Journal of
APPLIED PHILOSOPHY

Journal of Applied Philosophy
doi: 10.1111/japp.12616

A Problem for Generic Generalisations in Scientific Communication

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ABSTRACT *Generic generalisations like 'Opioids are highly addictive' are very useful in scientific communication, but they can often be interpreted in many different ways. Although this is not a problem when all interpretations provide the same answer to the question under discussion, a problem arises when a generic generalisation is used to answer a question other than that originally intended. In such cases, some interpretations of the generalisation might answer the question in a way that the original speaker would not endorse. Rather than excising generic generalisations from scientific communication, I recommend that scientific communicators carefully consider the kinds of questions their words might be taken to answer and try to avoid phrasing that might be taken to provide unintended answers.*

1. Generic Generalisations

> Children are not infectious (Daniel Koch, Swiss Federal Office for Public Health Delegate for COVID-19, 27 April 2020.)[1]

Koch uttered this sentence during a Swiss COVID-19 press conference, where he was explaining the decision to allow grandparents to hug their grandchildren. The utterance is what is known as a *generic generalisation* (or simply a *generic*). Generics can be expressed as bare plurals ('Intensive care patients are vulnerable to infections'), indefinites ('A broken leg is treated with a cast'), definites ('The bacteria salmonella is transmitted through ingestion of contaminated food'), and habituals ('SARS-CoV-2 causes Covid-19').[2] As I use the term, generics are characterised by two key properties: generics are generalisations that do not answer questions like 'How many/much?' or 'How often?'

Generics are generalisations. They tell us about regularities.[3] The generic 'Intensive care patients are vulnerable to infections', for example, might be accepted based on experience of a particular group of patients but tells us about intensive care patients in general, not only about those specific instances. In contrast, nongeneric bare plurals are not generalisations and talk only about a particular thing or collection of things. From 'Birds chased me down the street', you know that some particular collection of birds chased me down the street, but you cannot generalise the property of having chased me down the street to birds in general. Likewise for nongeneric indefinites ('A patient is waiting in Room 302') and definites ('The doctor will see you now').

Generics do not answer questions like 'How many?' or 'How often?'[4] For example, the question, 'How often is the bacteria salmonella transmitted through ingestion of contaminated food?' cannot be answered with the generic 'The bacteria salmonella is

transmitted through ingestion of contaminated food' but can be answered by a quantified generalisation that includes some explicit quantifier, e.g. 'The bacteria salmonella is *sometimes* transmitted through ingestion of contaminated food.' Note, however, that there can be various dimensions of genericity in a single sentence. One might be eliminated through the addition of a quantifier, while leaving others open. 'Mice eat cheese' is generic in two ways: it fails to tell us either how many mice are cheese-eaters or how often the cheese-eating mice eat cheese. Only the first element of genericity is eliminated in 'All mice eat cheese', and only the second element of genericity is eliminated in 'Mice eat cheese three times a day'. Whether we characterise these quantified generalisations as generic, the problem I describe in this article arises for them also. In what follows, however, I will focus on generalisations that include no explicit quantifiers.

I will raise a problem for the use of generics in scientific communication, focusing in particular on communication relating to the COVID-19 pandemic. Generics can often be interpreted in different ways. Although this is not a problem when all interpretations provide the same answer to the question under discussion, a problem arises when a generic is used to answer a question other than that originally intended. In such cases, some interpretations of the generic might answer the question in a way that the original speaker would not endorse. Despite this significant problem, I am reluctant to recommend that communicators try to avoid generics entirely. As we will see in the following section, generics have several advantages. Rather, I will recommend that scientific communicators carefully consider the kinds of questions their words might be taken to answer and try to avoid phrasing that might be taken to provide unintended answers.

2. Generics in Scientific Communication

Generic generalisations are rife in scientific communication. Jasmine DeJesus *et al*. found, for example, that 89% of 1,149 psychology articles surveyed contain at least one generic in the title, research highlights, or abstract.[5] In the following subsection, I describe some benefits of using generics in scientific communication. Section 2.2 will consider an earlier concern about generics in scientific communication.

2.1. Benefits of Generics in Scientific Communication

Generics have several features that make them useful for scientific communication. First, generics are easy to interpret. Indeed, children learn to use generics early and before they have mastered the use of simple quantifiers like 'all' and 'some'.[6] Experimental results, on the other hand, are often impossible to interpret for those untrained in statistics, and it can be difficult to fully grasp their significance even after training. When communicating important results to the public, generics provide a way for the population at large to get some grasp of complex results.

Second, generics, although simple, can imply a complex underlying regularity that is nomic or lawlike.[7,8] 'Intensive care patients are vulnerable to infections', for example, does not indicate that intensive care patients just happen to be vulnerable to infections; it implies that there is some non-accidental relationship between their status as intensive care patients and their vulnerability to infection. Accidental generalisations often sound

odd when put in generic form. Even supposing that all intensive care patients today happen to be under 30, it is peculiar to express this in the generic 'Intensive care patients are under 30'. Cimpian and Markman found that generics elicited more teleological explanations from children, in contrast to nongenerics which elicited more accidental explanations.[9] In response to the generic 'Dolphins have a lot of fat under their skin', for example, one child explained: '*Cause they dive deep, and deep is cold, and it's warm with big bellies*'. In response to the nongeneric 'She has a lot of fat under her skin', however, one child suggested: '*Cause she ate a lot of fish*'.[10]

Generics are well-suited to expressing scientific results, therefore, because they are easy to understand and yet indicate a more complex underlying reality. These two features make generics particularly attractive for conveying complex results to a lay audience. Koch, for example, has been reported[11] as basing his advice on Christoph Muus *et al.*, who summarised their results as follows:

> Notably, there was a particularly low expression of ACE2 in the few young pediatric samples in the analysis. Further analysis reveals a gene expression program shared by ACE2+TMPRSS2+ cells in nasal, lung and gut tissues, including genes that may mediate viral entry, subtend key immune functions, and mediate epithelial-macrophage cross-talk. Amongst these are IL6, its receptor and co-receptor, IL1R, TNF response pathways, and complement genes. Cell type specificity in the lung and airways and smoking effects were conserved in mice. Our analyses suggest that differences in the cell type-specific expression of mediators of SARS-CoV-2 viral entry may be responsible for aspects of COVID-19 epidemiology and clinical course, and point to putative molecular pathways involved in disease susceptibility and pathogenesis.[12]

If Koch was indeed relying on this article, it is easy to see why Koch opted for a generic, rather than quoting these results.

Generics also allow us to talk about the causal significance of results even when causal mechanisms are not fully understood. Experiments aim to identify causal relations in order to predict and to alter future events. The results of experiments are purely associative, however; we observe associations under certain conditions and can never be completely certain that we have identified all relevant causal factors.

Suppose that we conduct the following experiment. We take a group and ask half of them to give up red meat. We observe that this group has a lower rate of bowel cancer than the red-meat eaters. Suppose we can be close to certain that our intervention was responsible for the difference. How should we report these results?

One option is to limit our report to our observations, e.g. 'In this study, we found lower rates of bowel cancer in the group who gave up red meat than among the group who ate red meat.'[13] As Miguel Hernán has pressed, however, we aren't really interested in the levels of bowel cancer associated with the two groups in our experiment but with the causal relationship between bowel cancer and red meat.[14] Although our experiment might demonstrate that such a relationship exists, we might be unable to describe it in any detail, given that many different factors will have influenced the association we observed. Using generics, we can indicate the presence of an underlying causal relationship even if we are unable to elaborate it: 'Giving up red meat reduces the risk of bowel cancer'.

2.2. Problems for Generics in Scientific Communication

Generics are an extremely convenient way of describing causal relationships in simple terms. DeJesus *et al*. raise a problem for the use of generics in scientific communication, however.[15] They asked participants to rate the importance, generalisability, and conclusiveness of research summaries that were phrased in either generic or nongeneric terms. Their participants 'judged research summaries with generic language to be more important than nongeneric summaries, and under certain circumstances to be more generalizable and conclusive'. The researchers therefore suggest that generic language may lead readers to overestimate the significance of research findings. An alternative explanation, however, is that nongeneric language can lead readers to underestimate research findings. As noted above, generics are a simple way of representing causal relationships. Nongeneric language, in contrast, can often be true even when there is only an accidental regularity. The effects the researchers found were small but were most significant when there were multiple cues to nongenericity, e.g. 'Some people with dysphoria were less sensitive to positive information in the environment, under certain circumstances' which includes a quantifier, past-tense indicator, and restrictive clause. Such a statement, with all these hedges, provides less indication of an underlying causal relationship than the generic 'People with dysphoria are less sensitive to positive information in the environment.' When research supports causal conclusions, nongeneric language might lead participants to underestimate the significance of results.

Still, the use of generics calls for caution. If participants are not drawn from sufficiently diverse backgrounds, generics risk generalising to overly broad groups and exaggerating results. If all participants in a medical study are White, for example, generics about 'people' in general risk overgeneralisation. This problem can be addressed without eliminating generics entirely, however. For a start, researchers can use more diverse samples. When this is not possible, results can be expressed using generics that are representative of the sample, e.g. 'White, middle-class people aged 30–46'. As Simons, Shoda, and Lindsay suggest, we can also describe the population to which we expect the results to extend and potential constraints on generality.[16]

3. A New Problem

Daniel Koch's statements to the press were rife with generics, some of which are repeated below:

> Children … do not pass on the virus[17]
>
> Children are not infectious[18]
>
> Grandchildren do not transmit the virus[19] (Daniel Koch, Swiss Federal Office for Public Health Delegate for COVID-19, 27 April 2020.)

Different news outlets reported different interpretations of these generics. Some adopted a relatively strong interpretation of the generic as entailing that children cannot pass on the virus.[20] Others adopted weaker interpretations, however, e.g. that children do not 'transmit the disease to others at similar rates as adults',[21] that they 'rarely … transmit the new coronavirus',[22] or that they are 'unlikely to … spread the virus'.[23] These weaker

interpretations are unsurprising, as generics often tolerate exceptions.[24] Experimental studies have also shown significant variation between participants in the quantified generalisations they take to be implied by generics.[25]

Following Rachel Sterken,[26] I will use 'generally' to characterise these weaker interpretations. We therefore have two different interpretations for Koch's statements. Let us call these interpretations P_1 and P_2:

***P*₁**: Children do not generally spread the virus.
***P*₂**: Children do not ever spread the virus.[27]

For the purposes of this article, we need not take a stand on whether one of these interpretations is superior to the other. It is sufficient for the problem I want to pose that generics can be interpreted in different ways.[28]

A plurality of interpretations has often been taken to pose a significant threat to communication.[29] In short, the concern is that communication becomes too unreliable. If Koch's utterance can be interpreted as meaning P_1 or P_2, for example, Koch has to get very lucky for the audience to land on Koch's intended interpretation.

As I have argued in other work, however, a plurality of interpretations poses no threat to communication when all available interpretations have the same communicative effect in the conversational context.[30] Koch was responding to questions about the Swiss decision to allow hugging between grandparents and grandchildren. There was therefore a very clear question under discussion (QUD) in the context: Should grandparents be allowed to hug their grandchildren?[31] Speakers can communicate a clear answer to the QUD, even when there are many different interpretations of their utterance, so long as all interpretations provide the same answer. This is plausibly the case in Koch's utterance. If children do not generally spread the virus, then contact with grandparents should be allowed. This can of course be disputed. Perhaps the risk of contact, either to the individual or society, can be too great even when children do not generally spread the virus. For the purpose of illustration, however, I will assume that P_1 answers the question in the affirmative. If so, then P_2 provides the same answer. If hugging should be allowed, given that children do not *generally* spread the virus, then *a fortiori*, it should be allowed given that children do not *ever* spread the virus. Given the conversational context, both interpretations provide the same answer to the QUD, so the audience can understand the main point Koch intended to communicate whether they interpret the generic as P_1 or P_2: that hugging should be allowed between grandchildren and grandparents.

Problems arise, however, when a generic is used to answer a question other than that intended by the speaker. Koch's remarks have been quoted, for example, in discussions about whether schools should reopen.[32] Although P_1 and P_2 provide the same answer to the QUD in the original context, they can provide different answers to this alternative question. Suppose that children cannot transmit the virus. If virus transmission from children is impossible, and schools were closed to prevent transmission from children, then schools should reopen. If virus transmission from children is possible, however, then even if children do not generally spread the virus, many children mingling in school may lead to unacceptable spread. Communicators who use generics therefore run the risk of appearing to answer questions beyond those under discussion in the context of utterance. Someone who is disposed to interpret Koch as expressing P_2, for example, may be led to believe that schools should reopen even if that were not the speaker's original intent.[33]

To summarise, generics can often be interpreted in different ways. This might not pose a problem within a particular conversational context, as the speaker's answer to the question under discussion might be entirely clear whichever interpretation is taken. These same generics may be taken to answer the questions under discussion in different contexts, however. In these contexts, some interpretations of a generic might appear to support conclusions that the communicator would not endorse, leading to miscommunication.

4. Responding to the Problem

What can be done to avoid this problem? Certainly, the problem could be avoided by more careful interpretation. Journalists should be careful not to report generics in ways that distort the speaker's original meaning, for example. I think it would be a mistake for communicators to place all the blame on interpreters, however, if there is something that they can do to mitigate the problem.

So how should communicators respond to this problem? I suggest that scientific communicators should give serious consideration to the kinds of questions that their generics might be used to answer and avoid phrasing that might be taken to answer questions other than those they intend to answer. In Koch's case, for example, the problem could have been avoided relatively easily. Rather than 'Children do not pass on the virus', for example, he could have said 'Children with COVID-19 pose a low risk to their grandparents'. This utterance remains a generic and is very easy to understand but is not easily misconstrued as providing an answer to the question of whether schools should reopen. Through careful consideration of the words they use, therefore, scientific communicators may be able to avoid the problem raised in this article.

Another option is that scientific communicators avoid generics entirely, replacing them with quantified generalisations. The first thing to note is that the argument given in this article is not sufficient to justify a blanket prohibition on generics. While I have argued that some uses of generics can lead to miscommunication, I have not shown that all generics can lead to miscommunication. The example above illustrates this point. 'Children with COVID-19 pose a low risk to their grandparents' is not, it seems to me, likely to be misleading.

Still, it might be difficult to tell which questions a generic might be used to answer in the future. Avoiding generics entirely might seem a way of avoiding unforeseeable future miscommunication. There are several problems with this policy, however. First, it risks throwing the baby out with the bathwater. As noted above, generics are particularly useful for scientific communication because they concisely express lawlike regularities. Quantified generalisations, on the other hand, can be true accidentally. 'Most people with Disease X develop Disease Y' might be true, for example, because Disease Y is prevalent throughout the entire population. 'People with Disease X develop Disease Y', however, indicates that there is a lawlike connection between having Disease X and developing Disease Y. Rather than avoiding miscommunication, therefore, scientific communicators who use only quantified generalisations run the risk of failing to communicate a lawlike regularity. Second, generics are not the only expressions in language that admit of multiple interpretations. Indeed, so many expressions admit of multiple interpretations (see the references in notes 30 and 31) that it is impossible to communicate univocally. The

problem that arises for generics is therefore likely to arise for other expressions, and focusing on avoiding generics might generate the false sense that the problem has been avoided entirely. The most prudent way of responding, it seems to me, is for scientific communicators to choose all their words carefully so that they are unlikely to be used to answer unintended questions.

The points above see parallels in the literature on generics about social kinds. Sally Haslanger, for example, suggests that generics about social kinds can convey problematic essentialist implicatures.[34] An utterance of 'Women are submissive', for example, might implicate that women are submissive due to facts about the essential nature of women. Should we then stop using generics about social kinds? Sarah-Jane Leslie has recommended precisely that, to the extent that it is possible.[35] But while Haslanger concludes that we have reason to object to generics with essentialising implicatures, she stops short of arguing that all generics about social kinds introduce such implicatures. For an utterance of 'Women are oppressed', for example, the predicate and conversational context might block any problematic implicature.[36] This parallels my suggestion that some generics are unlikely to be used to answer unintended questions. Further, Katherine Ritchie points out that generics are a valuable tool in describing discrimination because, unlike quantified statements, generics indicate lawlike regularities rather than accidental ones.[37] This parallels my suggestion that a blanket ban on generics in scientific communication may deprive us of a useful resource for expressing causal relationships. Finally, Jennifer Saul notes that the problem with generics about social kinds may be an instance of a larger problem: labelling social groups.[38] Focusing on avoiding generics might give the false sense that the problem has been solved when it persists for other expressions. Again, this parallels my suggestion that the problem for generics in scientific communication is an instance of a larger problem: language that admits of multiple interpretations. Scientific communicators cannot avoid this larger problem simply by refusing to use generics but must carefully consider the questions that their words could be taken to answer, whatever expressions they use.

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Acknowledgements

My thanks to members of the Cognitive Development Lab, New York University (particularly April Bailey and Andrei Cimpian), to three anonymous reviewers, and to the editor for their helpful comments. This research was supported by the Irish Research Council, grant GOIPD/2018/605.

NOTES

1 Translated from German. https://www.youtube.com/watch?v=UQ7QAxURxNU&t=1815s. Accessed 20 July 2022.

2 Habituals are normally characterised by sentences associating individual persons or animals with activities, e.g. 'John smokes a cigar after dinner' (Krifka, M., F.J. Pelletier, G. Carlson, A.T. Meulen, G. Chierchia, and G. Link. 1995. "Genericity: An Introduction." In *The Generic Book*, edited by G.N. Carlson and F.J. Pelletier, 1–124. Chicago: University of Chicago Press) or 'Dr Novotny performs lobotomies' (McCawley, James D.

1993. *Everything That Linguists Have Always Wanted to Know About Logic … But Were Ashamed to Ask*. Chicago: University of Chicago Press, p. 268). The SARS-CoV-2 example ascribes an activity to a kind of virus, which is intuitively very different from an individual person, although note that Carlson takes kinds to be individuals; as I am related to my temporal stages, so the kind *SARS-CoV-2* is related to its members. Carlson, Gregory N. 1980. "Reference to Kinds in English." In *Outstanding Dissertations in Linguistics*, edited by J. Hankamer. New York: Garland Publishing, Inc.

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4 Carlson 1980 op. cit., p. 41.

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8 Some, e.g. Lyons (op. cit.), have suggested that generics are not true when there is only an accidental regularity, although, as Wasserman points out, the presence of a lawlike regularity may merely be implicated. Wasserman, Ryan. 2011. "Dispositions and Generics." *Philosophical Perspectives* 25: 425–53.

9 Cimpian and Markman 2009 op. cit.

10 See also Prasada op. cit. and Prasada and Dillingham op. cit.

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27 This formulation is intended to distinguish between two possible interpretations of 'Children cannot spread the virus'. On one reading, it is a quantified generalisation of the form: Cannot x [child x] [spreads the virus x]. On this reading, the statement is falsified if any child transmits the virus. On another reading, it is a generic of the form: Gen x [child x] [cannot spread the virus x]. As generics can tolerate exceptions, this generic might be judged true even if there are some rare cases in which children can spread the virus. P_1 should be interpreted in the first way.
28 See Bosse, Anne. 2021. "Generics: Some (Non) Specifics." *Synthese* 199: 14383–401; Nguyen, Anthony. 2020. "The Radical Account of Bare Plural Generics." *Philosophical Studies* 177: 1303–31; and Sterken op. cit. for authors who have argued that generics often have no unique best interpretation.
29 See, for example, Blackburn, William K. 1988. "Wettstein on Definite Descriptions." *Philosophical Studies* 53: 263–78; Borg, Emma. 2002. "Pointing at Jack, Talking About Jill: Understanding Deferred Uses of Demonstratives and Pronouns." *Mind & Language* 17: 489–512; Buchanan, Ray. 2010. "A Puzzle About Meaning and Communication." *Noûs* 44: 340–71; Buchanan, Ray, and Gary Ostertag. 2005. "Has the Problem of Incompleteness Rested on a Mistake?" *Mind* 114: 889–913; Clapp, L. 2002. "What Unarticulated Constituents Could Not Be." In *Meaning and Truth: Investigations in Philosophical Semantics*, edited by J.K. Campbell,

M. O'Rourke, and D. Shier, 231–56. London: Seven Bridges Press; Donnellan, Keith S. 1968. "Putting Humpty Dumpty Together Again." *Philosophical Review* 77: 203–15, fn 5; Reimer, Marga. 1992. "Incomplete Descriptions." *Erkenntnis* 37: 347–63; Schiffer, Stephen. 1981. "Indexicals and the Theory of Reference." *Synthese* 49: 43–100; Schiffer, Stephen. 1992. "Belief Ascription." *Journal of Philosophy* 89: 499–521; Schiffer, Stephen. 1993. "Belief Ascription and a Paradox of Meaning." *Philosophical Issues* 3: 89–121; Schiffer, Stephen. 1994. "A Paradox of Meaning." *Noûs* 28: 279–324; Schiffer, Stephen. 1995. "Descriptions, Indexicals, and Belief Reports: Some Dilemmas (but Not the Ones You Expect)." *Mind* 104: 107–31; Stanley, Jason, and Zoltán Gendler Szabó. 2000. "On Quantifier Domain Restriction." *Mind & Language* 15: 219–61; Travis, Charles. 2008. *Occasion-Sensitivity: Selected Essays*. Oxford: Oxford University Press; Wettstein, Howard K. 1981. "Demonstrative Reference and Definite Descriptions." *Philosophical Studies* 40: 241–57. For discussion focused on generics in particular, see Cappelen, Herman, and Josh Dever. 2019. *Bad Language*. Oxford: Oxford University Press, Chap. 8; McKeever, M., and R. Sterken. 2021. "Social and Political Aspects of Generic Language and Speech." In *The Routledge Handbook of Social and Political Philosophy of Language*, edited by J. Khoo and R.K. Sterken, 259–80. New York: Routledge.

30 Bowker, Mark. 2019. "Underdetermination, Domain Restriction, and Theory Choice." *Mind & Language* 34: 205–20; Bowker, Mark. 2019. "Saying A Bundle: Meaning, Intention, and Underdetermination." *Synthese* 196: 4229–52; Bowker, Mark. 2022. "Ineliminable Underdetermination and Context-Shifting Arguments." *Inquiry* 65: 215–36.

31 For more on questions under discussion, see the following paper and ensuing literature. Roberts, Craige. 2012 [1996]. "Information Structure: Towards an Integrated Formal Theory of Pragmatics." *Semantics and Pragmatics* 5: 1–69. Originally published in Yoon, J.-H., and A. Kathol, eds. 1996. *OSU Working Papers in Linguistics, Vol 49: Papers in Semantics*. Columbus: Ohio State University, 91–136.

32 Wells, Tom, and Nick McDermott. 2020. "COVID CLASS CHAOS Plans to Reopen Schools Plunged into Chaos as Experts Clash over Whether Children Can Pass on Covid-19." *The Sun*, 30 April 2020. https://www.thesun.co.uk/news/11521769/reopen-schools-experts-clash. Accessed 20 July 2022; Zweig, David. 2020. "The Case for Reopening Schools." *Wired*, 11 May 2020. https://www.wired.com/story/the-case-for-reopening-schools. Accessed 20 July 2022.

33 Koch has, however, been reported as justifying the reopening of schools in Switzerland by appealing to considerations similar to those he raised in supporting the hugging of grandchildren (Bachmann, Helena. 2020. "Why Switzerland's Plan to Re-Open Schools Is Causing Anger and Worry?" *The Local*, 20 April 2020. https://www.thelocal.ch/20200420/why-do-the-school-re-openings-in-switzerland-raise-concerns. Accessed 20 July 2022). I use Koch's utterance to illustrate a problem that can arise for generics in scientific communication, without assuming that the problem actually arose in Koch's case.

34 Haslanger, S. 2011. "Ideology, Generics, and Common Ground." In *Feminist Metaphysics: Explorations in the Ontology of Sex, Gender and the Self*, edited by C. Witt, 179–208. Dordrecht: Springer. See also Haslanger, Sally. 2014. "The Normal, the Natural and the Good: Generics and Ideology." *Politica & Societa* 3: 365–92.

35 Leslie, S.J. 2014. "Carving up the Social World with Generics." In *Oxford Studies in Experimental Philosophy*, Vol. 1, edited by J. Knobe, T. Lombrozo, and S. Nichols, 208–32. Oxford: Oxford University Press. See also Leslie, Sarah-Jane. 2017. "The Original Sin of Cognition: Fear, Prejudice and Generalization." *Journal of Philosophy* 114: 393–421.

36 Haslanger 2011 op. cit.

37 Ritchie, Katherine. 2019. "Should We Use Racial and Gender Generics?" *Thought* 8: 33–41. Similar points are made in Saul, Jennifer. 2017. "Are Generics Especially Pernicious?" *Inquiry*; and Haslanger 2014 op. cit.

38 Saul op. cit.