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Discourse Processes

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/hdsp20

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To cite this article: Theresa Redl, Agnieszka Szuba, Peter de Swart, Stefan L. Frank & Helen de Hoop (2022) Masculine generic pronouns as a gender cue in generic statements, Discourse Processes, 59:10, 828-845, DOI: 10.1080/0163853X.2022.2148071

To link to this article: https://doi.org/10.1080/0163853X.2022.2148071

Published online: 21 Dec 2022.

DISCOURSE PROCESSES
2022, VOL. 59, NO. 10, 828–845
https://doi.org/10.1080/0163853X.2022.2148071

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Masculine generic pronouns as a gender cue in generic statements

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ABSTRACT

An eye-tracking experiment was conducted with speakers of Dutch (N = 84, 36 male), a language that falls between grammatical and natural-gender languages. We tested whether a masculine generic pronoun causes a male bias when used in generic statements—that is, in the absence of a specific referent. We tested two types of generic statements by varying conceptual number, hypothesizing that the pronoun *zijn* "his" was more likely to cause a male bias with a conceptually singular than a conceptually plural antecedent (e.g., *Someone* (conceptually singular)/*Everyone* (conceptually plural) *with perfect pitch can tune his instrument quickly*). We found male participants to exhibit a male bias but with the conceptually singular antecedent only. Female participants showed no signs of a male bias. The results show that the generically intended masculine pronoun *zijn* "his" leads to a male bias in conceptually singular generic contexts but that this further depends on participant gender.

Research from social psychology indicates that we take notice of someone's gender almost instantaneously (Fiske, 2000; Zarate & Smith, 1990). It has been shown that we are quick to make inferences regarding someone's gender in language processing, too. For example, Carreiras et al. (1996) found that a sentence such as *The babysitter settled down to watch a video* makes readers think of the referent as female rather than male, even though the babysitter's gender is not explicitly mentioned in the sentence. This was evidenced by readers slowing down when learning later in the discourse that the babysitter was a man. Readers are able to infer someone's gender based on their world knowledge of gender stereotypes in a rapid and automatic manner (see also Banaji & Hardin, 1996; Garnham et al., 2002; Oakhill et al., 2005), and these inferences in turn inform readers' expectations about upcoming text (Garnham & Oakhill, 1996; Zwaan & Radvansky, 1998). Generically intended masculine word forms have been shown to give rise to gender inferences and discourse expectations in a similar way.

Masculine words such as the German noun *student* "student (masc.)" (e.g., Gabriel & Gygax, 2008) or the Dutch pronoun *zijn* "his" (Redl, 2021; Redl et al., 2018) can, in certain contexts, be used to refer to people with any gender—for instance, when a person's gender is unknown or irrelevant or when referring to a group of mixed gender (Gygax et al., 2008; Hamilton, 1988). Masculine words, when used in such a generically intended way are often referred to as *masculine generics* (e.g., Braun et al., 2005; Earp, 2012; Gastil, 1990; Gygax, Schoenhals et al., 2019). They occur in many of the world's languages (e.g., Aikhenvald, 2016, pp. 13–32), but how common they are differs between languages. German, for example, is a grammatical gender language; every noun carries grammatical gender and requires dependent words (e.g., articles) to agree. English, on the other hand, as a natural gender language does not mark grammatical gender on nouns and while masculine pronouns have been used as generics for centuries in English—partly due to explicit rules introduced by grammarians (Bodine,

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1975)—their use for generic reference has significantly decreased over the last decades (e.g., Baranowski, 2002; Earp, 2012).

Dutch falls in between grammatical and natural-gender languages (Audring, 2006; Gygax, Elmiger et al., 2019). Dutch nouns carry either neuter or common gender, but similar to English, more-elaborate gender distinctions are still made for third-person singular pronouns. However, unlike English, masculine pronouns are still commonly used for generic reference such as the masculine possessive pronoun *zijn* "his" (see Chapter 1 in Redl, 2021). The goal of the present paper is to establish whether language users make gender inferences based on this generically intended masculine pronoun in truly generic contexts.

The use of grammatically masculine words for generic reference has been severely criticized as gender exclusive and sexist (e.g., Earp, 2012; Hamilton, 1988; Pusch, 1984; Romein-Verschoor, 1975; Sontag, 1973). Research into the processing and the cognitive effects of these masculine word forms supports the notion that they are indeed not interpreted as gender inclusive but lead to a male bias instead. Put differently, masculine generic words give rise to a male gender inference. For example, Misersky et al. (2019) conducted an EEG-experiment in German in which they tested whether generically intended masculine role nouns such as *Studenten* "students (masc.)" can be interpreted as referring to all genders in a sentence such as the following:

(1) *Die Studenten gingen zur Mensa, weil manche der Frauen/Männer Hunger hatten.*

"The students (masc.) went to the canteen, because some of the women/men were hungry."

Misersky et al. saw a larger deflection in the ERP component for the female continuation *Frauen* "women," similar to the increase in reading time in the study by Carreiras et al. (1996). These results suggest that the grammatical gender of the role noun triggers a gender inference, even though it is not intended as an indication of the referents' actual gender. Thus, the generic reading was not achieved and the people referred to by the masculine role noun are thought of as male instead. Similar results for role nouns as masculine generics have been found by Gabriel and Gygax (2008), Garnham et al. (2012), Gygax and Gabriel (2008), Irmen and Roßberg (2004), and Stahlberg et al. (2001) among others.

Generic versus episodic contexts

Masculine generics are generic in the sense that they are intended to refer to humans of any gender, despite being grammatically or lexically masculine, as in (1) above. An example from Dutch is given in (2):

(2) *Een minister moet zijn verlies kunnen nemen.*

"A minister should take their (lit. *his*) loss."

The statement in (2) does not only contain the masculine generic pronoun *zijn* "his," but is also generic in another sense. As opposed to the so-called episodic statement in (1), the statement in (2) is generic, as it refers to a generic property of ministers as a *kind*. Unlike (1), (2) is a generic statement that does not refer to a specific situation at a specific time but generalizes across situations (Dahl, 1995; Krifka et al., 1995). As described above, there is substantial evidence that users of grammatical gender languages make gender inferences based on generically intended masculine role nouns. However, this has been tested using episodic contexts such as in (1) almost exclusively. Thus, when a masculine generic role noun (e.g., German *Studenten* "students (masc.)" in (1))—though intended to refer to persons of all genders—is used in episodic statements that denote specific events containing certain (groups of) individuals, readers often use the grammatical gender to infer the referents' supposed gender (e.g., for French and German, see Garnham et al., 2012; Gygax et al., 2008; Misersky et al.,

2019). Redl et al. (2021) found similar results for the processing of the Dutch masculine generic pronoun *zijn* "his" in episodic contexts such as (3). They conducted an eye-tracking experiment in which they presented participants with sentences such as the following:

(3) *Iedereen was zijn veters aan het strikken, waaronder een paar vrouwen/mannen die al tien minuten geleden hadden moeten vertrekken, maar zich hadden verslapen.*
"Everyone was tying his shoelaces, among whom a few women/men who would have had to leave ten minutes ago, but had overslept."

The sentence in (3) refers to a certain event in the past, hence it is episodic. Redl et al. (2021) found male participants to show signs of a male bias (i.e., an increase in reading time when reference was made to women) in these episodic contexts. They concluded that the generically intended pronoun *zijn* "his" can lead to a male bias as well. Note, however, that their study as well as previous studies found a male bias of generically intended masculine words in episodic contexts (e.g., Braun et al., 1998; Garnham et al., 2012; Gygax et al., 2008; Misersky et al., 2019; Stahlberg et al., 2001).

The question addressed here is whether we also find such a male bias when the masculine generic is part of a *truly generic* statement, such as in (2) above. Generic statements lack what episodic sentences have—namely, specific time reference (Dahl, 1995). Hence, when a masculine generic pronoun occurs in a generic statement, there is no longer a specific situation containing a certain individual or group of referents whose gender can be inferred. Do masculine generics then still stimulate a male bias? This is a particularly interesting and important question. If generically intended masculine words cause a male bias even in generic contexts—that is, in contexts that are ultimately intended to generalize over situations and individuals, then this is particularly strong evidence for a male bias of masculine generics.

The first to directly address whether masculine generics cause a male bias in generic contexts was Irmen (2007, Experiment 1). She conducted an eye-tracking experiment to test whether German masculine generic role nouns are a source of bias in generic (nonepisodic) contexts. Irmen varied the stereotypical gender of the role nouns between female, male, and neutral; whereas, their grammatical gender was always masculine. The generic antecedent introduced by means of the role noun was referred back to with the anaphoric definite noun phrase *these men* or *these women* later on in the stimulus. Irmen hypothesized that if generic entities are mentally represented as abstract and gender-less, the masculine generic role noun should not lead to a male bias. However, Irmen found both the masculine grammatical gender and the stereotypical gender information to affect reading times, despite being used in generic contexts. Regarding grammatical gender, Irmen found that reading times increased for the female continuation, suggesting that German masculine generic role nouns are not interpreted as generic or gender-neutral, not even in generic contexts. Note, however, that Irmen revealed the referents to *exclusively* consist of women (or men). Thus, the results allow us to conclude that masculine generic role nouns in German are not compatible with a fully female reading in generic contexts. However, we cannot determine whether a masculine generic role noun triggers a reading that includes men *and* women (i.e., a group of mixed gender) based on these results. This latter reading including men and women as opposed to a women-only reading is usually intended when using masculine generics in plural contexts, at least in German. Gygax et al. (2008), who tested episodic contexts, voiced similar criticism of Irmen's study. The authors ensured that the women or men mentioned in the second sentence were understood as a subgroup of the group introduced in the first sentence, as did other researchers after them (e.g., Misersky et al., 2019 who used stimuli similar to stimuli used in Gygax et al., 2018; Redl et al., 2021).

Furthermore, it is unclear whether these findings on role nouns generalize to pronouns. As Redl et al. (2018) point out, there are reasons to assume that generically intended masculine role nouns might not work the same as generically intended masculine pronouns. By definition, pronouns serve as stand-ins for noun phrases, and the class of pronouns within a language is small. As a consequence,

it is always the very same token that is used for generic reference (e.g., for Dutch *hij* "he," *zijn* "his," or *hem* "him"). Furthermore, generically intended masculine pronouns occur in different contexts than generically intended masculine role nouns. For example, it is often assumed that masculine role nouns are more likely to be used generically in grammatically plural contexts compared to grammatically singular contexts (e.g., Gygax et al., 2021). Therefore, experiments on role nouns typically use grammatically plural contexts (e.g., Garnham et al., 2012; Gygax et al., 2008; Irmen, 2007; Irmen et al., 2010; Misersky et al., 2019; Sato et al., 2013). Generically intended masculine pronouns, however, occur in grammatically singular contexts in, for example, German, English, and Dutch, since masculine generic pronouns such as *hij* "he" and *zijn* "his" are grammatically singular. Plural pronouns are not marked for gender in these languages. Thus, it is necessary to investigate generically intended masculine pronouns to be able to conclude whether they lead to a male bias when used in truly generic contexts.

There are several studies of English masculine generic pronouns that can shed light on this matter. However, as mentioned above, the use of generically intended masculine pronouns has significantly decreased in English over the past decades (Earp, 2012; LaScotte, 2016) in favor of an increased use of so-called singular *they/their* (e.g., *A minister should take* ***their*** *loss*). The research focus in English has shifted accordingly. For example, Foertsch and Gernsbacher (1997) conducted two self-paced reading experiments to test whether the plural pronoun *they* is a cognitively efficient substitute for the masculine generic *he* (or the less common generic *she*), despite the fact that it is used to refer back to a grammatically singular antecedent. In Experiment 1, Foertsch and Gernsbacher compared the processing of singular *they* with generic *he* and *she* in generic contexts, while these pronouns were embedded in episodic contexts in Experiment 2. Foertsch and Gernsbacher used stereotypically female, male, and neutral role nouns in both Experiments 1 and 2. In addition, the researchers used stimuli featuring the indefinite pronoun *anybody* in Experiment 1. The sentence in (4) is an example of a stimulus featuring the indefinite pronoun.

(4) Anybody who litters should be fined $50, even if he/she/they cannot see a trashcan nearby,

because littering is an irresponsible form of vandalism and should be punished.

Foertsch and Gernsbacher (1997) analyzed the reading times of the clause containing the generic pronoun *he, she* or *they*. They hypothesized that generic *he* (and *she*) could trigger a gender inference, while *they* would not. This gender inference would then be reflected in longer reading times for clauses containing *he* or *she* compared to *they* after neutral role nouns (e.g., *runner*) and after the indefinite pronoun *anybody* (e.g., *anybody who litters*). This hypothesis was confirmed for the indefinite pronoun, but not for the role nouns. Following Foertsch and Gernsbacher, the increase in reading time when the generically intended personal pronoun *he* was anaphorically linked to the indefinite pronoun *anybody* can be interpreted as an indication that masculine generic pronouns may give rise to a gender inference, even in generic contexts (see Speyer & Schleef, 2019 for a replication of these results for German-speaking learners of English).

Noll et al. (2018) adapted the stimuli designed by Foertsch and Gernsbacher (1997). In two experiments conducted 15 years apart, they presented participants with sentences similar to the sentence in (4) above. Unlike Foertsch and Gernsbacher, Noll et al. used only the pronouns *they* and *he* as anaphors, as well as neutral role nouns and an indefinite pronoun as potential antecedents. Participants had to read the sentences and subsequently perform a lexical decision task featuring nouns with female or male lexical gender (e.g., *uncle* and *mother*). The rationale was that if the masculine generic pronoun *he* triggers a gender inference, participants should be faster to recognize a subsequent male prompt compared to a female prompt. This hypothesis was not confirmed in the earlier of the two experiments. In the experiment that was conducted 15 years later, however, *he* was indeed found to slow down response times to female words. Noll et al. suggest that the difference in results is due to changes in the English language over time. When the first experiment was conducted, *he* was still more widely used as a generic pronoun, facilitating the interpretation of the pronoun as

generic. Since then, however, the popularity of singular *they* has vastly increased and pushed back generic *he*, which now has lost at least some of its generic potential. These results suggest that masculine generic pronouns can cause a male gender inference in generic contexts, but possibly only if the masculine generic reading of the pronoun is relatively infrequent or if there is no sufficiently frequent competing form.

In sum, there is tentative evidence that masculine generics *may* lead to a male bias in generic (nonepisodic) contexts under certain circumstances. Irmen (2007) found German generically intended masculine role nouns in generic contexts not to be compatible with an all-female reading, but it is unclear whether a gender-mixed reading (as for example, tested by Misersky et al., 2019) would be equally incompatible. It also remains unclear whether this finding generalizes to generically intended masculine pronouns. Foertsch and Gernsbacher (1997) indirectly provided evidence that masculine generic *he* may cause a gender bias in generic contexts, but they found this only with the indefinite antecedent *anybody* and not for role nouns as the antecedent. Noll et al. (2018) provide more direct evidence of a male bias induced by *he* in generic contexts in a recent experiment but not in an experiment conducted 15 years earlier, which suggests that a masculine generic pronoun may not lead to a male bias if the generic reading is sufficiently frequent.

Very little is known about the effect of masculine generics when embedded in generic statements, since research on the processing of masculine generics has largely focused on episodic contexts instead. This is particularly surprising considering that generic statements generalize over situations with no reference to particular situations or specific (groups of) individuals that play a role in these situations. Masculine generics are commonly used when a person's gender is unknown or irrelevant. Generic statements are therefore inviting contexts for masculine generics to be used. Do masculine generics then give rise to a male bias in generic contexts, where no specific referent is present? In other words, are gender inferences made based on masculine words, even when these words are used in generic statements, which generalize over situations and people?

The present experiment

In an effort to close this research gap, we conducted an eye-tracking experiment to investigate whether masculine generic pronouns trigger a gender inference in generic contexts. More specifically, we presented Dutch native speakers with generic statements featuring the masculine generic pronoun *zijn* "his." As described above, Dutch falls in between grammatical gender languages, such as German, and natural gender languages, such as English. Testing Dutch, Redl et al. (2021) previously found *zijn* "his" to cause a male bias in episodic contexts. We put the same pronoun to the test in generic statements such as the one below:

(5) *Iedereen met een absoluut gehoor kan snel zijn instrument stemmen.*

"Everyone with perfect pitch can tune his instrument quickly."

Like Redl et al. (2021), we combined the masculine generic pronoun *zijn* "his" with the indefinite pronoun *iedereen* "everyone." Redl et al. used episodic statements and *iedereen* "everyone," therefore, referred to a specific, contextually determined group in a specific situation (see (3) above). By contrast, in the current experiment, *iedereen* "everyone" was embedded in a generic statement with no reference to a specific time or situation.

Since very little is known about the processing of masculine generics in generic contexts, we tested two types of generic statements in the present experiment. This was done by alternating the indefinite antecedent *iedereen* "everyone" with the indefinite pronoun *iemand* "someone" in order to vary conceptual number:

(6) *Iemand met een absoluut gehoor kan snel zijn instrument stemmen.*

"Someone with perfect pitch can tune his instrument quickly."

Both indefinite pronouns are grammatically singular and anaphorically link to the third-person singular possessive pronoun *zijn* "his"; this is the only acceptable possessive pronoun to convey this generic meaning, as Dutch does not have a gender-neutral pronoun like "singular" *their*. Furthermore, both (5) and (6) are generic statements and apply to all individuals fitting the statement. However, we can assume that generic *someone* triggers a different mental representation than generic *everyone*. This is because *someone* is conceptually singular, while *everyone* is conceptually plural. Language users have been shown to be sensitive to conceptual number cues in building a mental representation of a text (e.g., Carreiras & Gernsbacher, 1992; Gernsbacher, 1991). Hence, *everyone* is likely represented as a group, while a generic statement featuring *someone* is more likely represented as a single prototypical individual. Both generic statements in (5) and (6) thus generalize over people, but the mental representation will most likely differ. Consequently, readers might be more likely to make a gender inference if the generic statement favors the mental representation of *one* prototypical individual (as is the case with *iemand* "someone") than when a group representation is favored (as is the case with *iedereen* "everyone").[1]

McConnell-Ginet (1979, p. 72) points out that a singular definite generic "invites us to hang flesh on the metaphorical bones," thus, "bringing to life a prototype to whom we can refer." She also argues that "personalization tends to promote sexualization and sexualization is in agreement with the gender of an anaphoric pronoun" (McConnell-Ginet, 1979, p. 79). It follows that the masculine generic *zijn* "his" might be processed differently depending on whether it is combined with an indefinite pronoun favoring the mental representation of a prototypical individual (i.e., *someone*) or with an indefinite pronoun favoring a group representation (i.e., *everyone*). Put differently, *zijn* "his" might be more likely to cause a male bias when anaphorically linked to *iemand* "someone" than to *iedereen* "everyone." One reason for this is the fact that assigning gender to a group is a more complex process than assigning gender to an individual. Kaup et al. (2002) present an analysis of linguistic data and experimental evidence that suggest that referents of conceptually plural expressions can be mentally represented in (at least) two ways, one representation (*atomic token representation*) in which each individual in a set could be associated with a gender, another one in which the individuals are represented as one single entity, a so-called group-level entity (*assemblage-token representation*). It is less clear how gender would be assigned to such an entity. Following Kaup et al., the referents of an indefinite pronoun such as *everyone* can be assumed to be represented as multiple individual tokens (i.e., atomic-token representation). The masculine generic pronoun *zijn* "his" could then potentially be used to determine the gender of all these individually represented tokens, giving rise to a male gender inference for most (if not all) of them. In case the pronoun is processed as generic and thus gender-neutral, the gender of the tokens could either be left unspecified or balanced between male and female. Conversely, in the case of generic statements featuring *someone*, the mental representation likely features only one token, the gender of which could be specified. If the pronoun triggers a gender inference, the token's gender would be represented as male. If the pronoun is processed as generic, this individual token would remain unspecified for gender. Based on these insights, we argue that a masculine generic pronoun such as Dutch *zijn* "his" could affect processing differently depending on whether it occurs in a conceptually singular or plural generic statement, since assigning gender on the group-level is a more complex process than assigning gender to the mental representation of one individual (McConnell-Ginet, 1979).

The primary goal of this eye-tracking experiment is to answer the question concerning whether a masculine generic pronoun such as *zijn* "his" leads to a male bias even when used in truly generic contexts, which generalize over situations and people. Since very little is known about the effect of masculine generics in generic contexts, we tested two different types of such generic contexts, which possibly trigger different mental representations and might therefore not be equally susceptible to a male bias. The secondary goal of this experiment was thus to explore generic antecedents differing in conceptual number in order to see whether a generically intended masculine pronoun might cause a male bias across different types of generic contexts.

Predictions

We use generic statements as in (5) and (6) to test whether the generically intended masculine pronoun *zijn* "his" causes a male bias across different types of generic contexts. The male bias is revealed by an increase in reading time when the sentence continuation mentions a woman as opposed to a man (e.g., *Someone with perfect pitch can tune his instrument quickly, such as the woman* . . .), relative to any such reading-time increase in the gender-neutral control conditions. We hypothesize (H1) that *zijn* "his" causes a male bias, and (H2) that this bias will be stronger when embedded in conceptually singular generic contexts featuring *iemand* "someone" than when embedded in conceptually plural generic contexts featuring *iedereen* "everyone." We also hypothesize (H3) that participant gender affects how the masculine generic pronoun is processed, with possibly even only men showing a male bias, as found by Redl et al. (2021; see Henley & Abueg, 2003, for a meta-analysis showing the robustness of this effect).

Materials and method

Materials

All experimental and control items followed a similar pattern. Examples are given in Table 1. An antecedent is introduced and a generic statement is made about them. Then one person fitting this generic statement is provided as an example and explicitly referred to by means of the definite noun phrase *de vrouw* "the woman" or *de man* "the man" followed by a prepositional phrase identifying them further.

For the experimental items, the antecedent was either conceptually singular and individual-referring (*iemand* "someone") or conceptually plural and group-referring (*iedereen* "everyone"). Both antecedents are grammatically singular and therefore could function as the antecedent for the possessive pronoun *zijn* "his." For the control items, the antecedent was grammatically and conceptually plural (*mensen* "people"). The control items therefore featured the pronoun *hun* "their" instead of *zijn* "his." The control items were added to serve as a baseline featuring a possessive pronoun that is unmarked for gender. Unlike English *their, hun* "their" cannot be used in grammatically singular contexts. We used a generic bare plural antecedent (i.e., *mensen* "people") in the control items to parallel the meaning of the experimental items while avoiding the masculine generic pronoun *zijn* "his." Adding control conditions is crucial to being able to conclude that any reading time difference between *de vrouw* "the woman" and *de man* "the man" in the experimental conditions is truly due to the masculine pronoun *zijn* "his" (and not, for example, due to a more general male bias or lexical differences between the words *man* "man" and *vrouw* "woman").

Initially, 120 possible items were created and subjected to two pretests to ensure that the generic statements were plausible (pretest 1) and stereotypically neutral (pretest 2). A total of 72 items (i.e., 12 per condition) were selected based on the pretests. All items and their translations as well as detailed

Table 1. Examples of Experimental and Control Items Including the Pattern Every Item Followed

Experimental items	*Example*	*Iemand/Iedereen met een absoluut gehoor kan snel zijn instrument stemmen, zo ook de vrouw/man op het conservatorium die nog nooit een stemvork nodig heeft gehad.* "Someone/Everyone with perfect pitch can tune his instrument quickly, such as the woman/man at the conservatory who has never needed a tuning fork."
	Stimulus frame	*iemand/iedereen met een* "someone/everyone with a" + adjective + noun + modal verb + adverb + *zijn* "his" + noun + verb, *zo ook de vrouw/man* "such as the woman/the man" + prepositional phrase . . .
Control items	*Example*	*Mensen met een absoluut gehoor kunnen snel hun instrument stemmen, zo ook de vrouw/man op het conservatorium die nog nooit een stemvork nodig heeft gehad.* "People with perfect pitch can tune their instrument quickly, such as the woman/man at the conservatory who has never needed a tuning fork."
	Stimulus frame	*mensen met een* "people with a" + adjective + noun + modal verb + adverb + *hun* "their" + noun + verb, *zo ook de vrouw/man* "such as the woman/the man" + prepositional phrase . . .

information on the pretests can be found in the Supplemental Material. The stimuli can also be found in this paper's OSF project at https://doi.org/10.17605/OSF.IO/8ADKB.

We also included 144 filler items in addition to the 72 experimental and control items. Thirty-six fillers were generic statements including the generic pronoun *je* "you." Another 36 fillers were very similar to the experimental items, but featured statements about objects rather than people. Finally, 72 items were episodic statements about people in order to counterbalance the genericity of the other filler and experimental items.

We created six lists, so that each item would occur in each condition, but never for the same participant. Lists were carefully distributed across participants, with each list being presented to six male and eight female participants. Each participant saw the items in a different pseudo-randomized order, which was created with the program Mix (Van Casteren & Davis, 2006).

Participants

We tested 91 participants (39 male). The data of three participants were not included in the analysis as they failed to follow the instructions. The data of an additional four participants were excluded as the eye-tracker could not be properly calibrated, leading to poor data quality. This left us with the data of 84 native speakers of Dutch (36 male) between the ages of 18 and 30 (M = 22.4). The majority of participants were students (N = 75). All participants had normal or corrected-to-normal vision. Participants received a 10€ coupon or course credit when preferred. Written consent was provided by all participants. The experiment was approved by the Ethics Assessment Committee Humanities (EACH) at Radboud University (Number 4592).

Apparatus

The experiment took place at the Center for Language Studies (CLS) Lab at Radboud University in Nijmegen, Netherlands. An EyeLink 1000+ remote desktop eye-tracker with a headrest was used. The sampling rate was 1000 Hz. We used Experiment Builder by SR Research (2011) for stimulus presentation on a BenQ XL 2420 T 24" screen. The used resolution was 1024 × 768. The distance between the headrest and the screen was 108 cm. The stimuli were presented in black letters on a gray background using Calibri with a font size of 19.

Procedure

Participants were tested individually. They were first given general information about the experimental procedure at the lab as well as information specific to the experiment, their rights as participants and information on how the data would be treated. They were then asked to sign the consent form. We tested for the participants' dominant eye. Participants were then seated in the testing booth and read the instructions off the screen. These stated that participants should read the presented sentences naturally —that is, in a manner that resembled their usual reading pace and habit. Participants were informed that they would have to verify statements after some of the items using a button box. The statements had to be judged as correct or incorrect and were presented following a quarter of all experimental and filler items. There was no time limit, but participants were instructed to respond quickly. We calibrated the eye-tracker to the participants' dominant eye by means of a 13-point calibration and validation procedure. Participants were given the chance to ask clarification questions after four practice items. Breaks were scheduled after one third and two thirds of all items. Afterward, participants filled in a short questionnaire probing them for the purpose of the experiment and asking several demographic questions. Participants then received either a coupon or were granted course credit. The experiment took approximately 50 minutes.

Analysis

Participants were required to respond correctly to at least 80% of all statements in order for their data to be included in the analysis. All participants scored above this threshold.

Pre-processing of the raw eye-tracking data was done with EyeLink Data Viewer. We checked all of our participants' trials individually for drift. If a systematic and clear drift had occurred in a trial, the fixations were reassigned to the appropriate lines. Furthermore, whenever the first fixation of a trial did not fall on the first line of the stimulus but the subsequent fixations did, the initial fixation was deleted so as to allow for proper calculation of first run reading times. Fixations smaller than 80 ms were merged with an adjacent fixation larger than 80 ms within 0.25 degrees in visual angle. This was done by means of Data Viewer's cleaning procedure. Subsequently, unmerged fixations below 80 ms and fixations above 1,200 ms were deleted.

We calculated three reading-time measures for the regions of interest: first run dwell time (i.e., the sum of the duration of all fixations in a region when it is entered for the first time), regression path duration (i.e., first run dwell time with the addition of the duration of fixations back to previous regions out of the analyzed region) and dwell time (i.e., the sum of the duration of all fixations in a region, also known as total fixation duration). We followed Redl et al. (2021) in their choice of measures and regions of interest, since these allow us to cover both early and late measures of reading. Redl et al. had only found evidence for a male bias in the earliest region and for the earliest measure (i.e., first run dwell time), but other eye-tracking studies have shown that indirect gender cues such as masculine generics and gender stereotypes can affect the reading process from early to late, making it desirable to cover various stages of processing (Irmen, 2007; Irmen & Schumann, 2011). First run dwell time is regarded as the upper bound of earliest processing, with regression path duration and dwell time being indicative of later processes (Kliegl & Laubrock, 2017). The regions of interest are indicated in (7) in bold and by square brackets:

(7) *Iemand met een lange vakantie kan even zijn stress vergeten,* ***[zo ook] [de vrouw] [in de duinen]***
die er drie weken tussenuit is met het hele gezin.
"Someone with a long vacation can forget about his stress, **[such as]** **[the woman]** **[in the dunes]**
who will be on holiday with the whole family for three weeks."

Semantic information up to six to eight characters to the right of the current fixation is processed (McConkie & Rayner, 1975; Schroyens et al., 1999); we therefore not only analyzed the gendered noun phrase (*de vrouw* "the woman" and *de man* "the man") but also the region preceding it. This was particularly important since Redl et al. (2021) found a male bias in the pre-view region only. We further defined the prepositional phrase further describing the woman or man in question as the spillover region.

We fitted linear mixed models using the *lmer* function from the *lme4* package (Bates, Mächler et al., 2015) in R (R Core Team, 2018). All described models were fitted to log-transformed reading times to correct for a right skew in the data. Participant gender (female versus male), antecedent (conceptually singular *iemand* "someone" versus conceptually plural *iedereen* "everyone" versus the grammatically plural control condition "people") and continuation (*de vrouw* "the woman" versus *de man* "the man") served as fixed effects. For continuation, *de vrouw* "the woman" was coded as ½, *de man* "the man" was coded as −½. For participant gender, female participants were coded as ½, male participants as −½. For the three-level factor antecedent, Helmer contrasts were used, which involves including two contrasts. First, the grammatically plural control condition featuring *mensen* "people" was compared to the experimental conditions featuring grammatically singular *iemand* "someone" and grammatically plural *iedereen* "everyone" (*iemand* "someone" = −⅓, *iedereen* "everyone" = −⅓, *mensen* "people" = ⅔). The second contrast compared conceptually singular *iemand* "someone" to conceptually plural *iedereen* "everyone" (*iedereen* "everyone" = −½, *iemand* "someone" = ½, *mensen* "people" = 0). The hypothesized male bias of *zijn* "his" in generic contexts (H1) would surface as

a two-way interaction effect between antecedent and continuation (Contrast 1). The stronger male bias in conceptually singular versus plural contexts (H2) would surface as a two-way interaction effect between antecedent and continuation (Contrast 2). The hypothesized stronger male bias for male participants (H3) would show as a significant three-way interaction between antecedent, continuation, and participant gender.

We included random intercepts for participants and items. Initially, we further fitted the full random slope structure permitted by the design (i.e., the maximal model, see Barr et al., 2013). We suppressed the correlation parameters as a first step to model simplification. We then tested for overparameterization by means of Principal Component Analysis using the *RePsychLing* package (Bates, Kliegl et al., 2015). In case of overparameterization, we reduced the random structure by removing random slopes that explained little to no variation, starting with higher-order effects and testing iteratively whether their removal decreased the model fit by means of the Anova function. All final models included random intercepts for items and participants. The random slope structure of the final models is reported below. *P*-values were calculated using the *lmerTest* package (Kuznetsova et al., 2017). Furthermore, we applied false discovery rate control to correct for multiple comparisons (Benjamini & Hochberg, 1995). We did this to correct for the number of analyzed reading-time measures and regions (three of each, leading to nine models or comparisons). Only *p*-values that were smaller than the FDR-corrected threshold are reported below as being significant. *P*-values below the original alpha level of 0.05, but that did fall above the FDR-corrected threshold are thus not reported. We also calculated standardized betas and their confidence intervals for all significant effects using the *std_beta* function from the *sjstats* package (Lüdecke, 2020) and report these below. The data and the R script for the analysis can be found in this paper's OSF project at https://doi.org/10.17605/OSF.IO/8ADKB. This study had not been preregistered.

Results

Region 1: zo ook "such as"

On the pre-view region *zo ook* "such as" we found significant effects for first run dwell time. The initial maximal model was simplified as described above. The final model for first run dwell time included random slopes per participant for continuation and both antecedent contrasts, as well as random slopes per item for antecedent (someone versus everyone). There was a significant three-way interaction between participant gender, continuation, and antecedent when comparing the control condition to the experimental conditions ($\beta = 0.17$, $SE = 0.05$, $t = 3.46$, $p < 0.001$, standardized $\beta = 0.14$, 95% *CI* [0.06; 0.21]).

As can be seen in Figure 1, for female participants, there is no male bias: If anything, the continuation *the woman* speeds up reading in the experimental conditions relative to the control condition. For male participants, however, we see an increase in reading time for the continuation *the woman* after reading the generic masculine pronoun *zijn* "his" relative to the control condition. Because the male bias only seems to appear for male participants (as predicted; H3), we continue our analysis on male participant data only. For this group, there was a significant two-way interaction between continuation and antecedent when comparing the experimental conditions to the control conditions ($\beta = -0.11$, $SE = 0.04$, $t = -2.99$, $p < .003$, standardized $\beta = -0.09$, 95% *CI* [−0.15; −0.03]). The same two-way interaction was also significant when comparing the two experimental conditions (*someone* versus *everyone*) ($\beta = -0.11$, $SE = 0.04$, $t = -2.49$, $p = .013$, standardized $\beta = -0.08$, 95% *CI* [−0.15; −0.02].

Region 2: de vrouw "the woman"/de man "the man"

For the region *de vrouw* "the woman"/*de man* "the man," we found a significant effect for dwell time. The final model included random slopes per item for participant gender and both antecedent contrasts

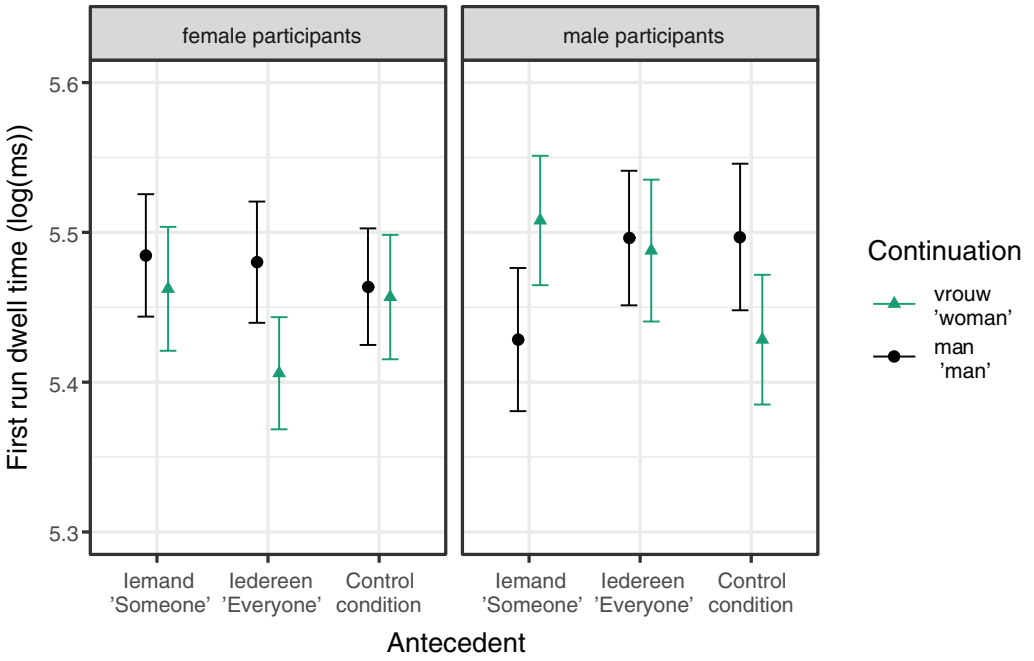

Figure 1. Mean first run dwell time on Region 1 *zo ook* "such as" with 95% within-subject confidence intervals.

but intercepts only per participant. There was a significant two-way interaction between continuation and antecedent when comparing *someone* to *everyone* (β = 0.01, *SE* = 0.006, t = 2.69, p = .007, standardized β = 0.06, 95% *CI* [0.01; 0.09]) but no significant interaction when comparing the two experimental conditions to the control condition (see also Figure 2). Hence, there was no sign of a male bias in Region 2.

Region 3: prepositional phrase

For the spillover region, we found a significant effect only for first run dwell time. The final model's structure included random slopes for antecedent (*everyone* versus *people*) and continuation*antecedent (*someone* versus *people*) for participants, as well as random slopes for continuation, antecedent (*everyone* versus *people*), continuation*antecedent (*everyone* versus *people*), and participant gender*antecedent (*someone* versus *people*) for items. There was a main effect of continuation, with female continuations leading to a longer first run dwell time in the spillover region overall (β = 0.05, *SE* = 0.01, t = 4.84, p = .001, standardized β = 0.04, 95% *CI* [0.02; 0.06]). Figure 3 below shows that this effect is mainly driven by the male participants. Continuation and participant gender did not reach significance, since a false discovery rate corrected p-value lower than 0.0056 would have been required in this instance (β = −0.06, *SE* = 0.02, t = −2.66, p = .008 > 0.0056, n.s.). There was no sign of male bias in Region 3.

Discussion

We conducted an eye-tracking experiment to test whether a masculine generic pronoun such as Dutch *zijn* "his" could trigger a gender inference and lead to a male bias when embedded in generic statements—that is, in the absence of a specific, contextually determined referent. Previously, little was known about the effect of masculine generics in generic as opposed to episodic contexts. We

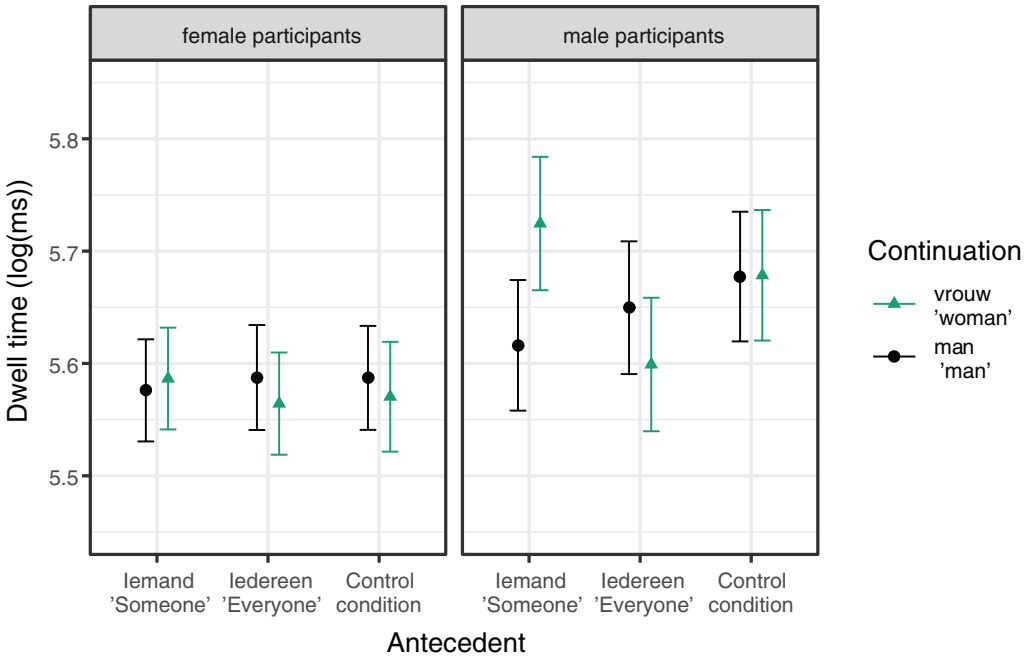

Figure 2. Mean dwell time on Region 2 *zo ook* "such as" with 95% within-subject confidence intervals.

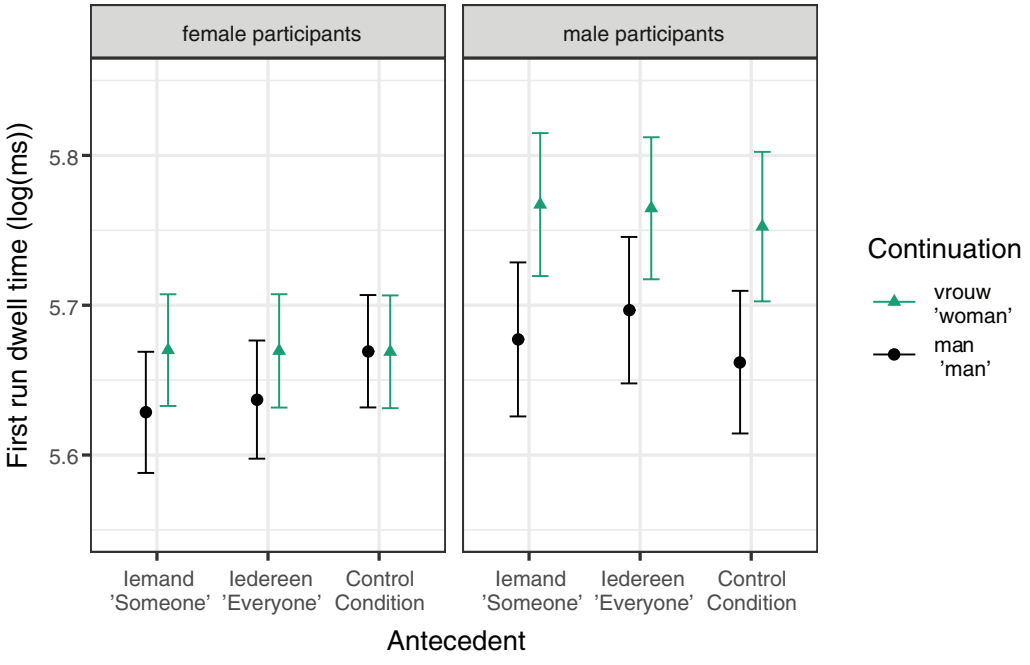

Figure 3. Mean first run dwell time on Region 3 with 95% within-subject confidence intervals.

presented participants with truly generic statements containing a generically intended masculine possessive pronoun (*Someone/Everyone with perfect pitch can tune his instrument quickly*). This statement was continued with either a specific female or male referent (*such as the woman/man*).

Moreover, we manipulated the antecedent in the generic statement, which was either conceptually singular and individual-referring (*iemand* "someone") or conceptually plural and group-referring (*iedereen* "everyone"). Our results parallel those of Redl et al. (2021), who investigated *zijn* "his" in episodic contexts and found a male bias to surface only for male participants. Also similar to Redl et al. (2021), we found this effect of a male bias only in the pre-view region. For male participants, we found a positive two-way interaction between type of antecedent and continuation when comparing the experimental and control conditions for first run dwell time in Region 1 (i.e., the pre-view region). In accordance with our hypothesis (H1), this result suggests that the generically intended possessive pronoun *zijn* "his" can give rise to a gender inference in generic statements. Thus, *zijn* "his" led to a male bias despite being intended as gender-neutral and despite being embedded in a generic context (i.e., in the absence of a specific time and referent). As hypothesized (H3), we found an asymmetry between the genders: This effect of a male bias surfaced solely for male participants and not for female participants. Furthermore, we found the effect in generic statements featuring the antecedent *iemand* "someone" but not for *iedereen* "everyone." This suggests that the conceptual number of the antecedent and consequently how the antecedent is mentally represented, can affect whether a masculine generic is readily processed as it is intended in generic contexts—namely, as referring to all genders. We had indeed hypothesized (H2) that a male bias was more likely to surface with the conceptually singular antecedent. Let us break down these findings individually.

Our results show that a masculine generic pronoun such as *zijn* "his" can trigger a male gender inference and therefore lead to a male bias even when no specific, contextually determined referent is presented. Previous research has largely focused on masculine generics in episodic contexts and only a small number of studies used generic contexts. For example, Noll et al. (2018) conducted two experiments 15 years apart in which they tested whether masculine generic *he* causes a male bias. They used generic contexts and found a male bias of *he* but only in the later of the two experiments. Noll et al. attribute this difference to the decrease in use of generic *he* (e.g., Earp, 2012; LaScotte, 2016). This could mean that the generic reading of a masculine generic pronoun is readily available in processing when it is relatively frequent. Dutch *zijn* "his" is still very commonly used generically, as there is no widely used gender-neutral alternative. Thus, the generic reading can also be assumed to be relatively more frequent compared to the generic reading of English *he*. Nonetheless, we found *zijn* "his" to cause a male bias when used in generic statements, albeit only for male participants and with a conceptually singular antecedent. This suggests that the generically intended pronoun *zijn* "his" can trigger a gender inference and lead to a male bias even in contexts wherein the generic reading should be easily accessible: a context generalizing over situations and individuals, when no specific referent is provided as an antecedent.

Our findings also suggest that, conversely, the generic pronoun may be processed as it is intended in some instances. While we have shown that the masculine generic pronoun *zijn* "his" can be the source of a gender inference in generic statements, we saw this only in conceptually singular contexts. Thus, there is evidence that a gender inference based on the possessive pronoun *zijn* "his" is more likely to be made when the pronoun refers back to a conceptually singular antecedent. Our hypothesis that a male bias was more likely to surface with *iemand* "someone" as the antecedent was based on the idea that a generic, conceptually singular antecedent would more likely be mentally represented as a prototypical person fitting the generic statement, including their (male) gender in agreement with the masculine possessive pronoun (McConnell-Ginet, 1979). In contrast, a conceptually plural generic antecedent would rather be represented the way plural expressions such as *everyone* typically are—namely, by means of multiple tokens (Kaup et al., 2002). Assigning gender in the latter case is a more complex process. Together with the absence of a prototypical, personalized referent in these generic contexts, the plural antecedent may allow for generic *zijn* "his" to indeed be processed as generic. Previous research has shown that conceptual number cues affect mental text representations (e.g., Carreiras & Gernsbacher, 1992; Gernsbacher, 1991), and the present experiment offers a first indication that this may also affect the male bias of a masculine generic.

As noted above, female participants showed no signs of a male bias at all—neither with the conceptually singular nor with the conceptually plural antecedent. This suggests that women can readily process the masculine generic pronoun as intended in a generic statement: as referring to men as well as women. This asymmetry between the genders in the processing of *zijn* "his" was also found by Redl et al. (2021). Several older offline studies on English masculine generic pronouns, too, had found women and men to respond to masculine generics differently (e.g., Moulton et al., 1978; Switzer, 1990). Henley and Abueg (2003) suggest that this asymmetry is rooted in language acquisition. While girls are required from a young age to interpret masculine generics as inclusive of persons on either gender, this is not the case for boys. Boys may process masculine generics either as generic or as male-specific and they will be included in both cases. The gender-neutral reading of a masculine generic would then be more strongly represented in women's mental lexicon, as they would have had to access this reading more often than men did. This could explain why the women in our experiment seemingly processed the masculine generic as referring to persons of any gender and did not show signs of a male bias.

A masculine generically intended pronoun such as *zijn* "his" can thus trigger a gender inference and lead to a male bias in generic statements under certain circumstances. This adds further evidence to the notion that the mental representation of nonspecific entities can still contain gender information, even based on as unreliable a cue as a masculine generic pronoun, which is not intended to give an indication of the referent's gender. A question remains: What is the gender information on *zijn* "his" in the conditions in which it did not cause a male bias? After all, we found no evidence of women experiencing a male bias at all, while for men this was restricted to conceptually singular antecedents. It could be that women and, under certain circumstances, men do not use the grammatical gender of the pronoun for a gender inference and therefore do not add a male gender to the mental representation of the referents. Alternatively, it could be that in the cases in which no gender inference is made, the pronoun is not processed as carrying masculine gender to begin with. In her analysis of English singular *they*, Bjorkman (2017) suggests a three-way distinction in gender features (i.e., masculine versus feminine versus ∅). She suggests that singular *they* is not marked for gender and can thus easily be combined with quantificational or indefinite antecedents, like the ones in our experiment. We can extend this line of thinking to Dutch *zijn* "his," which would then have to be thought of as ambiguous between two representations in the lexicon: one that is marked for masculine gender and the other not marked for gender at all. As mentioned above, it is possible that women can more easily access the latter, gender-unmarked representation of the pronoun due to differences in acquisition and the frequency of having to access the generic reading. Additional research is needed to further explore how a masculine generic pronoun, when successfully interpreted as generic, is in fact stored in the lexicon.

Regardless of the exact representation of the masculine generic pronoun *zijn* "his" in the mental lexicon, the results of our study suggest that language users can recuperate from the male bias induced by *zijn* "his" very quickly when presented with a female referent. Just like Redl et al. (2021), we found evidence of a male bias only in the region preceding the continuation revealing the referents' gender. Redl et al. conducted an eye-tracking experiment and a sentence-evaluation task similar to Gygax et al. (2008). The absence of a male bias in the latter experiment, which taps into the later stages of processing, further adds credibility to their conclusion that the male bias of *zijn* "his" can be overcome quickly *if* the reader is presented with information that contradicts the male-specific interpretation of the pronoun.

It has to be noted that it is theoretically possible that the male bias found for male participants in conceptually singular contexts is not actually due to the pronoun but resulted from a more general, nonlinguistic male bias. It has been suggested before that the prototypical human is generally thought of as male, which would in turn lead to even neutral word forms conjuring up the image of a man, rather than the image of a woman or a mental representation that is unspecified for gender (Hamilton, 1991; Silveira, 1980). We did not find evidence for a male bias in our control items, which did not feature *zijn* "his" and where such a general male bias could have surfaced. However, the control items were conceptually plural. It is therefore possible that conceptually singular generic statements favor a male gender representation as opposed to conceptually plural generic statements regardless of the masculine gender of the possessive pronoun, but for male participants only. While we deem this

possibility unlikely, we directly addressed this in follow-up research to rule it out. In a self-paced reading study featuring generically intended *hij* "he" in similar generic contexts, we employed control items featuring *iemand* "someone" and no pronoun. We did not find evidence for a more general male bias, suggesting that the male bias in the current experiment was indeed due to the generically intended masculine pronoun alone (Redl et al., 2020).

Finally, we found one result pattern that was not predicted by our hypotheses. There was a general increase in first run dwell time for female continuations across all conditions on the spillover region. This could simply be an effect of frequency. We found 308,343 occurrences of *man* "man" and 176,425 for *vrouw* "woman" through the OpenSoNaR application, which searches two large Dutch corpora—namely, the SoNaR corpus (Oostdijk et al., 2013) and the Corpus of Spoken Dutch (Corpus Gesproken Nederlands, 2014). Alternatively, it could also be a spillover effect caused by the length of *vrouw* compared to *man*. We deem such lexical explanations most likely. Alternatively, this effect could be interpreted as a sign of a more general male bias, as described above. However, a lexical explanation is simpler and therefore favored.

Conclusion

We found that male speakers of Dutch—a language falling in between natural and grammatical gender languages—make a gender inference based on the masculine generic possessive pronoun *zijn* "his" in generic statements when a conceptually singular indefinite antecedent (*someone*) was used. Female speakers of Dutch, on the other hand, were not found to make a gender inference based on the masculine generic with either a conceptually singular or conceptually plural antecedent. Our results therefore suggest that a male bias can arise even in generic statements but only under certain circumstances. The conceptual number of referents and the gender of the person processing the masculine generic possessive pronoun can influence whether or not a male bias arises in generic contexts.

Note

1. We are not aware of any studies investigating the mental representation of conceptually singular and plural indefinite pronouns, but differences between bare plural generics (e.g., *Knives are used to cut things*) and indefinite singular generics (e.g., *A knife is used to cut things*) have received attention in philosophy and (formal) semantics (cf., Krifka, 2012; Leslie et al., 2009; Prasada et al., 2013). Noun phrases of which the conceptual number and grammatical number differ (e.g., *pants* and *gang*) have also received attention in the literature, see for example Hartsuiker et al. (1999).

Acknowledgments

The authors would like to thank Joske Piepers and Maria van de Groep for their help with the stimuli.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

The authors received no specific funding for this work.

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Data availability statement

The data are openly available at https://osf.io/8adkb/. The DOI is 10.17605/OSF.IO/8ADKB

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