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Gender attribution trouble in interaction about a gender ambiguous robot

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ABSTRACT

Gender attribution is related to the linguistic system of many languages, for instance in person reference. However, gender may also become relevant to what the participants are doing socially (action relevance). This article examines practices related to gender attribution in the context of a gender ambiguous robot. We examine how gender attribution to the robot emerges, unfolds and thus impacts the course of interaction. Our data consist of videorecorded Dutch interactions of two participants in the presence of a Pepper robot. We use Conversation Analysis as a method. Our analysis shows that gender attribution may involve interactional trouble. Sometimes, this is minimal ("or he or it"), marking uncertainty regarding the robot's gender. But gender may surface more explicitly and even extensively in the case of gender negotiation and accounts that include gender assumptions ("in terms of figure I think it is more of a woman"). Such extended sequences are characterized by tensions: gender is constructed as an opinion versus a knowable; robot gender is deflected as irrelevant while gender relevance persists in the conversation. Overall, gender is treated as problematic and/or delicate, warranting a diversion from the ongoing activity. The recurrence of gender attribution talk in our data is striking in light of reported difficulty of capturing gender categorisation work in naturally-occurring interactions. Overall, deeply ingrained gender norms and their constitution in language and social interaction seem to surpass progressive robot design and may even create a context for the articulation of questionable gender assumptions.

1. Introduction

Gender is one of the first and main things members of (Western) societies note about each other (Kessler and McKenna, 1985). Relatedly, gender is normatively performed in ways that are recognizable to others, thus invoking a so-called gender order (West and Zimmerman, 1987; Stokoe, 2004). The gender order also permeates - and is constituted in - language and social interaction. While the use of gender categories is often smoothly built into interactions, the delicacy of gender attribution becomes manifest when gender attribution is treated as troublesome, for instance through repairs, accounts, or joint negotiations of gender.

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In this article, we focus on gender attribution trouble that impacts the course of action in Dutch interactions about a co-present gender ambiguous robot (the same as in de Rijk et al., 2024). Gender categorization is usually being treated as a delicate topic in everyday interaction and therefore difficult to capture in naturalistic settings (Stokoe, 2009). Similarly, gender ambiguity is delicate and may not surface in interaction for various reasons. From a conservative standpoint, it may be perceived as problematic and difficult to discuss explicitly, whereas from a more progressive perspective, the expectation may be to avoid resolving the ambiguity altogether, viewing any attempt to do so as conservative or outdated. Nevertheless, gender attribution trouble is abundant in our data involving nurses introducing a humanistic robot to a participant. It seems like the robot works as an unplanned "breaching experiment" (Garfinkel, 1967) which brings to the surface humans' tacit understandings of assumedly shared knowledge of gender. With humans, gender is typically evident and thus rarely topicalized, whereas with robots, ambiguity triggers explicit categorization efforts. Also, robots might serve as safe targets for gender speculations and negotiations that would be unacceptable with human interlocutors (cf. Pino and Edmonds, 2024). Hence, our dataset provides a unique occasion for studying gender ambiguity and attribution practices in human interaction, both in terms of their interactional embedding and the gender normativities involved.

Our analysis distinguishes various interactional practices of gender attribution trouble, including expansions with "or", information-seeking questions, accounts and gestures. Relevant to this analysis is the difference between *system* and *action* relevance of gender, as we specifically focus on how gender action relevance emerges and how gender assumptions are drawn upon. In the next Section, we explain the difference between system and action relevance and discuss some previous research on gender attribution trouble.

2. Gender attribution

2.1. System relevance and action relevance

Gender categorization is sometimes inherent in the use of a particular word (system relevance) but may also be prompted by or embedded in a particular action (action relevance). When we refer to other people with person categories ('husband', 'niece', 'waitress') or pronouns ('she', 'his'), we often casually categorize their gender even when it is not relevant for the course of action. One reason for speakers to make gender available in an initial reference is to help listeners manage subsequent references, which are usually done with gendered pronouns (Klein, 2011, p.71). Hence, with a gendered personal pronoun (e.g., 'her') we may capitalize on the initial gendered reference to the person categorized as female (e.g., 'waitress'), creating person reference in an intelligible and efficient way (cf. Schegloff, 1996). In such cases, gender categorization is related to the language system (so-called system relevance) more than to the action conducted, i.e. what is done with and in the talk (so-called action relevance). Klein (2011) showed that when a speaker uses an initial reference without gender categorization ('boss'), the recipient may choose a gendered pronoun in the next turn ('he'), upon which the first speaker may correct in next position ('she'). So, the exclusion of gender categorization in initial reference may be consequential. However, the example of 'boss' also shows that gender categorization does not always occur in person reference. When gender categorization is not included in reference to a person in languages in which such references are systematically available, this *may* signal special circumstances or trouble– the speaker may be lacking or hiding information about the person referred to. The normative inclusion of gender categorization as a minimum basic form of non-recognitional reference makes gender omnipresent in talk. When gender categorizations are treated as 'unproblematic' this contributes to keeping things run smoothly (Klein, 2011, also see Kitzinger, 2005a, 2005b).

In contrast to mere system relevance, gender categorization may also be action relevant (Klein 2011, see also Kitzinger and Wilkinson, 2017). An utterance like 'let's have the men clean up' (Robles and Kurylo, 2017) marks gender as relevant for doing domestic work and thus for the specific proposal. Similarly, asking a patient about the effect of domestic work on physical complaints treats the recipient as relevantly gendered (cf. Stommel et al., 2022). However, action orientations to gender are not always easily identified in social interaction; for example, linguistically gendered nouns can be used in a non-gendering way and vice versa (Kitzinger and Wilkinson, 2017). Action orientations are identifiable when gender is 'procedurally relevant for speakers, as evidenced through discursive phenomen[a] such as repair, disclaimers and "troubling" orientations to such categories' (Stokoe and Smithson, 2002: 79). The case of 'girl – woman – sorry', where one gender category is repaired with another (Stokoe, 2011), is one example of such procedural relevance. In such cases, the repaired gendered category is not related to categorical adequacy ('category-formed errors', Jefferson 1996), but to some other aspect of the category (e.g., socio-economic class, age). Stokoe (2011) notes that some repair *solutions* are produced more "emphatically" than the *repairable*, sometimes including accounts. Accounting for the use of the repairable category takes up more space in the turn and thus the repair becomes more marked compared to an immediate repair that implies virtually erasing the first category and commitment to the second (e.g., 'the wo-lady downstairs', Stokoe 2011). Rather than repairing the first category, speakers may also add a second with 'or', as an alternative to the first category ('woman or girl'). This has an epistemic function regarding the speaker's knowledge of

the 'correct' category for referring (Stokoe, 2011). Selecting alternative categories using 'or' implies a lack of knowledge of the person and/or treats the gender category as not the most important thing in the course of action. That is, the 'or'-construction implies the person is describable with either category. However, the categories in this research were relatively close (girl-woman), and arguably less mutually exclusive than what is normatively assumed about female and male, the gender binary (cf. Kessler and McKenna, 1985).

2.2. Gender attribution trouble

When gender is unknown or cannot be (easily) attributed, members rely on gender assumptions including particular cues (body shape, clothing, voice, activity, etc.) to attribute gender. As the traditional gender order is increasingly unsettled by those who do not observably identify as either of the two dominant gender categories, gender attribution may be challenging. Even the use of gender-neutral references has inferences due to the pervasiveness of gender in language and society (Klein, 2011). Topicalizing gender ambiguity seems rare in naturally occurring interaction. It may even be normatively avoided as it disturbs the gender order. Hence, whenever gender attribution trouble does surface in interaction, this is worthy of analysis.

To the best of our knowledge, four previous studies looked into gender attribution trouble. Speer (2005) examined how research participants allocated gender to images of people engaged in non-traditionally gendered activities. The participants displayed difficulties in making definitive gender attributions, which they grounded in the non-traditional gender cues in the images (e.g., male ballet dancer). So, gender assumptions and gender attribution trouble became manifest. However, the interaction by the participants was elicited by the research setting, so less ideal to draw conclusions from relevant to the study at hand.

Pino and Edmonds (2024) collected instances of gender attribution in their analysis of misgendering persons through a pronoun (e.g., 'she' for a nonbinary person) or noun (e.g., niece-nephew). They go beyond identifying which gender assumptions are (re)produced by misgendering by examining precisely *how* these assumptions become manifest at the surface level of the interaction. Their analysis shows that gender assumptions often remain relatively implicit, restricted to self-correction as the participants prioritize progressivity over more explicit explanations or accounts for the misgendering. Additionally, they consider the relevance of face threats involved in misgendering; leaving gender assumptions implicit reduces the threat to both the misgendered person's and the speaker's face. The authors also argue that the level of explicitness or implicitness of gender assumptions is relevant "because it determines the extent to which assumptions become available for possible contestation and revision" (p.5).

In another study, Edmonds and Pino (2023) focused on cases of 'designedly intentional misgendering'. Speakers were found to mark their misgendering of a co-present transgender person as intentional through framing it as deliberately different from a previously indicated self-identification or through linking it to a display of their anti-trans-position. Next, the misgendered person could leverage the misgendering to criticize the other speaker, highlighting their moral transgression.

The fourth study of gender attribution trouble was our own, namely a case study of gender attribution of a gender ambiguous robot (de Rijk et al., 2024). In this case, gender attribution initially surfaced with a gender-dual "person" reference to the robot ("young lady young gentleman"), hence system relevance. Subsequently, attributing gender evolved into a collaborative activity (action relevance) in which the participants were oriented towards reaching agreement. Gender assumptions related to the robot's body shape were drawn on as resources for female gender attribution, but silences, dispreferred responses and laughter also signalled delicacy of gender attribution. The study at hand expands on de Rijk et al., 2024 by analysing the full set of instances of gender attribution trouble in the dataset and approaching it from a slightly different perspective; while de Rijk et al., 2024 focused on gender ambiguous robot design and its interactional implications in one interaction, this article focuses on the variety of human gender attribution practices. It identifies gradual differences in interactional trouble, from moderate to extensive gender talk in which gender assumptions are invoked. We also describe the practices involved in the resolution of the trouble. The patterns we identify are likely applicable to gender ambiguity surfacing in interaction beyond the robot context.

3. Data & method

Our original data consist of 30 video-recorded interactions between a nurse and an elderly person in a hospital in the Netherlands. The 30 elderly volunteered to participate in an experiment in which a health survey was conducted by a Pepper robot and they gave their written consent for their participation. Pepper was intentionally designed as gender ambiguous or gender-neutral (Aldebaran-Softbank, 2019, para. B), which means that its shape (see Fig. 1) was aimed to have no explicitly defined gender characteristics and the robot's voice was crafted to be childlike and androgynous (Pandey and Gelin, 2018).

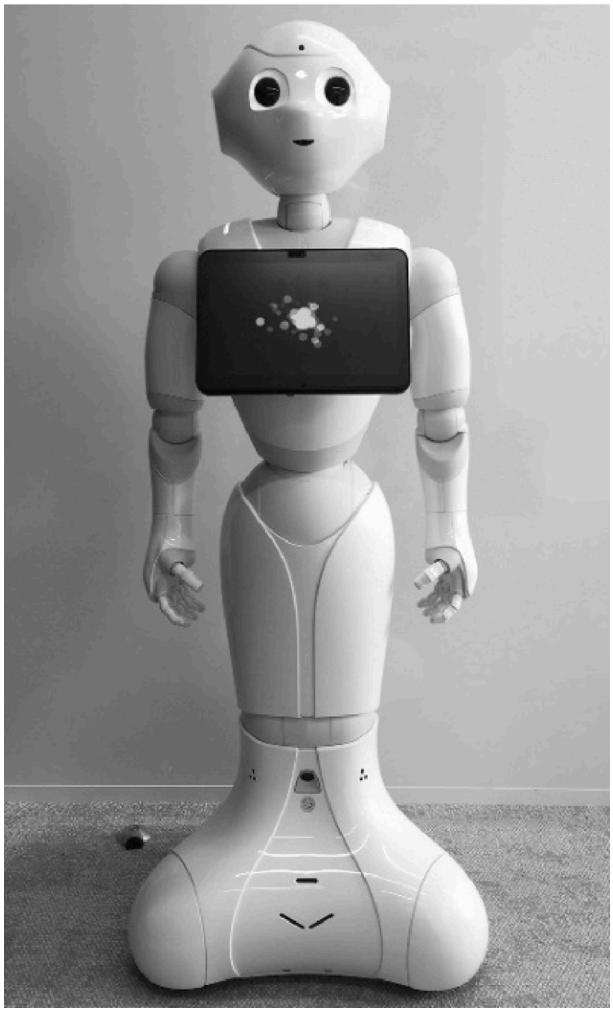

Fig. 1. The Pepper robot.
Boumans et al., 2019b, unedited, http://creativecommons.org/licenses/by/4.0/.

The elderly participants were unfamiliar with the robot prior to the experiment. The robot was programmed with 52 survey questions and some test questions (cf. Boumans et al., 2019a). Prior to activation of the robot, the nurse (one of two nurses) roughly explained to each participant how the robot worked and what to expect. Our cases are taken from this particular phase of the survey procedure: nurse and participant talking about the upcoming task and robot. Robot gender was not instructed to be part of the nurse's explanation. The use of non-binary/gender-neutral pronouns was generally still rare outside of queer communities in the Netherlands at the time of data collection (2017).

During the explanation the robot was gender categorized with (system) reference terms like *ze/zij* ('she') and '*ie/hij* ('he'). This could vary between the two participants (nurse 'she', participant 'he' or vice versa) or even in talk from one participant ('he' and later 'she' or vice versa). These system reference variations were often not treated as problematic, presumably because the referent, Pepper, was present and thus consistent use of one gendered pronoun (e.g., either 'he' or 'she') was not essential for the sake of narrative cohesion. In other words, contrastive gendered reference was often unproblematic. In 16 out of 30 interactions, robot gender did not surface in the interaction beyond system relevance.

In contrast to system relevance, the focus of this article is on *action* relevance of gender. By action relevance we mean that system-relevant gender attribution was oriented to as action-relevant. Actions could be an information-seeking question, a compliment or an account; some action that problematized robot gender. This occurred in roughly half of the interactions (14 out of 30), in most cases initiated by the nurses ($n = 10$). The analysis shows how gender attribution trouble comes up and is dealt with in various degrees, from minimal to extensive. In the Findings section, we present representative examples of the patterns we identified. The Excerpts include Dutch with English translations, made by the authors, that stay as close as possible to the original, sometimes leading to somewhat awkward wording in English.

4. Findings

Overall, robot gender attribution becomes relevant upon reference to the robot. In one instance, it concerns initial reference (see de Rijk et al., 2024) but overall, it is launched in subsequent reference using personal pronouns like *hij* ('he') or *zij* ('she') to refer to the co-present robot. The relevance of gender attribution varies: it may be minimal, marking low epistemic stance with regard to robot gender, moderate in case of inserted sequences displaying accountability for gender attribution, and extensive with accounts including gender assumptions in the service of gender attribution.

4.1. Adding gender alternative(s)

Gender attribution trouble is manifest relatively minimally when participants add alternative gendered pronouns to the initial pronoun as an increment, that is, grammatically parasitic to the prior TCU (cf. Walker, 2004). In both Excerpt 1 and 2, it is the speaker (nurse) who adds the alternatives (either 'he' or 'it'), respectively after a gap and after a recipient response. In Excerpt 2, the recipient adds a third alternative, also as an increment ('or her'). Notably, in both cases one of the alternatives is a *non-gendered* object reference ('it'), suggesting the robot may also be categorized as non-human, but in the analysis we focus on the *person* reference, hence gendering the robot. Henceforth, nurses will be referred to as NUR and elderly participants as PAR.

Excerpt 1. #3 P13 (Nur1) *00:55*

1	NUR:		ja in het begin is et een beetje- weet Pepper niet goed
			yes in the beginning it is a bit Pepper does not know well
2		→	omdat we hier met z'n tweeën zijn naar wie <ze> moet
			because there is two of us here who she should
3		→	kijken (.) of hij of: het
			look at or he or it
4			(0.6)
5	PAR:		(n-) [ja,]
			(n-) yes,
6	NUR:		[dus] so- soms loopt het oefenscherm goed, (0.5) en
			so so sometimes the screen runs well and
7			soms is- kijk want nu kijkt ze ook naar mij,
			sometimes is look because now she is also looking at me

Excerpt 2. #1 P2 (Nur1) *00.46*

1	NUR:		nou dat is ze
			well that is she
2	PAR:		°j↑a°
			yes
3			(0.2)
4	NUR:	→	of het of hem.
			or it or him
5	PAR:	→	of h↑aar
			or her
6	NUR:		of haar.
			or her
7	PAR:		Hheh. *((lacht))*
			Hheh *((laughing))*
8			(1.5)
9	NUR:		>ja< de vorige keer had u een gesprek met mij
			yes last time you had a conversation with me

In Excerpt 1, NUR does not immediately continue the course of action (explanation of the robot and task) after the incrementally added alternative attributions, leaving the floor to the recipient to respond and thus, arguably, to further expand on Pepper's gender (0.6s silence, line 4). In other words, the increment is more than a system-relevant gendered reference; the silence marks its action potential. However, PAR only produces a continuer ('yes' line 5), not responding to the gender categorization issue raised by NUR. In the follow-up referral to the robot in line 7, NUR uses *'ze'* ('she'), not further problematizing the gender attribution.

In Excerpt 2, the recipient does respond to the gender issue, providing a fourth option, which is in terms of gender equal to 'she' in line 1, but in a different grammatical form ('her', line 5). The design of the response 'or her' capitalizes on NUR's incrementally proposed alternatives (line 4), thus collaboratively expanding NUR's turn. Thereby, PAR confirms gender attribution trouble raised by NUR, which NUR acknowledges by repeating and thus accepting PAR's addition. This back and forth collaborative turn construction is closed with a laughter token, treating the robot gender trouble as laughable (Glenn, 2003) but not worthy of further talk (lines 8–9). Hence, robot gender may surface in interaction with increments to a turn gendering the robot with female person reference. This seems a way to mark robot gender uncertainty, displaying non-commitment to either gender (or non-gendered object) (cf. Stokoe, 2011). The recipient may let it go or respond to it in a similarly minimal way.

4.2. Inserting gender attribution-related actions

While adding a gender alternative involves only minimal interactional trouble, participants may also explicate the gender attribution trouble one way or another and thereby suspend the ongoing activity. Such diverting actions may be launched by the speaker of the initial gendering (Excerpt 3) or the recipient (Excerpt 4). In Excerpt 3, NUR produces a turn in which Pepper is system-gendered with the pronoun 'she' (line 3), which she expands after a gap.

Excerpt 3 #5 P16 (Nur2) 00:27

1	NUR:		da:n kunt u zeggen Pepper wat bedoel je,
			then you can say Pepper what do you mean
2	PAR:		ohja=
			ohyea
3	NUR:	→	=ze zal dan de vraag herhalen, (0.5) ik zeg ze, maar ik
			she will then repeat the question I say she but
4		→	weet niet wat het is.
			I don't know what it is
5	PAR:		(ohja)=
			(ohyes)
6	NUR:	→	=ik ga van een ze uit.=
			I assume a she
7	PAR:	→	=maakt (ook) niet [uit hehehehe] hh [eh (ja)]
			(also)does not matter hehehehe hh eh (yes)
8	NUR:		[hehehehe] [eh het kan voor]
			hehehehe eh it may happen
9			komen dat er vragen zijn
			that there are questions

What follows after the gap (line 3) is an account for the use of 'she' because NUR doesn't 'know what it is' (lines 3–4), hence claiming gender attribution trouble. This is first received with a news receipt marker which displays recognition of "the problem" ('ohyes', line 5). When NUR further elaborates that she assumes the robot is 'a she' (line 6), PAR responds to the account proper ('does not matter', line 7), downgrading the relevance and accountability of Pepper's gender. By implication, misgendering is impossible and/or inconsequential (cf. Edmonds and Pino, 2023). Shared laughter follows (lines 7–8), treating the gender trouble and/or its established irrelevance as laughable (cf. Glenn, 2003, p.49), upon which NUR returns to the activity of explaining the task (line 8–9), treating the issue as sufficiently dealt with (cf. Holt, 2010).

In Excerpt 4, it is PAR who softly adds 'or she' (line 8) an alternative pronoun for Pepper. Then, NUR suspends the ongoing activity with a gender attribution-related action.[1]

Excerpt 4 #6 P17 (Nur1) *01:26*

1	NUR:		we hebben vanochtend ontdekt dat 'ie het getal zeven niet
			we discovered this morning that he doesn't understand the
2			verstaat als zeuven
			number seven as *seven*[1]
3			((lines omitted))
4			(hij) verstaat het alleen als u zeven zegt.
			(he) understands it only if you say seven
5			((lines omitted))
6	PAR:		hij geeft zelf aan wanneer het afgelopen is.
			he indicates it when it is done
7	NUR:		ja dat geeft [('ie)] aan
			yes (he) indicates that
8	PAR:	→	[°of zij.°]
			or she
9	NUR:	→	en h- (en hij ze-) ja het is meer een vrouw hè?
			and h- (and he sa-) yes it is more of a woman huh
10	PAR:		ja.
			yes
11	NUR:		eh:m ze zegt ook >eh eh< dit mail ik of zo
			ehm she also says eh eh this I email or so
12			((lines omitted))
13	NUR:		als u dat zegt, wat u ziet, dan eh dan start ie met de
			if you say that what you see then um then he starts the
14			vragen.
			questions

[1] The first vowel in the Dutch word *zeven* (seven) may be pronounced in two different ways, see also https://ivdnt.org/actueel/woorden-van-de-week/woordbaak/waarom-zeggen-sommige-mensen-zeuven-in-plaats-van-zeven/

Although NUR has been using 'he' to refer to the robot (lines 1–4), PAR incrementally produces a gender alternative (line 8) to a question she posed about when the robot is finished (line 6). It is produced softly and NUR's next step in the explanation procedure is already projected ('and', line 9), but nevertheless NUR aborts the turn to confirm the gender alternative explicitly ('yes it is more of a woman huh', line 9). Thus, the initial minimal gender trouble is now manifest. PAR confirms ('yes', line 10), but does not further contribute to developing the issue, upon which NUR returns to the main activity, relevantly using the female pronoun to refer to the robot ('ehm she also says', line 11) and thus demonstrating a consequence of the gender attribution-related sequence. Hence, system relevance of robot gender may spark action relevance not only in increments but also in inserted actions that make the gender attribution trouble more manifest, turning it into a shared issue with the potential consequence of using linguistically female person pronouns in reference to the robot. Nevertheless, this consequence may be temporary, see line 13.

4.3. Extending gender talk

Sometimes the initial gender attribution (system relevance) leads to *extensive* gender attribution trouble and talk, hence more than a minimal inserted sequence. This gender talk includes the articulation of gender assumptions. In Excerpt 5, NUR refers to the robot with 'she', which elicits a compliment from PAR.

Excerpt 5 #10 P31 (Nur1) *00:11*

1	NUR:	ze kijkt u aan hheh
		she looks at you hheh
2	PAR:	>ja<
		yes
3	NUR:	en nou gaat ze dalijk naar mij kijken denk ik ik zal wat- wat
		and shortly she's going to look at me I think I will explain some-
4		dingen uitleggen over het schermpje wat u dalijk te zien krijgt-
		some things about the screen you are about to see-
5	PAR: →	>kijk< <u> zegt tenminste <ze>.
		look you at least say she
6		(0.6)
7	NUR: →	>ja<
		yes
8	PAR: →	[ze hebben het altijd over hij >en< 't is Pepper,]
		they always talk about he and it's Pepper
9	NUR: →	[(ik vind het) ik vind het een ze.]
		(I find it) I find it a she
10	PAR: →	ik helemAAl, hh 't is #zo zo zo # vrouwelijk als wat
		I absolutely agree hh it is so so so feminine as can be
	par: →	#----------#two-hand gesture to PEP, see Fig.2
11	→	(>hebben we de vorige keer oo-<) waarom is het dan steeds over
		(last time we have also) why is it then always about
12	→	over hij? nee het is het is zo duidelijk als wat vind ik=
		about he no it is it is as clear as can be I find
13	NUR: →	=ja vinnik ook.=
		yes I find that too
14	PAR: →	=dus (vink) leuk dat u dat nou zo zegt.
		so (I like) that you're saying that like that now
15	NUR: →	(maar wij) herkennen dat vrouwelijke- en ik denk de mannen ook wel
		(but we) recognize that feminine thing- and I think the men do too
16	→	hoor.
		though
17	PAR: →	ja: [he*heh]
		yes he heh
	par :	*leans towards NUR
18	NUR: →	[(t is)] ook niet voor niks #dat ze zo eh:# (is)
		(it is) also not for nothing that she (is) like eh that
	nur: →	#----------#up-down pointing to
	→	Pepper
19	PAR: →	#>mja.<#
		myes
	par: →	#shrugs#
20	NUR: →	[maar het is [een het eigenlijk he maar [ja]
		but it is an it actually huh but yes
21	PAR: →	[>ja< [>ja< [ja:]
		yes yes yes
22		tuurlijk °maar goed°. >ja< (.) >ja<
		sure but still yes yes
23		(0.8)
24	NUR: →	e:h we beginnen dalijk
		eh we start in a minute
25		[lines omitted]
26	NUR:	als Pepper niet goed reageert, dus als ie geen antwoord- als
		if Pepper does not respond properly, so if he [gives] no answer- if
27		<ze> geen antwoord geeft, dan heeft ze u niet goed verstaan
		she gives no answer then she has not heard you properly

The gender talk starts with a compliment from PAR to NUR about the reference to Pepper with 'she' (line 5). This moves the interaction away from the ongoing instructions. The compliment contrasts NUR's gender attribution with that of others ('you at least'), which is further unpacked with PAR's following complaint that others ('they') 'always talk about he' (line 8).[2] Hence, PAR complains about frequent misgendering of Pepper. NUR agrees in overlap, adding that her opinion ('I find', line 9, and again in line 13) is that Pepper is a 'she' with which PAR strongly aligns ('I absolutely [agree]', line 10). PAR continues with a firm statement 'it is so so so feminine as can be' (line 10), gesturing with two open hands with palm upwards towards Pepper during her word search for 'feminine' (Fig. 2).

Fig. 2. Participant's gesture during word search for 'feminine'.

This gesture displays a round shape, not referring to a specific part of Pepper's shape but doing more than deictically gesturing towards Pepper (line 10). The gesture gives an embodied conceptualization of 'feminine', making the abstract concept tangible (cf. Streeck, 2009, p.167). PAR further expands the complaint asking why people constantly use 'he' and contrasting this with what is clear as day in her opinion (line 11–12). NUR again overtly agrees (line 13), which elicits PAR's concluding ('so') restaged compliment ('so (I like) that you're saying that like that now', line 14). Nevertheless, this time NUR expands the topic, theorizing on the relevance of their own gender: as women they recognize 'that feminine [quality]' (line 15) followed by the qualification that probably the same holds for men (line 15–16). Thus, she poses the idea that gender attribution is informed by the participants' own gender, but immediately denies this inference. PAR agrees (line 17), laughing and leaning towards NUR, creating an ambiance of togetherness. In other words, they have extensively attributed femininity to Pepper with reference to their implied expertise when it comes to femininity. NUR continues suggesting there is a reason that Pepper is 'like that' accompanied by pointing up and down towards Pepper (line 18), whereby she implies Pepper's appearances are not coincidental, although which aspect of these appearances is left implicit. This implicitness indicates the delicacy of describing what exactly makes Pepper feminine, leaving it to the other to fill in the details (cf., Ogden, 2020). PAR agrees only minimally and shrugs, not committing to a particular stance (Streeck, 2009). NUR continues proposing Pepper's 'actual' (line 20) status: 'an it', attributing object status to Pepper and thus undermining prior gender attribution. PAR agrees that Pepper is actually an 'it', marking this as obvious ('sure', line 22), but adds 'but still', which resumes the previous gender talk (cf. Mazeland and Huiskes, 2001), thus recommitting to the relevance of gendering. In other words, the gender-neutral object status of the robot bears little relevance to the gender attribution. NUR resumes the instructions and later self-corrects a colloquial form of 'he' she used to refer to the robot (lines 26–27), which again shows that gender talk can be consequential (see also Excerpt 4).

With a compliment for attributing femaleness to the robot, gender system relevance is turned into action relevance, diverting the interaction from its goal. The compliment is further unpacked by the participants, complaining about those who (mis)gender Pepper as male, and arguing why. This arguing is notably different from treating the robot's gender as knowable (cf. de Rijk et al., 2024). It is the participants' shared gender that serves as a resource for the attribution of femaleness. When it comes to specifying reasons, straightforward description of physical features of Pepper is avoided by hand gestures, indicating the delicacy of gender attribution reasoning. Regardless of the participants' agreement on the 'actual' object status of Pepper, the gendering is upheld as justified ('but still', line 22).

Another way in which extended gender talk is launched is through questions, like in Excerpt 6.

Excerpt 6 #12 P37 (Nur1) *00:11*

1	NUR:	dit is Pepper. (0.4) .pt en de vorige keer hebt u (.) eh met mij	
		this is Pepper .pt and last time you spoke eh with me	
2		gesproken (.) [en] vandaag gaat Pepper dezelfde vragen stellen.	
		and today Pepper is going to ask the same questions	
3	PAR:	[hmm]	
		hmm	
4		okee	
		okay	

[2] The extension of the complaint in line 8 'and it's Pepper' seems to be a contrast with reference to the robot with the male personal pronoun, that is, Pepper seems to be proposed as evidence of the faultiness of 'he', hence presuming that Pepper is a name commonly known for women/girls. However, this aspect of the name Pepper is not made explicit and NUR does not respond to this claim, probably due to the overlap with her own turn (line 9), so the import of the extension of the complaint remains opaque in the interaction.

```
5    NUR: →   en voordat 'ie daarmee begint- #of ze          +(.)       +
              and before he starts with that  or she
     nur: →                                  #raises eyebrows+tucks lips+
6    NUR: →   + £of het (.) hhh         + hh:£* ehm=
                 or it      hhh           hh    ehm
     nur:     +turns gaze to PAR, smiling+
     par:                                  *return smiling
7    PAR: →   =is 't? het?
               is  it it
8    NUR: →   >£ja< nou:£ (.) meeste mensen vinden het meer een vrouw dan een man.
                yes well      most people think it's  more of a woman than a man
9         →   #(0.6) of een meisje dan een jongen#
                    or more of a girl than a boy
     par: →   #head tilt left/right + mouth tout #
10   PAR: →   't is beetje [#zeemeerminachtig he#     ]
              it's a bit     mermaid-like right
     par: →                 #------------------#two-hand gesture
11   NUR: →                [maar goed het is eigenlijk] strikt genomen natuurlijk
                            but well it is actually     strictly speaking of course
12        →   een het nf
              an it nf
13   PAR:     °hja° ((nodds))
               hyes
14             (1.0)
15   NUR:     en voordat eh- we zeg maar die vragen- (.) eh voordat u die vragen
              and before eh we so to speak those questions eh before u get those
16             krijgt
              questions
```

NUR starts by referring to Pepper by name (lines 1–2). The first pronoun she uses is the colloquial form of 'he' (*'ie* in Dutch, line 5), to which she adds two alternatives (see also Section 4.1). The production of 'or she' goes together with raised eyebrows and tucking lips, which seems to display accountability of raising the issue of gender. During the production of 'or it' with smiley voice NUR turns her gaze towards PAR. Hence, NUR treats 'or it' as laughable. PAR smiles in response and asks 'is it it', thus picking out 'it' as to be further discussed. Then, NUR's provides evidence in favour of gendering Pepper as female rather than male, orienting to the gender binary and to robot as human (not an 'it') based on the opinion of 'most people' (line 8). Gender attribution to Pepper is enforced by the addition of 'or more of a girl than a boy' (line 9), which indicates flexibility on Pepper's age but staying with only two gendered options of which 'it' is not one. Generally, this suggests that the majority opinion might be taken as a legitimate resource. Also relevant is that PAR ostensively inspects the robot (line 9), tilting her head from side to side with her mouth touted as if weighing options and thus not immediately going along with the majority opinion. Her inspection prompts a description which seems to imply femininity: 'it is a bit mermaid-like right' (line 10). Meanwhile, she gestures tracing Peppers lower body as fanning out near the bottom like a tail (line 10), showing what physical aspect of Pepper she bases her suggestion on. NUR, in overlap with PAR's mermaid suggestion, launches a conclusion with 'but well', indicating a resumption after a digression (Mazeland and Huiskes, 2001). She refers to a particular rule ('actually strictly speaking', line 11) on the basis of which the robot should be categorized as an object ('an it'), which PAR minimally agrees with (line 13), closing the gender attribution sequence. So, as in Excerpt 5, bringing up Pepper's actual genderless object status works to close the topic. However, unlike in Excerpt 5 no final gender attribution is agreed on apart from this 'strictly speaking' object status.

In the final case we discuss it is PAR who turns system relevant 'she' (line 1) into action relevance initiating gender talk (line 8).

Excerpt 7 #14 P52 (Nur2) *00:08*

```
1    NUR:     +dan is het risico heel groot [dat ze    ] al begint=
              then the risk is very high     that she    already starts
     res:     +walking in room with camera and glass of water--------
2    PAR:                                   [dat ze eh-]
                                             that she eh
3              =jaja £hh£=
               yesyes hh
4    NUR:     =dus vandaar dat u van mij £h£ de de [uitleg     al]
               so that is why you get from me h the the explanation already
5    PAR:                                         [(     ) okee)]
                                                   (     ) okay)
```

```
6     NUR:       vooraf kr[ijgt hh   ](.) we zullen-
                 in advance hh           we shall
7     RES:                [asjeblieft](putting glass of water on table))
                           there you go
8     PAR: →     is Pepper een meisje of een jongentje+ [of-wat moe-
                 is Pepper a girl or a boy              or what do
      res:       ------------------------------------+(camera positioned)
9     NUR: →                                         [ja dat t- dat-
                                                      yes that t that
10    PAR: →     dat- dat #vi- weten jullie nog niet [he he he
                 that that you (pl) don't know yet right he he he
      par:               #short gaze towards res and back
11    NUR: →     [nee ja ik- qua-
                                                   no yes I in
12          →    #qua- qua <figuur># vind ik het meer een vrouw,
                  in terms of figure I think it is more of a woman
                 #----------------#two-hand gesture up-down to Pepper
13    PAR: →     jaja,
                 yesyes
14    NUR: →     [maar] qua <naam> [is het misschien net weer wat meer een
                  but in terms of name it is maybe a bit more of a
15    PAR: →     [nf  ]            [ja precies   ja ja   ja       £h£
                  nf                yes exactly  yes yes yes       h
16    NUR: →     man [he dus ik denk dat we t in t-eh (.) neutrale [houden
                 man  right so I think that we keep it in th-eh neutral
17    PAR: →         [ja  £h£                                      [neutraal
                      yes  h                                        neutral
18                 >ja< £h£
                   yes  h
19    NUR:       ehm:: had ik al genoemd dat we het gaan opnemen ook?
                 ehm   did I mention we're going to record it as well
```

PAR interrupts NUR's explanation to explicitly address Pepper's gender, using ‘girl’ or ‘boy’ as in gender attribution to a newborn. Notably, PAR poses the question while earlier (lines 1–2) neither of the participants displayed trouble using ‘she’ for Pepper (cf. Excerpt 1, 2, 3 and 6). The interruption diverts the interaction from the ongoing course of action, and treats the prior system-relevant use of ‘she’ as questionable. The expansion of PAR's turn (‘that you (pl) don't know yet right’, line 10) is directed at both NUR and the researcher/camera person offering a glass of water (line 7) both verbally (you plural) and with gaze, which may be seen as reducing the accountability of the interruption. The tag-question (‘right’) arguably refers to a previous occasion of talking about Pepper's gender. In response, NUR affirms the not-knowing and accounts for her attribution of female gender on the basis of shape (‘in terms of Fig. I find it more a woman’), accompanied by a hand gesture, while also adding a counterargument: Pepper's name might indicate the robot is ‘more of a man’ (line 14–16). PAR agrees with both arguments, but somewhat reluctantly with femaleness (‘yes yes’ line 13) and more overtly and smiling with maleness (‘exactly’, line 15). Thus, irrespective of the earlier use of ‘she’ (line 2) she displays a preference for categorizing Pepper as male. Rather than seeking agreement, NUR proposes conclusively (‘so’ line 16) to keep it ‘in the neutral’, leaving implicit what this means system-wise (e.g., use of which pronoun). Nevertheless, PAR rephrases ‘neutral’ (line 17), not explicating an upshot, and agrees with laughter, which closes the sequence. Hence, attributing female gender to the robot with a personal pronoun here occasions extended gender attribution talk, away from the ongoing instruction. PAR questions the attribution of femaleness to the robot and suggests the robot's gender is ‘still’ unknown (cf. de Rijk et al., 2024), which NUR affirms. NUR draws on Pepper's name as pointing in the direction of maleness and on the robot's physical appearance, although this is treated as delicate by gesturing and withholding verbal explication, as pointing in the direction of femaleness. The gender talk is closed by agreeing to euphemistically ‘keep it in the neutral’, with undefined consequences.

5. Conclusion and discussion

Our study of gender attribution trouble, particularly in interaction involving a gender-ambiguous robot, presents unique insights into the complexity of gender categorization in social interaction. It adds evidence of deeply ingrained gender norms and assumptions, even when the “other” is non-human. We discerned a gradualness in gender attribution trouble, from minimal to moderate and extensive gender talk. Gender attribution trouble is kept relatively minimal in cases where either of the participants proposes potential alternative gendered pronouns and/or object reference with “or”-constructions, raising the issue without committing to either (Stokoe, 2011) and not further topicalizing robot gender. In these cases, the robot's gender ambiguity is thus minimally action-relevant and does not halt progressivity of the interaction. When participants insert gender attribution-related actions, like accounts and questions, this does interfere with the ongoing activity, albeit limitedly. These actions reflect an uncertainty regarding the use of ‘she’ for the robot. Such moderate gender attribution trouble may also lead to extensive gender talk (cf. de Rijk et al., 2024). This involves the articulation of gender assumptions related to features of the robot (shape, name), with a majority of assumptions about femaleness. Embodied

practices like laughter and gestures rather than descriptions indicate the delicacy of explicit gender attribution talk. However, gender attribution was sometimes intertwined with other actions, such as complimenting (see Excerpt 5), which suggests that it can have social functions beyond the assignment of gender. Although the robot's object status (an 'it') is recurrently drawn on to close a sequence, the relevance of robot male or female gender is upheld and references with gendered pronouns (system relevance) follow.

As previous research found that participants are oriented to keeping gender-related trouble in interaction minimal (Stokoe, 2011), the moderate and extensive sequences in our dataset are particularly remarkable. Our cases are also notably different from intentional misgendering and trans aggression in talk shows (cf. Edmonds and Pino, 2023; Pino and Edmonds, 2024), which can also be rather extensive. The gender attribution trouble we examined was not staged, not politicized as in talk shows and does not develop into an argument; rather, what we examined seemed ordinary gender attribution trouble, drawing on common sense assumptions about binary gender categories. Actions related to gender in our data were initiated by either of the participants, nurse or research participant, suggesting gender is a relevant issue to be brought up, particularly in the relative early stage of an encounter once system relevant gendering has occurred.

Overall, our analysis of extended gender attribution sequences revealed various complexities and tensions. The first is related to the locally constructed nature and basis of gender. On the one hand, gender is constructed as a matter of opinion, which resonates with the robot's designed gender ambiguity. Participants often propose a gender for the robot, suggesting that the robot's gender is not fixed or inherently knowable but instead a matter of discussion. On the other hand, robot gender is also constructed as knowable. Participants sometimes talk about the robot's gender as if it were something that may be definitively known or determined. For example, the declarative 'you don't know yet' (Excerpt 7) with reference to the robot's gender presupposes that this will or may be known at some point. So, gender may be treated as an open, flexible construct (a matter of opinion) but also as something that can be known or agreed upon based on certain cues or collective judgments ('most people think', Excerpt 6).

Another tension we observe is that robot gender may be deemed actually irrelevant or non-existent because the robot is an object, while gender relevance is nevertheless maintained in the conversation. So, participants explicitly state that, strictly speaking, the robot is an 'it', not a 'he' or 'she', thereby declining the need to attribute gender. This enhances the robot's status as a non-human entity and the lack of any inherent need to categorize it within the dominant human gender binary. As objects are referred to with 'he' in case of Dutch *de* nouns (in contrast to *het* nouns) (Haeseryn et al., 1997), *de robot* can be referred to with *hij*/'*ie* ('he') without overtly gendering it (cf. *de stoel* [the chair] - *hij staat* [*he stands]). But in our data 'he' is contrasted with 'she' and generally also with 'it'. So apparently, 'he' in our data is not exclusively or mainly used as object reference, but as *person* reference, which implies the robot is treated as human (-like). Despite acknowledging the robot's object status, participants continue to use person reference, potentially orienting towards its human-like appearance and/or role of interviewer.[3] Once system relevance has developed into action relevance, the pervasive nature of gender as a social institution, extending even to non-human entities, becomes tangible.

A third tension is related to the frequency of gender attribution trouble in our data, while capturing categorical work in unelicited interactions is generally difficult (Stokoe, 2009). An explanation for the recurrent manifestations of extensive gendering in our data is that it concerned a *robot's*, not a person's, gender. Gendering a robot is likely to be less sensitive than gendering (co-present) human others (cf. Pino and Edmonds, 2024). Perhaps the lack of a robot "face" allows for overt gender attribution, which suggests that the constraints on gender talk in human interactions are not solely about the categorization process itself but are heavily influenced by the potential social consequences of such categorizations. Nevertheless, our analysis revealed that attributing gender in interaction was still delicate. Future research could examine this further by studying, for example, animal gender attribution. Possibly, animals are also treated as not having a face.

Finally, two limitations of our study are worth mentioning. In our data, gender-relevant actions are overwhelming initiated by the nurses (10/14). Therefore, one could argue that these two nurses have developed the gender issue as a routine part of their instructions, not warranting claims about gender pervasiveness. However, we propose another explanation, which is related to the different roles of nurse and research participant. Taking part in an experiment at the hospital, participants mainly seem to orient to nurses leading the interaction and speaking most. Relatedly, nurses are the ones who introduce the robot and thus usually talk about the robot first, which means that they are the first to be confronted with system relevance of gender. Many of our cases include alternatives or accounts for the use of a particular pronoun by nurses, which thus relates to their role as instructors. Also notably, in 16 out of 30 encounters of the same two nurses, system relevance of gender did not lead to attribution trouble at all. Hence, system relevance *may* spark action relevance, but it also may not. Moreover, none of the practices we identified were exclusively used by the nurses, which does suggest that these are recognizable, recurrent interactional practices, not personal styles. Anecdotal evidence for the generalizability of our findings is abundant[4], but more research is needed.

[3] Nevertheless, the common use of 'he' for objects in Dutch may explain why reference to the robot with 'he' does not elicit moderate or extensive trouble (e.g., questions or compliments). Arguably, it is less gendered than 'she' in Dutch (but see Stringer and Hopper, 1998 regarding generic 'he' in English).

[4] For example, during an academic event, a short audio clip from a podcast was played in which a scientist explains the workings of fungus. The scientist refers to a fungus (*de schimmel* in Dutch) with 'he', but adding 'or she' and 'or it' (at minute 1:40). In response, the audience laughed loudly; so system relevance of gender was turned into action relevance by the speaker, which was recognized by the audience. The podcast is available at Radboud Science Snacks, retrieved Sept. 12, 2024 from https://open.spotify.com/episode/4ags2Xy80BilarlcfdFCZD)

A second limitation of the current study is that the research participants in our data were elderly people. They were presumably less accustomed to contemporary developments related to gender such as the use of non-binary or gender-neutral pronouns such as *hen* and *die* in Dutch than some other groups. This may also explain why the exposed gender assumptions about the female body are not questioned or contested (cf. Pino and Edmonds, 2024). Hence, gender attribution trouble in data from communities with more common acceptance of non-binary and gender-diverse identities would be worthy of further study. Additionally, investigating interactional practices in contexts where gender-neutral pronouns are more commonly used could provide further insights into how language shapes and reflects our "doing" of gender.

CRediT authorship contribution statement

Wyke Stommel: Writing – original draft, Validation, Supervision, Formal analysis, Conceptualization. **Lynn de Rijk:** Writing – review & editing, Validation, Formal analysis, Data curation. **Mieke Breukelman:** Writing – review & editing, Validation, Formal analysis. **Evi Dalmaijer:** Writing – review & editing, Validation, Formal analysis. **Marie Rickert:** Writing – review & editing, Validation, Formal analysis.

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Data availability

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