

UC Merced

Proceedings of the Annual Meeting of the Cognitive Science Society

Title

Both thematic role and next-mention biases affect pronoun use in Dutch

Permalink

<https://escholarship.org/uc/item/4n16608b>

Journal

Proceedings of the Annual Meeting of the Cognitive Science Society, 41(0)

Author

Vogels, Jorrig

Publication Date

2019

Peer reviewed

Both thematic role and next-mention biases affect pronoun use in Dutch

Jorrig Vogels (j.vogels@rug.nl)

University of Groningen, Center for Language and Cognition (CLCG)
Oude Kijk in 't Jatstraat 26, 9712 EK Groningen, the Netherlands

Abstract

An important question is whether speakers consider listeners' expectations when choosing whether to use a pronoun. It has been suggested that certain thematic roles are more expected to be mentioned again, and are therefore more likely to be pronominalized. In the present study, we aim to disentangle predictability effects on pronoun use from thematic-role effects. To this end, we conducted two web-based continuation experiments in Dutch, in which the next-mention biases associated with Source-Goal and Agent-Patient verbs were manipulated to create a shift in the bias. Experiment 1 confirmed that the manipulations changed the biases. Experiment 2 showed that while thematic role mainly influenced demonstrative and full pronoun use for non-subjects, next-mention biases played a role in the choice between reduced and full pronouns and between pronouns and full NPs, irrespective of thematic role or grammatical function. Thus, thematic role and predictability seem to affect pronoun use in different ways.

Keywords: Dutch; next-mention biases; predictability; pronouns; referring expressions; thematic role

Introduction

Listeners' expectations about whom or what the speaker will mention next influence their interpretation of pronouns. For example, in the sentence *Anna hurt Meryl so she...* the pronoun *she* most likely refers to Meryl (e.g. *so she got mad at her*), while in *Anna recognized Meryl so she...* the pronoun is more likely to refer to Anna (e.g. *so she walked up to her to greet her*). An important question is whether speakers take such expectations into account when choosing to use a pronoun or not. A logical hypothesis would be that speakers use a pronoun when its interpretation is in line with the semantic bias, i.e. when it refers to the person that the listener expects to be mentioned next. If the speaker instead wants to continue with the person that is not expected to be mentioned next, she will signal this by repeating the name.

This is exactly what certain accounts of reference production predict (e.g. Arnold, 2001, 2008; Givón, 1983): Speakers use pronouns for referents that they believe the listener is already expecting to be mentioned, and they use more elaborate referring expressions when the referent is thought to be not very predictable. However, several researchers have found that the choice for a pronoun is not influenced by how predictable the referent is (Fukumura & Van Gompel, 2010; Rohde & Kehler, 2014; Stevenson, Crawley, & Kleinman, 1994). Recently, it has been suggested that whether predictability plays a role in pronoun use may depend on the verb in the preceding clause (Rosa & Arnold, 2017). For example, whereas Fukumura and Van Gompel (2010) did not find a predictability effect on pronoun use in implicit causality contexts with Stimulus-Experiencer verbs,

Arnold (2001) and Rosa and Arnold (2017) found in transfer-of-possession verbs that Goal referents were more often pronominalized than Source referents, with the assumption that Goal referents are more predictable than Source referents. However, they did not test the effect of predictability directly (cf. Pickering & Majid, 2007; Kehler & Rohde, 2013). While it may be true that Goals are more likely to be pronominalized because they are more predictable, it may also be the case that this thematic role is more salient for other reasons, for instance because it is often an obligatory argument of the verb (cf. Fukumura & Van Gompel, 2010).

The first aim of this study is therefore to disentangle predictability effects on pronoun use from thematic-role effects. The second aim is to explore whether predictability and thematic role also play a role in the choice of referring expression in Dutch. So far, almost all psycholinguistic studies on this topic have been done on English (but see Bott, Solstad, & Pryslopska, 2018 for a study on German). Dutch is an interesting language to investigate, because it offers more referential options than English. First, Dutch, like German, has a set of demonstrative pronouns that can refer anaphorically to humans as well as inanimates. Second, most personal pronouns in Dutch have two variants: a full form (e.g. *zij* 'she_{full}') and a reduced form (e.g. *ze* 'she_{reduced}'); see e.g. Kaiser, 2011).¹ It is an open question how the different factors that are argued to play a role in referring expression selection affect speakers' choices between these multiple possible referential forms.

We conducted two web-based written continuation experiments in which participants were presented with a context sentence for which they needed to type a suitable continuation, starting with the connective *vervolgens* 'subsequently'. To be able to generalize across different thematic roles, the context sentences contained either a Source-Goal verb, such as *geven* 'give', or an Agent-Patient verb, such as *bellen* 'call'. All verbs had a default next-mention bias to the second NP (NP2) when combined with either a forward temporal or a consequence coherence relation, as established by previous research (Commandeur, 2010; Koornneef & Sanders, 2012)². That is, when the continuation of a sentence fragment expresses a consecutive event or a consequence of the event expressed by the verb, people tend to interpret a subject pronoun in the continuation as referring to the NP2.

¹ The masculine 3rd person reduced pronoun *ie* 'he' is different from the feminine reduced pronoun in that it mostly occurs in spoken language. It also behaves differently syntactically in that it cannot appear sentence-initially.

² We could not find data on next-mention biases for Dutch Source-Goal verbs, so we took these from translations of the English verbs in Rosa and Arnold (2017). Also, some Agent-Patient verbs were translations from English verbs used in Cheng (2016).

We then manipulated these next-mention biases, such that they would shift to the first NP (NP1), which is normally less likely to be mentioned next. We did this in two ways: For some sentences we varied the social status of the referents. When combining social roles with a high or low status with verbs such as ‘criticize’ or ‘mock’, the person with low status is expected to be more likely to feature in the continuation of the event (cf. Garvey, Caramazza, & Yates, 1974). Table 1A presents examples for this manipulation, with the expected effect on the next-mention bias. For other sentences we included either a neutral adverb such as *meteen* ‘right away’, an adverb expressing unintentionality such as *per ongeluk* ‘by accident’, or the adverb *eerst* ‘first’. In combination with the connective *vervolgens* ‘subsequently’, the latter is expected to create a strong expectation for a subject continuation, because it induces a parallel coherence relation (cf. Kehler, Kertz, Rohde, & Elman, 2008). For the unintentionality adverbs, we expected a tendency to shift the next-mention bias more to the Source/Agent character (cf. Cheng, 2016). Table 1B presents sample sentences for the adverb manipulation.

In Experiment 1, participants were free to continue the context sentences in any way they wanted, as long as they started with the connective *vervolgens* ‘subsequently’. The goal of this experiment was to test whether the manipulations indeed affected the next-mention bias. That is, we predicted that participants would be more likely to continue with the NP1 when it refers to a low-status character, or is accompanied by one of the critical adverbs (see Table 1). In Experiment 2, either NP1 or NP2 was underlined, and par-

ticipants had to refer to this NP as the subject of their continuation. The goal of this experiment was to test whether participants’ choice of referring expression would depend on whether they had to refer to a referent that was consistent or inconsistent with the next-mention bias. Here, we predicted that participants choose a more reduced type of referring expression for referents that are more likely to be mentioned next, and a more elaborate expression for less-expected referents. If the thematic-role effect found in previous research is a predictability effect, thematic role should not play a role in referring expression choice. Alternatively, if thematic role has a separate effect, it should affect referring expression choice irrespective of next-mention bias.

Experiment 1

Methods

Participants. Seventy-four Dutch-speaking participants were recruited via social media and email. We discarded the data from participants who did not complete the experiment, leaving 48 participants. Of these, 33 were women, 13 were men, and 2 did not make a choice. Mean age was 27.7 years (range 18-60). Participants were not paid.

Materials. We created 30 Dutch context sentences containing verbs identified as having an NP2 next-mention bias. Of these, 15 were Source-Goal verbs, and 15 were Agent-Patient verbs. For all items, the bias was manipulated either by varying the social status of the characters in the sentence

Table 1. Sample sentences for the social-status (A) and adverb (B) manipulations, by verb type. The rightmost column shows the expected next-mention bias for each condition. *Unintent.* = Unintentionality adverb.

A. Social-status manipulation			Expected bias
Source-Goal	High-Low	<i>De moeder gaf een uitbrander aan haar dochter. Vervolgens ...</i> ‘The mother gave a scolding to her daughter. Next ...’	NP2 (default)
	Low-High	<i>De dochter gaf een uitbrander aan haar moeder. Vervolgens ...</i> ‘The daughter gave a scolding to her mother. Next ...’	NP1
Agent-Patient	High-Low	<i>De bazin bekritiseerde de assistente. Vervolgens ...</i> ‘The boss _{female} criticized the assistant _{female} . Next ...’	NP2 (default)
	Low-High	<i>De assistente bekritiseerde de bazin. Vervolgens ...</i> ‘The assistant _{female} criticized the boss _{female} . Next ...’	NP1
B. Adverb manipulation			
Source-Goal	Neutral	<i>De gravin gaf op het feest de halsketting aan de meid. Vervolgens ...</i> ‘The countess gave the necklace to the maid at the party. Next ...’	NP2 (default)
	Unintent.	<i>De gravin gaf per ongeluk de halsketting aan de meid. Vervolgens ...</i> ‘The countess gave the necklace to the maid by accident. Next ...’	NP1~NP2
	First	<i>De gravin gaf eerst de halsketting aan de meid. Vervolgens ...</i> ‘The countess first gave the necklace to the maid. Next ...’	NP1
Agent-Patient	Neutral	<i>De boerin belde meteen de vroedvrouw. Vervolgens ...</i> ‘The farmer’s wife called the midwife right away. Next ...’	NP2 (default)
	Unintent.	<i>De boerin belde per ongeluk de vroedvrouw. Vervolgens ...</i> ‘The farmer’s wife called the midwife by accident. Next ...’	NP1~NP2
	First	<i>De boerin belde eerst de vroedvrouw. Vervolgens ...</i> ‘The farmer’s wife first called the midwife. Next ...’	NP1

(e.g. *bazin-assistente* ‘boss_{female}’–‘assistant_{female}’; 12 items: 9 Agent-Patient and 3 Source-Goal verbs) or by varying the adverb in the sentence (18 items: 6 Agent-Patient and 12 Source-Goal verbs). The adverb was either neutral (e.g. *meteen* ‘right away’), an unintentionality adverb (e.g. *per ongeluk* ‘by accident’), or the adverb *eerst* ‘first’. To discourage participants to only use pronouns, character pairs were always same-gender (although sometimes they were gender-ambiguous, such as ‘officer’–‘soldier’), and they did not include proper names. To control for grammatical function, we also created Goal-Source and passive Patient-Agent variants of each item (e.g. *De dochter kreeg een uitbrander van haar moeder* ‘The daughter got a scolding from her mother’; *De vroedvrouw werd eerst door de boerin gebeld* ‘The midwife was first called by the farmer’s wife’). The first word of the participant’s continuation was given, and was always the connective *vervolgens* ‘subsequently’.

In addition, we created 36 filler items using a variety of syntactic structures, and including proper names, animals and NP conjunctions. The connective was also varied. The items were presented in a pseudo-random order, interspersed with the filler items, such that no two experimental items followed each other directly.

Procedure. The experiment was distributed via the online survey software Qualtrics. Upon clicking on the link, participants received an instruction screen, saying that they would see a series of sentences, for which they had to type a continuation (starting with a pre-given connective) in the text-entry bar, using their first intuition. There was no time limit. After about every 10th trial, a cute animal picture appeared on the screen, and participants were allowed to take a short break. The experiment took about 30 minutes to complete.

Design and analysis. Varying thematic role order (Goal/Patient=NP2, Goal/Patient=NP1) and either social status of the Goal/Patient (low, high) or adverb (neutral, unintentional, first) as within-items factors resulted in a 2x2 or 2x3 design, depending on the manipulation. Given this design, the items were distributed over 6 lists, such that each item occurred only once on a list. Since social status had only two levels, lists 5 and 6 repeated conditions from lists 1 and 2 for this variable. Verb type (Source-Goal, Agent-Patient) was varied between items.

We analyzed the proportion of Goal/Patient references out of all references, in separate analyses for the social-status and the adverb manipulation. The binary predictors were centered. The predictor adverb was contrast coded with neutral adverb as the reference level. Logit mixed-effects analyses including all main effects and second-order interactions with either social status or adverb were run. We aimed for a maximal random-effects structure, but removed random slopes step-by-step in case of non-convergence (see Bates, Kliegl, Vasishth, & Baayen, 2015). We furthermore tested for the inclusion of random slopes and the fixed effects of the control variables verb type and thematic role order using Likelihood Ratio tests.

Results

We excluded trials in which participants did not refer to NP1 or NP2 as the subject of their continuation (298 cases), used a plural expression (47 cases), selected the wrong gender (15 cases), did not produce a completion (9 cases) or did not use verb second word order (4 cases), as well as trials in which three annotators could not reach agreement on the referent (68 cases). This resulted in the removal of 30.6% of the data, leaving 999 cases for analysis.

We found clear effects of both the social-status and the adverb manipulation on the choice of referent. In the social-status analysis, there were significant main effects of social status ($\beta = -1.49$, $SE = 0.26$, $p < .001$) and thematic role order ($\beta = 0.89$, $SE = 0.24$, $p < .001$): When the Goal/Patient had a higher social status than the Source/Agent, participants were less likely to continue with the Goal/Patient, and in the canonical (Source-Goal, Agent-Patient) orders even showed a Source/Agent-bias (see Figure 1). In the non-canonical (Goal-Source, Patient-Agent) orders, there was an overall stronger Goal/Patient-bias, suggesting an additional subject-bias. The main effect of verb type was not significant ($p = .10$), and there were no interactions ($ps > .1$).

For the adverb manipulation, there was a significant difference between the adverb ‘first’ and neutral adverbs ($\beta = -1.73$, $SE = 0.47$, $p < .001$), a significant main effect of the-

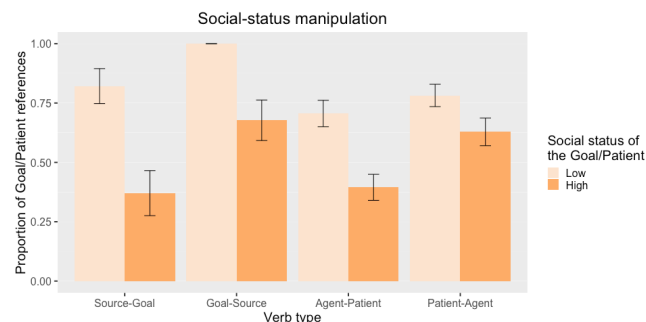


Figure 1: The proportion of Goal/Patient references after Source-Goal and Agent-Patient verbs, including their reversed orders, by the social status of the Goal/Patient.

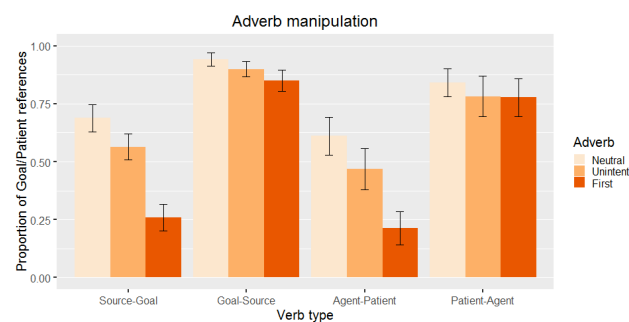


Figure 2: The proportion of Goal/Patient references after Source-Goal and Agent-Patient verbs, including their reversed orders, by type of adverb.

matic role order ($\beta = 2.26$, $SE = 0.25$, $p < .001$), and an interaction between the two predictors ($\beta = 1.55$, $SE = 0.67$, $p < .05$): In the canonical (Source-Goal, Agent-Patient) orders, participants were less likely to continue with the Goal/Patient when the context sentence contained the adverb 'first', and even showed a Source/Agent-bias (see Figure 2). In the non-canonical (Goal-Source, Patient-Agent) orders, there was again an overall stronger Goal/Patient-bias, and a weaker effect of adverb.³ The difference between unintentionality and neutral adverbs was not significant ($p = .55$), and neither was the main effect of verb type ($p = .13$).

Discussion

The results of Experiment 1 confirm that the next-mention bias of Source-Goal and Agent-Patient verbs can be influenced by manipulating the social status of the referents and by adding certain adverbs. For the canonical thematic role orders, the original Goal/Patient bias even shifted to a Source/Agent bias. In the non-canonical orders, the effect was smaller, probably due to an added bias to refer to the first-mentioned NP (e.g. Gernsbacher & Hargreaves, 1988).

In Experiment 2, we subsequently tested whether manipulating the next-mention bias also affects the choice of referring expression, predicting more pronouns for referents that are consistent with the bias.⁴ We used the same method as in Experiment 1, except that one referent in the context sentence was underlined, and participants were asked to start their continuation with this referent.

Experiment 2

Methods

Participants. Ninety-eight Dutch-speaking participants were recruited via social media and email. None had participated in Experiment 1. We removed 44 participants who did not complete the experiment, and 2 participants who were not native Dutch speakers, leaving 52 participants. Of these, 40 were women and 12 were men. Mean age was 37.0 years (range 16-75). Participants were not paid.

Materials. In order to shorten the experiment duration, we selected 16 items from Experiment 1 that showed the largest effect of the next-mention-bias manipulations: 8 from the social-status manipulation (5 Agent-Patient and 3 Source-Goal verbs) and 8 from the adverb manipulation (2 Agent-Patient and 6 Source-Goal verbs). Because the unintentionality

adverb condition was not significantly different from the neutral adverb condition, we dropped the former.

We manipulated which referent had to be referred to in the continuations (either NP1 or NP2) by underlining this referent in the context sentences. The referent had either a Source/Agent or a Goal/Patient role. Furthermore, in the social status manipulation the referent had either low or high social status. In the adverb manipulation, it was either combined with a neutral adverb or with *eerst* 'first'. The items were distributed over 6 lists, and interspersed with 24 fillers, in the same way as in Experiment 1.

Procedure. The procedure was identical to Experiment 1, except for the fact that participants were now instructed to start their continuation with the referent that was underlined. The experiment took about 20 minutes to complete.

Design and analysis. We performed separate analyses testing the effect of our next-mention-bias manipulations on three dependent variables: the proportion of pronouns *including* demonstratives out of all references, the proportion of pronouns *excluding* demonstratives out of all references, and the proportion of reduced pronouns out of all pronouns. In all analyses, we included the next-mention-bias manipulation (high/low social status; neutral adverb/first), as well as the referent's grammatical function (Subject (NP1), Non-Subject (NP2)) and thematic role (Source/Agent, Goal/Patient) as predictors, resulting in a 2x2x2 within-items design. Since the effect of verb type was not significant in Experiment 1, we collapsed over Source and Agent, and over Goal and Patient. All predictors were centered. Logit mixed-effects analyses including all main effects and second-order interactions with the bias manipulation were run in the same way as in Experiment 1.

Next, we also tested whether Goal referents were more likely to be pronominalized than Source referents. For this, we ran separate logit mixed-effects analysis on the two verb types (Source-Goal, Agent-Patient), with the referent's thematic role (Goal, Source; Agent, Patient) and grammatical function (Subject (NP1), Non-Subject (NP2)) as predictors, and the proportion of pronouns (including demonstratives) as the dependent variable.

Results

We excluded 61 cases where participants did not refer to the correct referent, 18 cases in which reference was unclear, and 1 case of self-correction, leading to the removal of 9.6% of the data and leaving 752 cases for analysis.

In the social-status analysis, we found a significant main effect of social status on the proportion of reduced pronouns out of all pronouns ($\beta = -1.40$, $SE = 0.65$, $p < .05$), with more reduced pronouns when the referent had lower social status (see Figure 3)⁵, as well as a main effect of gramma-

³ Contrary to expectation, in the non-canonical orders the preference to refer to the subject was weaker after 'first' than after a neutral adverb, suggesting a bias towards the Source/Agent rather than the subject. We henceforth consider Source/Agent referents in a sentence with 'first' as consistent with the manipulated bias.

⁴ We designed a new experiment to test this question rather than coding the results of Experiment 1 for choice of referring expression because the biases in that experiment would yield a very unbalanced design, i.e. there would be many more references to expected than to unexpected referents.

⁵ The data included only one occurrence of the masculine 3rd person reduced pronoun *ie* 'he'. The effect reported here is therefore entirely driven by the feminine reduced pronoun *ze* 'she'.

tical function ($\beta = -2.05$, $SE = 0.80$, $p < .05$), with more reduced pronouns for subjects than for non-subjects. No significant effect of social status was found on the proportion of pronouns out of all references, both including ($p = .25$) and excluding ($p = .26$) demonstrative pronouns.

In the adverb analysis, we found a significant interaction between adverb and thematic role on the proportion of pronouns (including demonstratives) out of all references ($\beta = -1.73$, $SE = 0.80$, $p < .05$), with more pronouns for Source/Agent and fewer pronouns for Goal/Patient referents in sentences with ‘first’ than with a neutral adverb (see Figure 4). This interaction effect was stronger when excluding demonstratives ($\beta = -2.29$, $SE = 0.83$, $p < .01$), suggesting that it is primarily driven by the use of personal rather than demonstrative pronouns. In both analyses, the main effect of grammatical function was also significant ($\beta = -3.47$, $SE = 0.57$, $p < .001$ and $\beta = -5.11$, $SE = 0.78$, $p < .001$, respectively), with more pronouns for subjects than for non-subjects. Although Figure 4 suggests an interaction between adverb and thematic role on the proportion of reduced pronouns out of all pronouns, this was not significant ($p = .18$).

Finally, Figure 5 shows that, irrespective of next-mention bias, pronouns were more frequent for Goal than for Source non-subjects, although the interaction did not reach significance ($p = .06$). In addition, the difference seems to be largely due to an increase in demonstrative and full pronouns.⁶ For Agent-Patient verbs, pronouns seem to be more frequent for Agent than for Patient non-subjects, but the interaction was not significant ($p = .95$).

Discussion

The results of Experiment 2 showed effects of the next-mention-bias manipulations on pronoun use: more reduced pronouns for low-status than for high-status referents, and more personal pronouns for Source/Agent referents (as well as fewer pronouns for Goal/Patient referents) in contexts including the adverb *eerst* ‘first’.

In addition, thematic role seemed to have an effect on the choice of referring expression beyond these next-mention-bias manipulations. Consistent with Rosa and Arnold (2017), Goal non-subjects were more likely to be pronominalized than Source non-subjects, although not reliably. Moreover, this difference seemed to be due to a larger number of full and demonstrative pronouns for Goal referents. Since full pronouns in Dutch are canonically used for contrastive referents, and demonstrative pronouns for less salient (non-topical) referents (e.g. Kaiser, 2011), this might suggest that Goals are not as salient as subject referents, but salient enough to not be referred to with a full definite NP.

⁶ Post-hoc analyses supported this: When excluding demonstratives, the trend for an interaction between thematic role and grammatical function disappeared ($p = .69$); An analysis on the proportion of reduced pronouns out of all pronouns showed a significant interaction between thematic role and grammatical function ($\beta = -2.05$, $SE = 0.91$, $p < .05$). Paired comparisons showed a significant increase in reduced pronouns for Goal vs. Source non-subjects ($p < .01$), but not for subjects ($p = .20$).

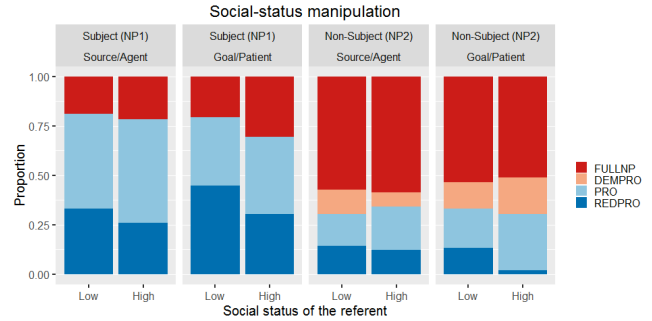


Figure 3. Choice of referring expression in the social status manipulation of Experiment 2, by the referent’s social status, grammatical function, and thematic role.

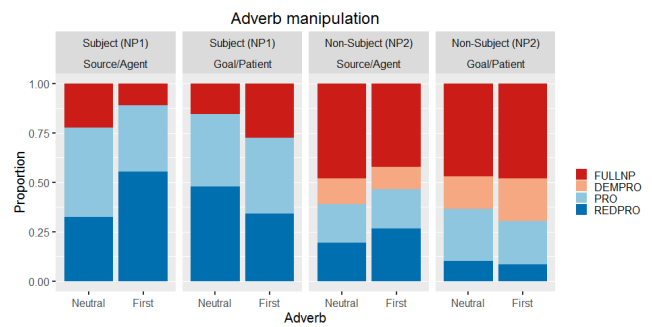


Figure 4. Choice of referring expression in the adverb manipulation of Experiment 2, by adverb and the referent’s grammatical function and thematic role.

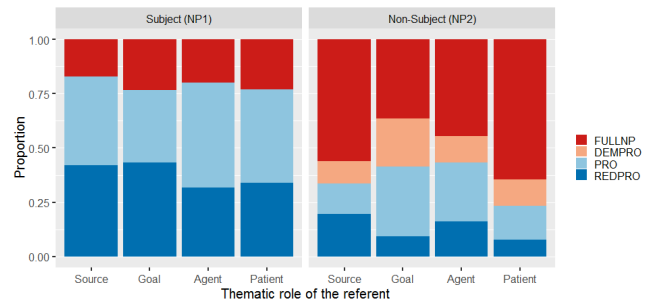


Figure 5. Choice of referring expression in Experiment 2, by the referent’s thematic role and grammatical function.

Thus, assuming that next-mention bias is an accurate measure of predictability, the results of Experiment 2 suggest that thematic role and predictability affect referential choices in different ways: Goals stand out among the thematic roles because they attract more demonstrative and full pronoun references, while predictable referents are more likely to be referred to with reduced forms (reduced vs. full pronouns or personal pronouns vs. full NPs).

General discussion

In this paper, we investigated whether expectations about what will be mentioned next influence the choice of referring expression. The first aim was to disentangle predictability effects on pronoun use from effects of thematic role. We did this by manipulating the next-mention bias in sentences with Source-Goal and Agent-Patient verbs. For some sentences, we varied the social status of the characters, hypothesizing that the lower-status character would be more likely to be mentioned next. For other sentences, we varied the type of adverb, hypothesizing a stronger Source/Agent bias with unintentionality adverbs and a stronger subject bias with the adverb *eerst* ‘first’. The second aim was to explore predictability effects on reference production in Dutch, which has a rich spectrum of anaphoric expressions.

The results of Experiment 1 confirmed that the manipulations affected next-mention biases, especially in sentences in which the Goal or Patient was the second NP, where the bias shifted from the NP2 to the NP1. Sentences including ‘first’ showed increased references to the Source/Agent rather than to the subject, suggesting that the induced parallel coherence relation was semantic rather than syntactic. The effect of the unintentionality adverb was not as strong (cf. Cheng, 2016), and we therefore removed this condition from Experiment 2.

Experiment 2 showed that the shifts in next-mention bias also affected the choice of referring expression: When the referent had a relatively low social status, participants were more likely to mention it in their continuations (Experiment 1), and they also produced more reduced pronouns as compared to full pronouns, irrespective of grammatical function or thematic role (Experiment 2). This finding is consistent with information-theoretic accounts of language production, which propose that more predictable linguistic material is reduced (e.g. Levy & Jaeger, 2007). It is also in line with a contrastive interpretation of full pronouns (Kaiser, 2011), in which use of the full form pragmatically implicates that it refers to something else than the predictable referent.

When the context sentence anticipated a parallel coherence relation (in the form of ‘first...next...’), participants were more likely to mention the Source/Agent referent in their continuations (Experiment 1), and they were also more likely to use a personal pronoun compared to a full NP to refer to these referents. Conversely, they were less likely to pronominalize the Goal/Patient character (Experiment 2). This suggests that next-mention biases may also affect the choice between a pronoun and a full NP in Dutch. Whether there is a fundamental difference between referential biases stemming from the social-status and the adverb manipulations is unclear. The current experiment may simply have lacked the power to detect all the effects.

Irrespective of next-mention bias, thematic role also seemed to have an effect on the choice of referring expression: Goals tended to be more likely to be pronominalized than Sources, at least for non-subjects, in line with Rosa and Arnold (2017). However, this preference was largely driven by the use of demonstrative and full pronouns as opposed to

reduced forms. Demonstrative pronouns in Dutch are considered to be used mainly for non-topical referents (e.g. Kaiser, 2011). Indeed, in our study these forms exclusively occurred with non-subjects (see Figures 3-5). The choice of a full over a reduced pronoun is often driven by some form of contrast (Kaiser, 2011). The use of these ‘stronger’ pronominal forms to refer to Goal non-subjects might suggest that such referents are intermediately salient: They are more salient than other non-subjects, warranting the use of pronouns over full NPs, but not as salient as the average subject to allow for the use of a reduced pronoun.

Taken together, the results of this study have implications for current theories of reference. One line of research argues that what drives referential choices is how likely the referent is to be mentioned next (e.g. Arnold, 2008; Tily & Pianadosi, 2009). If a referent is highly predictable, a pronoun will be used; if it is unexpected, the speaker will signal this by using a full NP. The main evidence for this claim comes from the finding that Goal referents are more likely to be pronominalized than Source referents (Arnold, 2001; Rosa & Arnold, 2017). However, other researchers have argued that what makes a referent predictable is not necessarily its thematic role, but the specific event structure and coherence relation that links two references (Kehler & Rohde, 2013; Pickering & Majid, 2007). The present results point to the possibility that both thematic role and predictability based on event structure affect the choice of referring expression, but in different ways. Although it may still be the case that Goal referents are more likely to be mentioned next, the increase in pronoun use for Goals may also have a different origin. It has been noted, for example, that Goal non-subjects are often an obligatory argument of the verb (indirect object), whereas Source non-subjects are mostly optional (Fukumura & Van Gompel, 2010). This may make Goals more salient. Our results are therefore consistent with a form-specific multiple-constraints approach to reference, in which different referential forms are sensitive to different aspects of the referent (Kaiser & Trueswell, 2008).

A second line of research argues that there is an asymmetry between production and interpretation of referring expressions (e.g. Fukumura & Van Gompel, 2010; Rohde & Kehler, 2014): While reference resolution may be influenced by next-mention biases, reference production is driven only by grammatical or information structural factors. The present results suggest that next-mention biases may in fact influence reference production, at least in Dutch. So far, most studies on this topic have been on English, and investigating referential choices in a language with a richer set of referring expression types, such as Dutch, may reveal patterns that otherwise remain hidden.

Finally, effects of predictability may become more manifest in more engaging communicative settings that involve an actual addressee (cf. Rosa & Arnold, 2017). Since the effects we are seeking are probably small and tend to be overridden by stronger factors, the logical next step is to replicate the current findings in a larger-scale study in a more naturalistic, but still controlled, context.

Acknowledgments

This research was supported by the Netherlands Organisation for Scientific Research (NWO), under Grant 275-89-0360. Many thanks to Daniëlle Fluks, Anouck Braggaar, and Boudewijn Blank for their help with the creation of the materials and the design, conduction and analysis of Experiment 1.

References

- Arnold, J. E. (2001). The effect of thematic roles on pronoun use and frequency of reference continuation. *Discourse Processes*, 31(2), 137–162.
- Arnold, J. E. (2008). Reference production: Production-internal and addressee-oriented processes. *Language and cognitive processes*, 23(4), 495–527.
- Bates, D., Kliegl, R., Vasishth, S., & Baayen, H. (2015). Parsimonious mixed models. *ArXiv Preprint ArXiv:1506.04967*.
- Bott, O., Solstad, T., & Pryslopska, A. (2018). Implicit causality affects the choice of anaphoric form. Poster presented at *AMLaP 2018*, September 6-8, 2018, Berlin, Germany.
- Cheng, W. (2016). *Implicit Causality And Consequentiality In Native And Non-Native Coreference Processing*. Doctoral dissertation, University of South Carolina.
- Commandeur, E. (2010). *Implicit causality and implicit consequentiality in language comprehension*. Doctoral dissertation, Tilburg University.
- Fukumura, K., & Van Gompel, R. P. (2010). Choosing anaphoric expressions: Do people take into account likelihood of reference? *Journal of Memory and Language*, 62(1), 52–66.
- Garvey, C., Caramazza, A., & Yates, J. (1974). Factors influencing assignment of pronoun antecedents. *Cognition*, 3(3), 227–243.
- Gernsbacher, M. A., & Hargreaves, D. J. (1988). Accessing sentence participants: The advantage of first mention. *Journal of Memory and Language*, 27(6), 699.
- Givón, T. (1983). *Topic continuity in discourse: A quantitative cross-language study (Vol. 3)*. John Benjamins Publishing.
- Kaiser, E. (2011). Salience and contrast effects in reference resolution: The interpretation of Dutch pronouns and demonstratives. *Language and Cognitive Processes*, 26(10), 1587–1624.
- Kaiser, E., & Trueswell, J. C. (2008). Interpreting pronouns and demonstratives in Finnish: Evidence for a form-specific approach to reference resolution. *Language and Cognitive Processes*, 23(5), 709–748.
- Kehler, A., Kertz, L., Rohde, H., & Elman, J. L. (2008). Coherence and Coreference Revisited. *Journal of Semantics*, 25(1), 1–44.
- Kehler, A., & Rohde, H. (2013). A probabilistic reconciliation of coherence-driven and centering-driven theories of pronoun interpretation. *Theoretical Linguistics*, 39(1–2), 1–37.
- Koornneef, A. W., & Sanders, T. J. (2013). Establishing coherence relations in discourse: The influence of implicit causality and connectives on pronoun resolution. *Language and Cognitive Processes*, 28(8), 1169–1206.
- Levy, R. P., & Jaeger, T. F. (2007). Speakers optimize information density through syntactic reduction. In *Advances in neural information processing systems* (pp. 849–856).
- Pickering, M. J., & Majid, A. (2007). What are implicit causality and consequentiality? *Language and Cognitive Processes*, 22(5), 780–788.
- Rohde, H., & Kehler, A. (2014). Grammatical and information-structural influences on pronoun production. *Language, Cognition and Neuroscience*, 29(8), 912–927.
- Rosa, E. C., & Arnold, J. E. (2017). Predictability affects production: Thematic roles can affect reference form selection. *Journal of Memory and Language*, 94, 43–60.
- Stevenson, R. J., Crawley, R. A., & Kleinman, D. (1994). Thematic roles, focus and the representation of events. *Language and Cognitive Processes*, 9(4), 519–548.
- Tily, H., & Piantadosi, S. (2009). Refer efficiently: Use less informative expressions for more predictable meanings. In *Proceedings of the workshop on the production of referring expressions: Bridging the gap between computational and empirical approaches to reference*.