesting that the choice of referring expressions was only affected by whether the context sentence mentioned the competing character or not. Participants produced fewer pronouns when the competitor was mentioned in the context

sentence (the two-character condition and the two/one-character condition) than when it was not (the single character condition).

Vogels et al. (2012) used a story completion task in which participants saw two characters in a picture and heard two sentences that mentioned both characters. Next, the participants saw a target picture in which one of the characters performed an action and were asked to describe the picture. Vogels et al. manipulated the visual salience of the characters in the target picture by placing one of the characters in the foreground and the other in the background. The participants were more likely to start their description by referring to the visually salient character in subject position than the visually non-salient character. However, visual salience did not affect the choice of the anaphoric expressions. The relative proportions of pronouns and definite noun phrases were similar for the visually salient character and non-salient character.

In contrast, Fukumura et al. (2010) did find an effect of visual presence on anaphoric reference. In this study, speakers first read aloud a context sentence (e.g., *The pirate's carpet had been cleaned* / *The pirate's carpet had been cleaned by a prince*) and saw a picture in which there were either one (*the pirate*) or two (*the pirate and a prince*) characters. Both the linguistic mention and visual presence of a competitor were manipulated; the competitor (*a prince*) was either mentioned or not mentioned in the context sentence, and the competitor was either present or absent in both the context picture and the target picture. The speakers' task was to describe the target picture in which the main character (*the pirate*) performed an action to an addressee who carried out the action using toy characters. Speakers produced pronouns (relative to repeated noun phrases) for the target character less often when the competitor was mentioned in the context sentence than when no competitor was mentioned. Moreover, the speakers produced fewer pronouns when the competitor was visually present than when it was absent. This effect also occured in a further experiment in which the referent

and competitor had different genders (e.g., *a pirate* and *a princess*) and pronominal reference was unambiguous. Fukumura et al. concluded that both the linguistic mention and the visual presence of a competing character reduce the salience of the referent resulting in more repeated nouns and fewer pronouns.

The results from Arnold and Griffin (2007) and Fukumura et al. (2010) showed that the linguistic mention of a competitor reduces the prominence of the referent for speakers. Fukumura et al. also showed that the presence of a competitor, even when it was not mentioned, resulted in fewer pronouns and more repeated noun phrases, whereas there was no unequivocal effect of visual context in the Arnold and Griffin and Vogel et al. (2012) studies. Speakers in the Arnold and Griffin and Vogel et al. studies had no real addressee so the use of reference in these studies may well have reflected speakers' own discourse representation; that is, what is easiest for speakers. This representation may not include elements from non-linguistic context but could be based on linguistic information only. But in communication with addressees, speakers might also take into account the non-linguistic information and use expressions that would better distinguish between potential references if they believed that these might benefit communication. This would suggest that there are two separate sources, the linguistic and the visual context, that affect speakers' discourse model. The linguistic context appears to be unaffected by the presence of an addressee whereas visual context effects could be the result of the speakers' awareness of the non-linguistic environment that they share with their listeners.

Interestingly, Wolter, Skovbroten Gorman, and Tanenhaus (2011) demonstrated that in language comprehension, linguistic and non-linguistic information made separate contributions to reference resolution. Their participants moved objects in a visual display according to instructions while their eye movements were recorded. The experimental set contained two objects that contrasted in size (e.g., a big candle and a small candle) among

other objects. Participants heard a sequence of two sentences that asked them to move the objects in the set (e.g., *Put the big candle above the heart. Now, put the small...* or *Put the object in the yellow square above the triangle. Now, put the small...*). When the first part of the instructions contained a prenominal scalar adjective (e.g., *big*) that contrasted the objects in the set, the participants, upon hearing the adjective (e.g., *small*), looked more often at the other member in the set (the small candle) relative to a distractor (e.g., a small tie) than when the first part of the instructions referred to the same object (e.g., the bigger candle in the set of two candles) but did not contain the scalar adjective (e.g., *Put the object in the yellow square*...). Instructions that did not contain the size description did not lead to an anticipation effect on the other member of the set. Wolter et al. argued for a language processing model in which linguistic mention is more prominent and differentiated from other types of information that affect reference resolution in discourse. This model is in line with discourse representation theories that implicitly assume that discourse representations are primarily constructed on the basis of the linguistic input (e.g., Asher & Lascarides, 2003; Grosz, Joshi, & Weinstein, 1995; Heim, 1982; Kamp & Reyle, 1993).

In the present study, we asked whether linguistic information and visual context influence speakers' choice of anaphoric expressions differently depending on whether they interact with addressees or not. To test this, we manipulated the linguistic mention and the visual presence of a character when speakers produced referring expressions either for an addressee (Experiment 1) or without addressees (Experiment 2). The comparison of the two experiments allowed us to investigate whether speakers use anaphoric expressions that clearly and unambiguously identify the referent more often in a task with addressees who benefit from the descriptions than in a task that was otherwise the same but no addressee was present.

In our study, we used a story-telling task (e.g., Arnold & Griffin, 2007). Participants first saw a picture of one or two cartoon-like characters involved in an activity (see Fig. 1)

and heard a context sentence (e.g., *A supporter kicks a footballer*) that described the picture. Next, they saw a follow-up picture (Fig. 2) in which one of the characters performed an action (e.g., throwing away a bottle in anger). The participants' task was to describe the follow-up picture. We analysed how participants referred to the character in the target picture (e.g., *The footballer/He throws away a bottle*). In Experiment 1, participants described the picture to an addressee whereas in Experiment 2, there was no addressee present and no potential addressee was mentioned in the instructions.

The experimental manipulation of the context sentence and the first picture included four conditions (Figs. 1a-d). We investigated the effect of grammatical role/order-of-mention on the choice of anaphor by comparing a condition in which the character in the target picture (Fig. 2) was a grammatical object and the second-mentioned character in the preceding context sentence (Fig. 1a: object antecedent - competitor mentioned and visible) to a condition in which the target character was a subject and mentioned first (Fig. 1b: subject antecedent - competitor mentioned and visible). In both conditions, a competitor (e.g., *a supporter*) was mentioned in the context sentence and visually present in the first picture. On the basis of previous research (e.g., Fletcher, 1984; Fukumura & Van Gompel, 2010; Stevenson, Crawley, & Kleinman, 1994), we expected that when describing the target picture (Fig. 2) the participants would use more pronouns and fewer repeated noun phrases when they referrred back to the subject (Fig. 1b) than to the object (Fig. 1a) in the context sentence. Also, assuming that preceding linguistic information is used regardless of the presence of an addressee, we expected that the effect of grammatical role or order of mention (topic vs. non-topic) would not differ between the experiments.

The effect of linguistic mention on reference to the target character was investigated by comparing the condition in which the target character was the subject of the context sentence and a competitor was mentioned and visually present (Fig. 1b: subject antecedent -

competitor mentioned and visible) to a condition in which only the target character was mentioned in the context sentence but the competitor was visually present (Fig. 1c: subject antecedent - competitor visible). Based on the results of Arnold and Griffin (2007) and Fukumura et al. (2010), we expected that participants would use fewer pronouns when the competitor was mentioned (Fig. 1b) than when it was not (Fig. 1c). If anaphoric usage is unaffected by addressee presence, then the between-experiment addressee manipulation should have no effect on anaphor choice.

Finally, we examined the visual context effect by comparing the two conditions in which only the target character was linguistically mentioned in the context sentence (Figs. 1c and 1d). The linguistic context was exactly the same in these conditions but in one condition a competitor was visually present (Fig 1c: subject antecedent - competitor visible) whereas in the other it was not (Fig. 1d: subject antecedent - no competitor). If speakers' attention is drawn to the visually present character they should use fewer pronouns in the condition in which a competitor is visually present (Fig. 1c) than when no competitor is present (Fig. 1d). The question of interest here was whether the visual competitor effect would be the same in both tasks or whether it would depend on the speaker's task. That is, does the visual competitor affect the way how speakers refer to the target character only in a task that involves interaction with an addressee or does it also occur in a task without an addressee.

EXPERIMENT 1

In Experiment 1 participants first saw a picture in one of the four conditions (Fig. 1) and heard a sentence that described the setting in the picture. Next, they saw another picture that showed the target character in an action (Fig. 2). Participants' task was to describe the

follow-up picture to an addressee whose task was to select a picture that matched the description of the target picture. Because in natural dialogues, participants' utterances are normally followed by an element of feedback, speakers in our experiment received a response that signalled to them whether their description had been successful or not. After every trial, speakers saw a feedback picture on their computer screen that indicated whether the choice that their addressee made was correct or not. We controlled the feedback so that all participants received the same feedback in all conditions.

Method

Participants.

Forty-eight students at the University of Dundee (35 females and 13 males, M_{age} = 23.1 years, age range: 18-46) participated in the experiment for course credit or were paid for their participation. Three female undergraduate students of psychology participated as confederates. All participants were native speakers of British English.

Materials and design.

There were 32 experimental item sets in four conditions (Figs. 1a-d). Each set consisted of two pictures. The first picture (Fig. 1) introduced one or two male or female characters involved in an action or an event. This picture had a context sentence written underneath the picture. The context sentence (Fig. 1a-d) was only visible to the confederate participant (see Appendix for all item sets). The second picture (the target picture) showed the target character in an activity that could follow from the action or event in the context picture. This target picture (Fig. 2) was the same in all four conditions.

The characters in the first picture had the same gender and were about the same size in the picture. In pictures where the size difference was relevant for the characters (e.g., a boy and a clown; a girl and a woman; a dwarf and a wizard) the smaller characters were depicted with uplifted arms and hands or the larger character was not fully visible to minimize the size difference. The characters' physical appearance was clearly different from each other and there was no phonological similarity in the noun phrases that described the characters. Both characters were always referred to with indefinite noun phrases in the context sentence.

In the condition in which the target character was the object in the context sentence the competitor carried out an action that affected the target character (Fig. 1a: object antecedent - competitor mentioned and visible). When describing the target picture (Fig. 2), participants were referring to the object in the previous sentence. The grammatical roles of the target character and the competitor were reversed in the condition in which the action was the same but the target character now carried out the action towards the competitor (Fig. 1b: subject antecedent - competitor mentioned and visible). Participants were now referring to the subject of the previous sentence when they described the target picture. In the condition in which the competitor was present but not mentioned the target character was acting alone and the competitor was depicted watching the target character (Fig. 1c: subject antecedent - competitor visible). In the fourth condition the target character performed the same action as in the condition in which the competitor was present (Fig. 1c) but now there was no competitor present (Fig. 1d: subject antecedent - no competitor).

In addition, 40 filler sets that consisted of two pictures each were constructed. The filler pictures varied in their settings. They had either one or two characters (humans and animals) but also inanimate objects (e.g., a limousine, a spaceship, a skyscraper) in the first picture. The second picture was either based on one of characters or objects in the first picture or introduced a new character or object that was connected to the event in the first picture. In

8 filler sets the second picture showed a character that was present in the first picture but was not mentioned in the context sentence.

The 32 experimental item sets together with the filler sets were placed in four presentation files, each containing 8 items from each of the four conditions (Figs. 1a-d). In every presentation file the position of the target character was counterbalanced so that the target character and the competitor appeared equally often on the righthand side and the lefthand side of the first picture resulting in a total of 8 presentation files. The items were placed in a single pseudo-random order. One to four filler items intervened between the experimental items.

Procedure.

The participants were told that the experiment was about describing events in a picture story in interaction with a partner. One participant would be the Picture Describer and the other would be the Picture Matcher. The experimenter assigned the role of the picture matcher to the confederate and the real participant was chosen to be the picture describer. Three female confederates took turns in acting as participants in the experiment and they arrived in the test laboratory together with their participants who did not know that their partner was a confederate. The participants were seated opposite to one another so that they could see each other but not what was on their computer screens.

The picture matcher (the confederate) first described the context picture (Figs. 1a-d) by reading aloud a sentence that was written underneath the picture on her screen. The picture describer (the participant) saw the same picture but could not see the context sentence on the screen and was asked to listen carefully when the picture matcher read aloud the sentence. Next, the picture matcher pressed a key on the keyboard and the first picture was replaced by the target picture (Fig. 2). The picture desciber's task was now to continue the story by

describing the follow-up picture to the picture matcher whose task was to select a picture that matched the description among two pictures that she saw on her screen. The participant was asked to use, if possible, only one sentence in their description but to try to make a good description that would be a natural continuation of the first sentence and form a coherent story together with it so that it would help the partner choose the right picture. After the participant had described the target picture, the picture matcher was told to press the key on her lefthand side if the description matched the picture on her left or press the key on her righthand side if the description matched the picture on her right. The picture that the picture matcher had chosen then appeared on both screens with the text RIGHT or WRONG above it to inform the participants whether the choice the picture matcher had made was correct or not. In reality, the confederate acting as the picture matcher used the same key all the time and saw the same pictures as the participant. To keep the participants focused on making clear descriptions during the whole session participants received WRONG six times during the experiment. In these trials the confederate chose a wrong picture which was shown to the participants. In the wrong pictures, some detail or the manner of the action in the target picture was changed. The main characters or objects were never changed in these pictures. If the participant had given a very accurate description of the picture which included the change, the confederate excused herself by saying that she pressed the wrong key by accident. Also, if the participant did not seem to pay enough attention to the descriptions or gave a very short and uninformative description the confederate was instructed to say that she now needed to guess which picture was the right one. This was, however, seldom needed.

Prior to the experimental trials, the participants did a practice round during which the experimenter explained and showed the procedure with the help of a demonstration trial. In this trial the participants saw a picture of a boy and a man playing football and the picture matcher (the confederate) was asked to read aloud the context sentence (*A father is playing*

football with his son) that was on her screen underneath the picture and then to press a button for the follow-up picture. After the participant had produced the description of the picture (a picture of a football breaking a window) both participants were shown two pictures (a picture of a football breaking a window and a picture of a football going through an open window) and the picture matcher was asked to choose the picture that matched the description the participant had produced. This was done to make clear to the participant that the picture matcher saw two pictures after the first picture and that it was important to produce a good description of the target picture.

The demonstration round was followed by three practice sets in which the confederate made one wrong choice. The error picture was very similar to the picture that the participant described (the change involved the size of a spoon that was used to feed a baby). Questions were allowed during the practice sets but were not encouraged during the experiment. After the three practice sets the experimenter withdrew to the other end of the room and the participants went on doing the session at their own pace.

The participants' descriptions were recorded with a digital voice recorder. At the end of the experiment participants were asked to fill out a short questionnaire about their personal details and answer three questions about the task itself. Participants were asked to mark how easy it was to describe the pictures and how accurate they believed their descriptions were on a 5-point scale. They were also asked if they noticed anything particular about their partner and her behaviour that might have somehow affected their descriptions. None of the participants suspected that their partner was a confederate. The experiment took about 35-40 minutes.

Scoring

The participants' descriptions of the target pictures were transcribed and the use of pronouns and repeated noun phrases for reference to the target character was scored for each of the four conditions (Figs. 1a-d). All forms of reference other than pronouns and noun phrases (1.2%) were excluded.

Results.

Figure 3 shows the percentages of repeated noun phrase and pronoun references by condition. We analysed the logit of repeated noun phrase references out of all repeated noun phrase and pronoun references by fitting a logit mixed effect model using the LMER function from the LanguageR Package in R (version 2.15.2; CRAN project; The R Foundation for Statistical Computing, 2012). R's LMER binomial function uses Laplace approximation to maximize quasi-log-likelihood. Condition (object antecedent - competitor mentioned and visible vs. subject antecedent - competitor mentioned and visible vs. subject antecedent - competitor visible vs. subject antecendent - no competitor) was included as a fixed-effect variable with forward difference coding, so that we could examine the effect of grammatical role/first mention (object antecedent - competitor mentioned and visible vs. subject antecedent - competitor mentioned and visible), linguistic mention of the competitor (subject antecedent - competitor mentioned and visible vs. subject antecedent - competitor visible) and visual presence of the competitor (subject antecedent - competitor visible vs. subject antecedent - no competitor). In all analyses in this study, we started with the model containing random participant and item slopes that included the maximal random effects structure (Barr, Levy, Scheepers, & Tily, 2012). If two contrasts highly correlated with each other ($r > .9$) or if a contrast highly correlated with the intercept, then we removed the redundant slope in order to avoid overparametrising (e.g., Baayen, Davidson, & Bates, 2008). Subject and item intercepts were always included.

Logit mixed effect modelling showed a significant difference between the object antecedent - competitor mentioned and visible and the subject antecedent - competitor mentioned and visible conditions, indicating that participants produced more repeated noun phrases (fewer pronouns) when the antecedent was the object than the subject: $\beta = 2.15$, $z = 4.48$, $p < .01$. Linguistic mention also had an effect; participants produced more noun phrases when the competitor was mentioned (subject antecedent - competitor mentioned and visible) than when it was not (subject antecedent - competitor visible): $\beta = 2.19$, $z = 6.67$, $p < .01$. Finally, participants produced more noun phrases when the competitor was visually present (subject antecedent - competitor visible) than absent (subject antecedent - no competitor): $\beta = .96$, $z = 3.77$, $p < .01$.

Discussion

The results showed that different variables affected the choice of anaphoric expression for the target character. The participants produced fewer pronouns and more repeated noun phrases when the referent was the object and the second-mentioned entity in the preceding sentence than when it was the subject and first-mentioned. This is consistent with previous research (e.g., Flecher, 1984; Fukumura & Van Gompel, 2010; Stevenson, Crawley, & Kleinman, 1994). They also produced fewer pronouns and more noun phrases when the competitor was linguistically mentioned than when it was not, consistent with previous research by Fletcher (1984), Arnold and Griffin (2007) and Fukumura et al. (2010). The results also showed evidence for a visual salience effect; participants produced fewer pronouns and more noun phrases for the referent when a competitor was visually present in the first picture than when it was not. This is in line with Fukumura et al. (2010) who also found that speakers tended to produce more explicit referring expressions when a competitor

was present in the visual context, but differs from the results in the Arnold and Griffin (2007) study in which there was no such clear visual context effect. The important difference between these studies was that participants in the Arnold and Griffin study had no addressee whereas participants in Fukumura et al.'s study described actions to an addressee. Taken together, the results from these studies and our study are consistent with the idea that the visual context effect is due to the presence of an addressee; that is, speakers take the presence of the visual competitor into account when referring to the target character for an addressee. The linguistic effects that we observed and were also found in the Fukumura et al. study (2010) and in the Arnold & Griffin study (2007) have been found in several other studies in which participants had no addressee such as sentence completion (e.g., Fletcher, 1984; Fukumura & Van Gompel, 2010; Stevenson, Crawley, & Kleinman, 1994) suggesting that these linguistic effects may occur whether or not participants produce utterances in the presence of an addressee.

EXPERIMENT 2

Despite a large body of research on dialogue, few studies (Schober, 1993; Van Der Wege, 2009) have directly compared the choice of referring expressions in situations where speakers and addressees interacted in describing pictures with situations in which participants were instructed to describe the same materials without an addressee. Chantraine and Hupet (1994; Hupet & Chantraine, 1992) had participants listen to descriptions of tangrams (e.g., Clark, 1996) that were recorded when speakers described them either to addressees or without addressees. They found no differences in how accurately the novel listeners recognised the tangrams between the conditions (see also Murfitt & McAllister, 2001 for similar results) suggesting that the clarity of the expressions was unaffected by addressee presence. Fox Tree

(1999), however, found that tangram descriptions in dialogues were better recognised by novel listeners than monologue descriptions.

In a study of lexical entrainment by Van Der Wege (2009), speakers described the same picture materials to a real addressee, to an imaginary addressee and in a situation in which no addressee was mentioned. The results showed that the magnitudes of the entrainment effects varied across the experimental conditions. Speakers imagining addressees were more likely to overspecify their referring expressions than the other groups. Because the speakers did not receive any feedback from addressees they might have compensated for that and used overly specific expressions more than they did when speaking to real addressees who gave feedback by choosing the right pictures. Speakers naming pictures without addressees in turn were found to underspecify their references in comparison to the other groups. According to Van Der Wege, when no potential addressee was mentioned, speakers might have tailored their expressions for a generic audience or described pictures for the experimenter. Also, when speakers had no explicit audience, they might have produced language without regard for an audience and used their own discourse model in doing that.

Our goal was to investigate whether the effects of linguistic mention and visual presence that appeared in the task in which speakers had an addressee present would also occur in a task in which the speakers described the same pictures but now in the absence of an addressee (either real or imagined).

Except for the absence of an addressee, the participants' task in Experiment 2 was the same as the one in Experiment 1. They were given the same description of the task as in Experiment 1 and were asked to try to produce a good description of the target picture that would be a natural continuation of the first sentence and form a coherent story together. No addressee was mentioned but instructions stressed the importance of giving good descriptions for the benefit of a coherent story.

Method

Participants.

Fifty-two students at the University of Dundee (37 females and 15 males, M_{age} = 23.4 years, age range: 18-46) participated in the experiment for course credit or were paid for their participation. All participants were native speakers of British English. One of the participants was replaced for not providing descriptions to all the pictures.

Materials and design.

The experimental and filler set materials were the same as in Experiment 1. The same design as in Experiment 1 was used in placing the experimental items in eight files. All the written context sentences (see Figs.1a-d) that the confederate read out aloud in Experiment 1 were now replaced by a soundfile that contained a recording of the context sentence. One of the female confederates in Experiment 1 recorded all the context sentences for Experiment 2. All the error pictures and the feedback displays that were used in Experiment 1 were removed from the presentation files.

Procedure.

The participants were informed that the experiment was about describing a follow-up picture in a picture story that was two pictures long. They were told that the first picture was already described and their task was to continue the story by describing the second picture as naturally as possible. First, participants saw a picture and heard a recorded sentence through the computer speakers. They were asked to listen carefully to the recorded sentence because they would hear it only once. After looking at the picture and listening to the sentence

participants pressed a button to see the follow-up picture that showed what happened next in the story. Participants' task was to continue the story by describing the second picture. As in Experiment 1, they were asked to use, if possible, only one sentence in their description but to try to make a good description so that it would be a natural continuation to the first sentence and form a coherent story together with it. No addressee was mentioned. After describing the second picture participants pressed the button again and the program displayed a screen with the word NEW on it. When participants pressed the button again the next story began with the first picture.

As in Experiment 1, the experiment was preceded by a demonstration trial to ensure that participants knew the procedure before starting the experiment. The demonstration trial was followed by three filler sets during which participants could ask questions if anything was unclear. After that, the experimenter withdrew to the other end of the room and participants worked through the experiment at their own pace. The experiment took about 25-30 minutes.

Results.

Figure 4 shows the percentages of pronoun and repeated noun phrase references by condition. We analysed the data in the same was as in Experiment 1. As in Experiment 1, participants produced more noun phrases when the antecedent was the object (object antecedent -competitor mentioned and visible) than the subject (subject antecedent - competitor mentioned and visible), indicating an effect of grammatical role/order of mention: $\beta = 3.86$, $z = 6.03$, $p < .01$. Participants also produced more noun phrases when the competitor was linguistically mentioned (subject antecedent - competitor mentioned and visible) than when it was not (subject antecedent - competitor visible): $\beta = 2.77$, $z = 8.28$, $p < .01$, again as in Experiment 1. However, in contrast to Experiment 1, there was no difference between the condition in which there was no linguistic or visual competitor (subject antecedent - no

competitor) and the condition in which the competitor was visually present but not mentioned (subject antecedent - competitor visible), indicating that visual presence of the competitor had no effect: $\beta = .22$, $z = .99$, $p = .32$.

We conducted additional analyses to compare the results from Experiments 1 and 2 directly. First, to test whether there was an overall effect of addressee presence (Experiment 1 vs. Experiment 2), we computed a model that included addressee presence (present vs. absent) and condition (but no interaction) and compared it with a model that included only condition. We used the same procedure for including random slopes as before. A log likelihood ratio test showed that the model that included addressee presence provided a better fit, indicating that overall, participants produced more repeated noun phrases when an addressee was present than absent: $\chi^2 = 4.48$, $p = .03$.

Next, we examined whether linguistic and visual salience interacted with addressee presence. We computed a mixed effect model that included addressee presence and condition as well as the interaction between them. This model showed that participants produced more noun phrases when they referred to the object (object antecedent - competitor mentioned and visible) than the subject (subject antecedent -competitor mentioned and visible) ($\beta = 2.81$, $z = 7.55$, $p < .01$) and this effect did not interact with addressee presence: $\beta = .46$, $z = 1.34$, $p = .18$. The effect of linguistic mention of the competitor (subject antecedent - competitor mentioned and visible vs. subject antecedent - competitor visible) ($\beta = 2.51$, $z = 8.43$, $p < .01$) also did not interact with addressee presence: $\beta = 0.18$, $z = .84$, $p = .40$. Finally, speakers produced more noun phrases when the competitor was visually present (subject antecedent - competitor visible) than absent (subject antecedent - no competitor): $\beta = 0.62$, $z = 3.52$, $p < .01$. However, this effect was qualified by an interaction with addressee presence ($\beta = .39$, $z = 2.37$ $p = .02$), consistent with the earlier analyses that showed that the visual competitor effect was significant in Experiment 1, but not in Experiment 2. To provide further evidence that the

visual competitor effect interacted with addressee presence, we compared two models that only included the condition in which there was no linguistic or visual competitor present (subject antecedent - no competitor) and the condition in which the competitor was visually present but not mentioned (subject antecedent - competitor visible): One model that included the experiment and condition variables as well as the experiment x condition interaction, whereas the other model did not include this interaction. A log likelihood ratio test showed that the fit of the model with the interaction was better (χ^2 (1) = 5.40; p = .02), confirming that the effect of visual competitor interacted with addressee presence.

Discussion

The same linguistic effects on reference as in Experiment 1 were found here when speakers produced referring expressions in the absence of an addressee. The results showed that the participants produced fewer pronouns and more repeated noun phrases when the referent was the object than when it was the subject in the context sentence. Fewer pronouns were also produced when the competitor was mentioned than when it was not. These results replicate the findings from Experiment 1 and are also in line with the studies of Arnold and Griffin (2007) and Fukumura et al. (2010). A difference that appeared compared to Experiment 1 was the absence of an effect of visual presence. In Experiment 1, the participants produced significantly fewer pronouns for the referent when a competitor was visually present (but not mentioned linguistically) in the first picture than when it was not. In Experiment 2, there was no visual competitor effect; the visual presence of a competitor in the context picture did not have an effect on how the participants referred to the target character in the stimulus picture compared to how they referred to it when no other character was present in the first picture. Thus, when there was no co-present addressee, the visual presence

of another character did not seem to result in competition with the referent and speakers did not reduce the use of pronouns.

Together, the results from the two experiments suggest an important difference in how linguistic mention and visual presence affect speakers' choice of anaphoric expressions. The linguistic effects of grammatical role (subject vs. object) and order of mention (first-mentioned vs. second-mentioned) were unaffected by the presence of an addressee. Similarly, the linguistic mention of a competitor reduced the use of pronouns for the target character both when an addressee was present and when there was no addressee. This suggests that these effects were not due to the speakers' adjustments to their addressees. In contrast, the visual competitor effect that was present when speakers' task involved producing reference for an addressee, disappeared when speakers had no addressee in the task. This suggests that the use of visual information in speakers' anaphoric expressions was affected by addressee-sensitive processes.

GENERAL DISCUSSION

The findings from our experiments showed the same linguistic context effects on the choice of anaphoric form when speakers described pictures in a task with an addressee and when they had no addressee present in the task. When speakers produced anaphoric expressions, the referent's grammatical role and order of mention affected their choice of anaphoric expressions; they produced fewer pronouns (and more repeated noun phrases) for grammatical objects that were mentioned second than for subjects that were mentioned first. This is in line with previous research on anaphor production (e.g., Arnold, 2001; Fletcher, 1984; Stevenson, Crawley, & Kleinman, 1994). In addition, when the context mentioned a

competitor, speakers used fewer pronouns and more repeated noun phrases for the referent than when there was no linguistic mention of a competitor. This effect of linguistic mention was also found in studies by Arnold and Griffin (2007), in which speakers had no addressee and Fukumura et al. (2010) in which speakers produced reference for addressees.

The linguistic context effects which we found in our study are also in line with the results from the Fukumura and Van Gompel study (2012), in which speakers' choice of anaphoric expressions was influenced by linguistic information whether or not this information was shared by the addressees. Together, the experimental evidence from this study and from our study indicate that linguistic effects on anaphoric reference appear whether or not speakers have addressees.

In contrast to the linguistic context effects, we observed an effect of visual context when speakers decribed pictures to an addressee; fewer pronouns were used for a referent when a visual competitor was present but no such effect was found when speakers had no addressee present. The contrast between linguistic mention and visual presence suggests that in the presence of an addressee speakers took the visual environment into account and produced more explicit expressions for the referent when there was a visual competitor present whereas they chose their referring expressions on the basis of linguistic context only when there was no addressee who shared the visual context. This could also explain why the Arnold and Griffin study (2007), in which speakers had no addressees, did not find a reliable visual effect whereas the study of Fukumura et al. (2007) in which speakers had an addressee did find a visual context effect. Together, the results suggest that in language production studies investigating visual context effects, it is important to use a task that involves an addressee; without such a task, some effects may not be observed. It appears that when speakers have an addressee who provides feedback, the need to be clear about the visual

context may be more important, and as a result, speakers are more explicit when producing reference.

One possibility to consider here is whether the linguistic effects were too weak to be modulated by addressee presence; that is, if the size of the linguistic effects were small when the speakers produced reference for an addressee (Experiment 1), there would be little room for these effects to become even smaller when the speakers had no addressee (Experiment 2). Our results do not support this possibility because in Experiment 1 the linguistic competitor effect (the difference between the subject antecedent - competitor mentioned and visible and the subject antecedent - competitor visible conditions) was larger (14.5% vs. 8.3%) than the visual competitor effect (the difference between the subject antecedent - competitor visible and the subject antecedent - no competitor conditions). Futhermore, the size of the grammatical role effect (the difference between the object antecedent - competitor mentioned and visible and the subject antecedent - the competitor mentioned and visible conditions) and the visual competitor effect were quite similar (6.7% vs. 8.3%), so it seems unlikely that the absence of an interaction between grammatical role and addressee presence is merely a result of a weak effect in Experiment 1.

The experiments here were designed first of all to investigate the addressee effect on speakers' production of referring expressions in discourse context. Our study shows that the effects of linguistic mention and grammatical role on the choice of anaphor were unaffected by speakers' task; that is, whether their task involved producing reference for an addressee or not, suggesting that speakers made use of the linguistic input in a similar way whether or not they had an addressee present in the task. This lends support to the idea that discourse representations are primarily constructed on the basis of the linguistic input and this use of linguistic information is unaffected by whether the task involved an addressee or not.

The visual context effect only emerged when speakers described pictures so that an addressee could identify them. The interaction with an addressee appears to have prompted speakers to be more precise in their descriptions to help their addressee to find the correct picture, whereas the speakers who had no partner who needed to act on their descriptions had no such explicit need to be precise. The task in Experiment 1 did not merely involve the copresence of an addressee without any specific demands on speakers' output; it involved a matching task in which speakers received feedback on their descriptions. We believe that this is critical for investigating addressee effects. In natural spoken dialogue interlocutors give feedback to each other by acting upon the information that they receive in different ways (e.g., showing signs of understanding it or failing to do so). If the addressee has no task and does not provide feedback, there is no *addressee* in the true sense of the word and there is no real communication. Without real communication, speakers are likely to produce reference in the same way as without an addressee.

It is possible, however, that in Experiment 2, although no addressee was mentioned in the instructions speakers may have imagined one. All the descriptions were recorded and speakers were aware that the experimenter would listen to the recordings later. It is plausible that speakers, at least to some extent, considered a possible addressee; if they did not, they would presumably have produced pronouns only, because these are shorter than full noun phrases. Yet, if speakers did imagine an addressee, they were less likely to adjust their anaphoric expressions to reflect the visual context than speakers who shared the visual context with a real addressee. Also, the main effect of addressee in the between-experiment comparison indicated that speakers with real addressees produced fewer pronouns than speakers without addressees. Thus, in the task without addressees, speakers produced expressions that could uniquely identify the given referent less often than speakers who produced referring expressions for an addressee. The linguistic salience effects, however,

were the same in both tasks indicating that speakers took into account the linguistic information whether or not they had an addressee.

The separation of linguistic and non-linguistic information in reference production in our study is in line with many formal models of discourse representation (e.g., Asher & Lascarides, 2003; Grosz, Joshi, & Weinstein, 1995; Heim, 1982; Kamp & Reyle, 1993) in which anaphor resolution is first and foremost influenced by previous, explicitly mentioned linguistic context. These models do not rule out that extra-linguistic context may also affect discourse representations but they do not postulate a mechanism through which non-linguistic context could be included into the representation of linguistic events. We suggest, based on the results from our study, that linguistic information is used automatically, whereas the use of visual context is more strategic and interactive and brought about by the presence of an addressee. This is in line with accounts that assume that adjustment to listeners' needs in a conversation takes place later, most often evoked by feedback, linguistic and extralinguistic, from addressees (e.g., Brown & Dell, 1987; Ferreira & Dell, 2000; Horton & Keysar, 1996). However, these accounts do not make a distinction between the use of linguistic and visual information, whereas our results strongly support the idea that there is a distinction.

Our results are also in line with the study of Wolter et al. (2011) in which they demonstrated separate effects of linguistic and non-linguistic information in reference resolution. They showed that the mention of a scalar adjective in the description of an object (e.g., *a tall candle*) facilitated subsequent reference to objects that were contrasted with the adjective (e.g., *a small candle*) whereas no such facilitation occured in cases in which participants attended to the same objects but no scalar adjectives were used in the description. Wolter et al. proposed a model of language processing in which linguistic information has a more prominent effect on the interpretation of sentences than other types information that are given simultaneously. Consistent with our findings from reference production, this model

implies a dissociation between immediately preceding linguistic information and information from extra-linguistic context on speakers' discourse representation.

One reason why visual context may be less readily used is its implicitness and vastness. The external visual context is potentially unlimited and many things are never conceptualised and will not be relevant for the on-going conversation. For example, in our experiments, much more visual information was present in the experimental pictures, such as the location and position of the characters, the clothes they were wearing, and the physical appearance of their faces. Including all visual information and all entities that are visually present into the discourse representation would greatly increase the complexity of the representation, so it seems reasonable to assume that speakers do not do it unless they assume that including some elements from the external situation might provide a benefit in terms of more successful communication with an addressee. In contrast, the number of entities that have been explicitly encoded linguistically in the prior discourse is more limited and these entities can be referred to using expressions from the same lexical level as the ones that were used to introduce them. Entities that are visually present but have not been mentioned, on the other hand, would need to be introduced to the context with a linguistic description. This might be too costly and speakers would only do it when they assume that it is necessary for the purpose of the communication.

In sum, our study provides new information about addressee effects on the production of anaphoric expressions. It confirms earlier findings of linguistic context effects on anaphoric reference; speakers produced less explicit anaphoric expressions when the prior linguistic context made the referent more accessible. These effects appeared both when the task involved describing pictures to an addressee and when there was no addressee present. In contrast, the visual context effect was strongly affected by the presence of the addressee in the task. When speakers produced anaphoric expressions for an addressee they used fewer

pronouns and more repeated noun phrases when a visual competitor was present than when there was no visual competitor. No such effect was found when speakers had no addressee. We have suggested that linguistic mention and visual information make distinct and independent contributions to the production of anaphoric expressions. The experiments demonstrate that linguistic salience affects the choice of anaphor to a similar extent regardless of the presence of an addressee, whereas in the presence of an addressee speakers recognise the need of being more explicit in reference and avoid less informative pronouns when there is a visual competitor present.

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Appendix

THE EXPERIMENTAL SENTENCES

1. A supporter kicks a footballer/A footballer kicks a supporter/A footballer falls.

2. A referee is applauding a rugby player/A rugby player is applauding a referee/A rugby player is cheering.

3. A woman is chasing a girl/A girl is chasing a woman/A girl is jumping.

4. An official slaps an athlete/An athlete slaps an official/An athlete is stretching.

5. A youngster pinches a toddler/A toddler pinches a youngster/A toddler is crying.

6. A captain salutes a soldier/A soldier salutes a captain/A soldier whistles.

7. A boy is patting a bodybuilder/A bodybuilder is patting a boy/A bodybuilder is shivering.

8. A woman is hushing a nun /A nun is hushing a woman/A nun is singing.

9. A prince is greeting a jester/A jester is greeting a prince/A jester is bowing.

10. A nun is dragging a ballerina/A ballerina is dragging a nun/A ballerina is dancing.

11. A king touches a peasant/A peasant touches a king/A peasant is kneeling.

12. A policeman is tying a burglar/A burglar is tying a policeman/A burglar is jumping down.

13. A security guard punches a robber /A robber punches a security guard/A robber is tiptoeing.

14. A woman kisses a girl/A girl kisses a woman/A girl is cartwheeling.

15. A policeman follows a fireman A fireman follows a policeman/A fireman is gesturing.

16. A waiter slaps a chef/A chef slaps a waiter/A chef is singing.

17. A referee is pushing a boxer/A boxer is pushing a referee/A boxer is cheering.

18. A patient is shaking a doctor/A doctor is shaking a patient/A doctor is trembling.

19. A vampire is pushing a priest/A priest is pushing a vampire/A priest is praying.

20. A boy is tickling a clown/A clown is tickling a boy/A clown is coughing.

21. A cowboy is painting an Indian/An Indian is painting a cowboy/An Indian is dancing.

22. A princess shoots a chambermaid/A chambermaid shoots a princess/A chambermaid is eavesdropping.

23. A monk is pulling up a mountaineer/A mountaineer is pulling up a monk/A mountaineer is climbing.

24. A pirate stabbs a sailor/A sailor stabbs a pirate/A sailor is running.

25. A Sumo wrestler is strangling a Samurai/A Samurai is strangling a Sumo wrestler/A Samurai is meditating.

26. A bandit is prodding a sheriff/A sheriff is prodding a bandit/A sheriff is laughing.

27. An alien is dragging an astronaut/An astronaut is dragging an alien/An astronaut is moonwalking.

28. A policeman stops a tourist/A tourist stops a policeman/A tourist is hitchhiking.

29. A witch is watching an angel/An angel is watching a witch/An angel is dreaming.

30. A hunter hits an Eskimo/An Eskimo hits a hunter/An Eskimo is skiing.

31. A gypsy girl embraces a bride/A bride embraces a gypsy girl/A bride is yawning.

32. A dwarf scares a wizard/A wizard scares a dwarf/A wizard is spitting.

Author note

We would like to thank Sang Hun Yu for drawing the experimental pictures and Rachel McCollum, Colette Robertson and Paula Richie for assisting in Experiment 1.

Figure 3

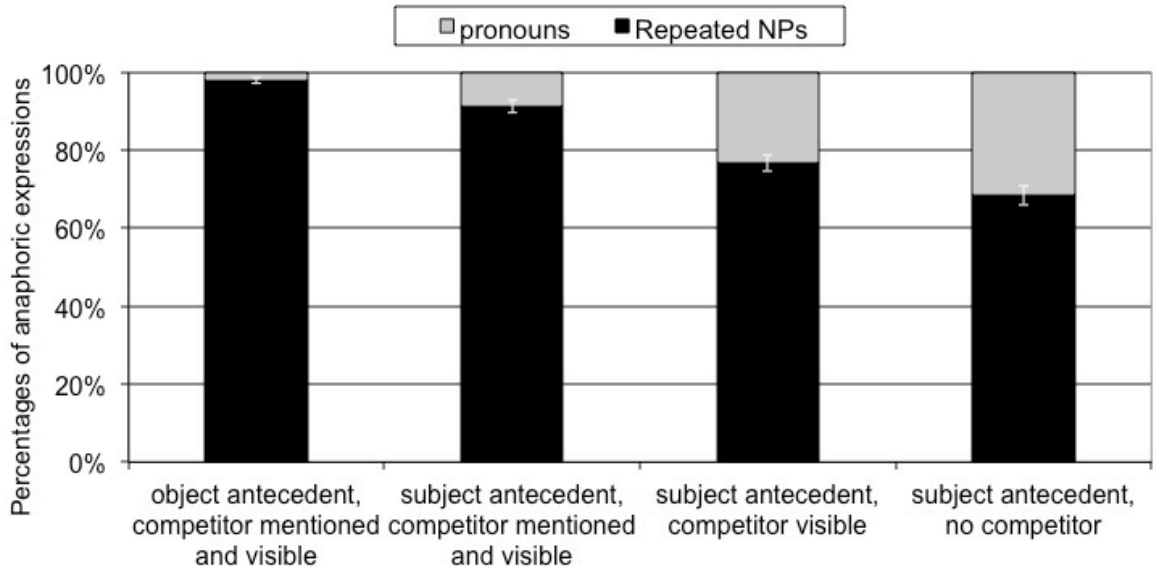

Figure 3. The percentages of repeated noun phrase and pronoun references by condition in Experiment 1.

Figure 4

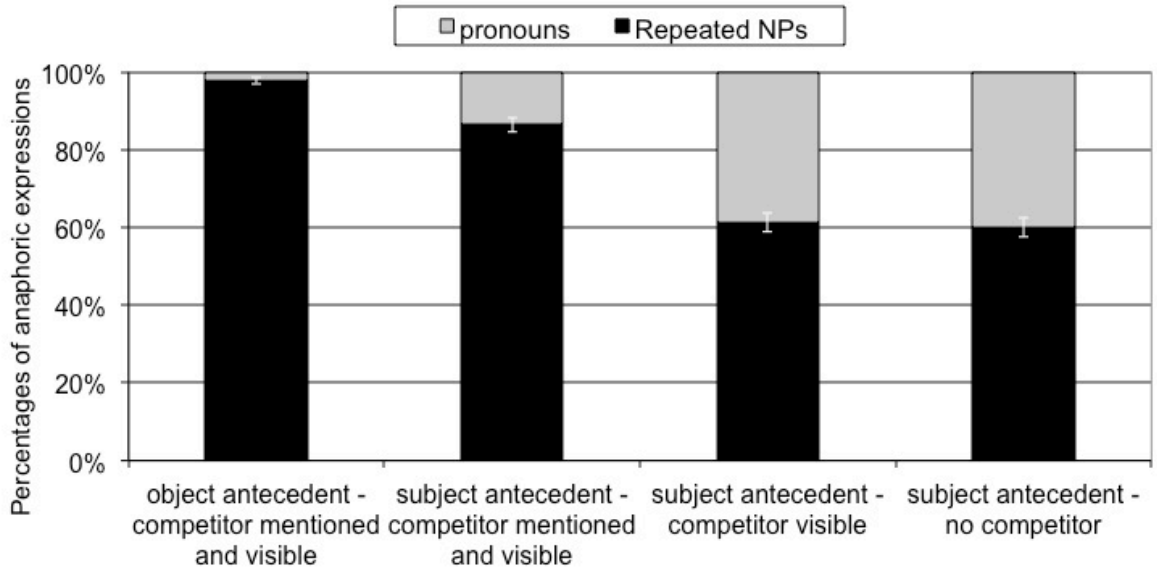

Figure 4. The percentages of pronoun and repeated noun phrase references by condition in Experiment 2.