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## What data from the simple-picture naming task tell us about lexical competition—A rejoinder to Janssen, Schiller, and Alario

Jörg D. Jescheniak<sup>a\*</sup>, Herbert Schriefers<sup>b</sup> and Kristin Lemhöfer<sup>b</sup>

<sup>a</sup>*Department of Psychology, University of Leipzig, Leipzig, Germany;* <sup>b</sup>*Donders Institute for Brain, Cognition, and Behaviour, Centre for Cognition, Radboud University, Nijmegen, The Netherlands*

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In our original article, we argued that in particular data from the simple-picture naming paradigm support the view that the selection of gender-marking determiners takes place in a competitive fashion. In this paradigm, participants produce singular and plural noun phrases consisting of a definite determiner and a noun. In their reply, Janssen, Schiller, and Alario argue that this conclusion is overly optimistic. In particular, they suggest that when the available data are viewed from a different, arguably more appropriate perspective, the pattern is less consistent than we described it. They also report two new experiments which they take as evidence against our hypothesis that effects observed in the simple-picture naming paradigm reflect a mixture of facilitation and interference, depending on the mix of singular and plural trials in a particular experiment. Here we add some thoughts on the suggested new view on the data and qualify our proportion argument.

**Keywords:** speech production; lexical selection; lexical competition; grammatical gender

In their comment on our review article regarding the selection of gender-marking morphemes in speech production, Janssen, Schiller, and Alario (2014) suggest that the issue should be viewed within a broad research context, including, e.g., data from error elicitation techniques, and we agree. However, empirically the authors focus primarily on the singular–plural task in simple picture naming, and we will do so in this rejoinder too. As a short reminder, in this task participants produce singular or plural noun phrases with gender marked determiners (or some other gender marked element). In languages like Dutch and German, the determiner forms for one gender class are identical in singular and plural, but differ for the other gender class(es). More specifically, in Dutch, “de” is the singular determiner for common gender and the plural determiner for common and neuter gender, while “het” is the singular determiner for neuter nouns. Similarly, in German, “die” is the singular determiner for feminine gender and the plural determiner for masculine, feminine, and neuter gender, while “der” is the singular determiner for masculine gender and “das” is the singular determiner for neuter gender. The relevant studies (Janssen & Caramazza, 2003; Lemhöfer, Schriefers, & Jescheniak, 2006; Schriefers, Jescheniak, & Hantsch, 2002, 2005) consistently show a gender by number interaction which indicates that in producing a

singular noun phrase (NP) only the appropriate singular determiner becomes activated while in producing a plural NP, the singular and the plural determiner become activated. The precise form of this interaction can then provide evidence on whether we are dealing with a competitive selection mechanism or not. When plural NPs of neuter gender show longer naming latencies than the corresponding singular NPs, this suggests that the different singular and plural determiners (e.g., “het” and “de” in Dutch, respectively) entered into competition in the selection of the plural determiner. Janssen et al. refer to this type of interaction as a cost-type interaction. By contrast, when the production of plural NPs of common gender is faster than the production of the corresponding singular NPs, this is presumably due to the fact that for common gender plural NPs, activation of the singular and plural determiner converges on the same determiner form (“de”). Janssen et al. refer to this interaction as a benefit-type interaction and interpret it as evidence for a noncompetitive selection mechanism.<sup>1</sup>

A first point to be mentioned in this context concerns the relation of a cost-type or benefit-type interaction with competitive vs. noncompetitive selection, respectively. The mapping between the observed interaction types and the type of selection mechanism is not one-to-one. Rather, a plural cost for neuter nouns

\*Corresponding author. E-mail: [jdj@uni-leipzig.de](mailto:jdj@uni-leipzig.de)

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indicates selection by competition, but finding a plural benefit for common nouns at the same time does not contradict a competitive selection mechanism. The plural cost for neuter nouns is due to the competition between two different determiner forms, while the plural gain for common nouns can be explained by the fact that the singular noun and its plural form give converging activation to the same plural determiner form, making selection of the appropriate determiner easier. Thus, the critical question with respect to a competitive selection mechanism concerns the presence or absence of a plural cost in cases where the singular and plural determiners have different forms. For the case of German (where masculine and neuter gender should give plural costs), Schriefers et al. (2002, p. 943) made this explicit as follows:

For plural noun phrases with feminine nouns, the activation from the noun lemma and from the plural feature will converge on the same definite determiner, *die*. As a consequence, production of noun phrases with masculine and neuter nouns in the plural will take longer than production of these noun phrases in the singular. For feminine nouns, by contrast, no such effect should obtain. Actually, for noun phrases with feminine nouns one might even expect an advantage of *plural* over *singular*, because in the former case the determiner *die* receives activation from the noun lemma and the number feature *plural*, whereas in the latter case it receives activation only from the noun lemma.

Janssen et al. correctly point out that the available evidence does not always point towards a plural cost component in cases of diverging singular and plural determiners (i.e., masculine and neuter in German, and neuter gender in Dutch). In our review, we proposed that the presence or absence of a clear cost component might depend on the proportion of plural trials in the specific experiment. Actually, here a word of clarification is in place. In our review, we introduced the proportion issue, and made clear that the relative proportion of singular and plural trials goes together with the proportion with which the different determiners have to be used. However, the relation between proportion of singular and plural trials and the proportion with which different determiners have to be used is not linear. Rather, the actual relation depends on the language tested and on details of the design (e.g., whether filler trials are used or not and whether the respective language has two or three different gender classes). To clarify this issue: the relevant proportion, in our view, concerns the proportion with which the different determiners have to be used in the course of the experiment.

For example, with 50% plural trials in German and all three gender classes included (and without filler

trials), 66% of the trials required the determiner “die” in Schriefers et al. (2002, Experiment 3). By contrast, with 50% plural trials in Dutch and the two gender classes included, 75% of the trials require the determiner “de” (which is the determiner for common gender singular and both gender classes in the plural) in Lemhöfer et al. (2006).

It might have remained somewhat unclear in our review that, in our argumentation, the crucial factor is the proportion with which a given determiner occurs in the experiment. When this proportion is very high (say, e.g., 75%), one could expect that this determiner is treated as a default determiner in the particular context of the experiment, such that it might consistently be kept in a high state of base activation. When this default determiner has to be used on a plural trial, competition from different singular determiners with this default determiner might play less of a role (leading to a reduction or absence of a plural cost) while convergence of the singular determiner with the default determiner will lead to a benefit.

Before applying this idea to the available data, one additional difference between the different sets of experiments has to be mentioned. In the experiments by Janssen and Caramazza (2003) and the new experiments reported in the comment by Janssen et al., the authors used one picture of an object to trigger a singular utterance and two pictures of an object to trigger a plural utterance. In Schriefers et al. (2002) as well as in Lemhöfer et al. (2006) and Schriefers et al. (2005), this was different. In these experiments, singular and plural trials were cued in a perceptually similar way:

Rather than presenting one versus two objects, two exemplars of an object were presented side by side on each trial. The to-be-named object (in a singular trial) or objects (in a plural trial) were identified by their colour. If only one object was foregrounded by its black colour (whereas the other object was presented in medium grey), the participant was instructed to produce a singular noun phrase. If both objects were foregrounded by their black colour, the participant was instructed to produce a plural noun phrase. (Schriefers et al., 2002, p. 943)

The motivation of this type of cuing was to discourage participants from strategically producing the (gender-unmarked) plural determiner on the grounds of shallow perceptual processing, i.e., after identifying two stimuli as opposed to one stimulus without access to their conceptual and lexical level of representation.

Janssen et al.’s remark that the effect of determiner proportion is not as clear as we had suggested in our review led us to look at the effect of proportion of

determiners again. As the driving force behind plural cost or gain seems to be whether singular and plural determiners converge on the same determiner (feminine gender in German, common gender in Dutch) or not (masculine and neuter gender in German, neuter gender in Dutch), and in order to make the German and Dutch data more comparable, it seems sensible to distinguish between these two cases only, rather than between all different gender classes. In particular, in the following we talk about average plural costs, after collapsing masculine and neuter gender classes in the studies conducted in German. If one does this, the following pattern emerges.

Schriefers et al. (2002, Experiment 1, German) had 33% trials with the determiner “die”, 33% with the determiner “der”, and 33% with the determiner “das” (across singular and plural trials). The results showed an average plural cost of 27 ms (for masculine and neuter NPs) and a nonsignificant plural gain of 6 ms (for feminine NPs). In Schriefers et al. (2002, Experiment 3, German), 66% of the trials required the determiner “die”, and the remaining 33% of the trials the determiner “der” or “das”. Now the average plural cost was reduced to 13 ms (for masculine and neuter NPs), while there was a plural gain of 18 ms (for feminine NPs). Almost the same picture emerges for Schriefers et al.’s (2005, Experiment 1, German), which had the same determiner proportions as Schriefers et al. (2002, Experiment 3). There was a plural cost of 16 ms (for masculine and neuter NPs) and a plural gain of 23 ms (for feminine NPs). Finally, Lemhöfer et al.’s (2006, Experiment 1), conducted in Dutch, had a proportion of 75% of trials requiring the determiner “de”, and it is precisely in this extreme case that we see a clear plural gain for common gender NPs of 61 ms and no signs of a plural cost for neuter gender NPs (actually even an opposite effect of 19 ms).

Thus, in summary, when restricting the analysis of potential effects of determiner proportion to studies that try to make the visual distinction between singular and plural trials less salient, and when considering the proportion of determiners (and not the proportion of plural trials), a picture emerges in which a higher proportion of a “default” determiner gradually decreases plural costs for masculine and neuter NPs (or for common gender NPs in Dutch) up to a point of a proportion of 75% of trials requiring the default determiner where only a plural gain for common gender is observed.

The experiments reported by Janssen and Caramazza (2003) and the experiments described in the comment by Janssen et al., all conducted in Dutch, do not follow this systematicity, possibly because the distinction between singular and plural trials is visually much more salient. We have no complete explanation

as to how this procedural difference concerning the visual displays matters for the presence or absence of proportion effects. But one possibility would be that a highly salient marking of singular and plural trials makes differences in the proportion of the different determiners subjectively smaller or even hides them completely.

In summary, as long as singular vs. plural trials are not differentiated in a highly salient manner, a more or less balanced proportion of different determiners within an experiment does go together with the finding of plural costs for diverging singular and plural determiner forms. By contrast, a clear predominance of one determiner (the determiner that is—also—used in the plural noun phrases) goes together with a plural gain for converging singular and plural determiner forms and a reduction or elimination of the plural cost in the diverging conditions (neuter gender in Dutch, or neuter and masculine gender in German).

We will next turn to the experiments reported in Janssen et al.’s reply. But before doing so, we will briefly comment on one additional important point raised by Janssen et al. As the authors correctly point out, the critical comparisons in this type of experiments concern between item comparisons as different nouns have to be used in the different grammatical gender conditions. Therefore, all the studies mentioned above include a so-called “bare noun” control experiment in which participants name the relevant stimuli by producing simple singular or plural nouns. Originally, these experiments were primarily meant as an independent control for potential item differences (see Janssen & Caramazza, 2003; Schriefers et al., 2002). From this point of view, the important point is whether a number by gender interaction obtained in NP production is absent in bare noun production. The overall reaction time level and main effects of number or gender are not relevant from this perspective. Janssen et al. go beyond this “pure control” approach and provide some new and important insights into the form of the relevant interactions. In particular, they argue that in order to evaluate the singular–plural differences per gender class in NP production, one ought to consider any singular–plural differences in bare noun production in the very same analysis in order to partial out idiosyncratic item effects. Consequently, they analyse their data by looking at number (singular vs. plural) by format (NP vs. bare noun) interactions for each gender class separately. Janssen et al. also look at these interactions in the data from the previous studies descriptively by taking the singular–plural difference in NP production and adjusting it for the respective difference in bare noun production by means of subtraction (see their Figure 2, in particular the bottom row). From the resulting pattern the authors conclude

that “there is little consistency in the most relevant effects” (p. 698). However, applying this approach to the data from the previous studies is not without problems. The descriptive subtraction approach (or, equivalently, the inferential number by format interaction approach) is only valid when the NP experiment and the bare noun experiment are fully parallel (as in the new experiments reported by Janssen et al.). To exemplify this point, Experiments 1 and 2 (NP vs. bare noun) of Schriefers et al. (2002) were fully parallel. But Janssen et al. also use Experiment 2 (bare noun) in the subtraction for Experiment 3 of Schriefers et al. (2002; see fourth column of Janssen et al.’s Figure 2). But in this case, the noun phrase experiment (Experiment 3) did contain singular filler trials (with objects of masculine and neuter gender in order to equate the proportion of determiners that were actually produced), while the bare noun control (Experiment 2) did not contain these fillers. In our view, in this case the application of the subtraction of mean NP naming latencies from mean bare noun naming latencies is not adequate. However, even if one ignores this point for the moment, it appears to us that the general pattern of effects (plural cost or plural gain) does not change much descriptively and seems to follow a systematicity, namely (average) plural costs are visible when singular and plural determiner diverge, and plural gain is visible when singular and plural determiner converge. The only clear exception is the plural gain for neuter gender in Lemhöfer et al. (2006), which, however, is likely due to the high proportion of the plural determiner in that experiment, see above.

This brings us to the experiments reported in Janssen et al.’s comment. The motivation of the new experiments is described as follows by Janssen et al.: “In the experiments reported we evaluated whether differences in the proportion of plural trials in the experiment impacts the gender by number interaction in determiner NPs” (p. 699). There are at least two points with respect to these experiments. First, these experiments use single vs. double pictures for triggering singular and plural NPs (i.e., the procedure used by Janssen & Caramazza, 2003). As we have noted above, it appears that potential proportion effects are most clearly seen when using double object displays. Thus, applying the 1 vs. 2 object technique might not have been the optimal strategy for testing effects of determiner proportion. Second, taking a closer look at the two experiments, it is somewhat unclear that the experiments were indeed designed for that purpose. Ideally, a direct test of an effect of proportion would ask for a comparison between experiments that differ substantially with respect to the proportion dimension while keeping all other aspects constant (as in Schriefers et al., 2002, Experiment 1 vs. 3).<sup>2</sup> However,

Experiments 1a and 1b in Janssen et al. differ on a number of additional dimensions that make a direct comparison at the very least difficult. First, the two experiments used different sets of materials and different numbers of critical items (48 in Experiment 1a, 60 in Experiment 1b). Second, they involved different utterance formats: in Experiment 1a, participants produced NPs consisting of a definite determiner, an adjective, and a noun. In Experiment 1b, participants produced NPs consisting of a demonstrative pronoun (the Dutch equivalents of *this* and *that*) and a noun. Thus, it appears that the experiments differ in too many ways as to allow for clear conclusions.<sup>3</sup> But still, when we put aside the proportion issue for a moment, the two experiments reported by Janssen et al. show a descriptive 21-ms trend indicating costs, converging with the pattern observed in the studies by Schriefers et al. (2002, 2005).

To conclude, the comment by Janssen et al. contains a number of valuable points. First, it has forced us to reconsider our “proportion argument” we derived post-hoc from the existing data. The proportion argument concerns the proportion of a potential default determiner within the experimental setting, and not the proportion of singular and plural trials as such. Second, it appears that potential proportion effects only obtain when the difference between singular and plural trials is not visually highly salient, e.g., when using double picture presentations. A direct experimental test of this hypothesis would, obviously, require additional experiments which directly cross a determiner proportion manipulation with the use of the different visual display types while keeping all other aspects constant. Third, using the average bare noun naming latencies as a way to have a closer look at the obtained interactions is valuable, but it requires one to have the NP experiment and the corresponding bare noun experiment fully parallel to be warranted.

When taking these points into account, it appears that singular–plural studies with dual-picture presentation for both singular and plural trials show a cost effect for plural NPs when singular and plural determiners differ. This is the case as long as the proportion of the plural definite determiner across singular and plural trials is low to medium. As the proportion of this determiner increases, this effect tends to diminish and eventually to vanish, being replaced by a gain-effect for plural NPs for which singular and plural determiners are identical. This pattern of results is most easily interpreted by assuming that closed class elements are selected by a competitive mechanism, but that this competitive mechanism is biased towards the plural determiner when this determiner acquires the status of a default by being produced on a very high proportion of the trials. In this case, convergence on the same



determiner form for plural NPs leads to a plural gain, and this plural gain is reduced or eliminated when the singular and plural determiner forms are different.

In the light of these considerations, we continue to maintain our earlier conclusion: with the present state of affairs, we still have a bias towards a competitive selection mechanism for closed class items. But, as always in science, there are clearly still some aspects to be sorted out empirically.

## Notes

1. Janssen et al. use these terms to refer to two different patterns. On p. 697, they introduce cost and benefit type interactions in terms of gender by number interactions, without including utterance format (NP vs. bare noun). Later on, they refer to cost and benefit interactions in terms of format by number interactions within each of the gender classes separately. This is also how they analyze their own data. However, they descriptively look at these interactions in data from previous articles by means of subtraction.
2. One can speculate whether the manipulation of the proportion of plural trials (50% in Experiment 1a vs. 40% in Experiment 1b) and the resulting manipulation of the proportion of the determiner form corresponding to the plural determiner (75% in Experiment 1a vs. 60% in Experiment 1b) is indeed substantial enough for expecting differential patterns. Moreover, at least with the method for cuing singular and plural trials used in the studies by Schriefers et al. (2002, 2005) and Lemhöfer et al. (2006), such a dominance of the plural determiner

form was associated with a reduced or absent cost component.

3. The experiments also do not allow for a direct comparison with existing studies. For example, although Experiment 1a used the same materials as Lemhöfer et al. (2006), it employed a different procedure for cuing singular and plural utterances.

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