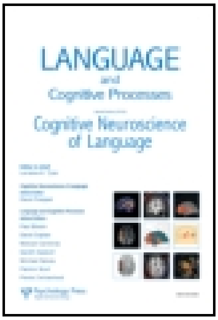

Language and Cognitive Processes
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/plcp20

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Version of record first published: 26 Mar 2007.

LANGUAGE AND COGNITIVE PROCESSES
2006, 21 (7–8), 945–973

Psychology Press
Taylor & Francis Group

Grammatical gender selection and the representation of morphemes: The production of Dutch diminutives

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In this study, we investigated grammatical feature selection during noun phrase production in Dutch. More specifically, we studied the conditions under which different grammatical genders select either the same or different determiners. Pictures of simple objects paired with a gender-congruent or a gender-incongruent distractor word were presented. Participants named the pictures using a noun phrase with the appropriate gender-marked determiner. Auditory (Experiment 1) or visual cues (Experiment 2) indicated whether the noun was to be produced in its standard or diminutive form. Results revealed a cost in naming latencies when target and distractor take different determiner forms independent of whether or not they have the same gender. This replicates earlier results showing that congruency effects

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The research was supported in part by NIH grant DC04542 to Alfonso Caramazza. Niels O. Schiller is supported by the Royal Netherlands Academy of Arts and Sciences (KNAW) and by the Netherlands Organisation for Scientific Research (NWO; grant no. 453-02-006). The authors would like to thank Suzan Kroezen and Marcel van Gerven (Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands) for running the participants.

This paper benefited from discussion at the 45th TeaP conference in Kiel, Germany (March, 2003), the XIIIth ESCoP conference in Granada, Spain (September, 2003), the 44th Annual Meeting of the Psychonomic Society in Vancouver, Canada (November, 2003), and the 9th NVP winter congress in Egmond aan Zee, The Netherlands (December, 2003). For discussion and helpful comments the authors wish to thank the members of the Utterance Encoding group at the Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands, Xavier Alario (CNRS & Université de Provence) and Albert Costa (Universitat de Barcelona).

http://www.psypress.com/lcp DOI: 10.1080/016909600824609

are due to competition during the selection of determiner forms rather than gender features. The overall pattern of results supports the view that grammatical feature selection is an *automatic* consequence of lexical node selection and therefore not subject to interference from incongruent grammatical features. Selection of the correct determiner form, however, is a competitive process, implying that lexical node and grammatical feature selection operate with distinct principles.

The basic question addressed in this study is whether or not the retrieval of grammatical gender in speech production can be delayed by presenting distractor words differing in gender from the target. Noun phrase (NP) production requires the retrieval of different forms of lexical information from long-term memory such as semantic, grammatical, and phonological. Semantic information refers to the meaning of a word (e.g., is it animate or inanimate, natural or man-made, etc.) while phonological information has to do with the actual form of a word (e.g., its phonemes, syllables, stress pattern, etc.). Grammatical information is necessary for constructing agreement between words. For example, in Dutch NPs, adjectives and nouns agree in number and gender, e.g., *groen boek*$_{\text{(neu)}}$ ('green book') vs. *groen**e** boeken*$_{\text{(neu)}}$ ('green books') vs. *groen**e** tafel*$_{\text{(com)}}$ ('green table') vs. *groen**e** tafels*$_{\text{(com)}}$ ('green tables'). The Dutch word *boek* has neuter (neu) gender while *tafel* has common (com) gender. In order to be able to produce the correct form of the adjective in Dutch (*groen* or *groen**e***) the gender (and number) features of the noun have to be retrieved (for an alternative view see Mirković, MacDonald, & Seidenberg, 2005). Once the target gender node is selected, it can be used to activate the appropriate gender-marking suffix for the adjective.

Gender is a lexical property of nouns (Corbett, 1991). Thus, the study of gender feature retrieval provides a window into the mechanisms that govern the selection of lexical grammatical features and their role in determiner and inflectional morphology processing. Recent interest in grammatical feature processing is in part due to the development of methods proposed by Schriefers (1993). His procedure provides a window on NP processing in speech production. For example, he used the picture-word interference paradigm to investigate the syntactic processes involved in selecting the definite article and the adjective's inflection in NP production by Dutch speakers. In this paradigm, participants are instructed to name a picture while ignoring a simultaneously presented distractor word. This task is a variant of the Stroop (1935) paradigm and it has been used successfully to investigate various aspects of lexical access in language production (for reviews see Glaser, 1992; MacLeod, 1991). Schriefers (1993) presented his participants with coloured line drawings and asked them to name the objects by producing a determiner (Det)-adjective (Adj) NP (e.g., ***het*** *groen**e** boek*$_{\text{neu}}$ 'the green book' vs. ***de*** *groen**e** tafel*$_{\text{com}}$ 'the green table', Experiment 1) or a plain adjective NP (e.g., *groen boek*$_{\text{neu}}$ 'green book' vs. *groene tafel*$_{\text{com}}$ 'green table', Experiment 2). Distractor words that were either of the same or different gender as the picture name were presented visually. On the assumption that noun lexical nodes automatically activate their gender information, gender incongruence between target picture and distractor word could delay the selection of the correct gender information if one assumed that selection of gender nodes is a competitive process – the *gender selection interference hypothesis* (GSIH).

Schriefers (1993) obtained faster reaction times in both experiments when target picture and distractor word had the same gender than when they had different genders. Van Berkum (1997), La Heij, Mak, Sander, and Willeboordse (1998), Schiller and Caramazza (2003) as well as Starreveld and La Heij (2004) replicated the gender congruency effect in Dutch. Similar results were obtained in German by Schriefers and Teruel (2000) and Schiller and Caramazza (2003) and in Croatian by Costa, Kovacic, Fedorenko, and Caramazza (2003), but not in Romance languages such as Italian (Miozzo & Caramazza, 1999; Miozzo, Costa, & Caramazza, 2002), Spanish, Catalan (Costa, Sebastián-Gallés, Miozzo, & Caramazza, 1999), and French (Alario & Caramazza, 2002). An overview and account of all of these results can be found in Caramazza, Miozzo, Costa, Schiller, and Alario (2001). Schriefers (1993) interpreted this *gender congruency effect* as reflecting competition in the selection of a word's syntactic features. He argued that the activation of the gender feature of the distractor word interferes with the naming of the picture in those cases where the distractor's gender is different from that of the target noun. This is because two different gender specifications compete for selection in the gender-incongruent condition, whereas only one gender is activated in the gender-congruent condition. The gender congruency effect was absent, however, when nouns were named *without* determiners (La Heij et al., 1998; Starreveld & La Heij, 2004; but see Cubelli, Lotto, Paolieri, Girelli, & Job, 2005). Levelt, Roelofs, and Meyer (1999) interpreted this latter result as follows: When no determiner is needed in speech production, no gender feature is selected. Therefore, there is no gender feature competition in the bare noun naming condition, and hence a gender congruency effect does not occur in such a situation.

Although the method proposed by Schriefers is useful for addressing grammatical feature selection during NP production, the specific locus of the gender effect is not obvious. For instance, the putative gender congruency effect observed in Dutch might in fact be a determiner selection interference effect as noted by Miozzo and Caramazza (1999). In Dutch, the determiner form in an NP can be selected on the basis of the noun's gender alone. The determiner for common gender singular nouns is

de and for neuter gender singular nouns it is ***het*** in *all* contexts (in contrast to Romance languages where the actual form of the determiner often depends on the phonological context of the following word). Once the noun's gender has been selected, its associated determiner form can be immediately selected for production. However, if gender selection were a non-competitive process in Dutch, the locus of the effect could theoretically be at the level of determiner selection and not at the level of gender feature selection. That is, if we assume that determiner form selection is a competitive process, we might expect slower determiner selection when target and distractor nouns have different genders. This is because the activation of a competing determiner (through the activation of the gender of the distractor noun) would interfere with the selection of the target determiner – the *determiner selection interference hypothesis* (DSIH).

The work on gender/determiner congruency is important because it allows the explicit formulation of assumptions about specific aspects of lexical access. Certainly, this is the case with respect to whether grammatical feature selection is a competitive process or whether grammatical features are accessed automatically as part of lexical node selection. Schiller and Caramazza (2003) provided experimental evidence from Dutch (and German) in support of this latter possibility. Dutch distinguishes two genders in the noun system, i.e. common and neuter. In the standard (singular) form, the determiner ***de*** is used for common gender and ***het*** for neuter gender, as for instance in ***de*** *tafel* ('the table', com) or ***het*** *boek* ('the book', neu). In a series of experiments, Schiller and Caramazza (2003) found gender congruency effects in the singular conditions where Dutch (and German) nouns take different determiners, but not in the plural conditions where the determiners are the same for all genders (e.g., ***het*** *boek* 'the book' – ***de*** *boeken* 'the books' and ***de*** *tafel* 'the table' – ***de*** *tafels* 'the tables'). If the gender congruency effect is caused by interference at the level of gender feature selection, we should have observed the effect in the production of both singular and plural NPs. This is because according to the GSIH the interference effect is independent of determiner form properties. However, if the gender congruency effect is caused by interference at the level of determiner selection (DSIH), we should not observe such an effect when the target and the distractor word, independently of whether or not the two nouns have the same gender, require the same determiner form. This latter hypothesis was supported by the results of the Schiller and Caramazza (2003) study.

Further evidence for determiner competition during NP naming came from a study by Janssen and Caramazza (2003). In this study, the authors demonstrated that during the naming of Dutch plural NPs (e.g., ***de*** *boeken* 'the books') the determiner of the singular form (e.g., ***het*** *boek* 'the book') is also activated. This was reflected in longer naming latencies when the singular and plural determiners were not the same (e.g., ***het*** *boek* 'the book' – ***de*** *boeken* 'the books') than when they were the same (e.g., ***de*** *kerk* 'the church' – ***de*** *kerken* 'the churches'). Schriefers, Jescheniak, and Hantsch (2002) replicated this effect in German (see also Schriefers, Jescheniak, & Hantsch, 2005; but see Schiller & Costa, in press). Bare noun (e.g., *boek* 'book' – *boeken* 'books' and *kerk* 'church' – *kerken* 'churches') and quantifier + noun naming (e.g., *een boek* 'one book' – *twee boeken* 'two books' and *een kerk* 'one church' – *twee kerken* 'two churches'), i.e., conditions that do not require the selection of gender-marked determiners, did not show the same competition costs. Therefore, Janssen and Caramazza (2003) argued, 'the selection of the determiner *de* in *de boeken* competes for selection with the determiner *het*, but no such competition occurs in the case of *de kerken*' (p. 640), supporting their interpretation that these results reflect determiner selection processes. In a second experiment Janssen and Caramazza (2003) showed that diminutive NP naming was faster for neuter gender nouns (e.g., ***het*** *boekje* 'the little book') than for common gender nouns (e.g., ***het*** *kerkje* 'the little church') relative to their corresponding base forms (i.e., ***het*** *boek* or ***de*** *kerk*). Interestingly, this effect disappeared when no determiner selection was necessary (bare noun naming) or when the gender-unmarked indefinite determiner was used to name the NPs. The authors interpreted these results as demonstrating that the gender feature of the base noun is visible to the determiner selection process and that the base form of a diminutive noun is active during morphological processing in diminutive NP production in Dutch.

Recently, Spalek and Schriefers (2005) replicated and extended Janssen and Caramazza's (2003) data by demonstrating that the determiner competition effect is modulated by the relative dominance of the morphological forms (standard vs. diminutive). Spalek and Schriefers (2005) used words that occurred dominantly in the diminutive in Dutch (e.g., *lepel* 'spoon' or *blik* 'can') and words that occurred dominantly in the base form (e.g., *fakkel* 'torch' or *paleis* 'palace'). For base-form dominant words they replicate Janssen and Caramazza (2003), i.e., *de*-words were named slower in the diminutive (***het*** *fakkeltje*) than in the base form (***de*** *fakkel*) and for *het*-words the reverse pattern emerged (***het*** *paleis* faster than ***het*** *paleisje*). Moreover, even for diminutive-dominant words there was an interaction between gender and format of the target words reflecting the fact that *het*-words were produced significantly faster than their corresponding base forms but for *de*-words no such difference occurred. Spalek and Schriefers (2005) concluded that 'the form of the interaction for diminutive-dominant items implies that the gender of the base form becomes activated, even in the case of words with a strong diminutive preference' (p. 110).

The investigation of diminutive production in Dutch may also provide another way of disentangling the DSIH and the GSIH. Dutch has the interesting linguistic property that all diminutives take the determiner ***het*** whether or not the base word has neuter gender (e.g., ***het*** *boek* 'the book' – ***het*** *boekje* 'the little book' vs. ***de*** *kerk* 'the church' ***het*** *kerkje* – 'the little church'). Thus, in Dutch, different determiners are selected for common and neuter gender nouns when used in the standard form (***de*** and ***het***), but in the diminutive form always the same determiner is used for both genders (***het***). However, the formulation of specific hypotheses about diminutive production depends on the assumptions made about the representation of diminutives. There are at least two possibilities how to represent diminutives: (a) a whole word representation such as *kerkje* or (b) a separate morpheme representation such as ($kerk_{\mathrm{com}}$)*je*. In the latter representation the gender feature of the base word is visible to the determiner selection process, while in the former it is not. Dutch diminutives are treated as 'neuter' and always take the determiner *het*. That is, there is a strong correlation in Dutch between the grammatical feature 'neuter' and a phonological property of diminutives, i.e. the suffix *–tje* (or predictable allomorphs such as *–je* or *–pje*). Therefore, the gender feature 'neuter' of diminutives can be conceived of as an emergent property from phonological (and semantic) information of the diminutive word form (see Mirković et al., 2005). An explicit connection between the suffix *–tje* and a neuter gender feature is not required.

If (a) were the case, DSIH and GSIH would make the same predictions with respect to a potential gender/determiner congruency effect but the underlying causes of the effects are different. According to the GSIH the gender congruency effect is caused at the level of gender feature selection, i.e., when incongruent gender features such as *common* and *neuter* compete for selection. Therefore, we should observe the effect in the production of both standard (*de* $kerk_{\mathbf{com}}$ – *het* $glas_{\mathbf{neu}}$ 'the glass' vs. *de* $kerk_{\mathbf{com}}$ – *de* $jas_{\mathbf{com}}$ 'the jacket'; the first noun of each pair refers to the target picture name, the second to the printed distractor word) and diminutive (*het* $kerkje_{\mathbf{neu}}$ – *het* $glas_{\mathbf{neu}}$ vs. *het* $kerkje_{\mathbf{neu}}$ – *de* $jas_{\mathbf{com}}$) NPs. The DSIH would make the same prediction but for a different reason. According to the DSIH, gender features are selected automatically in the course of lexical access; the congruency effect occurs due to determiner competition when incongruent determiners compete for selection at the phonological form level. The conditions of determiner mismatch would be the same as those of grammatical feature mismatch both in standard (***de*** $kerk_{\mathrm{com}}$ – ***het*** $glas_{\mathrm{neu}}$ vs. ***de*** $kerk_{\mathrm{com}}$ – ***de*** jas_{com}) and diminutive (***het*** $kerkje_{\mathrm{neu}}$ – ***het*** $glas_{\mathrm{neu}}$ vs. ***het*** $kerkje_{\mathrm{neu}}$ – ***de*** jas_{com}) NP production.

However, data provided by Janssen and Caramazza (2003) and by Spalek and Schriefers (2005) make possibility (a) quite unlikely: Their data suggest that the gender feature (e.g., *common*) and determiner (e.g., *de*) of the base form of a noun (e.g., *kerk*) become activated when its diminutive form (*het kerkje*) needs to be produced (see above). Furthermore, the assumption that diminutives are represented as separate morphemes and that the gender feature of the base word is visible to the determiner selection process is at least plausible for transparently derived diminutives. Transparently derived diminutives are words like *kerkje* ('small church') where the diminutive predominantly expresses a size relation between the base word *kerk* ('church') and its diminutive form. However, there are also diminutives for which this does not hold. In colloquial Dutch, a diminutive form does not necessarily mean that the object being referred to with a diminutive form is physically small, but often there is a connotation of 'cuteness' carried by the diminutive. Examples are *kopje* ('cup'; not 'small cup'), *bloemetje* ('bunch of flowers'; 'small flower' is *bloempje*; Booij, 2002), *flensje* ('thin pancake'; where the base word *flens* ['flange'] has no semantic relationship with the diminutive form), and *meisje* ('girl'; where the base word 'meis' does not exist [anymore] – only the form *meid* ['maid'] occurs in contemporary Dutch). In those opaque diminutives it is at least questionable whether or not the gender of the base word – if available at all – is visible to the determiner selection process. Therefore, the materials used in this study were carefully selected such that only transparently derived diminutives that refer to the (small) size of objects were included. Formally, this was done by making sure that the diminutive form referred primarily to the smaller size of the referent relative to its base form referent and by including only those diminutives, which were of lower frequency of occurrence than their base words.

If (b) were the case, however, GSIH and DSIH would make different predictions. According to the DSIH we should observe a congruency effect when target and distractor word require different determiner forms, independent of whether or not the two nouns have the same gender. This condition is met in the diminutive NP production for common nouns (***het*** *kerk*$_{\text{com}}$*je* – ***de*** *jas*$_{\text{com}}$ vs. ***het*** *kerk*$_{\text{com}}$*je* – ***het*** *glas*$_{\text{neu}}$). The GSIH makes the opposite prediction in this case since congruency effects are accounted for at the level of grammatical feature selection (*het kerk*$_{\textbf{com}}$*je* – *de jas*$_{\textbf{com}}$ vs. *het kerk*$_{\textbf{com}}$*je* – *het glas*$_{\textbf{neu}}$). This latter contrast between the GSIH and the DSIH forms the basis for the research reported here.

Thus, we test complex hypotheses, which combine assumptions about the representation of diminutives with assumptions about the way in which distractor words affect the access of properties required for target NP production. Implicit in the predictions we have derived for the production of standard and diminutive NPs from the two hypotheses under consideration here is the assumption that the processing of a distractor word influences the production system in certain ways. Specifically, it is assumed that the distractor word activates its corresponding lexical node and associated grammatical features in the production network. The general plausibility of this assumption has been confirmed by the studies showing a gender congruency effect in NP production (Costa et al., 2003; La Heij et al., 1998; Schriefers, 1993; Schriefers & Teruel, 2000; Schiller & Caramazza, 2003; Schiller & Costa, in press; Starreveld & La Heij, 2004; Van Berkum, 1997). That is, the gender congruency effect can be taken to indicate that the gender feature of the distractor word is activated in the picture-word interference task when NPs are produced.

EXPERIMENT 1: STANDARD AND DIMINUTIVE NP PRODUCTION IN DUTCH (WITH AUDITORY CUES)

In our first experiment, we attempted to replicate and extend the determiner congruency effect in Dutch with a different linguistic structure in order to provide further evidence that the effect occurs at the level of determiner selection. Native Dutch participants were required to name a set of pictures. Each picture was paired with a gender-congruent distractor word and with a gender-incongruent distractor word. Additionally, we added semantically related and phonologically related distractor words as control conditions to check whether or not distractor words were processed. Pictures appeared as single objects and were preceded by a low (standard condition) or a high tone (diminutive condition). Participants were asked to name the picture with the appropriate determiner in the NP format indicated by the tone, e.g., *de kerk* ('the church') or *het kerkje* ('the small church'). The Det + N naming task is equivalent to the task employed by Costa et al. (1999), La Heij et al. (1998), Miozzo and Caramazza (1999), Schiller and Caramazza (2003), and Schriefers and Teruel (2000). The GSIH and DSIH make different predictions in naming standard and diminutive NPs. The GSIH predicts a gender congruency effect independently of whether production involves standard or diminutive NPs. The DSIH predicts different effects for standard and diminutive NPs. More specifically, this latter hypothesis predicts a three-way interaction between the format of the NP (standard or diminutive), the gender of the target (common or neuter), and the congruency condition between the target gender and the distractor gender (congruent or incongruent).

Method

Participants. Experiment 1 included 28 participants. All participants were native Dutch speakers recruited from the pool of participants of the Max Planck Institute for Psycholinguistics in Nijmegen (mostly students from Nijmegen University in the Netherlands). They were paid for their participation.

Materials. Forty-eight target pictures corresponding to monomorphemic Dutch nouns were selected for naming. The diminutive is extremely productive in Dutch and some forms may already have lexical status (e.g., *een kopje koffie* 'a cup of coffee' and not 'a small cup of coffee' or *een toetje* 'a desert' and not 'a small desert'). There were equally many common and neuter gender picture names (e.g., *de kerk* 'the church', com; *het boek* 'the book', neu). The mean frequency of occurrence per one million word forms was similar for the common and the neuter gender picture names. Each picture was paired with a gender-congruent, a gender-incongruent, a semantically related, and a phonologically related distractor word. The distractor words had similar frequency characteristics as the picture names. Mean length in syllables and segments was matched between the gender-congruent and incongruent distractor words. Gender-congruent and incongruent distractor words were semantically and phonologically unrelated to the picture names. Semantically and phonologically related distractors had the same gender as the target. Therefore, the ratio of gender-congruent to gender-incongruent trials was three to one. This means that the unequal distribution between these two conditions might have an impact on the results. However, this objection was addressed in a study by Schriefers et al. (2002) who obtained similar interaction patterns independent of whether the distribution of grammatical features or the distribution of determiner forms was controlled. Therefore, this argument could be empirically refuted.

The complete list of target pictures and distractor words can be found in Appendix A. Pictures were simple black line drawings of everyday objects presented on a white background. They were taken from the pool of pictures of the Max Planck Institute for Psycholinguistics in Nijmegen. Distractor words were displayed without their determiners in their singular form in black characters (font type and size: Geneva, 30 pts) in or across the object. Pictures appeared in the centre of the screen with the distractor words appearing at slightly different positions around fixation to prevent participants from ignoring the distractors. For an individual picture, however, the position of all four distractor words was the same.

Procedure. Participants were tested individually in a dimly lit testing booth. They sat in front of a computer screen at a viewing distance of approximately 80 cm. The experimenter scored potential errors via headphones in a separate room. The computer screen was a NEC MultiSync M500 monitor. On each trial, a fixation point appeared for 500 ms followed by the picture and the distractor word. After 300 ms, participants heard a tone via headphones indicating whether the target was to be produced in the standard format (low tone) or in the diminutive (high tone). Depending on the tone (low or high) they were required to name the object with the appropriate determiner in the standard or in the diminutive format. Since participants only knew 300 ms *after* target and distractor onset whether a standard or a diminutive NP had to be produced, they could not prepare the appropriate determiner in the diminutive format upon perceiving the pictures. However, 300 ms is long enough to allow them to recognise and process the word.

Participants were instructed to fixate the fixation point and to name the target picture as quickly and as accurately as possible with the appropriate determiner in Dutch. At picture onset, a voice key connected to a microphone was activated to measure the naming latencies. As soon as a response was given and the voice key was triggered, picture and distractor word disappeared from the screen and after a short pause of one second the next trial started. If no response was recorded within 2 s, the next trial started automatically. The Nijmegen Experimental Set-Up (NESU) controlled the presentation of the trial sequences. A response was considered invalid when it exceeded the response deadline of 2 s, when it included a speech error, when a wrong determiner or picture name was produced, or when the voice key was triggered incorrectly. Invalid responses were excluded from the reaction time analyses.

Design. The experiment consisted of three parts. First, participants were engaged in a familiarisation phase. They saw each picture once on the computer screen to become familiarised with the pictures and learn the designated picture names (in case alternative names were preferred by the participants). Each picture appeared on the screen and after 2 s the designated name was added below the picture. Both remained in view until the participants pressed a button. Participants were asked to use the designated name for each picture. After the familiarisation phase, participants received a practice phase during which each picture was presented once as single objects in the centre of the screen preceded by a fixation point. A row of Xs was presented where the distractor word would appear in the naming phase (see below). Participants' task was to name the picture as quickly and as accurately as possible using the appropriate determiner and picture name, e.g., *de kerk* ('the church'). This procedure was adopted to make sure that participants knew the correct determiner for each picture name. After completion of the practice phase, the experimenter corrected participants in case they did not use the designated name for a given picture.

The naming phase began immediately after the practice phase. Stimuli were presented in 4 blocks of 96 trials each (48 items $\times$ 4 conditions $\times$ 2 formats = 384 trials). Target pictures and distractor words appeared at the same time (i.e., the SOA was 0 ms). Twelve times during the naming phase, feedback was given on the screen about the mean naming latencies, which participants were required to write down. This procedure had the purpose of speeding participants up. In each block, each target occurred twice, once accompanied by a low and once by a high tone in different conditions. Blocks were randomised individually for each participant with the following constraints: (a) Before the same object or distractor word was presented again, at least one other object or distractor word appeared in between; (b) targets could have the same format or the same gender on no more than two consecutive trials; (c) the same condition could not appear more than twice in a row. Tones could be of the same type no more than three times in a row. Finally, the order of the blocks was varied across participants. The experiment lasted approximately one hour.

Results

Naming latencies shorter than 350 ms and longer than 1500 ms (4.7% of the data) were counted as outliers. The mean naming latencies and error rates are summarised in Table 1. Analyses of variance were run with Format of Target (standard or diminutive), Gender of Target (common or neuter), and Congruency (gender-congruent vs. gender-incongruent) as independent variables. Separate analyses were carried out with participants (F_1) and items (F_2) as random variables. Variability is reported with 95% confidence intervals (CIs).

Naming latencies. The effect of Format of Target was highly significant, $F_1(1, 27) = 49.61$, $CI = 13.6$ ms, $p < .01$; $F_2(1, 46) = 47.23$, $CI = 9.1$ ms, $p < .01$. Naming latencies to diminutive NPs (578 ms) were 47 ms faster than naming latencies to standard NPs (625 ms). Furthermore, neuter gender targets were named slightly faster (598 ms) than common gender targets (605 ms), but this 7 ms effect of Gender of Target was not significant, $F_1(1, 27) = 2.12$, $CI = 10.1$ ms, *ns*; $F_2(1, 46) < 1$. Gender of Target and Format of Target interacted significantly, $F_1(1, 27) = 16.12$, $CI = 13.3$ ms, $p < .01$; $F_2(1, 46) = 8.37$, $CI = 12.9$ ms, $p < .01$, reflecting the fact that the diminutive form (566 ms) was named 65 ms faster than the standard form (631 ms) for neuter gender targets but the same contrast led only to a 29 ms difference for the common gender targets (591 ms and 620 ms for diminutive and standard forms, respectively).

The effect of Congruency was not significant, $F_1(1, 27) = 3.75$, $CI =$ 8.4 ms, *ns*; $F_2(1, 46) = 2.24$, $CI = 7.8$ ms, n.s. However, Congruency interacted significantly with Format of Target, $F_1(1, 27) = 12.24$, $CI =$ 8.0 ms, $p < .01$; $F_2(1, 46) = 4.20$, $CI = 10.1$ ms, $p < .05$. This interaction is

TABLE 1
Mean naming latencies (in ms) and percentage errors (in parentheses) in Experiment 1 (Dutch Det + Noun naming with auditory cues)

Format of target	*Condition*	*Gender of Target*		*Mean*
		Common	*Neuter*	
Standard		(e.g., de kerk)	(e.g., het boek)	
	Gender-congruent	607 (5.4)	625 (3.1)	616 (4.2)
	Gender-incongruent	632 (5.7)	636 (3.9)	634 (4.8)
	Semantically related	623 (4.8)	637 (3.1)	630 (3.9)
	Phonologically related	600 (6.1)	633 (3.3)	616 (4.7)
	Differences			
	Congruency effect	+25 (+0.3)	+11 (+0.8)	+18 (+0.6)
	Semantic effect	+16 (–0.6)	+12 (0.0)	+14 (–0.3)
	Phonological effect	–7 (+0.7)	+8 (+0.2)	0 (+0.5)
Diminutive		(e.g., het kerkje)	(e.g., het boekje)	
	Gender-congruent	602 (5.1)	556 (1.8)	579 (3.4)
	Gender-incongruent	580 (5.1)	575 (2.2)	578 (3.6)
	Semantically related	615 (6.3)	564 (4.3)	590 (5.3)
	Phonologically related	606 (5.4)	563 (2.7)	585 (4.0)
	Differences			
	Congruency effect	–22 (0.0)	+19 (+0.4)	–1 (+0.2)
	Semantic effect	+13 (+1.2)	+8 (+2.5)	+11 (+1.9)
	Phonological effect	+4 (+0.3)	+7 (+0.9)	+6 (+0.6)

due to an 18 ms gender congruency effect in the standard format, while in the diminutive format there was a 2 ms difference in the reverse direction. Congruency did not interact with Gender of Target, $F_1(1, 27) = 2.71$, $CI =$ 11.7 ms, *ns*; $F_2(1, 46) = 1.31$, $CI = 11.1$ ms, *ns*. Most importantly, however, the three-way interaction between Congruency, Gender of Target, and Format of Target was significant, $F_1(1, 27) = 13.46$, $CI =$ 15.2 ms, $p < .01$; $F_2(1, 46) = 7.05$, $CI = 14.6$ ms, $p < .05$, reflecting the fact that for common gender nouns in the diminutive format the gender-incongruent (but determiner-congruent) condition (580 ms) produced faster naming latencies than the gender-congruent condition (602 ms). In contrast, common gender nouns in the standard format as well as neuter gender nouns in both formats yielded faster naming latencies in the gender-congruent than in the gender-incongruent condition. This interesting three-way interaction is visualised in Figure 1.

The differences between the gender-congruent and the gender-incongruent conditions were assessed by paired *t*-tests. For common gender targets in the standard format (*de kerk*) the 25 ms difference between the gender-congruent (607 ms) and the gender-incongruent

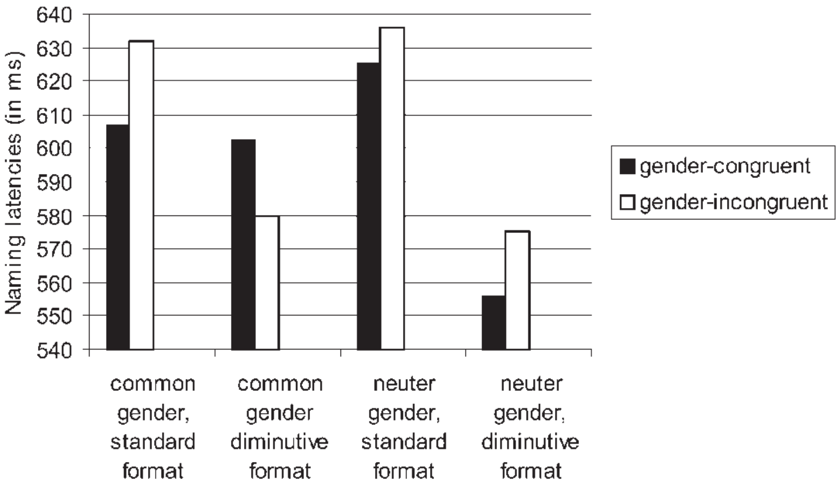

Figure 1. Naming latencies (in ms) for gender-congruent and gender-incongruent conditions in Experiment 1.

condition (632 ms) was significant, $t_1(27) = 3.33, p < .01; t_2(23) = 2.56, p < .05$. In the diminutive format (*het kerkje*) the corresponding 22 ms difference (602 ms vs. 580 ms, respectively) was marginally significant, $t_1(27) = 2.93, p < .01; t_2(23) = 1.80, p = .08$. For neuter gender targets in the standard form (*het boek*) the 11 ms difference between the gender-congruent (625 ms) and the gender-incongruent condition (636 ms) was not significant $t_1(27) = 1.20$, *ns*; $t_2(23) = 1.16$, *ns*. However, in the diminutive format (*het boekje*) the corresponding 19 ms difference (556 ms vs. 575 ms, respectively) was marginally significant, $t_1(27) = 3.42, p < .01$; $t_2(23) = 1.75, p = .09$.

The semantically related condition (610 ms) was produced significantly slower than the gender-congruent condition, $t_1(27) = 2.77$, $SD = 24.75$, $p < .01$; $t_2(47) = 3.02$, $SD = 29.88$, $p < .01$, showing that distractor words were processed and influenced the naming of the target pictures. Phonological relatedness (600 ms) did not have an effect, $t_1(27) < 1$; $t_2(47) = 1.11$, $SD = 26.40$, *ns*, possibly due to the SOA of 0 ms applied in this experiment. Phonological effects were mostly reported for positive SOAs, i.e., the distractor being presented after picture onset (see Schriefers, Meyer, & Levelt, 1990; but see also Starreveld, 2000 and Jescheniak & Schriefers, 2001).

Error rates. The effect of Form of Target was not significant, $F_1(1, 27) = 1.84$, $CI = 0.4\%$, *ns*; $F_2(1, 46) = 2.87$, $CI = 0.2\%$, *ns*. The effect of Target Gender, however, was significant, $F_1(1, 27) = 12.78$, $CI = 0.3\%$,

$p < .01$; $F_2(1, 46) = 15.85$, $CI = 0.3\%$, $p < .01$, reflecting the fact that more errors were made on common gender targets than on neuter gender targets. However, there was no interaction between Form of Target and Target Gender, $F_1(1, 27) < 1$; $F_2(1, 46) < 1$. The effect of Congruency was not significant, either $F_1(1, 27) < 1$; $F_2(1, 46) < 1$, nor did it interact with Form of Target or Target Gender.

Discussion

The results of Experiment 1 are interesting for several reasons. First, the experiment demonstrates that the gender congruency effect is a stable phenomenon in Dutch. Schriefers (1993) obtained the original gender congruency effect in Dutch. More recently, Van Berkum (1997), La Heij et al. (1998), and Schiller and Caramazza (2003) replicated this effect in Dutch. As can be seen in Table 1, the gender congruency effect in the standard format was similar for both genders, as reflected by the absence of an interaction between Gender of Target and Congruency.

Second, our results go beyond earlier results because they show that the gender congruency effect is reversed when pictures with common gender names are named with the appropriate determiner in the diminutive format. Thus, our results support the claim that the putative gender congruency effect may actually be a determiner congruency effect, as suggested by Miozzo and Caramazza (1999) and empirically supported by Schiller and Caramazza (2003). According to this account, the interference effect does not occur in selecting the gender of the target noun but in selecting its appropriate determiner form.

How does the determiner form actually become selected? Lexical representations activate their corresponding determiners via features. According to Alario and Caramazza (2002), activation is collected in a determiner frame. Features of relevance for determiner selection in Dutch are Gender of Target (common or neutral) and Format of Target (standard or diminutive). The features definiteness and number also affect determiner selection in Dutch, but since we did not manipulate these features in the current study, we will not discuss them here. Each activated feature or combination of features in a frame activates a corresponding determiner (see also Spalek & Schriefers, 2005). Specifically, the gender feature *common* activates the determiner *de*, *neuter* activates the determiner *het*, and the feature *diminutive* activates the determiner *het*. The format feature *standard* does not activate a specific determiner as this depends on the gender of the referent. The combination of the features *common* + *standard* activates the determiner *de*, *common* + *diminutive* activates the determiner *het*, as well as *neuter* + *standard* and *neuter* + *diminutive*. Following Spalek and Schriefers (2005), we assume that combination of features weight more in determiner selection than individual features because it is the combination of features that eventually governs the selection of the determiner.

Common gender nouns (e.g., ***de*** *kerk*) activate the determiner *de* by virtue of the features *common* and *common* + *standard*. A gender-congruent distractor word (e.g., ***de*** *jas* 'the jacket') also activates the determiner *de*, whereas a gender-incongruent distractor word (e.g., ***het*** *glas* 'the glass') activates the determiner *het*. This forms the basis of the classic gender/determiner congruency effect. In the diminutive format (e.g., ***het*** *kerkje*), the target activates the determiner *de* by virtue of the feature *common* and to a larger extent the determiner *het* by virtue of the feature *diminutive* and the feature combination *common* + *diminutive*. A gender-congruent distractor word (e.g., ***de*** *jas*), however, activates the determiner *de* via its gender feature *common* and the feature combination *common* + *standard*. In other words, the gender-congruent common gender distractor word becomes determiner-incongruent in this special situation (e.g., target: ***het*** *kerkje*, distractor: ***de*** *jas*). Therefore, before the correct determiner *het* can be selected, relatively more competition between *de* and *het* must be resolved than in the gender-incongruent, but determiner-congruent condition (e.g., target: ***het*** *kerkje*, distractor: ***het*** *glas*), when the distractor word (e.g., ***het*** *glas*) activates the target determiner *het* by virtue of the feature *neuter* and the feature combination *neuter* + *standard*. Therefore, the gender-incongruent, determiner-congruent condition yielded faster naming latencies than the gender-congruent, determiner-incongruent condition. This is exactly what is predicted by the DSIH, but not by the GSIH according to which the effect should have been the reverse of what we found.

Neuter gender nouns (e.g., ***het*** *boek*) similarly activate the determiner *het* through the features *neuter* and *neuter* + *standard*. A gender-congruent word (e.g., ***het*** *glas*) will do the same, while a gender-incongruent distractor word (e.g., ***de*** *jas*) activates the competing determiner de via the feature *common* and the feature combination *common* + *standard*. In the diminutive format (e.g., ***het*** *boekje*), the target activates the determiner *het* by the features *neuter* and *diminutive* as well as by the feature combination *neuter* + *diminutive*. A gender-congruent distractor word (e.g., ***het*** *glas*) will again activate the determiner *het*, while a gender-incongruent distractor word (e.g., ***de*** *jas*) will activate the competing determiner *de*. Therefore, for neuter gender targets, there is no difference in determiner competition between standard and diminutive format, whereas for common gender targets there is.

One might argue, however, that the determiner congruency effect should be larger for diminutives than for standard forms because in the former condition the determiner *het* receives more activation than in the latter. This difference is actually reflected numerically in a (marginally) significant difference between the gender-congruent and the gender-incongruent condition for neuter gender diminutives while the same difference is not significant for neuter gender targets in standard format. However, the interaction between Congruency and Format of Target is not significant for neuter gender targets (both Fs < 1).

The results obtained for Dutch in Experiment 1 do not support the GSIH. Instead, the experimental outcome so far supports the alternative DSIH. However, although the outcome of the experiment was exactly as predicted by the DSIH, it resides on one crucial comparison (common gender nouns with gender-congruent vs. gender-incongruent distractor words in diminutive format). The other conditions (i.e., common gender nouns in standard format and neuter gender nouns in both standard and diminutive format) do not allow us to distinguish between the GSIH and the DSIH because both hypotheses make identical predictions for these conditions. Therefore, it is important to replicate the effect to exclude the possibility that the outcome of Experiment 1 is due to Type I error. In Experiment 2, we set out to replicate the determiner congruency effect in Dutch with a slightly different methodology. Instead of auditory signals (low vs. high tones) that cued participants about the utterance format (standard vs. diminutive NP) we manipulated the relative size of the objects. A relatively large object indicated that a standard NP was to be used (*de kerk* or *het boek*) and a relatively small object indicated that a diminutive NP had to be used (*het kerkje* or *het boekje*).

EXPERIMENT 2: STANDARD AND DIMINUTIVE NP PRODUCTION IN DUTCH (WITH VISUAL CUES)

In this experiment, native Dutch participants were asked to name a set of pictures paired with a gender-congruent and a gender-incongruent distractor word. Pictures appeared as single objects but varied in size: A relatively large picture would indicate that participants should produce a standard Det+N NP, whereas a relatively small picture would indicate that they were required to name the target using a diminutive Det+N NP. Thus, Experiment 2 is a replication of Experiment 1 with a slightly different procedure.

There is, however, one potential problem with Experiment 2. It could be argued that as soon as participants detected that an object was presented in its smaller variant they automatically selected the determiner ***het*** (without further consideration of the target's gender) and started to produce their response. By doing so, the gender-incongruent distractor would not get a chance to interfere with the selection of the picture's name gender specification in the diminutive condition. According to this scenario, there should not be a difference between the gender-congruent and the gender-incongruent condition in the diminutive format. However, if we replicate the outcome of our first experiment, we can be sure that participants processed the distractor words also in the diminutive condition. Furthermore, we again included a semantically related and a phonologically related control condition in order to obtain additional positive evidence that the distractor words are being processed and affect the selection/production of the target noun.

Method

Participants. Nineteen Dutch students from the same population as described for Experiment 1 took part in Experiment 2. All participants were paid for their participation and none of them had also taken part in Experiment 1.

Materials, procedure, and design. Materials, procedure, and design were the same as in Experiment 1 except the NP format was no longer cued by a tone but by a visual cue. Pictures appeared in two sizes, a relatively large one and a relatively small one. A large picture indicated the use of a standard NP such as *de kerk* or *het boek*. A relatively small picture indicated that a diminutive NP was to be used as, for instance, *het kerkje* or *het boekje*. Large pictures fitted into a 12-cm by 12-cm frame, small pictures were no bigger than 5 cm by 5 cm, and participants could easily discriminate between the two picture sizes.

Results

Using the same criteria as in the first experiment 1.3% of the data was counted as outliers. The mean naming latencies and error rates are summarised in Table 2.

Naming latencies. The effect of Format of Target was again highly significant, $F_1(1, 18) = 11.41$, $CI = 16.6$ ms, $p < .01$; $F_2(1, 46) = 39.90$, $CI = 6.2$ ms, $p < .01$. Naming latencies to diminutive NPs (658 ms) were 26 ms faster than naming latencies to standard NPs (684 ms). Furthermore, neuter gender targets were named slightly faster (665 ms) than common gender targets (676 ms), but this 11 ms effect of Gender of Target was not significant, $F_1(1, 18) = 3.99$, $CI = 11.9$ ms, *ns*; $F_2(1, 46) < 1$. Gender of Target and Format of Target did not interact, $F_1(1, 18) < 1$; $F_2(1, 46) < 1$.

The effect of Congruency was significant $F_1(1, 18) = 13.00$, $CI = 6.7$ ms, $p < .01$; $F_2(1, 46) = 4.56$, $CI = 9.0$ ms, $p < .05$. Pictures were named 11 ms faster in the gender-congruent (665 ms) than in the gender-

TABLE 2
Mean naming latencies (in ms) and percentage errors (in parentheses) in Experiment 2 (Dutch Det + Noun naming with visual cues)

Format of target	Condition	Gender of Target		Mean
		Common	*Neuter*	
Standard		(e.g., de kerk)	(e.g., het boek)	
	Gender-congruent	671 (3.9)	674 (4.2)	672 (4.1)
	Gender-incongruent	706 (8.6)	686 (3.5)	696 (6.0)
	Semantically related	691 (5.3)	685 (3.1)	688 (4.2)
	Phonologically related	673 (4.4)	667 (4.6)	670 (4.5)
	Differences			
	Congruency effect	+35 (+4.7)	+12 (–0.7)	+24 (+1.9)
	Semantic effect	+20 (+1.4)	+11 (–1.1)	+16 (+0.1)
	Phonological effect	+2 (+0.5)	–17 (+0.4)	–2 (+0.4)
Diminutive		(e.g., het kerkje)	(e.g., het boekje)	
	Gender-congruent	676 (5.7)	640 (5.3)	658 (5.5)
	Gender-incongruent	654 (5.5)	659 (5.0)	657 (5.3)
	Semantically related	681 (6.8)	654 (6.1)	667 (6.5)
	Phonologically related	654 (7.0)	635 (4.8)	644 (5.9)
	Differences			
	Congruency effect	–22 (–0.2)	+19 (–0.3)	–1 (–0.2)
	Semantic effect	+5 (+1.1)	+14 (+0.8)	+9 (+1.0)
	Phonological effect	–22 (+1.3)	–5 (–0.5)	–14 (+0.4)

incongruent condition (676 ms). Congruency did not interact with Gender of Target $F_1(1, 18) = 2.43$, $CI = 8.4$ ms, *ns*; $F_2(1, 46) < 1$, but the interaction between Congruency and Format of Target was significant, $F_1(1, 18) = 13.09$, $CI = 10.6$ ms, $p < .01$; $F_2(1, 46) = 6.62$, $CI = 9.0$ ms, $p < .05$, reflecting the fact that the gender-congruency effect was 24 ms in the standard format, but 1 ms in the reverse direction when a diminutive NP was produced. Most importantly, the three-way interaction between Condition, Gender of Target, and Format of Target was again significant, $F_1(1, 18) = 17.79$, $CI = 15.8$ ms, $p < .01$; $F_2(1, 46) = 10.34$, $CI = 12.7$ ms, $p < .01$, due to the fact that for common gender nouns in the diminutive format – but not for the other three Congruency conditions the gender-incongruent (but determiner-congruent) condition produced faster naming latencies (654 ms) than the gender-congruent condition (676 ms). This important three-way interaction is visualised again in a graph (see Figure 2).

The differences between the gender-congruent and the gender-incongruent conditions were again assessed by paired *t*-tests. For common gender targets in the standard format (*de kerk*) the 35 ms difference

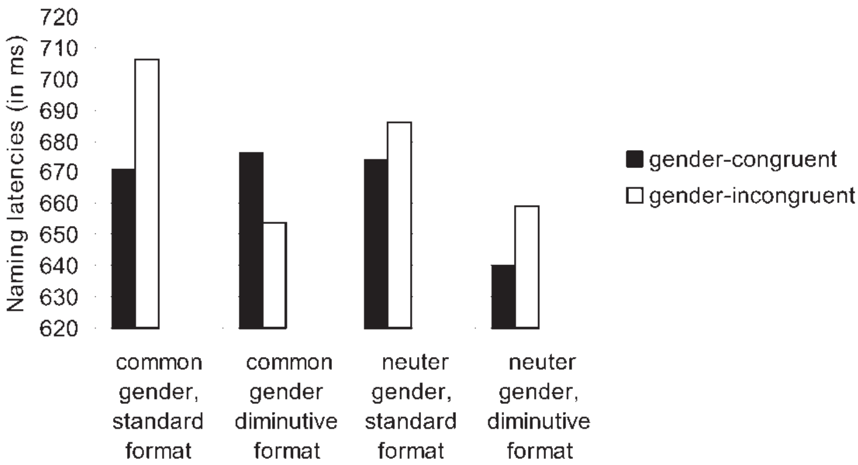

Figure 2. Naming latencies (in ms) for gender-congruent and gender-incongruent conditions in Experiment 2.

between the gender-congruent (671 ms) and the gender-incongruent condition (706 ms) was significant, $t_1(18) = 4.57, p < .01$; $t_2(23) = 2.88, p < .01$. In the diminutive format (*het kerkje*) this difference (22 ms; 676 ms vs. 654 ms, respectively) was marginally significant, $t_1(18) = 4.11, p < .01$; $t_2(23) = 1.91, p = .07$. For neuter gender targets in the standard form (*het boek*) the 12 ms difference between the gender-congruent (674 ms) and the gender-incongruent condition (686 ms) was not significant, $t_1(18) = 1.63$, *ns*; $t_2(23) = 1.20$, *ns.* However, in the diminutive format (*het boekje*) the corresponding 19 ms difference (640 ms vs. 659 ms, respectively) was significant by participants but not by items, $t_1(18) = 3.37, p < .01$; $t_2(23) = 1.51$, *ns.*

The semantically related condition (678 ms) yielded a significant inhibition effect relative to the gender-congruent condition (665 ms); $t_1(18) = 2.73$, $SD = 20.68$, $p < .05$; $t_2(47) = 2.08$, $SD = 41.27$, $p < .05$, demonstrating that distractor words were processed and influenced the naming of the target pictures. The effect of phonological relatedness (657 ms) was again negligible, $t_1(18) = 1.55$, $SD = 22.02$, *ns*; $t_2(47) = 1.21$, $SD = 35.47$, *ns*, possibly due to the same reasons discussed in Experiment 1.

Error rates. The effect of Form of Target was not significant, $F_1(1, 18) = 2.93$, $CI = 0.5\%$, *ns*; $F_2(1, 46) = 3.11$, $CI = 0.2\%$, *ns.* The effect of Target Gender, however, was significant by participants but not by items, $F_1(1, 18) = 4.58$, $CI = 0.4\%$, $p < .05$; $F_2(1, 46) = 1.85$, $CI = 0.4\%$, *ns.* However, there was no interaction between Form of Target and Target Gender,

$F_1(1, 18) < 1$; $F_2(1, 46) < 1$. The effect of Congruency was not significant, either $F_1(1, 18) < 1$; $F_2(1, 46) < 1$, nor did it interact with Form of Target or Gender of Target.

Discussion

The results of Experiment 2 are very similar to those of Experiment 1. The effect of a gender-incongruent distractor word in Dutch only yielded an interference effect when the determiner was also incongruent with the determiner of the target – just as in Experiment 1. However, when the gender-incongruent distractor word had the same determiner as the target, whereas the gender-congruent distractor word had a different determiner, which was the case for common gender nouns in the diminutive format (e.g., ***het*** *kerkje*), the gender congruency effect was reversed. This effect is not in agreement with the GSIH but it was predicted by the DSIH.

In Dutch, there are two different determiners in the standard utterance format, which mark the gender of a noun (i.e., ***de*** for common gender or ***het*** for neuter gender). In the diminutive format, however, there is only one determiner for both genders (i.e., ***het***). If the gender congruency effect obtained in Experiment 2 genuinely reflected competition in selecting gender features, it should have been obtained independently of whether an object is named in the standard or in the diminutive utterance format. However, Experiments 1 and 2 showed that gender-incongruent distractors only yielded a competition effect when the determiners were also incongruent. No gender congruency effect was obtained in naming common gender diminutive NPs where the same determiner is used for both the target and the gender-incongruent distractor. In this condition, a genuine determiner congruency effect occurred. Together with the results obtained in Experiment 1, the outcome of Experiment 2 strongly suggests that the gender congruency effect may be better characterised as a determiner congruency effect as suggested by Miozzo and Caramazza (1999) and Schiller and Caramazza (2003).

GENERAL DISCUSSION

The GSIH (Gender Selection Interference Hypothesis) predicts that a gender congruency effect should be observed irrespective of the type of NP that must be produced, under the assumption that the gender feature of the base word of the diminutive form is specified. In contrast, the DSIH (Determiner Selection Interference Hypothesis) predicts that a gender congruency effect should be obtained only for certain types of NPs – those involving the selection of different determiner forms. Earlier experimental evidence by Schiller and Caramazza (2003) supported the DSIH but not the GSIH. A gender congruency effect was found only for Dutch and

German singular NP production (when different determiners compete for selection) and not for plural NP production (when only one determiner form could be selected). These results suggest that grammatical feature selection is a non-competitive process. That is, grammatical features automatically become available as part of the lexical node selection process (Caramazza et al., 2001). However, if the phonological realisation of grammatical features results in different *lexical forms*, there is interference due to competition at the level of form selection.

The present results are important for at least two reasons: First, they show that the gender/determiner congruency effect is robust. Second, the present results support earlier results by Schiller and Caramazza (2003) and provide additional evidence for the DSIH from Dutch. As we noted earlier, the gender feature *neuter* of diminutives is an emergent property of phonological features of diminutive forms since all diminutives in Dutch end in the suffix *tje* (or predictable allomorphs of –*tje*) (see Mirković et al., 2005). Therefore, it is possible to contrast the GSIH and the DSIH in Dutch. If the GSIH is correct, effects of gender congruency should occur for common gender nouns in standard as well as in diminutive NPs. If, in contrast, the DSIH is correct, common gender nouns should exhibit a gender congruency effect in standard NPs and a reversed gender congruency effect in diminutive NPs. This is exactly what was found in both experiments reported in the present study.

It is important to note that the only possible way to account for the data presented above is by assuming a combination of the DSIH and the hypothesis of a separate (decomposed) representation of diminutives. A decomposed representation of diminutives would, for instance, assume one lexical entry for the noun (e.g., *kerk* 'church'), which is connected to a specific gender node (e.g., *com*). When the diminutive *kerkje* is to be produced, two concepts must be activated: the concept for TABLE and the concept for DIMINUTIVE. These two concepts activate (a) the lexical entry *kerk* (with its gender node *com*) and (b) the lexical entry for diminutive form, i.e., the appropriate allomorph of *tje*. Together these two forms are combined to yield the derived morpheme *kerkje*, i.e., the desired diminutive form. Our data support the view that the gender node *com* of the base word (i.e., *kerk*) is activated and selects its corresponding determiner. The plausibility of a decomposed representation of morphemes is further supported by data from Janssen and Caramazza (2003) as well as Spalek and Schriefers (2005). However, ultimately we will need to carry out further work to more precisely establish how diminutives are represented before a firmer interpretation of our results is possible.

If the DSIH is the correct account of the gender congruency effect observed in Dutch, German (Schiller & Caramazza, 2003; Schiller & Costa, in press), and Croatian (Costa et al., 2003), the effect has a further important implication for theories of speech production. The DSIH implies that the determiner *form* of the distractor word is activated even though the distractor lexical node itself is not selected for production (since it is never produced); otherwise there could not be interference at the level of determiner selection. That is, interference arises because of the following set of events: (1) the distractor noun's gender feature is activated, (2) it sends activation to its determiner form, and (3) the activated form competes for selection with the determiner form activated by the target noun. However, this scenario of how determiner selection interference arises presupposes *cascaded processing of information* from the level where grammatical features are specified to the level of word form encoding. Discrete serial stage models (e.g., Levelt et al., 1999), which claim that only the word forms of the *selected* lexical nodes are encoded, are not compatible with the DSIH. Hence, they cannot account for the pattern of determiner selection interference in NP production in Dutch reported in this study – or for NP production in German (Schiller & Caramazza, 2003; Schiller & Costa, in press) or pronoun production in Croatian (Costa et al., 2003).

In both experiments reported in this study, the determiner interference effect was weakest for neuter gender nouns in the standard utterance format. Although the effect pointed into the expected direction – according to the DSIH – in all conditions in both experiments, the individual differences were not always significant. This may have to do with the fact that the two genders are not equally distributed in Dutch. There are more than twice as many *de*-words than *het*-words in Dutch. This marginal occurrence of *het*-words (relative to *de*-words) may be responsible that *het*-words behave somewhat different from *de*-words. For instance, Van Berkum (1997) only considered *de*-words in his gender congruency experiment. Note, however, that in our experiments reported here, the common gender nouns in the diminutive format formed the most important condition. This crucial condition always behaved as predicted by the DSIH, but not as the GSIH predicts. Also note that diminutive response times were consistently faster than response times to nouns in standard format – contrary to what one would have expected, for instance, on the basis of the word frequencies (diminutive forms were always of lower frequency than their corresponding standard forms). This may have been due to the tone pitch in Experiment 1 or the absolute size of the pictures in Experiment 2, but in any case, it does not compromise our primary conclusion, that these data support the DSIH, but not the GSIH.

One may argue, however, that the present results contradict the results of Schiller and Caramazza (2003) in certain respects. In that study, we claimed that in plural conditions the plural target forces the selection of an

NP frame specifying *plural*. For that reason, neuter gender singular distractors (e.g., *het boek* 'the book') did not show more interference than common gender distractors (e.g., *de tafel* 'the table') – although the latter but not the former did not have the same determiner as the plural targets. This is presumably because all singular distractors receive a plural interpretation (*de boeken/de tafels* – target: *de poezen* 'the cats'), hence leading to determiner congruency. The same argument might be put forward here: In the diminutive condition, an NP frame marked for *diminutive* might be selected, and hence the distractors might receive a diminutive interpretation and consequently neuter gender might get activated independently of the distractor word's original gender. If this were the case, distractors in the diminutive condition would activate the determiner *het* no matter what their original gender was. This should have led to a situation in which no difference should have been visible between the gender-congruent and the gender-incongruent condition for diminutive targets.

However, this is not what we found in our experiment. We did find significant differences in the diminutive condition, which were contingent on whether or not the distractor was gender-congruent with the target. Therefore, it might be the case that no diminutive NP frame is imposed on the determiner selection process by diminutive targets. One reason why an NP frame is imposed in the case of *plural* but not in the case of *diminutive* might be that *plural* is a grammatical feature while *diminutive* is a semantic feature. In some cases, i.e. opaque diminutives, the diminutive derivation process can lead to rather dramatic changes in meaning. Therefore, imposing a diminutive frame might not always be desirable. *Plural*, however, being a grammatical feature, changes the meaning of the base word only minimally and in a predictable way. Although it is beyond the scope of the current study, further research on this topic is needed.

Another reason might be that a *diminutive* and a *plural* frame are qualitatively different: An NP frame marked for plural may just specify N + plural, without specifying the gender of the noun. The whole plural frame would then be assigned the determiner *de*, i.e., the only determiner used in plural NPs in Dutch. One reason for such a frame structure might be that noun plurals are often irregular in Dutch (and especially in German; see Schiller & Caramazza, 2002). Concatenating the base word's singular form with some sort of plural suffix cannot generate irregular plurals. Therefore, activating the base word to form the plural would often be useless. In contrast, diminutive derivation is a rather regular morphophonological computation. Therefore, a diminutive NP frame might not only specify N + diminutive, but it might consist of the actual noun including its gender, e.g., $kerk_{\mathrm{com}}$ + diminutive or $boek_{\mathrm{neu}}$ +

diminutive – at least in the case of transparently derived diminutives (opaque diminutives might not even appear in a diminutive NP frame since their meaning does not include any diminutive semantic features). Since the gender feature would be visible to the determiner selection process in those diminutive NP frames, it might activate its determiner and cause competition in determiner selection. Here, we cannot decide between these two and maybe other possibilities. However, our data show that the gender of the base word in transparently derived diminutives is most likely visible to the determiner selection process either because no diminutive NP frame is selected or because gender is visible in the frame.

In conclusion, this study has produced evidence in support of the hypothesis that grammatical feature selection is an automatic, non-competitive process (Caramazza et al., 2001). Word-specific grammatical features automatically become available as part of the selection of a lexical node. These grammatical features activate their associated form representations when the information cascades down to the level of phonological encoding. However, when two different determiner forms compete for selection, a determiner congruency effect is found – independent of the nouns' genders. Consistent with the DSIH, interference effects from gender-incongruent distractors were reversed in the diminutive format for common gender nouns but not in the standard format. This result suggests that the gender congruency effect first observed by Schriefers (1993) is a misnomer. A more appropriate name for the phenomenon is *determiner congruency effect*. The determiner congruency effect observed in Dutch reflects competition at the level of determiner form selection. Effects of determiner congruency between a target picture name and a distractor word are only found in languages where the selection of the determiner depends on the gender (and number) of the noun alone and thus can occur very early in the NP production process.

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APPENDIX A

Stimulus materials in Experiments 1 and 2

Target picture name		*Gender*	*Distractor word conditions*	
Standard	*Diminutive*		*Gender-congruent*	*Gender-incongruent*
appel ('apple')	appeltje	common	kat ('cat')	lint ('ribbon')
auto ('car')	autootje	common	magneet ('magnet')	podium ('stage')
bezem ('broom')	bezempje	common	sleutel ('key')	stuur ('steering wheel')
bijl ('ax')	bijltje	common	mond ('mouth')	gewei ('antlers')
boom ('tree')	boompje	common	muur ('wall')	kompas ('compass')
dolfijn ('dolphin')	dolfijntje	common	gitaar ('guitar')	graf ('tomb')
draak ('dragon')	draakje	common	vork ('fork')	gras ('grass')
emmer ('bucket')	emmertje	common	muis ('mouse')	tapijt ('carpet')
fakkel ('torch')	fakkeltje	common	zoon ('son')	loket ('counter')
fiets ('bike')	fietsje	common	taart ('cake')	kuiken ('chicken')
hand ('hand')	handje	common	boot ('boat')	vuur ('fire')
harp ('harp')	harpje	common	fles ('bottle')	wiel ('wheel')
jurk ('dress')	jurkje	common	kers ('cherry')	zadel ('saddle')
kerk ('church')	kerje	common	jas ('jacket')	glas ('glas')
klomp ('wooden shoe')	klompje	common	ladder ('ladder')	wapen ('weapon')
koffer ('suitcase')	koffertje	common	helm ('helmet')	ei ('egg')
maan ('moon')	maantje	common	zak ('bag')	touw ('rope')
muts ('cap')	mutsje	common	lamp ('lamp')	rooster ('scheme')
pijp ('pipe')	pijpje	common	hengel ('fishing-rod')	brood ('bread')
raket ('rocket')	raketje	common	pleister ('band aid')	bureau ('desk')
robot ('robot')	robotje	common	staart ('tail')	blad ('leaf')
stoel ('chair')	stoeltje	common	cactus ('cactus')	anker ('anker')
vis ('fish')	visje	common	bank ('bank')	masker ('mask')
wortel ('carrot')	worteltje	common	das ('tie')	gordijn ('curtain')
bad ('bath')	badje	neuter	gewei ('antlers')	mond ('mouth')
been ('leg')	beentje	neuter	kompas ('compass')	muur ('wall')
boek ('book')	boekje	neuter	ei ('egg')	helm ('helmet')
bord ('plate')	bordje	neuter	graf ('tomb')	gitaar ('guitar')
bot ('bone')	botje	neuter	gras ('grass')	vork ('fork')
fornuis ('stove')	fornuisje	neuter	loket ('counter')	zoon ('son')
geweer ('rifle')	geweertje	neuter	kuiken ('chicken')	muis ('mouse')
harnas ('armor')	harnasje	neuter	wiel ('wheel')	fles ('bottle')
hek ('fence')	hekje	neuter	vuur ('fire')	boot ('boat')
kasteel ('castle')	kasteeltje	neuter	podium ('stage')	magneet ('magnet')
konijn ('rabbit')	konijntje	neuter	glas ('glas')	jas ('jacket')
kruis ('cross')	kruisje	neuter	stuur ('steering wheel')	sleutel ('key')
nest ('nest')	nestje	neuter	tapijt ('carpet')	taart ('cake')
oor ('ear')	oortje	neuter	lint ('ribbon')	kat ('cat')
orgel ('organ')	orgeltje	neuter	wapen ('weapon')	ladder ('ladder')
paard ('horse')	paardje	neuter	brood ('bread')	hengel ('fishing-rod')
pak ('suit')	pakje	neuter	zadel ('saddle')	kers ('cherry')
raam ('window')	raampje	neuter	bureau ('desk')	pleister ('band aid')
spook ('ghost')	spookje	neuter	anker ('anker')	cactus ('cactus')
varken ('pig')	varkentje	neuter	masker ('mask')	bank ('bank')
vergiet ('sieve')	vergietje	neuter	touw ('rope')	zak ('bag')
vlot ('raft')	vlotje	neuter	blad ('leaf')	staart ('tail')
web ('web')	webje	neuter	gordijn ('curtain')	das ('tie')
zwaard ('sword')	zwaardje	neuter	rooster ('scheme')	lamp ('lamp')

(continued)

Appendix A

Stimulus materials in Experiments 1 and 2; continued

Target picture name		*Gender*	*Distractor word conditions*	
Standard	*Diminutive*		*Semantically Related*	*Phonologically Related*
appel ('apple')	appeltje	common	peer ('pear')	abdij ('abbey')
auto ('car')	autootje	common	trein ('train')	aula ('auditorium')
bezem ('broom')	bezempje	common	hark ('rake')	beer ('bear')
bijl ('ax')	bijltje	common	zaag ('saw')	bijbel ('bible')
boom ('tree')	boompje	common	plant ('plant')	boog ('bow')
dolfijn ('dolphin')	dolfijntje	common	haai ('shark')	dolk ('dagger')
draak ('dragon')	draakje	common	heks ('witch')	draad ('wire')
emmer ('bucket')	emmertje	common	gieter ('bucket')	engel ('angel')
fakkel ('torch')	fakkeltje	common	kaars ('candle')	fabriek ('factory')
fiets ('bike')	fietsje	common	brommer ('scooter')	finale ('final')
hand ('hand')	handje	common	voet ('foot')	halte ('stop')
harp ('harp')	harpje	common	viool ('violin')	hals ('neck')
jurk ('dress')	jurkje	common	trui ('sweater')	juf ('miss')
kerk ('church')	kerje	common	tempel ('temple')	ketting ('chain')
klomp ('wooden shoe')	klompje	common	laars ('boot')	klok ('clock')
koffer ('suitcase')	koffertje	common	tas ('bag')	koffie ('coffee')
maan ('moon')	maantje	common	ster ('star')	maag ('stomach')
muts ('cap')	mutsje	common	pet ('cap')	mus ('sparrow')
pijp ('pipe')	pijpje	common	sigaar ('cigar')	pijl ('arrow')
raket ('rocket')	raketje	common	tank ('tank')	radijs ('radish')
robot ('robot')	robotje	common	computer ('computer')	rotonde ('rotunda')
stoel ('chair')	stoeltje	common	tafel ('table')	stoep ('pavement')
vis ('fish')	visje	common	eend ('duck')	vinger ('finger')
wortel ('carrot')	worteltje	common	tomaat ('tomato')	wurm ('worm')
bad ('bath')	badje	neuter	toilet ('toilet')	balkon ('balcony')
been ('leg')	beentje	neuter	hoofd ('head')	beest ('animal')
boek ('book')	boekje	neuter	schilderij ('painting')	boeket ('bouquet')
bord ('plate')	bordje	neuter	mes ('knife')	bos ('forest')
bot ('bone')	botje	neuter	skelet ('skeleton')	bont ('fur')
fornuis ('stove')	fornuisje	neuter	servies ('dinner-set')	fossiel ('fossile')
geweer ('rifle')	geweertje	neuter	kanon ('cannon')	gewicht ('weight')
harnas ('armor')	harnasje	neuter	schild ('shield')	hart ('heart')
hek ('fence')	hekje	neuter	gaas ('wire-netting')	hemd ('shirt')
kasteel ('castle')	kasteeltje	neuter	huis ('house')	kado ('gift')
konijn ('rabbit')	konijntje	neuter	schaap ('sheep')	koord ('cord')
kruis ('cross')	kruisje	neuter	vierkant ('square')	kruid ('herb')
nest ('nest')	nestje	neuter	hol ('whole')	net ('net')
oor ('ear')	oortje	neuter	gezicht ('face')	orakel ('oracle')
orgel ('organ')	orgeltje	neuter	klavier ('keyboard')	object ('object')
paard ('horse')	paardje	neuter	hert ('deer')	paleis ('palace')
pak ('suit')	pakje	neuter	vest ('waistcoat')	palet ('palette')
raam ('window')	raampje	neuter	luik ('shutter')	ravijn ('canyon')
spook ('ghost')	spookje	neuter	monster ('monster')	spoor ('track')
varken ('pig')	varkentje	neuter	kalf ('calf')	vat ('barrel')
vergiet ('sieve')	vergietje	neuter	bestek ('cover')	verkeer ('traffic')
vlot ('raft')	vlotje	neuter	schip ('ship')	vlies ('membrane')
web ('web')	webje	neuter	rag ('cobweb')	werk ('work')
zwaard ('sword')	zwaardje	neuter	speer ('spear')	zwijn ('hog')

(continued)

Note to Appendix A. The mean frequency of occurrence per one million word forms of the 48 base words used in this study was 76.0 (according to CELEX; Baayen, Piepenbrock, & Gulikers, 1995). Only 10 diminutive forms of these words were actually listed in CELEX, with a mean frequency of 7.3 per million. The average overall frequency of all diminutives (assuming a frequency of zero for those that were not listed) was 1.5 per million. That means that the difference in frequency of occurrence between base words and diminutives is more than a factor of 50.