

PDF hosted at the Radboud Repository of the Radboud University Nijmegen

The following full text is a publisher's version.

For additional information about this publication click this link.

<http://hdl.handle.net/2066/54796>

Please be advised that this information was generated on 2021-10-22 and may be subject to change.

Selection of Gender-Marked Morphemes in Speech Production

Herbert Schriefers
Nijmegen University

Jörg D. Jescheniak and Ansgar Hantsch
University of Leipzig

N.O. Schiller and A. Caramazza (2003) and A. Costa, D. Kovacic, E. Fedorenko, and A. Caramazza (2003) have argued that the processing of freestanding gender-marked morphemes (e.g., determiners) and bound gender-marked morphemes (e.g., adjective suffixes) during syntactic encoding in speech production follows distinct principles, with only freestanding morphemes being subject to a competitive selection process. In 3 experiments, the authors tested this hypothesis in German, extending a previous study by H. Schriefers, J.D. Jescheniak, and A. Hantsch (2002). The results suggest that freestanding and bound morphemes are basically processed in the same way, although competition appears to be attenuated for bound morphemes relative to free morphemes. The authors discuss theoretical and methodological implications of this pattern.

In the past years, the (grammatical) gender-congruency effect obtained in variants of the picture–word task has attracted much attention, as it is viewed as a tool for exploring syntactic encoding processes in speech production. At present, however, there is some dispute with respect to both the locus of the effect and its scope.

The gender-congruency effect was first described by Schriefers (1993). In this study, speakers of Dutch were instructed to describe colored line drawings of common objects by producing noun phrases consisting of a gender-marked definite determiner, an adjective, and a noun (e.g., *de rode tafel* [_{the_{com}} red table]; *het rode huis* [_{the_{neut}} red house]) while hearing distractor words that had to be ignored.¹ These distractors had either the same grammatical gender as the noun of the target utterance (gender-congruent condition) or a different grammatical gender (gender-incongruent condition). Naming latencies were longer in the gender-incongruent condition than in the gender-congruent condition (see also LaHeij, Mak, Sander, & Willeboordse, 1998; Schiller & Caramazza, 2003; van Berkum, 1997, for replications in Dutch, and Schiller & Caramazza, 2003; Schriefers & Teruel, 2000, for replications in German). A similar interference pattern was obtained when participants produced noun phrases consisting of an adjective with a gender-marked suffix and a noun (e.g., *rode tafel* [_{red_{com}} table]; *rod huis* [_{red_{neut}} house]), but the effect was descriptively smaller than it was for noun phrases with definite determiners. These data suggested that the gender-congruency effect is indicative of lexical competition during syntactic process-

ing, regardless of whether the results of these processes surface as freestanding gender-marked morphemes (e.g., determiners) or bound gender-marked morphemes (e.g., adjective suffixes).

Schriefers (1993) interpreted the gender-congruency effect as resulting from competition in selecting the abstract gender feature of the target noun (i.e., either *common* or *neuter*). In the gender-congruent condition, it is assumed that the target noun and distractor activate the same gender feature. By contrast, in the gender-incongruent condition, it is assumed that they activate different gender features. Therefore, two gender features compete for selection in the latter condition, leading to prolonged naming latencies. Miozzo and Caramazza (1999), however, pointed out that the effect could also arise from lexical competition among determiner forms rather than from competition among abstract syntactic features.

Meanwhile, evidence has accumulated suggesting that competition among form representations indeed plays a role. In a recent study, Schriefers, Jescheniak, and Hantsch (2002) investigated the production of definite determiner noun phrases consisting of a determiner and a noun (e.g., *das Haus* [_{the_{neut}} house]) with speakers of German. In this study, Schriefers et al. made use of the fact that singular definite determiners in German are gender-marked (*der*, *die*, and *das*, for nouns of masculine, feminine, and neuter gender). By contrast, the plural definite determiner for all three gender classes is *die*, which corresponds to the singular definite determiner for nouns of feminine gender. Schriefers et al. asked participants to name one or two target objects by producing either a singular or a plural noun phrase consisting of a determiner and a noun. The results showed that it took longer to produce plural noun phrases than it did to produce singular noun phrases for masculine and neuter nouns. It is important to note, however, that no such costs were present for feminine nouns; in fact, for these nouns, a reverse effect (i.e., faster production of plural noun phrases than

Herbert Schriefers, Nijmegen Institute for Cognition and Information (NICI), Nijmegen University, The Netherlands; Jörg D. Jescheniak and Ansgar Hantsch, Department of Psychology, University of Leipzig, Germany.

Our research was supported by Grant DFG JE229/6–1 and a Heisenberg Fellowship from the German Research Council awarded to Jörg D. Jescheniak. Many thanks to Stefanie Hoffman and Frank Oppermann for their help in data collection.

Correspondence concerning this article should be addressed to Herbert Schriefers, Nijmegen University, NICI, P.O. Box 9104, NL-6500 HE Nijmegen, The Netherlands. E-mail: schriefers@nici.kun.nl

¹ We use subscripts to indicate those elements that are marked for gender in the target language: com = common gender (in Dutch); masc = masculine; fem = feminine; neut = neuter.

singular noun phrases) was obtained. This pattern was interpreted by Schriefers et al. (2002) as evidence for the *singular-as-default* hypothesis; when one produces a plural noun phrase, the corresponding singular determiner also becomes activated. If the singular determiner differs from the plural determiner (as is the case for masculine and neuter nouns), this leads to competition between the singular and the plural determiner. By contrast, if singular and plural determiner forms are identical, as is the case for nouns of feminine gender, no such competition in plural noun phrase production is present. Rather, the convergence onto a single form facilitates the response. Finally, when producing a singular noun phrase, only the singular determiner becomes activated. Note that in the case of competition in plural noun phrases with masculine or neuter nouns, this competition cannot concern an abstract gender feature, as the gender of the respective nouns obviously does not change between singular and plural. Thus, in contrast with picture-word studies that allow for an interpretation in terms of competition between abstract gender features or competition between determiner forms, the results of Schriefers et al. (see also Janssen and Caramazza (2003) for parallel results in Dutch) support the idea of competition among determiner forms.

Recently, Schiller and Caramazza (2003) reported a series of picture-word experiments in German and Dutch that is also compatible with the notion of determiner form competition, using the same task as Schriefers (1993).² For the production of singular noun phrases consisting of a gender-marked determiner, an adjective, and a noun, the authors replicated the gender-congruency effect. However, for corresponding plural noun phrases, no gender-congruency effect was obtained. Note that competition between abstract gender features should affect singular and plural noun phrases in the same way. By contrast, competition between actual determiners should affect singular noun phrases but not plural noun phrases. This is the case because in Dutch and German, there is only one plural determiner for all gender classes. Thus, as the gender-congruency effect was only obtained for singular noun phrases, Schiller and Caramazza (2003) concluded that competition among different determiner forms is the source of the gender-congruency effect rather than competition among abstract grammatical features.

Schiller and Caramazza (2003) also argued that such competition among morphophonological forms is confined to freestanding gender-marked morphemes like definite determiners and does not apply to bound gender-marked morphemes. This claim is based on the fact that in their study, the gender-congruency effect was only obtained for the production of singular noun phrases consisting of a gender-marked determiner and a noun (for which gender marking is realized as a freestanding morpheme) but not for singular noun phrases consisting of an adjective with a gender-marked suffix and a noun (for which gender marking is realized as a bound morpheme). The same pattern held for German and Dutch. The authors concluded that “the results [. . .] are consistent with the view that effects of gender-congruency reflect competition of free standing phonological forms such as definite determiners but not bound morphemes such as affixes.” (Schiller & Caramazza, 2003, p. 187). Schiller and Caramazza acknowledged the conflict with the original findings by Schriefers (1993) but defer a resolution of these conflicting data patterns to future research.

When evaluating the conclusion by Schiller and Caramazza (2003), one should keep in mind that there exist only two studies

contrasting free and bound morphemes within one language (Dutch), one study showing an effect for bound morphemes (Schriefers, 1993), and one study showing no effect for bound morphemes (Schiller & Caramazza, 2003), whereas both studies show an effect for free morphemes. Furthermore, no satisfying account has been offered with respect to the question of why one study found the effect for bound morphemes whereas the other one did not. Hence, before one considers possible differences in the processing of freestanding versus bound gender-marked morphemes, the conflicting pattern needs to be resolved.

How, then, could one account for the conflicting findings? One possible reason has to do with the fact that generally, competition processes might be more difficult to detect for elements that occur in noninitial position of an utterance. For the utterances and languages studied by Schiller and Caramazza (2003) and Schriefers (1993), the type of gender-marked morpheme (freestanding vs. bound) and the position the respective element (initial vs. noninitial) takes in the utterance are fully confounded. Gender-marked determiners always occur in initial position, whereas gender-marked adjective suffixes always occur in noninitial position, as suffix to the adjective stem. This fact could have important consequences for processing. When producing determiner-adjective-noun utterances, speakers logically need to have selected the appropriate gender-marked determiner before articulation can be initiated. This situation is different when producing adjective-noun utterances. In this case, participants can, in principle, initiate articulation as soon as the adjective stem is available without having selected the appropriate gender-marked suffix yet. Such behavior could be advantageous, as it would enable fast speech onset while providing the production system with additional time for resolving a conflict between different suffixes. At the same time, the chance of detecting existing competition processes for noninitial elements would be reduced when focusing on the initiation of articulation.³ Still, there is the possibility that corresponding competition processes manifest themselves, at least in part, in the duration of articulation; the presence of competition yet to be resolved could occasionally lead to either a lengthening of the initial part of the utterance or to minimal, not always detectable interruptions. In other words, competition processes for noninitial elements might, in part or fully, be masked when analyzing speech-onset latencies, but might—in part—become visible when analyzing speech durations.

How does this issue relate to the conflicting findings? Both Schiller and Caramazza (2003) and Schriefers (1993) reported analyses on speech-onset latencies only, but a closer look at their data is instructive. Schriefers obtained a significant gender-congruency effect of 56 ms for determiner-adjective-noun utterances and a smaller but also significant effect of 31 ms for adjective-noun utterances, with a stimulus onset asynchrony (SOA) of 0 ms. Schiller and Caramazza obtained a significant

² With respect to the issue at hand here, the gender systems of Dutch and German have comparable properties.

³ One should point out that Schiller and Caramazza (2003) considered the possibility that “any effects of competition in the selection of affixes is not measurable with the currently used paradigms” (p. 178), but ultimately refuted it in favor of the idea that gender-marked bound morphemes undergo qualitatively different processes.

gender-congruency effect of 16 ms (Experiments 1c and 4b, SOA = 0 ms) for determiner–adjective–noun utterances and no effect for adjective–noun utterances (–3 ms and –8 ms; Experiments 1b and 4a, SOA = 0 ms). Clearly, the effect for utterance-initial gender-marked morphemes (which one could take as an estimate of the base effect indexing full lexical competition that has to be resolved before speech onset) was much larger in the study by Schriefers than it was in the study by Schiller and Caramazza. The small base effect in the latter study, then, might have substantially reduced the chance of detecting a modulated effect with smaller size.

If our considerations are correct, the failure to obtain a gender-congruency effect in the production of adjective–noun utterances in the study by Schiller and Caramazza (2003) might not be indicative of particular differences in processing freestanding versus bound morphemes but could simply have to do with a more general problem of detecting competition effects for utterance-noninitial elements. In this respect, two other conditions included in the experiments by Schriefers (1993) are instructive. Apart from distractors that were either gender-congruent or gender-incongruent to the noun, the experiment also included distractors that were semantically related or unrelated to the adjective. The gender-congruency effect amounted to 56 ms for gender-marked elements in initial position and 31 ms for gender-marked elements in noninitial position. Similarly, the semantic interference effect amounted to 39 ms for adjectives in initial position and 26 ms for adjectives in noninitial position. Thus, in both cases, the experimental effects were attenuated when the target element shifted to a later position in the utterance.

In the present article, we report a series of experiments with speakers of German in which we tested whether competition effects between gender-marked elements are a general phenomenon, in that they apply to freestanding and bound morphemes alike (as suggested by Schriefers, 1993), or of more limited scope, in that they are restricted to freestanding morphemes (as suggested by Schiller and Caramazza, 2003). Our experiments differ from those reported by Schiller and Caramazza (2003) and Schriefers (1993) in that we used a different paradigm, namely a simple picture-naming task, in which no distractors were present. This choice was

motivated by the fact that this task has been shown to be sensitive to competition processes among determiner forms (Janssen & Caramazza, 2003; Schriefers et al., 2002) and allows for a more straightforward interpretation of possible interaction patterns than the more complex picture–word task (see Schriefers et al., 2002, for discussion).

We report three experiments that were identical except for the utterance format used to name the stimuli. Native speakers of German saw pictures of either one or two target objects varying in size (small vs. large). In Experiment 1, participants named the stimuli by means of singular or plural noun phrases consisting of a definite determiner, a size adjective, and a noun. Note that in these noun phrases, gender marking is carried by the definite determiner, whereas the adjective is not marked for gender (see Table 1 for an overview of the utterance formats used in Experiments 1–3).

We expected to replicate the pattern reported in Schriefers et al. (2002) with new materials and to extend it to a more complex utterance format (determiner–adjective–noun in place of determiner–noun). The aim of this experiment was to identify the base effect indexing competition among utterance-initial freestanding morphemes. Experiment 2, in which participants produced bare nouns in place of definite noun phrases, served as a control experiment. It assessed possible differences in the ease of producing singular versus plural forms among the item sets used in the three gender classes that might have contributed to the pattern of results for utterances with gender-marked elements. Finally, Experiment 3, in which participants named the same stimuli by means of noun phrases consisting of a size adjective and a noun, was most critical. Note that in these noun phrases, gender marking is carried by the suffixes of the adjectives. To be more specific, for this type of noun phrase in the singular, gender is marked on corresponding inflectional suffixes of the adjective (see Table 1). For the corresponding noun phrases in the plural, there is only one inflectional suffix for all three gender classes, which coincides with the feminine singular affix. Thus, for the gender-marking adjective inflections, the situation is, in principle, the same as it is for the gender-marked definite determiners, with the only difference being that the latter are free morphemes in utterance-initial

Table 1
Examples of Utterance Formats in Experiments 1–3

Number and gender	Experiment 1 (det + adj + noun)	Experiment 2 (bare noun)	Experiment 3 (adj + noun)
Singular			
Neuter	<i>das große Haus</i> [the _{neuter} large house]	<i>Haus</i> [house]	<i>großes Haus</i> [large _{neuter} house]
Masculine	<i>der große Pfeil</i> [the _{masculine} large arrow]	<i>Pfeil</i> [arrow]	<i>großer Pfeil</i> [large _{masculine} arrow]
Feminine	<i>die große Kirsche</i> [the _{feminine} large cherry]	<i>Kirsche</i> [cherry]	<i>große Kirsche</i> [large _{feminine} cherry]
Plural			
Neuter	<i>die großen Häuser</i> [the _{plural} large houses]	<i>Häuser</i> [houses]	<i>große Häuser</i> [large _{plural} houses]
Masculine	<i>die großen Pfeile</i> [the _{plural} large arrows]	<i>Pfeile</i> [arrows]	<i>große Pfeile</i> [large _{plural} large arrows]
Feminine	<i>die großen Kirschen</i> [the _{plural} large cherries]	<i>Kirschen</i> [cherries]	<i>große Kirschen</i> [large _{plural} cherries]

Note. English translations appear in brackets. det = determiner; adj = adjective.

position, whereas the inflectional suffixes are bound morphemes in noninitial position. To the extent that competition between gender-marked morphemes is a general phenomenon and occurs for free morphemes (e.g., determiners) and bound morphemes (e.g., adjective suffixes) alike, the general pattern from Experiment 1, though possibly attenuated, should be replicated. However, if competition is confined to free morphemes (as suggested by Schiller & Caramazza, 2003), no such interaction pattern should be obtained.

Experiment 1

In Experiment 1, participants named one or two target objects by producing either a definite singular or a definite plural noun phrase consisting of a gender-marked determiner, a size adjective, and a noun (e.g., *das große Haus* [the_{neut} large house]). We expected to replicate the pattern reported by Schriefers et al. (2002): There should be costs when producing plural noun phrases compared with singular noun phrases for nouns with masculine or neuter gender, whereas these costs should be absent for the nouns with feminine gender.

Method

Participants. Thirty-two native speakers of German, most of them students from the University of Leipzig, Leipzig, Germany, took part in the experiment. In all experiments described here, participants were paid EUR7 (approximately U.S.\$7). They had no known hearing deficits, and they had normal or corrected-to-normal vision.

Materials. There were line drawings of 72 different objects that all had one unambiguous name, as established in previous studies. An equal number of objects had names with masculine, feminine, and neuter gender; see the Appendix for a complete list. Pictures of each object were prepared in three sizes: small (filling a square of approximately 55×55 mm; 175×175 pixel), medium (filling a square of approximately 82×82 mm; 262×262 pixel), and large (filling a square of approximately 110×110 mm; 350×350 pixel). We selected these sizes on the basis of pretests ensuring that small-sized and large-sized pictures were easily discriminated. We used the small- and large-picture versions in the main experiment, and we used the medium-sized picture version during the study and training phase. During the main experiment, two exemplars of a picture were presented side by side as double-object pictures. We cued singular trials by presenting one target exemplar in black color (RGB 0 0 0) and a second exemplar in medium gray color (RGB 200 200 200) on a light gray background (RGB 244 244 244; in the stimulus presentation system used, RGB color codes vary from 0 to 255). We cued plural trials by presenting both exemplars in black color (cf. Schriefers et al., 2002). Each experimental picture appeared once in the singular condition and once in the plural condition. We chose this way of cueing singular and plural trials in order to control display complexity across singular and plural trials (see also Schriefers et al., 2002).

For the construction of a practice block to be presented at the beginning of the main experiment, we selected 18 additional objects (6 from each gender group). We used each of these items twice (once in the singular and once in the plural condition) for constructing 36 practice and warm-up trials.

Design. There were two crossed variables: the three-level variable, gender (neuter vs. masculine vs. feminine), and the two-level variable, number (singular vs. plural). Both variables were tested within subjects. Gender was tested between items, and number was tested within items.

Each participant received each of the 72 experimental pictures exactly once in the singular condition and once in the plural condition, resulting in a total of 144 experimental trials.⁴ For the singular trials, the position of the target object (left vs. right) was systematically counterbalanced. The same

held for the presentation sequence of the singular and plural condition. Across groups of participants, the items were reassigned to these four conditions in a way such that, overall, each item occurred in each condition equally often.

Sixteen different experimental lists were created according to the following general criteria: (a) Repetitions of an object were separated by at least eight intervening trials, (b) semantically or phonologically related objects did not appear in adjacent trials, (c) no more than five trials from the same gender class or with the same determiner form followed each other, (d) no more than five plural trials or five singular trials with the same position of the target object followed each other, and (e) no more than 5 trials with pictures of the same size followed each other. The 16 experimental lists were used equally often.

Procedure. Each participant was tested individually in a session lasting about 35 min. The participant was comfortably seated in a dimly lit room, separated from the experimenter by a partition wall. The visual stimuli were presented centered on a 37.4-cm (17-in.) monitor. Viewing distance was about 60 cm (~23.6 in.). The presentation of the visual stimuli and the online collection of the data were controlled by a computer with a Pentium processor (Intel, Santa Clara, CA). Speech-onset latencies were measured to the closest millisecond with a voice key connected to the computer.

The actual experiment consisted of three parts: a study phase, a training phase, and the main session. During the study phase, participants studied a written instruction booklet that emphasized both the speed and accuracy of their responses. Participants also previewed all pictures and their names on the monitor. Each picture was presented in black color and medium size in the center of the screen along with its name (as bare noun, i.e., without the definite determiner), and participants were instructed to use these names only during the experiment. During the training phase, each of the 72 experimental and 18 warm-up items was presented once as a single medium-sized object in black color in the center of the monitor, and participants named them by producing singular bare nouns. The next two practice blocks consisted of 9 practice trials each. Participants had to name the 18 practice items with either their singular or their plural form. The main experimental session consisted of two blocks. Each block consisted of 9 warm-up trials followed by 72 experimental trials. There was a short break between blocks.

In the main experiment, a double-object picture was presented for 1,000 ms. Participants named the picture as quickly as possible by producing either a singular noun phrase (if only one of the objects in the double-object picture appeared in black color; e.g., *das große Haus* [the_{neut} large house]) or a plural noun phrase (if both objects appeared in black color; e.g., *die großen Häuser* [the large houses]). Speech onset latencies were measured during 3,000 ms from the onset of the target picture. The next picture was presented 2,500 ms after the offset of a picture.

Results and Discussion

Observations were discarded from the reaction time analyses whenever any of the following conditions held: (a) A picture had been named other than expected, including the use of a deviant name, an incorrect size adjective, or an incorrect determiner; (b) a nonspeech sound preceded the target utterance, triggering the voice key; or (c) a dysfluency occurred, or an utterance was

⁴ This design controls for the distribution of singular and plural trials but leads to unequal distributions of the different determiner forms, with a predominance of the determiner form *die* (1/6 *der*, 1/6 *das* and 2/3 *die*), and one might suspect that this asymmetry might have an impact on the patterning of results. However, this objection was addressed and refuted by Schriefers et al. (2002), who found parallel interaction patterns when the distribution of singular and plural trials was controlled (Experiment 3) and when the distribution of determiner forms was controlled (Experiment 1).

Table 2
Mean Reaction Times (RTs; in ms) and Error Rates (in Percentages) for Experiment 1

Number	Gender											
	Neuter				Masculine				Feminine			
	RT		%		RT		%		RT		%	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
Singular	702	12	5.0	0.8	688	13	4.4	0.7	714	13	3.5	0.7
Plural	718	16	5.1	0.8	703	12	3.4	0.7	691	13	3.1	0.8
Difference	16	9	0.1	1.1	15	7	-1.0	0.8	-23	6	-0.4	0.8

Note. Difference = plural minus singular.

repaired. Observations deviating from a participant's and an item's mean by more than two standard deviations were considered as outliers and were also discarded from the reaction time analyses. According to these criteria, 207 observations (4.5%) were marked as erroneous, and 82 observations (1.8%) were marked as outliers.

Averaged reaction times were submitted to analyses of variance involving the two fixed variables number (singular vs. plural) and gender (neuter vs. masculine vs. feminine). Two analyses were computed, one treating participants and one treating items as random variable (Clark, 1973).

Table 2 displays mean reaction times and error rates broken down by number and gender class. There was no effect of number (all $F_s < 1$). Gender was significant in the participant analysis of speech-onset latencies, $F_1(2, 62) = 3.98, p < .05, MSE = 802.96$; $F_2(2, 69) = 1.58, p = .21, MSE = 1,658.39$, and approached significance in the analysis of error rates, $F_1(2, 62) = 2.71, p = .07, MSE = 1.00$; $F_2(2, 69) = 3.01, p = .06, MSE = 1.21$, reflecting slightly longer latencies and more errors for nouns of neuter gender. Most important, there was a reliable interaction between the two variables in the analysis of speech-onset latencies, $F_1(2, 62) = 12.58, p < .01, MSE = 620.44$; $F_2(2, 69) = 10.20, p < .01, MSE = 512.59$. According to t tests, there was a significant decrease in naming latencies from singular to plural noun phrases for nouns of feminine gender (23-ms difference), $t_1(31) = 3.56, p < .01$; $t_2(23) = 3.50, p < .01$. By contrast, the pattern was reversed for nouns of either masculine or neuter gender. The increase in naming latencies from singular to plural noun phrases approached significance in the participant analysis and was reliable in the item analysis: 15-ms difference for nouns of masculine gender, $t_1(31) = 2.00, p = .06$; $t_2(23) = 2.11, p < .05$; and 16-ms difference for nouns of neuter gender, $t_1(31) = 1.74, p = .09$; $t_2(23) = 2.27, p < .05$.⁵

With the significant Gender \times Number interaction in the production of definite noun phrases, we replicated the pattern reported in Schriefers et al. (2002, Experiments 1 and 3) using new materials. It extends the previous findings in that it shows that competition processes between determiners are also observable for more complex noun phrases consisting of a determiner, a (size) adjective, and a noun (as opposed to noun phrases consisting of a determiner and a noun only). The overall size of the obtained effect (about 40 ms when pooling interference and facilitation effects) seems large enough to expect modulations in size to be measurable. Thus, the experimental materials and technique seem suited

to address the key question of this article: Is competition between gender-marked lexical elements a general phenomenon in that it applies to elements that are realized as freestanding morphemes (e.g., determiners) and bound morphemes (e.g., adjective suffixes) alike, or is it confined to elements realized as freestanding morphemes only?

However, before turning to this question, we must first establish that the pattern of results is really due to competition between gender-marked determiners and not just due to other differences between the item sets of feminine, masculine, and neuter gender. In Experiment 2, therefore, we compared the production of bare singular nouns with the production of bare plural nouns, for which no selection of gender-marked morphemes (i.e., determiners) was required, using the same materials and the same procedure as in Experiment 1.

Experiment 2

If the Gender \times Number interaction observed in Experiment 1 was due to competition among gender-marking morphemes and not to differences between the experimental item sets used in the three gender classes with respect to the ease of producing singular versus plural forms, this interaction should disappear in Experiment 2.

Method

Participants, materials, and design. Thirty-two students from the University of Leipzig took part in the experiment. The materials and design were identical to those used in Experiment 1.

Procedure. The procedure was the same as the one used in Experiment 1; the only exception was that in the main experiment, participants were instructed to produce singular nouns (e.g., *Haus* [house]) if only one of the objects in the double-object picture was presented in black color and plural nouns (e.g., *Häuser* [houses]) if both objects were presented in black color.

⁵ Including the factor size in the analysis showed that the Size \times Gender \times Number interaction was just significant in the analysis by participants, $F_1(2, 62) = 3.19, p = .048, MSE = 602.19$, and clearly not significant in the analysis by items, $F_2(2, 69) = 2.01, p = .141, MSE = 698.51$. Thus, the critical Gender \times Number interaction appears to be stable across the two levels of the factor size.

Table 3
Mean Reaction Times (RTs; in ms) and Error Rates (in Percentages) Experiment 2

Number	Gender											
	Neuter				Masculine				Feminine			
	RT		%		RT		%		RT		%	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
Singular	687	10	1.8	0.5	670	10	1.3	0.4	664	10	0.9	0.4
Plural	684	11	2.9	0.6	667	11	3.5	0.7	663	11	1.3	0.4
Difference	-3	5	1.1	0.6	-3	5	2.2	0.7	-1	5	0.4	0.6

Note. Difference = plural minus singular.

Results and Discussion

The raw data were treated as they were treated in Experiment 1. According to these criteria, 109 observations (2.3%) were marked as erroneous, and 88 observations (1.9%) were marked as outliers. Table 3 displays mean reaction times and error rates broken down by number and gender class. Overall, there were more errors with plural noun utterances than there were with singular noun utterances (3% vs. 1.3%), $F_1(1, 31) = 8.88, p < .01, MSE = 0.46$; $F_2(1, 69) = 6.90, p < .05, MSE = 0.79$. There was no systematic effect of gender. Neuter nouns were produced slightly slower than were either masculine or feminine nouns, $F_1(2, 62) = 21.83, p < .01, MSE = 382.94$; $F_2(2, 69) = 1.91, p = .16, MSE = 3,716.44$. There were fewer errors with nouns of feminine gender than there were with nouns of either masculine or neuter gender, $F_1(2, 62) = 4.79, p < .05, MSE = 0.39$; $F_2(2, 69) = 2.92, p = .06, MSE = 0.34$. Most important, in contrast with Experiment 1, there was no Gender \times Number interaction: for speech-onset latencies, all $F_s < 1$; for error rates, $F_1(2, 62) = 2.43, p = .10, MSE = 0.32$; $F_2(2, 69) = 1.33, p = .27, MSE = 0.79$.

The absence of a Gender Class \times Number interaction in Experiment 2 confirms that the corresponding interaction in Experiment 1 is due to competition among gender-marking determiners. In the case of nouns of feminine gender, the selection of the plural determiner benefits from the fact that it receives additional activation from the singular number feature. In the case of nouns of either masculine or neuter gender, no such facilitation is obtained. Rather, the selection of the plural determiner is delayed by the activation of a different singular morpheme. Having established the Gender Class \times Number interaction for utterances with a gender-marked determiner and having ruled out the ease of plural formation for the particular item sets tested as the source of this effect, we can turn to the main point of the present article: Is a corresponding interaction also obtained for utterances consisting of an adjective with a bound suffix that marks gender? We tested this issue in Experiment 3.

Experiment 3

In Experiment 3, participants produced singular or plural noun phrases consisting of a size adjective with a gender-marked suffix and a noun. To the extent that competition between gender-marked lexical elements is a general phenomenon, we expected to replicate the interaction pattern observed in Experiment 1, though possibly

in a somewhat attenuated form, as the gender-marked element (the inflectional suffix of the adjective) does not occur in utterance-initial position.

Method

Participants, materials, and design. Thirty-two students from the University of Leipzig took part in the experiment. The materials and design were identical to those used in Experiment 1.

Procedure. The procedure was the same as the one used in Experiment 1; the only exception was that in the main experiment, participants were instructed to produce singular noun phrases consisting of a size adjective and a noun (e.g., *großes Haus* [large_{neut} house]) if only one of the objects in the double-object picture was presented in black color and corresponding plural noun phrases (e.g., *große Häuser* [large houses]) if both objects were presented in black color.

Results and Discussion

The raw data were treated as they were treated in Experiment 1. According to these criteria, 241 observations (5.2%) were marked as erroneous, and 79 observations (1.7%) were marked as outliers.

Table 4 displays mean reaction times and error rates broken down by number and gender class. Plural utterances were produced faster than were singular utterances (702 ms vs. 712 ms), $F_1(1, 31) = 6.33, p < .05, MSE = 729.10$; $F_2(1, 69) = 7.24, p < .01, MSE = 425.51$. Naming latencies were slightly shorter for nouns of masculine gender than they were for nouns of either feminine or neuter gender, yielding a significant effect of gender in the participant analysis only, $F_1(2, 62) = 5.28, p < .01, MSE = 453.51$; $F_2 < 1$. Fewer errors were obtained with nouns of feminine gender than with nouns of either masculine or neuter gender, $F_1(2, 62) = 6.62, p < .01, MSE = 0.89$; $F_2(2, 69) = 4.22, p < .05, MSE = 1.97$. The Number \times Gender interaction reached significance in the participant analysis of reaction times, $F_1(2, 62) = 3.12, p = .05, MSE = 379.45$; $F_2(2, 69) = 1.29, p = 0.28, MSE = 425.51$.⁶ According to *t*-tests, the decrease in naming latencies from singular to plural noun phrases for nouns of feminine gender

⁶ Including the factor size in the analysis showed that the Size \times Gender \times Number interaction was not significant, $F_1(2, 62) = 2.68, p = .08, MSE = 1077.82$; $F_2(2, 69) = 1.70, p = .19, MSE = 789.44$, indicating that the critical Gender \times Number interaction appears to be stable across the two levels of the factor size.

Table 4
Mean Reaction Times (RTs; in ms) and Error Rates (in Percentages) for Experiment 3

Number	Gender											
	Neuter				Masculine				Feminine			
	RT		%		RT		%		RT		%	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
Singular	715	14	6.1	0.9	701	14	5.3	0.6	719	13	4.2	0.9
Plural	707	16	5.5	1.0	699	14	5.2	0.9	700	14	2.6	0.6
Difference	-8	6	-0.6	1.4	-2	5	-0.1	1.0	-19	6	-1.6	1.1

Note. Difference = plural minus singular.

was reliable (19-ms difference), $t_1(31) = 3.18$, $p < .01$; $t_2(23) = 2.39$, $p < .05$, whereas there was no significant difference for either nouns of masculine gender (2-ms difference), $t_1(31) = .47$, $p = .64$; $t_2(23) = .92$, $p = .37$, or for nouns of neuter gender (8-ms difference), $t_1(31) = 1.35$, $p = .19$; $t_2(23) = 1.11$, $p = .28$.

The critical Gender Class \times Number interaction observed in Experiment 1 was replicated. This pattern suggests that competition among gender-marked elements is independent of their realization as either freestanding morphemes (as in Experiment 1) or bound morphemes (as in the present experiment). It should be noted, however, that free and bound morphemes did not behave exactly in the same way. Although the production of plural utterances with nouns of feminine gender was facilitated for free morphemes (Experiment 1) and for bound morphemes (Experiment 3), inhibition effect for plural utterances with masculine and neuter nouns was obtained for free morphemes (Experiment 1) but not for bound morphemes (Experiment 3). We will return to this difference between Experiments 1 and 3 in the General Discussion.

Above, we mention the possibility that competition effects for utterance-noninitial morphemes might—in part—manifest themselves in terms of articulatory lengthening of utterance-initial parts preceding the gender-marked adjective inflection. In this way, speakers might be able to initiate articulation of the utterance without having retrieved the gender-marked inflection before utterance onset. We tested this possibility in the following way. For a subsample of 16 of the 32 participants in Experiment 3, representative of the full sample tested, we assessed the following measures: (a) reaction times (as in the analyses above); (b) articulatory duration of adjective stem, in other words, utterance duration up to the onset of the gender-marked suffix; and (c) composite of reaction time and adjective stem duration. The corresponding data are presented in Table 5.⁷

For reaction time and for the composite of reaction time and stem duration, there was facilitation of comparable size for nouns of feminine gender: 21 ms facilitation, $t_1(15) = 4.15$, $p < .01$; $t_2(23) = 1.94$, $p = .07$; and 25 ms facilitation, $t_1(15) = 5.28$, $p < .01$; $t_2(23) = 2.04$, $p = .05$, respectively, and there was no effect for nouns of neuter gender (nonsignificant 3 ms and 2 ms facilitation, all $ps > .75$). The only feature that is descriptively in line with the hypothesis of an articulatory lengthening of initial parts of the utterance is a trend toward inhibition for nouns of masculine gender when considering the composite of reaction time and stem duration (8 ms, $ps > .15$) that is not visible when considering

reaction time alone (4 ms in the opposite direction, $ps > .45$). That is, there is little evidence for the possibility that competition among noninitial gender-marked morphemes would manifest itself in articulatory duration in this experiment. It should be noted, however, that this does not necessarily exclude that competition might be resolved during articulation of the stem without prolonging it. This is the case because the mean stem durations (~220 ms) are much longer than the size of the gender competition as obtained in Experiment 1. Taken together, the present experiments show a Gender \times Number interaction for gender-marked free morphemes (Experiment 1) and gender-marked bound morphemes (Experiment 3). The latter interaction effect was somewhat smaller than the former effect,⁸ but one cannot account for this difference by a lengthening of initial parts of the utterance preceding the gender-marked element.

General Discussion

In three experiments, we explored the processing of freestanding gender-marked determiners and bound gender-marked adjective inflections in language production. Participants named one or two target objects in different formats: by producing a determiner-adjective-noun utterance (in which the gender-marked morpheme occurred as a freestanding morpheme, i.e., a determiner; Experiment 1), by producing an adjective-noun utterance (in which the gender-marked morpheme occurred as a bound morpheme, i.e., an adjective suffix; Experiment 3), or by producing a bare noun (in which no gender-marked morpheme was involved; Experiment 2).

⁷ An analysis of reaction times with the additional factor group (participants selected for duration analysis versus participants not selected for duration analysis) showed a significant Gender \times Number interaction, but the Group \times Gender \times Number interaction was not significant (both $F_s < 1$). The absence of the triple interaction shows that the subsample of participants selected for the duration analysis is representative for the whole sample of participants as far as the critical Gender Class \times Number interaction in reaction times is concerned.

⁸ We confirmed this descriptive observation of a reduction of the effect in Experiment 3 as compared with Experiment 1 in an analysis with experiment (Experiment 1 vs. 3) as a between-subjects factor and gender class and number as within-subjects factors. The triple interaction among these factors was significant in the analysis by participants, $F_1(2, 124) = 14.49$, $p = .04$, $MSE = 500.24$; and marginally significant in the analysis by items, $F_2(2, 69) = 3.00$, $p = .06$, $MSE = 424.03$.

Table 5
Reaction Times and Adjective-Stem-Duration Measures (in ms) for a Subsample of Participants From Experiment 3

Number	Reaction time						Adjective stem						Total					
	Neut		Masc		Fem		Neut		Masc		Fem		Neut		Masc		Fem	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
Singular	646	15	635	14	656	15	227	7	215	6	228	6	877	20	850	17	885	18
Plural	643	18	631	16	635	15	229	6	228	7	227	7	875	21	858	20	860	17
Difference	-3	8	-4	7	-21	5	2	2	13	2	-1	2	-2	10	8	7	-25	5

Note. Difference = plural minus singular. Reaction time = stimulus onset to speech onset; adjective stem = speech onset to end of adjective stem; total = stimulus onset to end of adjective stem (reaction time + stem); neut = neuter; masc = masculine; fem = feminine.

For determiner–adjective–noun utterances, latencies were shorter when participants produced plural noun phrases as opposed to singular noun phrases for nouns of feminine gender, for which singular and plural determiner forms are identical. By contrast, for nouns of masculine or neuter gender, for which singular and plural determiner forms are different, no such gain was obtained. Rather, latencies were longer when participants produced plural noun phrases as opposed to singular noun phrases. This pattern replicates the Gender \times Number interaction that we had found in our previous study (Schriefers et al., 2002, Experiments 1 and 3) for utterances consisting of a gender-marked determiner and a noun. Experiment 2 demonstrated that there was no difference between plural and singular utterances for bare noun utterances. Thus, the interaction found in Experiment 1 was not due to differences in the difficulty of plural formation or differences in other properties of the item sets for the three gender classes.

We addressed the central question of the present study in Experiment 3. In this experiment, we tested whether lexical competition as reflected in the Gender \times Number interaction is restricted to freestanding morphemes, as suggested by Schiller and Caramazza (2003), or whether it also occurs for bound morphemes like adjective inflections, as suggested by the results of Schriefers (1993). Participants produced noun phrases consisting of an adjective with a bound gender-marked suffix (exhibiting the same distributional properties over gender classes and number, singular vs. plural, as the definite determiner, see Table 1) and a noun. As in Experiment 1, there was a Gender \times Number interaction. However, the interaction obtained for bound morphemes was different from the one obtained for free morphemes in that it was due to a plural gain for adjective–noun phrases with feminine nouns but no plural costs for the corresponding noun phrases with neuter and masculine nouns. Before considering whether this difference does imply that free and bound morphemes are processed differently in language production, as suggested by Schiller and Caramazza, we first introduce a recent study by Costa, Kovacic, Fedorenko, and Caramazza (2003) that further specifies the theoretical position taken by Schiller and Caramazza.

Costa et al. (2003) used the gender-congruency effect in the picture–word task to investigate the processing of gender-marked elements in Croatian. In their first experiment, they obtained a gender-congruency effect for utterances with a gender-marked accusative pronoun, in other words, with a free-standing gender-marked morpheme (e.g., *vidim ga* [see it_{masc}] or *vidim je* [see it_{fem}]). By contrast, for utterances with gender-marked possessive

pronouns (e.g., *moj krevet* [my_{masc} bed] or *moja kuca* [my_{fem} house]), they did not obtain a gender-congruency effect (Costa et al., 2003, Experiments 2 and 3).

Costa et al. (2003) interpreted this result by assuming that morphophonological processes operating with bound morphemes (like gender-marked suffixes) do not involve a simple concatenation in which a stem and an inflectional suffix are first selected independently and are subsequently combined in a phonological frame. Rather, they assume that morphophonological processes involve phonological transformations, and thus “the role of grammatical features would not be to select a specific bit of phonological material but to select a phonological transformation” (p. 1279). On the basis of their results, Costa et al. suggested that the selection of such a transformation might be a noncompetitive process.

How do the results of Costa et al. (2003) relate to the other evidence in this domain? They confirm that it is in principle possible to find a (possibly attenuated) gender-congruency effect in the picture–word task for gender-marked elements not occurring in utterance-initial position (see Schriefers, 1993), in this particular case, for freestanding gender-marked personal pronouns.

However, there are also divergences between the present data (and those reported by Schriefers, 1993) and those reported by Costa et al. (2003). Let us first turn to the gender-congruency effect in the picture–word task. Schriefers obtained a gender-congruency effect for inflected gender-marked adjectives, whereas Schiller and Caramazza (2003) failed to observe such an effect. Costa et al., using possessive pronouns, also did not find a gender-congruency effect, taking this finding as further support for the hypothesis that gender-marked inflectional suffixes come for free via phonological transformations that are noncompetitive processes. The question, of course, arises whether inflected possessive pronouns and inflected gender-marked adjectives are in fact directly comparable. It appears that Costa et al. implicitly assume this to be the case, as they refer to possessive pronouns as “possessive adjectives.”

Note, however, that this labeling is at odds with standard linguistic classification and obscures important differences. In fact, inflected adjectives are open-class items, whereas possessive pronouns are considered to be closed-class items and sometimes even a subclass of determiners. From this perspective, the absence of a gender-congruency effect in Costa et al.’s (2003) experiments for utterances consisting of a possessive pronoun and a noun (Experiments 2 and 3) would be more the exception than the rule, as all relevant studies in Dutch and German until now have obtained a

gender-congruency effect with determiners in utterance-initial position (LaHeij et al., 1998; Schiller & Caramazza, 2003; Schriefers, 1993, Schriefers & Teruel, 2000; van Berkum, 1997). Thus, one might suspect that the null effect obtained by Costa et al. is due either to some special property of Croatian or to some specific details of the experiments of Costa et al.⁹

Taken together, it is questionable whether the results presented by Costa et al. (2003) really speak to the issue of how bound morphemes are processed in language production. But even if we would assume this to be the case, their account does not provide a straightforward explanation of the present results. If bound morphemes were processed via phonological transformations that are selected by noncompetitive processes (as suggested by Costa et al.), this would provide an explanation for the absence of plural costs for adjective–noun utterances with masculine or neuter nouns but no straightforward explanation for the presence of a plural gain for corresponding noun phrases with feminine nouns. Put differently, on this account there would be no explanation why the convergence of syntactic features (i.e., feminine singular and feminine plural) onto the same phonological transformation leads to facilitation although the divergence of syntactic features (masculine/neuter singular and masculine/neuter plural) does not have any effect. It should be noted, however, that the same problem arises for the position taken by Schriefers et al. (2002). Given the assumption that the production of plural noun phrases implies a divergence of activation onto different gender-marked morphemes for singular and plural in the case of masculine and neuter nouns, and a convergence of activation on one gender-marked morpheme in the case of feminine nouns, it remains unclear why the latter led to facilitation for free and bound morphemes, whereas the former led to inhibition for free morphemes and no effect for bound morphemes.

In this context, it is useful to have a closer look at the two experimental paradigms used in the relevant studies, in other words, picture–word studies focusing on the gender-congruency effect (e.g., Schiller & Caramazza, 2003; Schriefers, 1993) on the one hand and simple noun-phrase production studies focusing on a potential Gender \times Number interaction on the other (e.g., Schriefers et al., 2002, and the present experiments). The gender-congruency effect in picture–word experiments refers to the reaction time difference between a gender-congruent and a gender-incongruent condition. In the gender-congruent condition, activation from picture and distractor is assumed to converge on the same determiner form (or some other gender-marked element like an adjectival inflection), whereas in the gender-incongruent condition, picture and distractor activate two different determiner forms (or some other gender-marked forms). This implies that it is impossible to decide whether the overall gender-congruency effect is due to facilitation in the gender-congruent condition, inhibition in the gender-incongruent condition, or some mixture of these two effects. Furthermore, it is impossible to decide whether the relative contributions of a potential inhibitory and a potential facilitatory component of the overall gender-congruency effect are the same for free and bound gender-marked morphemes or whether the relative contributions change as a function of the type of morpheme.

For the simple naming experiments of the present study, the situation is somewhat different. In contrast with the congruency effect in picture–word experiments, convergence versus diver-

gence of activation of gender-marked elements does not concern different singular gender-marked elements activated by picture and distractor but, rather, the singular and plural gender-marked elements activated by the to-be-named object(s). Given the logic of these experiments and the singular-as-default hypothesis as established in previous experiments (Schriefers et al., 2002), the singular condition can be considered as a neutral baseline. Thus, the present experiments allow one to judge whether diverging activation of different gender-marked elements for plural noun phrases with masculine or neuter nouns leads to inhibition, or whether convergent activation onto the same gender-marked element for plural noun phrases with feminine nouns leads to facilitation.

The present results show a Gender \times Number interaction for noun phrase with free gender-marked morphemes and for noun phrases with bound gender-marked morphemes. However, the former interaction is carried by inhibition for plural noun phrases with masculine and neuter nouns and facilitation for plural noun phrases with feminine nouns, whereas the latter interaction is carried by facilitation for plural noun phrases with feminine nouns. Thus, the present experiments provide a more fine-grained picture than the overall gender-congruency effect. The resulting picture indicates that the selection of freestanding and bound gender-marked morphemes does not differ in a principled sense, such that the former are selected by a competitive process, whereas the latter “do come for free”, in contrast with the proposal put forward by Schiller and Caramazza (2003; see also Costa et al., 2003). The present data also do suggest a difference in the processing of free and bound gender-marked morphemes such that in the selection of free morphemes, an inhibitory and a facilitatory component appear to play a role, whereas in the selection of bound morphemes, the facilitatory component appears to dominate. In this respect, it is interesting to note that the seemingly contradictory patterns of results from picture–word studies show a high degree of parallelism. As noted in the introduction, Schriefers (1993) obtained a 56-ms gender-congruency effect for Dutch noun phrases with a free gender-marked morpheme (i.e., definite determiners) and an effect of 31 ms for corresponding noun phrases with a bound gender-marked morpheme (i.e., gender-marked adjectival inflections). The corresponding values for Dutch noun phrases obtained by Schiller and Caramazza (2003) were 16 ms and -8 ms, respectively. Thus, the reduction of the gender-congruency effect when going from free gender-marked morphemes to bound gender-marked morphemes is almost identical, 25 ms in the former study and 24 ms in the latter study. The fact that the reduction of the gender-congruency effect is highly comparable, whereas the studies clearly differ with respect to the presence or absence of a gender-congruency effect for bound gender-marked morphemes, once more suggests that investigation of this issue asks for exper-

⁹ One such feature concerns the fact that Costa et al. (2003) used only masculine and feminine nouns in their experiments despite the fact that Croatian is a three-gender language. Such a reduction of the full range of gender-marked elements to only a subset might affect the participants' behavior in some unknown way. It should be noted, however, that Costa et al. did obtain a gender-congruency effect in their experiment with gender-marked personal pronouns (Experiment 1), although they used the same reduction to two gender classes. Thus, the reduction to two gender classes in Costa et al.'s experiments alone cannot provide a complete account of their results.

imental techniques that can tease apart the inhibitory and facilitatory components of the overall gender-congruency effect.

To conclude, the present data do not support the proposal that bound morphemes come for free whereas freestanding morphemes are selected by a competitive process. On such an account, we should not have obtained a Gender Class \times Number interaction for both free morphemes (Experiment 1) and bound morphemes (Experiment 3). On the other hand, the present data also indicate that there must be some difference between utterances with gender-marked free morphemes and bound morphemes, at least for the type of utterances studied in the present experiments. This is reflected in the fact that the critical Gender Class \times Number interaction took a different form for free morphemes and bound morphemes: A plural gain for feminine nouns was observed for both types of morphemes, whereas a plural cost for nouns of masculine and neuter gender was only observed for free morphemes. This can either be due to a genuine difference in the selection mechanism for free and bound morphemes or due to a common selection mechanism together with some additional effect induced by the different utterance types (e.g., utterance-initial versus -noninitial position of the critical morpheme and potential consequences for processes of phonological encoding; cf. Jescheniak, Schriefers, & Hantsch, 2003).

References

- Clark, H. H. (1973). The language-as-fixed-effect fallacy: A critique of language statistics in psychological research. *Journal of Verbal Learning and Verbal Behavior*, *12*, 335–359.
- Costa, A., Kovacic, D., Fedorenko, E., & Caramazza, A. (2003). The gender-congruency effect and the selection of freestanding and bound morphemes: Evidence from Croatian. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *29*, 1270–1282.
- Janssen, N., & Caramazza, A. (2003). The selection of closed-class words in noun phrase production: The case of Dutch determiners. *Journal of Memory and Language*, *48*, 635–652.
- Jescheniak, J. D., Schriefers, H., & Hantsch, A. (2003). Utterance format affects phonological priming in the picture–word task: Implications for models of phonological encoding in speech production. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *29*, 441–454.
- LaHeij, W., Mak, P., Sander, J., & Willeboordse, E. (1998). The gender-congruency effect in picture-word tasks. *Psychological Research*, *61*, 209–219.
- Miozzo, M., & Caramazza, A. (1999). The selection of determiners in noun phrase production. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *25*, 907–922.
- Schiller, N. O., & Caramazza, A. (2003). Grammatical feature selection in noun phrase production: Evidence from German and Dutch. *Journal of Memory and Language*, *48*, 169–194.
- Schriefers, H. (1993). Syntactic processes in the production of noun phrases. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *19*, 841–850.
- Schriefers, H., Jescheniak, J. D., & Hantsch, A. (2002). Determiner selection in noun phrase production. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *28*, 941–950.
- Schriefers, H., & Teruel, E. (2000). Grammatical gender in noun phrase production: The gender interference effect in German. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *26*, 1368–1377.
- van Berkum, J. J. A. (1997). Syntactic processes in speech production. The retrieval of grammatical gender. *Cognition*, *64*, 115–152.

Appendix

Names of Experimental Objects Used in Experiments 1–3 (With Approximate English Translations in Brackets)

Grammatical gender		
Neuter	Masculine	Feminine
<i>Auto</i> [car]	<i>Affe</i> [monkey]	<i>Ampel</i> [traffic light]
<i>Baby</i> [baby]	<i>Apfel</i> [apple]	<i>Blume</i> [flower]
<i>Bein</i> [leg]	<i>Baum</i> [tree]	<i>Bombe</i> [bomb]
<i>Bett</i> [bed]	<i>Brunnen</i> [fountain]	<i>Brezel</i> [pretzel]
<i>Blatt</i> [leaf]	<i>Frosch</i> [frog]	<i>Bürste</i> [brush]
<i>Buch</i> [book]	<i>Fuchs</i> [fox]	<i>Dusche</i> [shower]
<i>Dach</i> [roof]	<i>Hund</i> [dog]	<i>Feder</i> [feather]
<i>Dorf</i> [village]	<i>Knopf</i> [button]	<i>Glocke</i> [bell]
<i>Fenster</i> [window]	<i>Koffer</i> [suitcase]	<i>Gurke</i> [cucumber]
<i>Gehirn</i> [brain]	<i>Korken</i> [cork]	<i>Hose</i> [trousers]
<i>Gewicht</i> [weight]	<i>Kuchen</i> [cake]	<i>Insel</i> [island]
<i>Haus</i> [house]	<i>Pfeil</i> [arrow]	<i>Kirsche</i> [cherry]
<i>Kreuz</i> [cross]	<i>Pilz</i> [mushroom]	<i>Krone</i> [crown]
<i>Messer</i> [knife]	<i>Roller</i> [scooter]	<i>Mütze</i> [cap]
<i>Nest</i> [nest]	<i>Sack</i> [sack]	<i>Muschel</i> [shell]
<i>Pferd</i> [horse]	<i>Schrank</i> [cupboard]	<i>Note</i> [note]
<i>Rad</i> [wheel]	<i>Schuh</i> [shoe]	<i>Rutsche</i> [slide]
<i>Schloss</i> [castle]	<i>Schwamm</i> [sponge]	<i>Schere</i> [scissors]
<i>Schwein</i> [pig]	<i>Spiegel</i> [mirror]	<i>Spritze</i> [syringe]
<i>Seil</i> [rope]	<i>Stern</i> [star]	<i>Tafel</i> [board]
<i>Wappen</i> [emblem]	<i>Teppich</i> [carpet]	<i>Tube</i> [tube]
<i>Zebra</i> [zebra]	<i>Tisch</i> [table]	<i>Waage</i> [scale]
<i>Zelt</i> [tent]	<i>Trichter</i> [funnel]	<i>Welle</i> [wave]
<i>Zimmer</i> [room]	<i>Zahn</i> [tooth]	<i>Weste</i> [vest]

Received November 1, 2003

Revision received May 19, 2004

Accepted June 11, 2004 ■

Copyright of Journal of Experimental Psychology / Learning, Memory & Cognition is the property of American Psychological Association and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.