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How a question context aids word production: Evidence from the picture–word interference paradigm

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Abstract

Difficulties in saying the right word at the right time arise at least in part because multiple response candidates are simultaneously activated in the speaker's mind. The word selection process has been simulated using the picture–word interference task, in which participants name pictures while ignoring a superimposed written distractor word. However, words are usually produced in context, in the service of achieving a communicative goal. Two experiments addressed the questions whether context influences word production, and if so, how. We embedded the picture–word interference task in a dialogue-like setting, in which participants heard a question and named a picture as an answer to the question while ignoring a superimposed distractor word. The conversational context was either constraining or nonconstraining towards the answer. Manipulating the relationship between the picture name and the distractor, we focused on two core processes of word production: retrieval of semantic representations (Experiment 1) and phonological encoding (Experiment 2). The results of both experiments showed that naming reaction times (RTs) were shorter when preceded by constraining contexts as compared with nonconstraining contexts. Critically, constraining contexts decreased the effect of semantically related distractors but not the effect of phonologically related distractors. This suggests that conversational contexts can help speakers with aspects of the meaning of to-be-produced words, but phonological encoding processes still need to be performed as usual.

Keywords

Conversational context; semantic interference; phonological facilitation; word production

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Speech production is experienced as one of the easiest tasks among all the things we routinely do. People typically speak about 150 words per minute (Maclay & Osgood, 1959), and this rapid speech rate causes the illusion that speech production is effortless. In contrast with this illusion, speaking is not a trivial task but involves a series of complex cognitive processes. One of the critical processes is the selection of words. There is broad consensus among theories of word production (e.g., Dell, 1986; Levelt, Roelofs, & Meyer, 1999; Rapp & Goldrick, 2000) that it consists of at least two essential components: retrieving the meaning of a lexical item from memory (hereafter semantic retrieval) and encoding the corresponding phonological representations (hereafter phonological encoding).

Words are unlikely to be stored in our mind randomly or in the form of a long list, but instead seem to form part of a highly organised and interconnected network (e.g., D. E. Meyer & Schvaneveldt, 1971). When a word (e.g., dog) is activated, other words of similar meaning (e.g., cat) and form (e.g., dot) are also activated. It is assumed that related words are stored closely together or are strongly linked (e.g., Neely, 1977), and thereby activation of one word automatically spreads to its related words.

To investigate the effect of co-activation in word production, researchers often use the picture–word interference task. In this task, participants name pictures of simple objects. In addition, distractor words are presented simultaneously with the target pictures. In a related condition, the distractor words either belong to the same category as

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the target, such as *dog* and *cat*, or sound similarly to the target, such as *bed* and *bell*; in a control condition, the distractor words are unrelated to the target in meaning and sound. It is typically found that, even though participants are instructed to ignore the distractor words, compared with the control condition, their naming reaction times (RTs) are slower in the semantically related condition. This phenomenon is known as the *semantic interference effect* (Glaser & Düngelhoff, 1984). Conversely, naming RTs are faster in the phonologically related condition, a phenomenon known as the *phonological facilitation effect* (e.g., Damian & Martin, 1999; A. S. Meyer & Schriefers, 1991). The semantic interference effect is often explained to be due to stronger lexical competition at the lexical selection phase (e.g., Roelofs, 2003) or a harder response-exclusion process at the post-lexical phase in the semantically related condition than in the unrelated condition (e.g., Finkbeiner & Caramazza, 2006; Mahon, Costa, Peterson, Vargas, & Caramazza, 2007). The common explanation of the phonological facilitation effect is that the phonologically related distractor activates a cohort of words, including the target which partly shares the phonological representations, and therefore speeds up phonological encoding of the target.

Although the picture–word interference paradigm has been used to investigate the complex processes involved in word production for many years, most studies ask participants to name pictures without any context. In real life, especially in conversations, we rarely produce single words out of context. Eventually, a comprehensive theory of word production should incorporate influences of communicative context on word production during speaking. One likely reason this issue remains largely unaddressed is that it is difficult to control the content of participants' speech in communicative settings. The present study extends the earlier laboratory work by embedding the picture–word interference task in a controlled but more dialogue-like setting, namely, by using the picture to elicit an answer to an auditorily presented question.

An important way in which context could play a role in word production is that it may facilitate word activation and selection by activating relevant concepts or words, or by restricting the range of concepts and words that are likely to be expressed. Facilitatory effects are well known from language comprehension studies, in which it has been found that comprehension is easier when words are highly possible continuations of a given sentence (e.g., Fischler & Bloom, 1979). This may be due to ease of integration, or even due to prediction, as there is now evidence for pre-activation of the meaning and identity of upcoming words by constraining contexts (e.g., DeLong, Urbach, & Kutas, 2005; Federmeier & Kutas, 1999; Szewczyk & Schriefers, 2013; Van Berkum, Brown, Zwitserlood, Kooijman, & Hagoort, 2005; Wicha, Bates, Moreno, & Kutas, 2003; Wicha, Moreno, & Kutas, 2003, 2004). Constraining sentence contexts can also facilitate the naming of predictable objects (Griffin & Bock, 1998), and such sentence contexts can modulate brain activity prior to object onset (Piai, Roelofs, & Maris, 2014; Piai, Roelofs, Rommers, & Maris, 2015).

Although the findings from comprehension studies suggest the impact of context on word retrieval, it is unclear at what levels of representation or processing constraining contexts influence language production; more specifically, whether context can facilitate semantic retrieval and/or phonological encoding. Existing evidence indicates that context affects eventual selection of the word produced (e.g., Brennan & Clark, 1996; Van der Wege, 2009); however, less work has investigated the activation processes preceding selection and the specific semantic and phonological levels involved. A few picture–word interference studies investigated alternative picture names that can be activated even if they were not actually produced (e.g., the basic-level name "bird" when naming a picture of a duck). Whether a naming request provides a constraining context (e.g., "name the bird") or not ("name the object") seemed to have no influence on the phonological activation of such alternative picture names (Jescheniak et al., 2017; see also Jescheniak, Hantsch, & Schriefers, 2005). This suggests that the phonology of the alternative name was activated despite being pragmatically inappropriate in the context (when asked to "name the bird," one would not say "bird"). At the same time, this leaves open how context influences semantic retrieval and phonological encoding of the produced target words.

Here, we carried out two experiments where we embedded picture naming in a dialogue-like setting to simulate language production in conversation. Participants heard a question before they named each picture. The question was either tightly or loosely linked to the picture name. The questions served as context in the present study, and the relationship between the questions and the picture names was varied to manipulate the degree of constraint. For example, for the picture name *banana*, the strongly linked question was "what did the monkey eat yesterday?" and the loosely linked question was "what did the men buy yesterday?"

Although sentence completion tasks were often used in previous studies to examine the impact of context on language production, the task used in the present study can be considered somewhat more realistic because speakers likely answer questions more often than they finish other people's sentences. The ease of semantic retrieval and phonological encoding was manipulated in separate experiments.

In Experiment 1, target pictures were accompanied by semantically related or unrelated distractors, and in Experiment 2, target pictures were accompanied by phonologically related or unrelated distractors. We investigated whether the degree of contextual constraint could modulate the semantic interference effect in Experiment 1 and the phonological facilitation effect in Experiment 2. In both experiments, we expected to find a facilitatory effect of constraining contexts on naming RTs. Furthermore, if contexts have an impact on both semantic and phonological processing in speaking, we should find that both the semantic and phonological effects are more influenced by the tightly linked questions (hereafter constraining context) than by the loosely linked questions (hereafter nonconstraining context); if not, we should see independent effects of the semantic or phonological effects and of contextual constraint.

Figure 1. Example stimuli for the semantically related (left) and unrelated (right) distractors (target: *paraplu* [umbrella]; semantically related distractor: *regenjas* [raincoat]; unrelated distractor: *teddybeer* [teddy bear]).

Experiment 1

Method

Participants. The experiment was carried out with 32 native speakers of Dutch (eight men, *M* age = 22 years, range = 18–28 years). The participants of both experiments in the present study were recruited from the participant pool of the Max Planck Institute for Psycholinguistics, Nijmegen. All participants had normal or corrected-to-normal vision. They were paid €8 for their participation. All participants provided informed consent before the experiment. Both experiments were approved by the ethics board of the faculty of Social Sciences of the Radboud University.

Materials and design. The materials consisted of 192 pre-recorded questions (*M* length = 1,859 ms, *SD* = 413 ms), 96 distractor words, and 96 line-drawings of common objects adopted from the Snodgrass and Vanderwart (1980) corpus and the Druks and Masterson (2000) corpus (all stimuli are listed in the Supplementary Material). The average word length of the picture names was 1.60 syllables (*SD* = 0.84). The average log-word-form frequency obtained from the SUBTLEX-NL database was 2.75 (*SD* = 0.66; Keuleers, Brysbaert, & New, 2010), and the average age of acquisition was 6.99 years (*SD* = 2.03 years; Ruts et al., 2004). All line-drawings fitted into a virtual frame of 4 cm × 4 cm (2.29° of visual angle) and were shown on a white background in the centre of the computer screen. The distractors were superimposed in the centre of the pictures and presented in black in lowercase Arial font at a size of 26 points. The picture and distractor were presented simultaneously.

The 96 pictures were combined with semantically related and unrelated distractors, and with constraining and nonconstraining questions. The semantically related distractors were from the same semantic category as the picture names. For the unrelated condition, the same distractors were recombined with the pictures into semantically unrelated pairs (see Figure 1). Targets and distractors did not share onset consonants or rhymes. Each picture was presented 4 times, and each distractor and each sentence were presented 2 times. This led to a total of 384 trials. The order of the trials was pseudo-randomised, such that consecutive pictures were not semantically or phonologically related and the same questions or distractors did not appear in succession. Moreover, the strongly constraining questions were equally often presented for the first time with semantically related and unrelated distractors (48 times each). Four pseudo-randomised lists were created, and each list was presented to eight participants.

We created simple quiz questions that were either semantically strongly (constraining) or loosely (nonconstraining) linked to the targets. To ensure that the constraining questions were more semantically related to the target words than the nonconstraining questions, 16 native speakers of Dutch were given a rating task. In this rating task, participants were asked to rate how semantically related the answers were to the questions on a 5-point Likert-type scale, for example, *Wat verlicht de hoek van de kamer? Een lamp*[1] (What illuminates the corner of the room? A lamp). A rating of 1 indicated that the answer was unrelated, and a rating of 5 meant the answer was closely related. Each question was combined with the target and the semantically related and unrelated distractors. The average rating of the targets was higher for the constraining questions (*M* = 4.74, *SD* = 0.59) than for the nonconstraining questions (*M* = 3.02, *SD* = 1.08). Similarly, the average ratings of the related distractors were higher for the constraining questions (*M* = 3.52, *SD* = 1.31) than for the nonconstraining questions (*M* = 2.76, *SD* = 1.13). The average ratings of the unrelated distractors were lower for the constraining questions (*M* = 1.17, *SD* = 0.50) than for the nonconstraining questions (*M* = 1.93, *SD* = 1.04; suggesting a narrower set of answers was acceptable in response to the constraining questions). In addition, for constraining questions, the average ratings of the targets were higher than those of related distractors. *t* tests confirmed all rating differences between constraining and nonconstraining questions (*t*s > 6.73).

Procedure. Participants were tested individually. Participants familiarised themselves with the pictures and their names before starting the actual experiment. After the familiarisation phase, the participants took part in the picture–word interference task. On each trial, a pre-recorded question was first presented via a Sennheiser headphone. After a blank interval of 300 ms, the singular indefinite article "een" (a/an) was presented for 300 ms, and after a blank interval of 500 ms, a picture and a superimposed distractor were presented until the participants responded or for a maximum of 1,500 ms. The inter-trial interval was 1,500 ms. Every response was recorded in a 3-s .wav file.

Data analyses. Naming responses were categorised as errors when participants used different names from those given in the picture booklet or when the response included a repair or disfluency or started with a filled pause (e.g., "um"). Naming reaction times (RT) longer than 2,000 ms were categorised as outliers (0.23% of the data). Errors and outliers were excluded from the RT analyses.

Naming RTs were submitted to linear mixed-effects model analyses using the software package lme4 (Version 3.2.0; Bates, 2005) implemented in R.[2] As the distribution of naming RTs was right-skewed, RTs on correct trials were log-transformed and then fit using a linear model. The fixed factors were context type (constraining, nonconstraining; coded as −0.5 and 0.5, respectively) and distractor type (related: −0.5, unrelated: 0.5). The random factors were random intercepts by participants and pictures and random slopes for context type, distractor type, and their interaction by participants (the maximal random effects structure warranted by the design; Barr, Levy, Scheepers, & Tily, 2013). The significance of each fixed effect was assessed by comparing the model with a model that did not include the fixed effect of interest but was otherwise identical, using a likelihood ratio test.

Apparatus. This and the following experiment were controlled by the Presentation® software package (Version 14.3, www.neurobs.com). Naming RTs were manually coded using the speech analysis program Praat (Boersma, 2001).

Results and discussion

Table 1 shows the average error rates and average naming RTs in different conditions in Experiment 1. Due to the small number of errors for each participant in each condition (on average four errors out of 96 trials), we did not perform statistical tests on error rates. The naming RTs were shorter in the constraining context than in the nonconstraining context, $\beta = .06$, $SE = 0.004$, $t = 14.69$, $p < .001$. There was no main effect of distractor type, $\beta = -.004$, $SE = 0.003$, $t = -1.07$. However, there was an interaction between context type and distractor type, $\beta = -.015$, $SE = 0.007$, $t = -2.01$, $p = .039$. Separating by context revealed that there was a semantic interference effect in nonconstraining contexts, $\beta = -.012$, $SE = 0.004$, $t = -3.00$, $p = .003$, but not in constraining contexts, $\beta = .004$, $SE = 0.006$, $t = 0.57$, $p = .57$.

To sum up, in Experiment 1, we replicated the typical semantic interference effect that participants need more time to name pictures when viewing semantically related distractors than when viewing unrelated distractors. The magnitude of the semantic interference effect size in the nonconstraining context was similar to that reported by our previous studies where a similar set of stimuli was used (e.g., 34 ms in Shao, Roelofs, Martin, & Meyer, 2015; and 39 ms in Shao, Meyer, & Roelofs, 2013). Moreover, consistent with findings from previous studies using a similar paradigm (e.g., Griffin & Bock, 1998; Piai et al., 2015), we found that participants responded faster in the constraining contexts than in the nonconstraining contexts (a context facilitation effect).

As mentioned in the Introduction, the main goal of the present study was to examine how context influences word retrieval during speaking. In Experiment 1, we focused on how contexts influence semantic retrieval during word production. Evidence from language comprehension studies shows that constraining contexts can help readers and listeners process and even anticipate aspects of the semantics of upcoming words (e.g., Altmann & Kamide, 1999; Federmeier & Kutas, 1999; Szewczyk & Schriefers, 2013). If conversational contexts have a similar effect, and these contexts influence both language production and comprehension, one would expect the semantic interference effect to be smaller in constraining contexts than in nonconstraining contexts (Experiment 1). Our results support this hypothesis, suggesting that the constraining contexts can benefit retrieval of the target words. Furthermore, the interaction between context and distractor type suggests that the semantic facilitation and context effects are not additive but rather interactive. This suggests that conversational contexts can influence semantic retrieval in speaking. Interestingly, the semantic interference effect was not only reduced but essentially vanished in the constraining contexts. It is possible that

Table 1. Mean naming response time (in milliseconds) per sentence context and distractor condition for Experiment 1, with by-subjects standard deviation in parentheses and the 95% CI in brackets.

Context condition	Related distractor	Unrelated distractor	Distractor effect
Constraining	600 (114)	587 (109)	+13 [4, 22]
Nonconstraining	816 (99)	779 (84)	+37 [24, 51]
Context effect	−216 [−196, −237]	−192 [−169, −215]	

CI: confidence interval; RTs: reaction times. The CIs are based on mean RTs averaged by participants for interpretability, and thus they may not align with the LMER estimates based on log RTs.

Table 2. Error rate per sentence context and distractor condition for Experiment 1, with by-subjects standard deviation in parentheses.

Context condition	Related distractor	Unrelated distractor	Distractor effect
Constraining	4% (4%)	3% (3%)	+1%
Nonconstraining	5% (4%)	4% (3%)	+1%
Context effect	−1%	−1%	

constraining contexts can enhance the activation of semantic representations of the target words to such an extent that distractors can no longer interfere. Future studies are needed to replicate this finding and further understand how contexts can modulate the semantic interference effect.

Experiment 2

In Experiment 1, we found that constraining contexts can facilitate semantic retrieval of the target words during word production. The following question we asked is whether the degree of contextual constraint can also influence the encoding of phonological forms of the to-be-produced words. It has been proposed that speakers plan their own and interlocutor's words at grammatical, semantic, and phonological levels (Pickering & Garrod, 2013). On one hand, specific upcoming words can be predicted during comprehension (e.g., DeLong et al., 2005; Laszlo & Federmeier, 2009; Van Berkum et al., 2005; Wicha, Bates, et al., 2003; Wicha, Moreno, & Kutas, 2003; Wicha et al., 2004), and this can elicit phonological effects prior to hearing the word (Ito, Pickering, & Corley, 2018). On the other hand, it is unclear whether pre-activation activates the same phonological forms that are used in language production. In one of the few studies to investigate this issue, Drake and Corley (2015) combined strongly constraining sentence contexts with picture naming. Sentence-final predictable words were phonologically related or unrelated to the names of presented pictures. No phonological facilitation effect was observed.

To examine whether conversational contexts can help speakers plan the phonological forms of their speech, we carried out a new experiment using the same design as in Experiment 1, except that pictures were presented together with phonologically related distractors instead of semantically related distractors. In nonconstraining contexts, we expected to replicate the phonological facilitation effect reported in previous studies. In addition, if the degree of contextual constraint can influence phonological encoding during word production, an interaction between context and distractor type should be observed, such that the phonological facilitation effect is reduced in constraining contexts.

Method

Participants. The experiment was carried out with 32 native speakers of Dutch (six men, *M* age = 25 years, range = 18–69 years). All participants had normal or corrected-to-normal vision. They were paid €8 for their participation, and they provided informed consent before the experiment.

Materials and design. The materials consisted of 236 prerecorded questions (*M* length = 1,934 ms, *SD* = 444 ms), 118 distractor words, and 118 line-drawings of common objects adopted from the Snodgrass and Vanderwart (1980) corpus and the Druks and Masterson (2000) corpus. Among the stimuli, 192 out of 236 questions and 96 out of 118 pictures were also used in Experiment 1 (see Supplementary Material for all stimuli). The average word length of the picture names was 1.63 syllables (*SD* = 0.85). The average log-transformed word frequency in the SUBTLEX-NL database was 2.82 (*SD* = 0.73), and the average age of acquisition was 7 years (*SD* = 2 years) (Ghyselinck, Lewis, & Brysbaert, 2004). All line-drawings fitted into a virtual frame of 4 cm × 4 cm (2.29° of visual angle) and were shown on a white background in the centre of the computer screen. The distractors were superimposed in the centre of the pictures and presented in black in lowercase with Arial font at a size of 26 points. The picture and distractor were presented simultaneously.

In total, 118 pictures were combined with phonologically related and unrelated distractors, and with highly constraining and nonconstraining questions, which led to a total of 472 trials. As in Experiment 1, the strongly constraining and nonconstraining sentences were equally often presented for the first time with phonologically related and unrelated distractors (59 times each). The phonologically related distractors and picture names shared at least the onset consonant(s), and the unrelated distractors did not have any phonological overlap with the target names (see Figure 2). In the unrelated condition, the same distractors were recombined with the pictures to create unrelated pairs, avoiding semantic relationships between picture names and distractors. The order of the trials was pseudo-randomised, such that consecutive pictures were not semantically or phonologically related and the same question or distractor did not appear in succession. Four pseudo-randomised lists were created.

To ensure that the constraining questions were more related to the target words than the nonconstraining questions were, 16 native speakers of Dutch (who did not participate in the main experiment) were given a rating task. Each question was followed by the target, phonologically related and unrelated distractors. The ratings of the targets were higher for the constraining questions (M=4.63, SD=0.93) than for the nonconstraining questions (M=3.24, SD=1.33), $t(117)=19.85$, $p<.001$. In addition, the ratings of the distractors for the constraining questions (M=1.13, SD=0.55) were lower than the ratings of the distractors for the nonconstraining questions (M=1.46, SD=0.88), $t(117)=-7.47$, $p<.001$.

Procedure, data analyses, and apparatus. The design, procedure, data analyses, and apparatus were the same as in Experiment 1.[3]

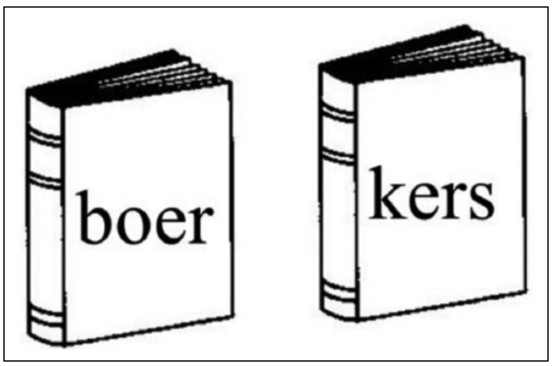

Figure 2. Example stimuli for the phonologically related (left) and unrelated (right) distractors (target: *boek* [book], distracters: *boer* [farmer], *kers* [cherry]).

Results and discussion

Table 2 shows the average error rates and naming RTs in each condition. As in Experiment 1, the error rates were not analysed because of the small number of errors in each condition (on average four errors out of 118 trials). We excluded naming RTs longer than 2,000 ms (0.39% of the data). The remaining naming RTs were log-transformed and submitted to linear mixed-effects modelling analyses. Naming RTs were shorter in the constraining context than in the nonconstraining context, $\beta=.226$, $SE=0.020$, $t=10.89$, $p<.001$, and naming RTs were shorter in the phonologically related condition than in the unrelated condition, $\beta=.019$, $SE=0.005$, $t=3.62$, $p<.001$. No interaction between context and distractor type was observed ($\beta=-.002$, $SE=0.008$, $t=-0.29$), providing no evidence for the phonological facilitation effect being modulated by the degree of contextual constraint. The magnitudes of the phonological facilitation effect size in the nonconstraining contexts (30 ms) and the constraining contexts (31 ms) were similar to those observed in previous studies which used auditory distractors instead of written distractors (e.g., 29 ms in Damian & Bowers, 2003; and 40 ms in A. S. Meyer & Schriefers, 1991). Note that the set of items was slightly different from those in Experiment 1. However, within the subset of items that was also used in Experiment 1, the same pattern of results was observed, including the Context effect, $\beta=.222$, $SE=0.022$, $t=9.94$, $p<.001$; the Distractor effect, $\beta=.019$, $SE=0.007$, $t=2.96$, $p=.004$; and the lack of evidence for an interaction, $\beta=.000$, $SE=0.010$, $t=0.05$ (see Tables 3 and 4).

In Experiment 2, we found the phonological facilitation effect: The presence of phonologically related distractors facilitated picture naming RTs. Moreover, we replicated the context facilitation effect found in Experiment 1: Participants responded faster after they heard the constraining questions than after the nonconstraining questions. Importantly, there was no interaction between context and phonological distractor type on the mean naming RT, suggesting that phonological forms were not primed by the conversational contexts.

We used written distractors to keep the design of Experiment 1 and Experiment 2 consistent, although in most previous studies, auditory distractors instead of

Table 3. Mean naming response time (in milliseconds) per condition for Experiment 2, with by-subjects standard deviation in parentheses and the 95% CI in brackets.

Context condition	Related distractor	Unrelated distractor	Distractor effect
Constraining	516 (143)	548 (171)	−31 [−13, −50]
Nonconstraining	752 (113)	781 (119)	−30 [−15, −45]
Context effect	−235 [−206, −264]	−233 [−201, −266]	

CI: confidence interval; RTs: reaction times. The CIs are based on untransformed RTs averaged by participants for interpretability, and thus they may not align with the LMER estimates based on log RTs.

Table 4. Error rate per condition for Experiment 2, with by-subjects standard deviation in parentheses.

Context condition	Related distractor	Unrelated distractor	Distractor effect
Constraining	3% (4%)	3% (3%)	0
Nonconstraining	4% (3%)	5% (4%)	−1%
Context effect	−1%	−2%	

written distractors were used to examine the phonological facilitation effect (e.g., Jescheniak et al., 2005; Jescheniak et al., 2017; A. S. Meyer & Schriefers, 1991). This means that the phonological effect might be confounded with orthography (see Damian & Martin, 1999, for further discussion). Although the written distractors help make the results of the two experiments comparable, and we prefer the phonological interpretation, it is difficult to distinguish phonology from orthography in the current materials because Dutch has a relatively transparent orthography.

General discussion

The picture–word interference paradigm is a major workhorse in language production research and has successfully revealed many aspects of the architecture and processes underlying the complex task of word production. The present study asked to what extent the core semantic interference and phonological facilitation effects, which are often observed in the picture–word interference paradigm, can still be obtained when the paradigm is extended to a strictly controlled but more dialogue-like setting.

In two experiments, we embedded the picture–word interference task in a setting where before naming pictures, participants first heard questions that were either strongly or loosely linked to the names of pictures. In addition, we manipulated the ease of semantic retrieval (in Experiment 1) and phonological encoding (in Experiment 2) of the picture name to examine how context influences two essential components of word production.

First, we replicated the typical semantic interference effect in Experiment 1 and the phonological facilitation effect in Experiment 2. In addition, both experiments revealed a contextual facilitation effect where the constraining contexts facilitated picture naming. Most importantly, the semantic interference effect was reduced in the constraining context compared with the nonconstraining context. Using a continuous naming paradigm, Kleinman, Runnqvist, and Ferreira (2015) also found that constraining sentence contexts facilitated picture naming (relative to bare picture naming), but the cumulative semantic interference effect was not affected by the contexts. Taken together, this suggests that while constraining contexts can have immediate effects (as in the present study), there are limited downstream consequences on word production in later trials.

Regarding phonological encoding, the results of Experiment 2 show that the phonological facilitation effect was unaffected by the conversational contexts. The lack of an interaction between phonological and context effects is in line with a recent study showing no phonological facilitation in naming pictures with names that were phonologically related to predictable words (Drake & Corley, 2015). They are also in line with studies with a different context setting (Jescheniak et al., 2005; Jescheniak et al., 2017) where phonological effects were also not influenced by the context. Thus, combined with previous findings, the results of the present study suggest that the degree of contextual constraint has an impact on semantic but not phonological processes during word production.

One could argue that the pattern of semantic effects, but no phonological effects, is related to the fact that the contexts were biasing at a semantic level, but perhaps did not bias speakers towards a specific phonological form. Future studies could consider using purely phonologically biasing contexts to increase the chances of finding a phonological effect, such as rhyming materials, which would form a stricter test of whether context never affects phonological encoding. In addition, one may wonder where exactly the semantic effects of contextual constraint originate from. We remain agnostic as to whether the picture name was activated by the question as a whole or by an association between the picture name and the particular key word(s) in the question, and on whether or not a predictive process was involved (given that we do not have an independent online measure of prediction). In the paradigm employed here, it is difficult to distinguish between prediction during comprehension of the question context and semantic retrieval underlying word production, especially in light of the hypothesis that prediction reflects covert production (e.g., Chang, Dell, & Bock, 2006; Federmeier, 2007; Pickering & Garrod, 2013).

Overall, it appears that, like sentence contexts, conversational contexts that fit with certain kinds of answers can substantially facilitate semantic processing during speaking. Obviously, further steps are needed to study these processes in actual dialogue settings, as this paradigm did not capture access to the rich knowledge, common ground, and experience necessary in conversational settings. Regarding phonological encoding, the story is different: Even in a supportive context, speakers still need to retrieve and encode phonological forms as usual. Models of language production should take into account these differential contextual influences on semantic and phonological processes during speech planning.

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Supplementary material

The Supplementary Material is available at qjep.sagepub.com

Notes

1. The indefinite article was presented before the picture to have a more natural question–answer sequence (which also further constrains towards the singular form of the target nouns).
2. We also ran by-subject and by-item analyses of variance (ANOVAs) with the raw naming reaction times (RTs) as suggested by an anonymous reviewer. Results showed a main effect of context type, $F_1(1, 31)=413.09$, $p<.001$, $F_2(1, 95)=398.27$, $p<.001$; a main effect of distractor type, $F_1(1, 31)=31.04$, $p<.001$, $F_2(1, 95)=12.92$, $p=.001$; and an interaction between the context type and distractor type, $F_1(1, 31)=9.87$, $p=.004$, $F_2(1, 95)=5.19$, $p=.025$.
3. We also ran by-subject and by-item ANOVAs with the raw naming RTs. Results showed a main effect of context type, $F_1(1, 31)=280.54$, $p<.001$, $F_2(1, 117)=408.55$, $p<.001$, and a main effect of distractor type, $F_1(1, 31)=21.90$, $p<.001$, $F_2(1, 117)=28.13$, $p<.001$, but no interaction between the context type and distractor type, $F_1(1, 31)=0.02$, $p=.88$, $F_2(1, 117)=0.14$, $p=.71$.

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