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Context Effects on Lexical Choice and Lexical Activation

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Speakers are regularly confronted with the choice among lexical alternatives when referring to objects, including basic-level names (e.g., *car*) and subordinate-level names (e.g., *Beetle*). Which of these names is eventually selected often depends on contextual factors. The present article reports a series of picture–word interference experiments that explored how the designated target name (basic level vs. subordinate level) and contextual constraints rendering the name alternative either appropriate or inappropriate affect lexical activation and lexical choice. The experimental data demonstrate clear context effects on the eventual lexical choice. However, they also show that alternative nonselected object names are phonologically activated, even if a constraining context makes these alternative names currently inappropriate.

Keywords: speech production, lexical access, context effects

How shall a thing be called? In his classical 1958 article, Roger Brown started out with the simple observation that every referent has, of course, many names. For example, faced with a particular type of Volkswagen, a speaker might call it a “vehicle,” a “car,” or a “Beetle.” That is, a speaker can refer to a given entity at different levels of specificity. There is quite some research on the factors determining the choice between such alternative names for a given entity, and we provide a selective overview below. However, so far, no study has addressed the consequences of such choices for the lexical activation of nonselected alternative names. In the present article, we address this latter issue, focusing on two core questions. The first question is whether nonselected name alternatives are lexically activated and whether this activation percolates to the lexical phonological level. The second question is whether the activation of the alternative name is modulated by the context. That is, does a constraining context rendering the name alternative inappropriate prevent lexical activation of name alternatives to occur whereas a nonconstraining context does not? These questions have received relatively little attention thus far in the literature. But, as we argue below, answers to these questions have important implications for the evaluation of competing models of lexical access in speech production and also are relevant to models of categorization.

Naming Objects at Different Levels of Specificity

When referring to a certain object, speakers need to choose among a set of more or less specific names, many of which bear a hierarchical relation to each other. However, not all of these name alternatives are used equally often. Brown (1958) pointed out that parents talking to their children prefer an intermediate level of specificity. Rosch, Mervis, Gray, Johnson, and Boyes-Braem (1976) called this level the basic level. They observed that, in a neutral context, most objects were named most frequently and fastest with their basic-level names (e.g., *car*, *bird*, *tree*, etc.). However, as Jolicoeur, Gluck, and Kosslyn (1984) pointed out, this does not hold for all objects alike, and also, the *vehicle/car/Beetle* example (mentioned above) makes an exception here. In particular, special and/or atypical members of a category (e.g., a Beetle as an instance of the category *car*, or a chicken as an instance of the category *bird*) are often named faster with a subordinate-level term (e.g., *Beetle*) than with a basic-level term (e.g., *car*). To account for this fact, the authors introduced the term entry point. They suggested that for most objects the entry point coincides with the basic level, but for some objects the entry point tends to be located at the subordinate level (see also Murphy & Brownell, 1985). Objects of the latter type were also used in the experiments reported in this article.¹ The reason for doing so is

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¹ In this article, we adopt the classical definition of the term *basic level* to denote an intermediate level of abstraction. In concert with others, we further assume that whether the preferred name (or entry point) for any given object coincides or does not coincide with this basic level of categorization is dependent on a number of variables, including the typicality of the object (e.g., Jolicoeur et al., 1984), the expertise of the speaker (e.g., Tanaka & Taylor, 1991), and the given context (e.g., Murphy & Wisniewski, 1989). We should point out that the status of what we refer to as basic-level category was not independently determined for the experimental materials used. Thus, one might call into question whether our interpretation of basic-level status and subordinate-level status is correct for all experimental items in a strict sense. However, even if we were wrong in some instances, the rationale of our study would not be undermined, as the issue at stake here is in which way the context constrains the

that, for objects with an entry point at the subordinate level, it is very likely that speakers can relatively easily switch between two name alternatives, namely, the subordinate-level name and the basic-level name. This is because there are two forces at work—the general preference for basic-level names on the one hand and the item-specific preference for subordinate-level names on the other—inducing biases toward the two name alternatives. This assumption was empirically demonstrated to be valid in a norming study.

Apart from the entry point, the context in which a to-be-named object appears is another strong factor affecting the choice of a certain name. As Olson (1970) noted, “A word specifies a perceived referent relative to a set of alternatives” (p. 265). For example, when a speaker wants to refer to a Beetle in the context of another unrelated object such as a palm tree, both the basic-level term *car* and the subordinate-level name *Beetle* unambiguously identify the target object for a potential listener. By contrast, when the same Beetle occurs in the context of another car such as a Trabi, the notorious type of car built in the former German Democratic Republic, the speaker has to use the more specific subordinate-level term *Beetle* to provide unambiguous reference. Such context manipulations, in which different configurations of target and context objects are presented, were also used in the experiments reported here and are described below.

Somewhat surprisingly, the early observations of context effects on lexical choice have thus far attracted only little attention from researchers interested in the chronometric analysis of lexical access during speech production. Most extant studies have focused on basic-level naming and the question of whether category coordinates (e.g., *train*, if *car* is the target name) are lexically activated and compete for selection. Only occasionally has naming at different levels of specificity been contrasted (e.g., Glaser & Döngelhoff, 1984; Hantsch, Jescheniak, & Schriefers, in press; Kuijpers & La Heij, 2004; Roelofs, 1992; Vitkovitch & Tyrell, 1999; Zwitserlood, Bölte, & Dohmes, 2004). Moreover, none of these studies has addressed the questions of whether activation of name alternatives from a different hierarchical level extends to lexical phonological representations and/or whether manipulation of the context in which a target object appears has an impact on the activation pattern. The experiments reported in this article systematically explored these issues. They tested phonological activation patterns during object naming at different levels of specificity under conditions in which the context rendered an (more or less specific) alternative name either appropriate or inappropriate.

Retrieval of Object Names From the Mental Lexicon

In the following section, we discuss potential context effects on lexical choice and lexical activation in relation to recent theories of lexical access in speech production. These theories assume that the pathway from conceptual identification to naming entails access to

three levels of representation: a conceptual nonlexical representation; a more abstract nonphonological lexical representation, the so-called lemma representation, coding a word's syntactic properties (e.g., Levelt, Roelofs, & Meyer, 1999); and the phonological word form representation (e.g., Dell, 1990; Garrett, 1988; Kempen & Huijbers, 1983; Levelt et al., 1999; Levelt et al., 1991; see Levelt, 1999, for a review). Supportive evidence for this distinction comes from such divergent sources as the distributional properties of spontaneously occurring speech errors (e.g., Garrett, 1988), the analysis of tip-of-the-tongue states in aphasic patients and healthy speakers (e.g., Badecker, Miozzo, & Zanuttini, 1995; Vigliocco, Antonini, & Garrett, 1997), chronometric behavioral data (e.g., Jescheniak & Levelt, 1994; Jescheniak, Meyer, & Levelt, 2003; Jescheniak, Schriefers, & Hantsch, 2001; Levelt et al., 1991; Schriefers, Meyer, & Levelt, 1990), and electrophysiological measures (van Turennout, Hagoort, & Brown, 1998; see Roelofs, Meyer, & Levelt, 1998, for a detailed discussion; but see Caramazza, 1997, and Starreveld & La Heij, 1995, for different views).

Linking the potential effects of context to models of speech production introduces the question up to which level potential coactivation of name alternatives extends. Models of lexical access in speech production converge on the assumption that, during an early phase in speech planning, the to-be-verbalized target concept and a number of semantically related concepts are activated and then activate their corresponding lemma representations. Thus, these models (implicitly) assume that nonselected name alternatives become activated to this level. However, they disagree on the question of whether all activated lemmas also activate their corresponding phonological representations. Some researchers maintain that conceptual and lemma-level processing strictly precede phonological processing and that phonological codes are activated only for the words actually selected for articulation (serial-discrete models; e.g., Levelt et al., 1991, 1999). Other researchers, by contrast, assume that the activation of lemma representations and of phonological representations is a more continuous process, in that phonological activation can begin before semantic-syntactic processing has terminated with the selection of one candidate lemma (forward-cascading models, e.g., Peterson & Savoy, 1998; interactive models, e.g., Dell, 1986; Dell & O'Seaghdha, 1991, 1992; Dell, Schwartz, Martin, Saffran, & Gagnon, 1997; Harley, 1993).

Past research has addressed this issue by testing whether retrieval of a picture name (e.g., *car*) affects or, depending on the particular experimental task used, is affected by the processing of a word that is phonologically related to a semantic category coordinate to the picture name (e.g., *trait*, phonologically related to *train*). Corresponding effects are considered as indexing phonological activation of lexical competitors, and thus, a crucial test case that allows one to distinguish between serial-discrete models that restrict phonological activation to the target word from non-discrete models that allow for the activation of multiple phonological codes (e.g., Dell & O'Seaghdha, 1991, 1992; Jescheniak et al., 2003; Jescheniak & Schriefers, 1998; Levelt et al., 1991, 1999; O'Seaghdha & Marin, 1997; Peterson & Savoy, 1998). Thus far, corresponding behavioral and electrophysiological studies have failed to detect such effects for semantic category coordinates (Jescheniak et al., 2003; Levelt et al., 1991; Peterson & Savoy, 1998). One clear exception to this pattern, however, holds for near

activation of an alternative name that is either less specific (in Experiment 1) or more specific (Experiment 2) than the eventually selected target name. Our use of the terms *basic level* and *subordinate level* should thus be conceived as convenient labels used to simplify the exposition. For a comprehensive discussion of taxonomic hierarchies and the basic level, see Murphy (2002, p. 199).

synonyms (e.g., *sofa*, if *couch* is the target) for which the nonselected name alternative was found to be phonologically active (Jescheniak & Schriefers, 1998; Peterson & Savoy, 1998), and this latter effect is in line with predictions from nondiscrete models. Its presence suggests that phonological coactivation effects that must be assumed to be small on theoretical grounds (e.g., Dell & O'Seaghdha, 1991, 1992; Harley, 1993) can be observed only if lexical competition among lemma is sufficiently strong. Levelt et al. (1999), however, pointed out that this empirical pattern is also compatible with some version of a serial-discrete model, as near synonyms possibly make a very special case. Near synonyms, unlike category coordinates, are viable lexical alternatives in the context of the communicative situation and thus might be erroneously selected in addition to the target, leading to the simultaneous activation of multiple phonological forms: "When you have two equivalent ways of making reference to an object, you may occasionally select both lemmas and hence spread activation to both phonological codes" (Levelt et al., 1999, p. 230). This notion of multiple selection of appropriate lemmas is supposedly not restricted to near synonyms but should, in principle, hold for any lexical competitor being a viable name alternative in the given context: "What is appropriate depends on the communicative context . . . It may, under certain circumstances, be equally appropriate to call an object either flower or rose. In that case, the two lemmas will compete for selection although they are not synonyms, and multiple selection may occur" (Levelt et al., 1999, p. 17).

This position predicts that contextual constraints on the appropriateness of subordinate-level and basic-level concepts should have clear effects on lexical activation patterns. When both concepts are contextually appropriate, activation of both concepts could percolate to the level of the phonological word form representation. By contrast, if only one of the concepts is contextually

adequate, coactivation should be restricted to the conceptual level and the lemma level but should not reach the level of phonological form. Note that this prediction is not testable with near-synonymous name alternatives (i.e., the type of competitors for which phonological coactivation effects have thus far been obtained), as such near synonyms, by definition, are mutually exchangeable regardless of contextual constraints.

Overview of the Experiments

In all experiments, we used displays composed of color photographs of two objects positioned side by side. In each display, either one object or both objects were cued as target(s) by a superimposed green frame, and participants were instructed to name the target object(s) with a single word. If only one object was marked as the target (e.g., a Beetle), the context object could either be unrelated (e.g., a palm tree; Type A) or be drawn from the same basic-level category (e.g., a Trabi; Type B). If both objects were marked as targets, they could either be identical (e.g., two Beetles; Type C) or be different exemplars from the same basic-level category (e.g., a Beetle and a Trabi; Type D; see Figure 1).

For Type A and Type C displays, the context is nonconstraining, as both the subordinate-level name (e.g., *Beetle[s]*) and basic-level name (e.g., *car[s]*) are appropriate labels. By contrast, Type B and Type D displays introduce constraining contexts, as a Type B display rules out use of the basic-level name, and a Type D display rules out use of the subordinate-level name, because these names do no longer allow unambiguous or correct reference to the target(s), if participants are instructed to refer to the target(s) collectively by a single word. Of course, these constraints on name choice do not hold in an absolute sense, as they depend on the simultaneous restriction to single-word responses. For example, speakers could—correctly—refer to the target in Type B displays





Type	Example display	Used in Exp.	Context	Subordinate-level name appropriate?	Basic-level name appropriate?
A		1	Non-constraining	Yes*	Yes
B		1	Constraining	Yes*	No
C		2, 3	Non-constraining	Yes	Yes*
D		2	Constraining	No	Yes*

Figure 1. Illustration of the materials used in Experiments 1–3. Designated target name level is marked by an asterisk.

as “the red car” (as the Beetle was colored in red, and the Trabi was colored in light blue), that is, with a basic-level name, and in Type D displays as “the Beetle and the Trabi,” that is, with subordinate-level names. In all experiments reported below, participants followed the instruction to use single-word responses only without problems. In fact, not a single utterance of the type just mentioned was produced. Also, during the debriefing, none of the participants verbalized concerns that the requested constraints on the utterance format would result in “unusual” or “unnatural” utterances.

Experiments 1 and 2 explored the question of whether alternative names from a different level of specificity are phonologically activated during object naming and whether this pattern depends on the contextual appropriateness of these alternative names. The effectiveness of the context manipulation on the eventual lexical choice (subordinate-level or basic-level name) was validated in a norming study reported in the *Materials* sections of Experiments 1 and 2. Designated level of target name (subordinate level vs. basic level) and contextual appropriateness of the name alternative (appropriate vs. inappropriate) were factorially crossed in the experiments. Experiment 1 used Type A and Type B displays to test for the phonological activation of the objects’ basic-level names, when participants were instructed to name the objects with their subordinate-level names in nonconstraining contexts (i.e., with the alternative basic-level name being contextually appropriate) and constraining contexts (i.e., with the alternative basic-level name being contextually inappropriate). Experiment 2 used Type C and Type D displays to test for the phonological activation of the objects’ subordinate-level names, when participants were instructed to name the objects with their basic-level names in nonconstraining contexts (i.e., with the subordinate-level name being contextually appropriate) and constraining contexts (i.e., with the subordinate-level name being contextually inappropriate). Finally, Experiment 3 used Type C displays to test for the phonological activation of subordinate-level names of nondepicted category exemplars during basic-level naming (e.g., *Trabis* when participants refer to two Beetles with the word *cars*).

To assess lexical activation patterns, we used the cross-modal picture–word interference task (cf. Schriefers et al., 1990), which has become a prominent tool for the study of lexical access in speech production. It requires participants to name pictures while ignoring auditory distractor words. The dependent measure is naming latency, that is, the time between picture onset and onset of articulation. It has been shown that distractors denoting a semantic category coordinate of the object name (e.g., *train*, if the picture shows a car), which are presented simultaneously with, or in close temporal succession to, the target object, interfere with the naming response when compared with unrelated distractors (e.g., Damian & Martin, 1999; Glaser & Döngelhoff, 1984; Jescheniak et al., 2001; La Heij, 1988; Lupker, 1979; Rosinski, 1977; Schriefers et al., 1990; Starreveld & La Heij, 1995; Underwood, 1976), and this effect has been attributed to the activation of a competing semantic lexical representation, as opposed to a nonlinguistic conceptual representation (e.g., Damian & Bowers, 2003; Schriefers et al., 1990), because it is confined to lexical tasks. To tap the phonological activation of alternative object names, we followed the logic advanced in earlier studies and used distractor words that were phonologically related to the alternative names (e.g., *cast* during subordinate-level naming, or *bean* during basic-level nam-

ing, when the target object was a Beetle; see Jescheniak, Hahne, & Schriefers, 2003; Jescheniak & Schriefers, 1998; Jescheniak et al., 2001; Levelt et al., 1991; O’Seaghdha & Marin, 1997; Peterson & Savoy, 1998).

All experiments also included distractors that were phonologically related to the target name. Such related distractors are known to reliably facilitate the naming response and are taken as an index of the target word’s phonological activation (e.g., Damian & Martin, 1999; Meyer & Schriefers, 1991; Schriefers et al., 1990; Starreveld, 2000). The motivation for including these distractors in the present study was twofold. First, they demonstrate the general sensitivity of an experiment for the case that no effect from distractors related to the name alternative should be obtained. Second, there are only a few objects with an entry point at the subordinate level, and the selection constraints mentioned below further reduced the candidate item set. Given these facts, the four combinations resulting from the crossing of contextual appropriateness or inappropriateness and designated target name level had to be realized between participants to ensure enough observations in each combination while avoiding an extensive number of repetitions of the critical target pictures. Therefore, the conditions with distractors phonologically related to the target name were included to validate the pairwise comparability of these between-participants comparisons. More specifically, the facilitation effects from these phonologically related distractors were expected to be of equal size across all conditions.

Finally, the experiments also included a manipulation of stimulus onset asynchrony (SOA) between picture and distractor. The primary motivation for including the SOA manipulation was to enhance the chance of tapping into a time window in which lexical activation of alternative names can be observed. It also allows one to assess whether the time course of the potential activation of the alternative names is modulated by contextual constraints, with contextually appropriate alternative names possibly competing for a longer period of time than contextually inappropriate alternative names.

Experiment 1

Experiment 1 tested for the lexical activation of basic-level name alternatives that were either contextually appropriate (in a nonconstraining context) or inappropriate (in a constraining context) during subordinate-level naming. In each trial, the to-be-named target object (e.g., a Beetle) was accompanied by a context object, which was drawn from either a different basic-level category (e.g., a palm tree; nonconstraining context) or the same basic-level category (e.g., a Trabi; constraining context). The question of whether the basic-level name alternative is phonologically activated was addressed by comparing effects from a distractor phonologically related to the target object’s basic-level name (e.g., *cast*, related to *car*) to effects from an unrelated distractor.

Method

Participants. Forty-eight participants were tested in the nonconstraining context condition, and an additional 48 participants were tested in the constraining context condition. In this and all other experiments described in this article, participants were paid Euro 7 (approximately \$6 U.S.). All were native speakers of German and students from the University of Leipzig. They had no known hearing deficit, and they had normal or

corrected-to-normal vision. No participant took part in more than one of the experiments, or the pretest, or the norming study.

Materials. The visual materials were composed of 20 color photographs of common objects, each of which filled a 100 × 100 mm square and had its background removed by a masking tool. There were two exemplars, each from 10 different basic-level categories. For these items presented in isolation, normed name preference was located at the subordinate level, as revealed in a pretest ($M = 89.3\%$, $SD = 8.3\%$, range = 72.7%–100.0%, $N = 27$ participants). Items were included only if there was no initial phonological overlap between basic-level and subordinate-level name and if both subordinate and basic-level names were monomorphemic words.

Two different experimental display conditions were created from these photographs as follows (see also Figure 1, Types A and B). In each display, two objects appeared side by side, and one object was cued as target by a superimposed green frame (RGB 0 255 0). In the nonconstraining context condition, the context object was unrelated and was drawn from a different basic-level category (e.g., a palm tree, if the target was a Beetle). In the constraining context condition, the context object was drawn from the same basic-level category (e.g., a Trabi). In all cases, the two object names had different initial phonological segments. The position of the target object was systematically varied.

A norming study ($N = 32$ participants) validated the effectiveness of the context manipulation. In this study, each participant received each of the 20 experimental objects once in each of the two context conditions. The two pictures and the frame appeared simultaneously in the middle of a computer monitor, and the participants were instructed to name the target object(s) quickly but accurately with a single word in such a way that another person seeing the objects but not the frame would be able to unambiguously identify the target object. Subordinate-level naming responses were recorded in 78.8% of the cases in the nonconstraining context condition and in 96.4% of the cases in the constraining context condition. These results show the context manipulation to be highly effective in that the constraining context prevented participants from choosing the contextually inappropriate name alternative.²

For each target object, two distractors were chosen: One distractor minimally shared the initial consonant–vowel segments with the subordinate-level name, and a second distractor minimally shared the initial consonant–vowel segments with the basic-level name. Both distractors had no semantic relation with the object name. Two unrelated control conditions were created by reassigning the related distractors to the experimental pictures (see the Appendix for a complete list of the experimental materials). Care was taken that all distractors for one picture of a pair were unrelated to the other picture of the pair, and vice versa.

The acoustic distractor words were spoken by a female native speaker of German. Distractors related to the subordinate-level names varied in duration from 500 ms to 755 ms, with an average of 620 ms ($SD = 73$ ms). Distractors related to the basic-level names varied in duration from 471 ms to 715 ms, with an average of 611 ms ($SD = 90$ ms). All auditory materials were digitized at a sampling rate of 22 kHz for presentation during the experiment.

Design. There were two critical comparisons of distractor conditions (related to subordinate-level name vs. unrelated, and related to basic-level name vs. unrelated). SOA was varied in four steps (0 ms, 100 ms, 200 ms, 300 ms), and context was varied in two steps (nonconstraining vs. constraining). Thus, there were three completely crossed variables, namely, the four-level variable SOA, the two-level variable relatedness, and the two-level variable context. The former two variables were tested within participants and within items; the latter variable was tested between participants and within items.

SOAs were blocked, with the sequence of SOA blocks being counterbalanced across participants with a sequentially balanced Latin square procedure. Within each SOA block, the sequence of distractor conditions was counterbalanced with a sequentially balanced random Latin square

procedure; across different lists, each distractor condition appeared equally often at each repetition level of a given item in each SOA block, with the transition probability for distractor conditions being sequentially controlled. Each participant received half of the targets at the left position within a display and half of the targets at the right position. For a given picture, the position varied within SOA blocks as well as between SOA blocks, with the constraint that, within a given SOA block, the picture appeared at the same position in a related distractor condition and in the corresponding unrelated control condition. For an individual SOA block, the proportion of appearances at the left position and at the right position varied for individual pictures, but across experimental lists, each picture appeared equally often in each distractor condition at both positions. Moreover, the following general criteria were applied in creating 16 different experimental lists: (a) Semantically or phonologically related pictures did not follow in adjacent trials, (b) repetitions of a component picture were separated by at least two intervening trials, (c) repetitions of an expected target name were separated by at least four intervening trials, (d) there were no more than three trials from the same condition, (e) no more than five trials with the same target position appeared in succession, and (f) repetitions of a distractor were separated by at least three intervening trials. Each SOA block began with eight filler items. The 16 experimental lists were used equally often.

Procedure. Each participant was tested individually. The participant was seated comfortably in a dimly lit room, separated from the experimenter by a partition wall. The visual stimuli were presented on a 17-in. EIZO F520 computer monitor on a light gray background (RGB 244 244 244). Viewing distance was about 60 cm.

The presentation of the visual and auditory stimuli and the online collection of the data were controlled by a computer with a Pentium processor (Intel Corporation, Santa Clara, CA). Auditory distractors were presented with Sennheiser HD450 headphones at a comfortable listening volume. Speech-onset latencies were measured to the closest millisecond with a voice key connected to the computer (NESU [Nijmegen Experimental Setup Unit] system developed at the Max Planck Institute for Psycholinguistics, Nijmegen, the Netherlands), and a Sennheiser ME40 microphone.

Visual stimuli were displayed for 1 s, with 3 s between the offset of one display to the onset of the next display. Auditory distractors were presented either simultaneously with the onset of the visual stimuli (SOA = 0 ms), 100 ms later (SOA = 100 ms), 200 ms later (SOA = 200 ms), or 300 ms later (SOA = 300 ms). Participants were instructed to name the target object as quickly as possible with its subordinate-level name. Speech-onset latencies were measured from the onset of the target picture. The total length of one trial was about 4 s.

The actual experiment consisted of four parts: a study phase, a practice phase, the main session, and a follow up. During the study phase, participants studied a written instruction booklet that emphasized both the speed and accuracy of their responses. Participants also received a booklet showing all experimental pictures. The depicted object's subordinate-level name was printed next to each picture. Participants were instructed to use these names only. Next, a practice block was administered, in which participants named every picture used in the experiment twice. No auditory

² The number of subordinate-level responses in the nonconstraining context condition appears to be relatively low when compared with the results of the pretest, in which the same objects were named with the subordinate level name in 89.3% of the cases. This difference between pretest and norming study might be due to the fact that the display types used in Experiment 2 were also included in this norming study and the fact that half of these additional displays required a contextually induced basic-level response. This might have enhanced the tendency to use basic-level terms in other contexts in which basic-level and subordinate-level responses were adequate.

distractors were presented during this practice phase. The experimenter monitored whether participants used the designated target names and corrected them if necessary. Next, the main experiment started with the first of four SOA blocks. There were short breaks between these blocks. After the main session, participants completed a questionnaire in which each experimental picture was presented in isolation. Participants indicated which name they would use in spontaneous naming outside the context of the experiment. These data resembled the findings from the pretest and are not reported in detail here.

Results and Discussion

Observations were coded as erroneous and discarded from the reaction time analyses whenever any of the following conditions held: (a) A picture had been named with a word other than the expected name; (b) a nonspeech sound preceded the target utterance, triggering the voice key; (c) a dysfluency occurred or an utterance was repaired; or (d) a speech-onset latency exceeded 3 s. Observations deviating from a participant's and an item's mean by more than 2 SDs were considered as outliers and were discarded from the reaction-time analyses. In this and the following experiments, participants with overall error rates exceeding 10% or mean naming latencies exceeding 1 s were replaced (12 participants; this rather high rate might be due to the fact that part of the experiment was conducted during the summer break, when recruitment of motivated participants from our regular student population was

difficult). After replacement of these participants, we identified 4.6% erroneous responses and 1.9% outliers. These data points were discarded from the reaction-time analyses.

Averaged reaction times were submitted to analyses of variance, separately for the subordinate-level distractor conditions and the basic-level distractor conditions. Statistical analyses involved the variables context (nonconstraining vs. constraining), relatedness (related to subordinate-level name vs. unrelated, and related to basic-level name vs. unrelated), and SOA (0 ms, 100 ms, 200 ms, 300 ms). Two complementary analyses were computed, one treating participants and one treating items as a random variable (Clark, 1973). Table 1 displays mean reaction times and error rates per SOA and distractor type for the nonconstraining and the constraining context condition.

Effects from distractors related to the basic-level name alternative. There was a main effect of context, with longer reaction times for the constraining context condition than for the nonconstraining context condition, $F_1(1, 94) = 24.49$, $MSE = 32,220.33$, $p < .001$; $F_2(1, 19) = 104.36$, $MSE = 3,090.31$, $p < .001$. The main effect of SOA was also significant, reflecting shorter reaction times at longer SOAs, $F_1(3, 282) = 31.31$, $MSE = 3,173.72$, $p < .001$; $F_2(3, 57) = 53.21$, $MSE = 803.53$, $p < .001$. Reaction times were longer in the related condition than in the unrelated condition, yielding a significant main effect of relatedness, $F_1(1, 94) =$

Table 1
Mean Reaction Times (in Milliseconds) and Error Rates (as Percentages) by Stimulus Onset Asynchrony (SOA) and Distractor Type From Experiment 1

Distractor	SOA							
	0 ms		100 ms		200 ms		300 ms	
	<i>M</i>	%	<i>M</i>	%	<i>M</i>	%	<i>M</i>	%
Distractors (un-) related to basic-level name alternative: Nonconstraining context								
BAS-REL	758 (13)	5.7 (0.7)	761 (13)	4.8 (0.8)	731 (9)	4.3 (0.6)	701 (9)	4.4 (0.7)
BAS-UNR	740 (11)	5.6 (0.8)	736 (11)	4.1 (0.7)	727 (10)	5.5 (0.9)	706 (10)	3.9 (0.7)
Difference	18***/† (7)	0.1 (0.9)	25***/** (6)	0.7 (0.8)	4 (6)	-1.2 (0.9)	-5 (7)	0.5 (0.8)
Distractors (un-) related to basic-level name alternative: Constraining context								
BAS-REL	831 (11)	6.9 (0.9)	817 (10)	6.1 (1.0)	794 (11)	4.3 (0.7)	771 (12)	5.8 (0.8)
BAS-UNR	812 (12)	5.2 (0.8)	804 (11)	5.3 (0.8)	780 (11)	3.8 (0.7)	763 (11)	5.2 (0.7)
Difference	19**/* (7)	1.7 (1.0)	13* ^{ns} (5)	0.8 (1.1)	14*/† (7)	0.5 (0.9)	8 (7)	0.5 (0.8)
Distractors (un-) related to subordinate-level target name: Nonconstraining context								
SUB-REL	698 (11)	3.1 (0.7)	676 (11)	3.5 (0.7)	665 (10)	3.2 (0.6)	673 (8)	2.7 (0.5)
SUB-UNR	753 (11)	5.1 (0.8)	758 (14)	4.2 (0.7)	727 (10)	4.4 (0.6)	717 (10)	4.5 (0.8)
Difference	-55***/** (9)	-2.0*/† (0.9)	-82***/** (10)	-0.7 (1.0)	-62***/** (7)	-1.2 (0.8)	-44***/** (6)	-1.8**/* (0.9)
Distractors (un-) related to subordinate-level target name: Constraining context								
SUB-REL	769 (13)	3.5 (0.6)	744 (12)	4.3 (0.7)	732 (11)	3.9 (0.6)	730 (10)	4.7 (0.7)
SUB-UNR	826 (12)	4.7 (0.8)	830 (12)	4.5 (0.8)	794 (12)	6.3 (0.9)	783 (12)	4.7 (0.8)
Difference	-57***/** (8)	-1.2 (1.2)	-86***/** (10)	-0.2 (1.0)	-62***/** (8)	-2.4**/* (0.9)	-53***/** (7)	0.0 (1.0)

Note. Designated target name is at the subordinate level. Standard error of the mean is shown in parentheses. Positive difference scores reflect interference, and negative difference scores reflect facilitation. Significance of these scores is indicated by superscripts. Results from the *t* tests by participant precede the results from the *t* tests by item. BAS-REL = related to the basic-level name alternative; SUB-REL = related to the subordinate-level target name; BAS-UNR and SUB-UNR = unrelated controls.

^{ns} = not significant. † $p < .10$ (marginally significant). * $p < .05$. ** $p < .01$. *** $p < .001$.

27.49, $MSE = 1,031.34$, $p < .001$; $F_2(1, 19) = 6.01$, $MSE = 1,962.92$, $p < .05$. Most important, this interference effect did not differ across context conditions (Context \times Relatedness, both $F_s < 1$; and Context \times Relatedness \times SOA, $F_1(3, 282) = 1.39$, $MSE = 1,078.64$, $p = .25$; $F_2(3, 57) = 2.37$, $MSE = 409.14$, $p = .08$). None of the other interactions reached significance, except for Relatedness \times SOA, $F_1(3, 282) = 3.34$, $MSE = 1,078.64$, $p < .05$; $F_2(3, 57) = 2.75$, $MSE = 572.34$, $p = .051$, which is due to the fact that the interference effect faded out with longer SOAs. For error rates, no main effect and no interaction reached significance. Table 1 supplements these analyses by providing the results of t tests comparing the related and the unrelated condition within each level of SOA for each context condition.

Effects from distractors related to the subordinate-level target name. There was a main effect of context, with shorter reaction times for the nonconstraining context condition than for the constraining context condition, $F_1(1, 94) = 27.37$, $MSE = 32,155.11$, $p < .001$; $F_2(1, 19) = 133.80$, $MSE = 2,705.03$, $p < .001$. The main effect of SOA was also significant, reflecting shorter reaction times at longer SOAs, $F_1(3, 282) = 17.02$, $MSE = 3,395.88$, $p < .001$; $F_2(3, 57) = 41.70$, $MSE = 561.01$, $p < .001$. Reaction times were shorter in the related condition than in the unrelated condition, yielding a significant effect of relatedness, $F_1(1, 94) = 244.63$, $MSE = 3,059.93$, $p < .001$; $F_2(1, 19) = 76.63$, $MSE = 4,168.23$, $p < .001$. This facilitation effect did not differ across context conditions (Context \times Relatedness and Context \times Relatedness \times SOA, all $F_s < 1.25$). However, there was a Relatedness \times SOA interaction, $F_1(3, 282) = 9.75$, $MSE = 1,136.61$, $p < .001$; $F_2(3, 57) = 7.85$, $MSE = 327.58$, $p < .001$, reflecting the fact that interference was confined to short SOAs (see Table 1 for the results from t tests). For error rates, only the main effect of relatedness was significant, $F_1(1, 94) = 10.21$, $MSE = 1.01$, $p < .01$; $F_2(1, 19) = 9.59$, $MSE = 2.58$, $p < .01$.

The central finding from Experiment 1 is that distractors related to the basic-level name alternative interfered with the subordinate-level naming response. This shows that the nontarget name alternative was phonologically activated. More important, this held for the nonconstraining and the constraining context condition alike, suggesting that the name alternative was also phonologically activated, if it was contextually inappropriate. In fact, the absence of an interaction between context and relatedness shows that the amount of activation the name alternative received was not modulated by context. In addition, the absence of a triple interaction of context, relatedness, and SOA suggests that contextual constraints did not affect the time course of alternative name activation either, at least within the SOA range tested.³

In view of the identical patterning of interference and facilitation effects indicative of lexical activation, one might wonder whether the context manipulation was effective at all in this experiment. There is some indirect evidence that this was in fact the case. This evidence comes from the fact that overall latencies were substantially and significantly slower in the constraining context condition as compared with the nonconstraining context condition, suggesting that the presentation of a context object from the same basic-level category as the target object interfered with the processing of the target object. The locus of this effect cannot be determined with certainty, and it may be a composite of perceptual, conceptual, and possibly lexical contributions. Still, whatever the exact source might be, this finding suggests that the

context object was processed and thus had the potential power of effectively modulating the lexical activation pattern in a similar way as it had determined lexical choice in the norming study, attesting to the effectiveness of the context manipulation on lexical choice.

One might also object that there was a procedural difference between the norming study on the one hand and Experiment 1 on the other, limiting the strength of the claim that the context manipulation in Experiment 1 did not affect lexical activation of alternative names. In the norming study, speakers were instructed to freely choose a name such that a listener could unambiguously pick out the referent, whereas in Experiment 1, speakers were asked to use particular terms provided by the experimenter. The change was necessary because the different experiments had different objectives. The norming study sought to verify the effectiveness of the context manipulation on lexical choice. Experiment 1, by contrast, explored the effect of the context manipulation on lexical activation. To address this latter question, the procedural change was essential, as we needed (a) to maximize the number of valid observations and (b) to reduce the variability of naming latencies to get a valid basis for the chronometric analysis. Still, one might object that the change in procedure might have caused task demands that differed in some important respect from those in the norming study. This possible difference, then, could weaken the claim that context information cannot prevent lexical activation of currently inappropriate name alternatives. To address this issue, we replicated the constraining context condition of Experiment 1, using the same instructions that had been used in the norming study. The constraining context condition was selected for this replication for two reasons. First, extrapolating from the results of the norming study, one can expect the intended target names to be produced on the vast majority of trials in this replication, even if participants are free in their name choice. Second, the constraining context condition provides the strongest test case for the issue at hand, as it renders the alternative basic-level name contextually inappropriate.

Subordinate-level naming responses produced without error were observed in 90.4% of cases in this replication with 48 new participants. The reaction-time and error data yielded a clear pattern. There was an overall 10-ms interference effect from distractors related to the contextually inappropriate basic-level name alternative—for reaction times, $F_1(1, 47) = 9.93$, $MSE = 850.55$, $p < .01$; $F_2(1, 19) = 3.69$, $MSE = 760.82$, $p = .07$; for error rates, both $F_s < 1$ —which did not differ reliably from the 14-ms effect observed in the constrained context condition of Experiment 1 [Experiment (Experiment 1 vs. replication) \times Relatedness: for reaction times, $F_1(1, 94) = 1.77$, $MSE = 966.09$, $p = .19$; $F_2(1, 19) = 1.49$, $MSE = 576.15$, $p = .24$; for error rates, $F_1(1, 94) = 1.54$, $MSE = 1.04$, $p = .22$; $F_2 < 1$; Experiment \times Relatedness \times SOA: for reaction times and error rates, both $F_s < 1$]. In summary, the pattern from the constraining context condition from Experiment 1 was replicated when participants were free in their lexical choice. This observation is in line with the conclusion that con-

³ An additional post hoc contrast of the numerically differently sized interference effects at SOA 100 ms (25 vs. 13 ms) revealed no significant difference: Context \times Relatedness, $F_1(1, 94) = 2.03$, $MSE = 800.80$, $p = .16$; $F_2(1, 19) = 2.57$, $MSE = 448.65$, $p = .13$.

textual constraints cannot prevent lexical phonological activation of currently inappropriate name alternatives.

To further strengthen this conclusion, we sought to replicate our finding by taking a slightly different approach. We used a set of complementary conditions with two target object displays to test the lexical phonological activation of the objects' subordinate-level names during basic-level naming. Again, the context was either nonconstraining or constraining, rendering the subordinate-level name alternative either contextually appropriate or inappropriate.

Experiment 2

Experiment 2 tested for the lexical phonological activation of subordinate-level name alternatives that were either contextually appropriate (nonconstraining context condition) or inappropriate (constraining context condition) during basic-level naming. In each trial, there were two target objects. In one condition, there were two identical exemplars from a basic-level category (e.g., two Beetles; nonconstraining context condition); in this situation, speakers could use either the basic-level name or the subordinate-level name to refer to the objects collectively with a single name. In a second condition, there were two different exemplars from a basic-level category (e.g., a Beetle and a Trabi; constraining context condition); this situation rendered use of the subordinate-level name contextually inappropriate.

The question of whether the subordinate-level name alternative is phonologically activated in these two situations was addressed by comparing effects from a distractor related to the target object's subordinate-level name (e.g., *bean*, related to *Beetle*) to effects from an unrelated distractor.

Method

Participants. Thirty-two participants were tested in the nonconstraining context condition, and an additional 32 participants were tested in the constraining context condition.

Materials. The visual materials were constructed from the same single-object pictures as were the materials in Experiment 1. Each display consisted of two target objects that either were identical (e.g., two Beetles; nonconstraining context condition) or were different exemplars from the same basic-level category (e.g., a Beetle and a Trabi; constraining context condition; see Types C and D in Figure 1). In the latter case, the two object names had different initial phonological segments. Their spatial position (left vs. right) was systematically varied in the same way as had been the position of target and context object in Experiment 1. The effectiveness of the context manipulation was verified in the norming study mentioned earlier. When participants were instructed to name the two target objects collectively with a single name, basic-level naming responses were recorded in 41.3% of cases in the nonconstraining context condition and in 98.0% of cases in the constraining context condition. Again, this result testifies to the strong impact of the context manipulation on speakers' lexical choice.⁴

Plural forms of the objects' basic-level names were used as target words. As plural formation of the basic-level names of two experimental items involved a vowel change in the initial syllable, the corresponding two distractors related to the basic-level name were replaced to maintain the criterion of overlapping initial consonant–vowel segments between basic-level names and corresponding distractors (see the Appendix).

Design. The design was identical to that used in Experiment 1. The same criteria were applied in creating 16 different experimental lists.

Procedure. The procedure was identical to that used in Experiment 1, with the exception that both objects of a display were marked as targets, and participants were instructed to name them collectively with the plural form of their basic-level name.

Results and Discussion

The raw data were treated in the same way as in Experiment 1. After replacing 4 participants, we identified 4.0% erroneous responses and 1.9% outliers. It is unclear whether displays used in the constraining context condition with the same target objects appearing in changed positions (e.g., a Beetle on the left and a Trabi on the right vs. a Trabi on the left and a Beetle on the right, with the distractors tapping for the activation of the subordinate-level name *Trabi*, and participants using the basic-level name *cars*) should be regarded as one item or two items in the statistical analyses. Therefore, we performed analyses in both ways and found the results to be highly comparable. Below, the statistics from the analysis in which the two displays were treated as one item and in which a correction for unequal *N* was applied in the overall item analysis are reported. Table 2 displays mean reaction times and error rates per SOA and distractor type for the nonconstraining and constraining context conditions.

Effects from distractors related to the subordinate-level name alternative. There was no main effect of context in the analysis of reaction times (both *F*s < 1). SOA was significant, reflecting shorter reaction times at longer SOAs, $F_1(3, 186) = 83.38$, $MSE = 2,858.62$, $p < .001$; $F_2(3, 84) = 120.16$, $MSE = 1,055.54$, $p < .001$. Related distractors interfered with the naming response, $F_1(1, 62) = 44.86$, $MSE = 1,999.07$, $p < .001$; $F_2(1, 28) = 36.89$, $MSE = 1,688.84$, $p < .001$. The relatedness effect was larger in the nonconstraining context condition than in the constraining context condition: 39 ms vs. 15 ms, when pooled across SOAs; $F_1(1, 62) = 9.30$, $MSE = 1,999.07$, $p < .01$; $F_2(1, 28) = 5.29$, $MSE = 1,688.84$, $p < .05$. Subsequent analyses revealed that, despite the difference in size, the interference effect was reliable in each context condition: nonconstraining context condition, $F_1(1, 31) = 30.58$, $MSE = 3,105.58$, $p < .001$; $F_2(1, 19) = 28.02$, $MSE = 2,382.43$, $p < .001$; constraining context condition, $F_1(1, 31) = 14.90$, $MSE = 892.56$, $p < .01$; $F_2(1, 9) = 19.97$, $MSE = 224.60$, $p < .01$. In general, interference was confined to short SOAs, as reflected in a significant Relatedness \times SOA interaction, $F_1(3, 186) = 20.70$, $MSE = 879.01$, $p < .001$; $F_2(3, 84) = 20.51$, $MSE = 674.19$, $p < .001$. However, it persisted longer in the nonconstraining context condition than in the constraining context condition, as revealed by a significant Context \times Relatedness \times SOA interaction, $F_1(3, 186) = 7.57$, $MSE = 879.01$, $p < .001$; $F_2(3, 84) = 4.95$, $MSE = 674.19$, $p < .01$. Subsequently computed *t* tests showed interference effects to be present at SOAs of 0 ms, 100 ms, and 200 ms in the nonconstraining context condition and at SOAs of 0 ms and 100 ms in the constraining context condition

⁴ The number of subordinate-level responses in the nonconstraining context condition appears to be relatively low when compared with the results of the pretest. This difference between pretest and norming study might be due to the fact that some display types required a contextually induced basic-level response. This might have enhanced the tendency to use basic-level terms in other contexts in which basic-level and subordinate-level responses were adequate.

Table 2
Mean Reaction Times (in Milliseconds) and Error Rates (as Percentages) by Stimulus Onset Asynchrony (SOA) and Distractor Type From Experiment 2

Distractor	SOA							
	0 ms		100 ms		200 ms		300 ms	
	<i>M</i>	%	<i>M</i>	%	<i>M</i>	%	<i>M</i>	%
Distractors (un-) related to subordinate-level name alternative: Nonconstraining context								
SUB-REL	747 (27)	7.5 (1.1)	719 (27)	6.7 (0.9)	641 (24)	5.6 (1.1)	591 (12)	4.5 (0.9)
SUB-UNR	666 (17)	4.1 (0.8)	663 (23)	4.1 (0.8)	616 (16)	4.5 (0.9)	598 (13)	4.5 (0.9)
Difference	81***/** (13)	3.4**/* (1.2)	56***/** (8)	2.6**/ns (1.0)	25†/** (12)	1.1 (1.2)	-7 ^{ns} /† (6)	0.0 (1.0)
Distractors (un-) related to subordinate-level name alternative: Constraining context								
SUB-REL	694 (15)	5.9 (1.1)	681 (17)	3.8 (0.9)	640 (12)	2.5 (0.7)	610 (12)	2.0 (0.5)
SUB-UNR	669 (15)	5.0 (0.8)	659 (14)	3.1 (0.9)	634 (14)	2.5 (0.6)	604 (12)	2.0 (0.5)
Difference	25**/** (7)	0.9 (1.1)	22**/* (7)	0.7 (1.0)	6 (6)	0.0 (0.8)	6 (6)	0.0 (0.7)
Distractors (un-) related to basic-level target name: Nonconstraining context								
BAS-REL	616 (19)	3.8 (0.8)	582 (20)	2.7 (0.7)	567 (12)	4.2 (0.7)	582 (11)	2.2 (0.5)
BAS-UNR	664 (17)	3.4 (0.9)	672 (23)	3.3 (0.7)	616 (17)	4.4 (0.8)	603 (14)	3.0 (0.9)
Difference	-48***/** (8)	0.4 (1.0)	-90***/** (13)	-0.6 (1.0)	-49***/** (8)	-0.2 (0.9)	-21 (7)	-0.8 (1.0)
Distractors (un-) related to basic-level target name: Constraining context								
BAS-REL	626 (20)	3.6 (0.6)	596 (15)	3.6 (0.9)	585 (10)	3.4 (0.7)	595 (12)	3.1 (0.7)
BAS-UNR	671 (15)	2.7 (0.6)	668 (15)	3.4 (0.8)	635 (12)	3.0 (0.7)	606 (12)	2.3 (0.7)
Difference	-45***/** (10)	0.9 (0.8)	-72***/** (7)	0.2 (0.9)	-50***/** (6)	0.4 (0.9)	-11†/† (6)	0.8 (0.9)

Note. Designated-target name is at the basic level. Standard error of the mean is shown in parentheses. Positive difference scores reflect interference, and negative difference scores reflect facilitation. Significance of these scores is indicated by superscripts. Results from the *t* tests by participant precede the results from the *F* tests by item. SUB-REL = related to the subordinate-level name alternative; BAS-REL = related to the basic-level target name; SUB-UNR and BAS-UNR = unrelated controls.

^{ns} = not significant. † $p < .10$ (marginally significant). * $p < .05$. ** $p < .01$. *** $p < .001$.

(see Table 2). Finally, there was a significant Context \times SOA interaction, reflecting the fact that the decrease in reaction times with longer SOAs was stronger in the nonconstraining context than in the constraining context, $F_1(3, 186) = 4.17$, $MSE = 2,858.62$, $p < .01$; $F_2(3, 84) = 4.61$, $MSE = 1,055.54$, $p < .01$, due to the particularly long reaction times in the related condition in a nonconstraining context observed at early SOAs.

The analyses of error rates complement this pattern. A small trend toward more errors in the nonconstraining context condition was significant only in the participant analysis, $F_1(1, 62) = 10.07$, $MSE = 1.71$, $p < .01$; $F_2(1, 28) = 2.07$, $MSE = 7.25$, $p = .16$. In line with the reaction-time data, less errors were obtained at longer SOAs, $F_1(3, 186) = 5.02$, $MSE = 1.04$, $p < .01$; $F_2(3, 84) = 5.97$, $MSE = 2.14$, $p < .01$, and more errors were obtained in the related condition, $F_1(1, 62) = 7.81$, $MSE = .78$, $p < .01$; $F_2(1, 28) = 7.48$, $MSE = 2.21$, $p < .05$. The Context \times SOA interaction was significant in the item analysis only, $F_1(3, 186) = 1.36$, $MSE = 1.04$, $p = .26$; $F_2(3, 84) = 4.65$, $MSE = 2.14$, $p < .01$. No other effects reached significance.

Effects from distractors related to the basic-level target name. There was no main effect of context in the analysis of reaction times (both $F_s < 1$). SOA was significant, reflecting shorter reaction times at longer SOAs, $F_1(3, 186) = 21.03$, $MSE = 3,166.24$, $p < .001$; $F_2(3, 84) = 61.58$, $MSE = 501.13$, $p < .001$. Related distractors facilitated the naming response, $F_1(1, 62) =$

225.70, $MSE = 1,321.77$, $p < .001$; $F_2(1, 28) = 100.20$, $MSE = 1,491.99$, $p < .001$. It is important to note that this relatedness effect did not differ across context conditions, $F_1(1, 62) = 1.38$, $MSE = 1,321.77$, $p = .24$; $F_2 < 1$. Facilitation was strongest at SOA 100 ms and weakest at SOA 300 ms, yielding a significant Relatedness \times SOA interaction, $F_1(3, 186) = 22.27$, $MSE = 1,010.65$, $p < .001$; $F_2(3, 84) = 25.07$, $MSE = 444.69$, $p < .001$. However, its time course did not differ across context conditions (both $F_s < 1$).

In the analysis of error rates, context was significant in the item analysis, but this effect could not be confirmed in the participant analysis, $F_1 < 1$; $F_2(1, 28) = 14.49$, $MSE = 3.77$, $p < .01$. No other effect reached significance.

When participants named the target objects with their basic-level names, interference from distractors related to the subordinate-level name alternative was observed, suggesting that the subordinate-level alternative names were phonologically activated. However, in contrast to Experiment 1, this interference effect was larger when the name alternative was contextually appropriate (in the nonconstraining context condition) than when it was contextually inappropriate (in the constraining context condition).

As for Experiment 1, we replicated the constraining context condition with a new sample of 48 participants, using the instructions from the norming study that had validated the effectiveness

of the context manipulation. In this replication, expected basic-level naming responses produced without error were observed in 94.8% of cases. There was an overall 18-ms interference effect (along with a 1.1% difference in error rates in the same direction) from distractors related to the contextually inappropriate subordinate-level name alternative—for reaction times, $F_1(1, 31) = 31.40$, $MSE = 606.97$, $p < .001$; $F_2(1, 9) = 16.90$, $MSE = 332.00$, $p < .01$; for error rates, $F_1(1, 31) = 7.83$, $MSE = .36$, $p < .01$; $F_2(1, 9) = 11.84$, $MSE = .83$, $p < .01$ —which did not differ from the 15-ms effect observed in the corresponding condition of Experiment 2—Experiment \times Relatedness: for reaction times, both $F_s < 1$; for error rates, $F_1(1, 62) = 1.14$, $MSE = .49$, $p = .29$; $F_2 < 1$; Experiment \times Relatedness \times SOA: for reaction times, $F_1(3, 186) = 1.33$, $MSE = 523.34$, $p = .27$; $F_2(3, 27) = 1.04$, $MSE = 264.57$, $p = .39$; for error rates, both $F_s < 1$. This replication clearly shows that the interference effect obtained in the constraining context condition of Experiment 2 was not induced by the instruction to use designated target names.

The experiments reported so far have revealed that name alternatives to a target name become phonologically activated and compete with the target name for selection, regardless of whether speakers used designated names or were free in their name choice. This corroborates our earlier observation that competition for selection is not confined to words from the same level within a semantic hierarchy but that it also obtains across the basic level and the subordinate level of a semantic hierarchy (Hantsch et al., in press). The present experiments add to this finding that (a) competition is not confined to the lemma level but carries over to the phonological level and (b) the lexical activation of the respective name alternatives cannot effectively be prevented by contextual constraints. The latter aspect is most obvious in Experiment 1, in which the interference effects were similar sized for basic-level name alternatives during subordinate-level naming regardless of whether the context constrained speakers' lexical choice. Interference effects were also obtained for subordinate-level name alternatives during basic-level naming in Experiment 2, but this time, the effects differed as a function of context with respect to size and time course. At first glance, this seems to suggest that a constraining context was selectively effective in reducing the activation of inappropriate name alternatives during basic-level naming but not during subordinate-level naming. However, an alternative explanation might be found when considering in detail how the different display types might have been processed in the experiments.

Assume that, generally, each object of an experimental display activates corresponding concepts at different levels of specificity, including subordinate-level and basic-level representations, which in turn activate their lexical representations. In our example, the picture of a Beetle will activate the lexical representations *Beetle* and *car*, the picture of a Trabi will activate the lexical representations *Trabi* and *car*, and the picture of a palm tree will activate the lexical representations *palm tree* and *tree* (note that morphological overlap was not present in the German stimulus materials). Let us further assume that the cue marking the target object in Experiment 1 is effective in that it enables participants to focus on the target at some early point in time such that the context object is lexically processed to some minor extent only. Support for this assumption comes from recent studies by Bloem and La Heij (2003) and Damian and Bowers (2003). These authors used different types of production tasks to observe interference effects

from context words denoting a category coordinate of the target but not from corresponding context pictures. Likewise, experiments from our lab show that naming a target object (cued by its color) was facilitated by a phonologically related context word presented in the spatial proximity of the target but not by a corresponding line drawing it denoted (Jescheniak, Oppermann, Hantsch, Wagner, & Schriefers, 2005). All these studies strongly suggest that context objects are not substantially activated at a lexical level of representation (but see Morsella & Miozzo, 2002).

Note, however, that this assumption does not imply that the context object is not processed at all. In fact, the difference in overall naming latencies as a function of context in Experiment 1 (with longer latencies in the constraining context condition) suggests that the context object had some impact on the processing of the target object at earlier stages (i.e., during perceptual and/or conceptual processing). On these two assumptions, the subordinate-level target name *Beetle* and the basic-level name alternative *car* are activated by one (target) stimulus in the non-constraining context condition of Experiment 1. With respect to the constraining context condition of Experiment 1, the situation remains unchanged for the subordinate-level target name. The basic-level name alternative receives some additional activation from the context object Trabi, but this contribution might be too small to yield differential effects. Overall, then, one would expect comparably sized effects from distractors related to the subordinate-level target name and similarly sized effects from distractors related to the basic-level name alternatives in both context conditions of Experiment 1, just as was empirically observed.

Turn now to the displays used in Experiment 2, which contain two target objects that are either identical exemplars from one basic-level category (i.e., two Beetles in the nonconstraining context condition) or two different exemplars from one basic-level category (i.e., a Beetle and a Trabi in the constraining context condition). As both objects were cued as targets, each of them should activate the corresponding lexical codes. In the nonconstraining context condition, the basic-level target name *cars* and the subordinate-level name alternative *Beetles* are activated by both (target) stimuli. In the constraining context condition, the situation remains unchanged for the basic-level target name. However, the subordinate-level name alternative is phonologically activated by one of the two stimuli only and hence receives less activation than in the displays used in the nonconstraining context condition. Thus, there should be comparably sized effects from distractors related to the basic-level target name, but the effects from distractors related to the subordinate-level name alternatives should be much smaller in the constraining context condition than in the nonconstraining context condition and, due to the general decrease of the effect size with increasing SOA, could possibly fail to reach significance at an earlier SOA. This is in fact what we empirically observed.

Clearly, this account is speculative and in need of further independent validation. However, it illustrates that a few assumptions, namely, that a salient cue can limit lexical activation of context objects and that to-be-named target objects activate lexical representations at different levels of specificity, can provide a good account of the data pattern observed in Experiments 1 and 2.

We turn now to a more general issue. Given that, so far, the context manipulation had little effect on lexical activation patterns,

one could hypothesize that the obtained results do not reflect phonological activation of alternative names but rather the phonological activation of semantically related words, irrespective of whether they are name alternatives for a given object. If that were the case, we would not only expect that, for example, *Beetle* would become activated when naming the corresponding object with the word *car* (see the nonconstraining context conditions in Experiments 1 and 2), but we would also expect that other names of specific cars (e.g., *Trabi*) also become activated, even if these names are not correct names of the to-be-named object. In fact, on a simple spreading-activation mechanism, there should be no qualitative difference between correct and incorrect subordinate-level names, as one-step priming (i.e., spread of activation from the basic-level concept to a subordinate-level concept) is involved in both cases. There might be a quantitative difference, though, with the effect being larger for correct subordinate-level names—a likely reason being that correct subordinate-level names, unlike incorrect subordinate-level names, receive additional activation from the picture input. Any demonstration of lexical coactivation of words that are not viable name alternatives for the depicted object would also provide a simple explanation of why context did not effectively block the coactivation of contextually inappropriate name alternatives in the experiments reported so far. In such a case, the pattern of results would have to be attributed to a spreading activation mechanism that is largely independent of the actual details of the stimulus configuration. On an alternative account, however, one could predict that coactivation is restricted to words that are true name alternatives of the to-be-named object. This latter prediction can be derived by extrapolating the results from an experiment reported by Levelt et al. (1991) that failed to detect measurable lexical activation of category coordinates during basic-level naming (e.g., *goat*, if *sheep* was the target) to the hierarchical semantic relations that are in the focus of the present study. These contrasting predictions were tested in Experiment 3.

Experiment 3

Experiment 3 tested whether subordinate-level names of other category exemplars (e.g., *Trabi*) are phonologically activated during basic-level naming (e.g., when speakers respond with the word *cars* to the picture of two Beetles), by comparing effects from a distractor related to the subordinate-level name of a different exemplar (e.g., *trance*, related to *Trabi*) to effects from an unrelated distractor. As in the nonconstraining context condition of Experiment 2, there were two identical target objects in each trial (e.g., two Beetles).

Method

Participants and materials. Sixty-four participants were tested. The visual and auditory materials were identical to those used in the nonconstraining context condition of Experiment 2, with the exception that the distractors related to the subordinate-level names were rearranged such that they were now related to the subordinate-level name of the second exemplar from the same basic-level category (e.g., *trance*, related to *Trabi*, when two Beetles were presented) rather than to the subordinate-level name of the depicted target object(s), while being phonologically unrelated to the target objects' basic-level name and to their subordinate-level name. For two items, there was word-final overlap of two segments between the target objects' subordinate-level name and the distractors phonologically related

to the subordinate-level name of the second exemplar. Due to this overlap, corresponding trials might be expected to contribute to an interference effect, even if incorrect subordinate-level names are not activated. In view of this possibility, we opted for the following procedure. To keep the distractor sets constant across experiments, we included these items in the experiment. We then performed separate statistical analyses on the full item set and on the reduced item set (excluding the two items). These analyses yielded virtually identical results; the analyses on the full item set are reported.

Design and procedure. To reduce the chance that lexical activation of incorrect subordinate-level names would be artificially induced by including multiple exemplars from a basic-level category (in particular, the nondepicted exemplar to which the distractor was related), we changed the design in the following way. We split the set of experimental items into two subsets such that each subset contained only one exemplar from each basic-level category and such that, for each subset, the sets of distractors used in the related and unrelated conditions were identical. For each subset, 16 experimental lists were created according to the same general criteria that were applied in Experiment 1. Each experiment consisted of two parts. In the first part, participants received a list composed of one subset of items, and in the second part, they received a list composed of the other subset, with the presentation order of lists derived from the two item subsets being systematically varied. Two different booklets, showing only the pictures used in a given part of the experiment, were presented to the participants prior to the start of that part. This design allowed us to present the full item set to each participant but, at the same time, to trace the source of possible interference effects from distractors related to an incorrect subordinate-level name. If such effects are induced by the inclusion of multiple exemplars from a given category, they should largely be confined to the second half of the experiment, that is, there should be an interaction of the variables part of experiment (first vs. second) and relatedness (related vs. unrelated). By contrast, true interference effects should be visible throughout the experiment, that is, there should be no such interaction. The procedure was identical to the one used in Experiment 1.

Results and Discussion

The raw data were treated in the same way as in the preceding experiments. After replacement of 4 participants, we identified 3.6% erroneous observations and 1.7% outliers. There were no reliable interactions involving the variables part of experiment and relatedness, suggesting that the critical effects were present (or absent) throughout the experiment. Thus, Table 3 displays mean reaction times and error rates per SOA and distractor type for Experiment 3, collapsed across the two parts of the experiment.

Effects from distractors related to an incorrect subordinate-level name. Naming latencies and error rates decreased from short to long SOAs, as reflected in significant SOA effects: for reaction times, $F_1(3, 189) = 55.49$, $MSE = 3450.37$, $p < .001$; $F_2(3, 57) = 93.13$, $MSE = 636.40$, $p < .001$; for error rates, $F_1(3, 189) = 5.18$, $MSE = .32$, $p < .01$; $F_2(3, 57) = 4.35$, $MSE = 1.31$, $p < .01$. There was neither a significant main effect of relatedness—for reaction times, $F_s < 1$; for error rates, $F_1(1, 63) = 1.65$, $MSE = .29$, $p = .20$; $F_2(1, 19) = 1.09$, $MSE = 1.27$, $p = .31$ —nor a significant Relatedness \times SOA interaction: for reaction times, $F_1(3, 189) = 1.21$, $MSE = 1,010.63$, $p = .31$; $F_2(3, 57) = 1.18$, $MSE = 346.42$, $p = .32$; for error rates, $F_s < 1$.

Effects from distractors related to the basic-level target name. Naming latencies were faster at long SOAs, as reflected by a significant SOA effect, $F_1(3, 189) = 33.64$, $MSE = 2,586.77$, $p < .001$; $F_2(3, 57) = 62.45$, $MSE = 434.34$, $p < .001$. Related distractors yielded faster responses than did unrelated distractors,

Table 3
Mean Reaction Times (in Milliseconds) and Error Rates (as Percentages) by Stimulus Onset Asynchrony (SOA) and Distractor Type From Experiment 3

Distractor	SOA							
	0 ms		100 ms		200 ms		300 ms	
	<i>M</i>	%	<i>M</i>	%	<i>M</i>	%	<i>M</i>	%
Distractors (un-) related to incorrect subordinate-level name								
SUB-REL	620 (11)	3.7 (0.6)	610 (11)	3.4 (0.6)	586 (10)	3.4 (0.6)	564 (8)	2.2 (0.4)
SUB-UNR	623 (11)	4.3 (0.7)	611 (11)	4.3 (0.7)	581 (10)	3.6 (0.6)	558 (7)	2.3 (0.5)
Difference	-3 (3)	-0.6 (0.8)	-1 (5)	-0.9 (0.8)	5 (4)	-0.2 (0.8)	6 ^{ns} /† (4)	-0.1 (0.6)
Distractors (un-) related to basic-level target name								
BAS-REL	565 (10)	4.5 (0.5)	542 (9)	3.1 (0.5)	545 (8)	3.6 (0.6)	550 (7)	2.5 (0.5)
BAS-UNR	632 (11)	4.1 (0.6)	623 (13)	3.8 (0.6)	583 (10)	3.9 (0.6)	565 (8)	3.2 (0.5)
Difference	-67 ^{***} / ^{***} (5)	0.4 (0.7)	-81 ^{***} / ^{***} (8)	-0.7 (0.8)	-38 ^{***} / ^{***} (5)	-0.3 (0.8)	-15 ^{**} / ^{***} (4)	-0.7 (0.5)

Note. Designated target name is at the basic level. The subordinate-level name denotes a nondepicted category exemplar. Standard error of the mean is shown in parentheses. Positive difference scores reflect interference, and negative difference scores reflect facilitation. Significance of these scores is indicated by superscripts. Results from the *t* tests by participant precede the results from the *t* tests by item. SUB-REL = related to an incorrect subordinate-level name; BAS-REL = related to the basic-level target name; SUB-UNR and BAS-UNR = unrelated controls.

^{ns} = not significant. † $p < .10$ (marginally significant). * $p < .05$. ** $p < .01$. *** $p < .001$.

yielding a significant effect of relatedness, $F_1(1, 63) = 160.74$, $MSE = 4,086.87$, $p < .001$; $F_2(1, 19) = 165.84$, $MSE = 1,198.75$, $p < .001$. The facilitation effect decreased from short to long SOAs, as reflected in a reliable $SOA \times Relatedness$ interaction in the analysis of reaction times, $F_1(3, 189) = 39.51$, $MSE = 1,410.40$, $p < .001$; $F_2(3, 57) = 39.22$, $MSE = 434.67$, $p < .001$, although the effect was significant at all SOAs. There were no significant effects in the analysis of error rates.

When participants named the target objects with their basic-level names, no specific effect was obtained from distractors related to an incorrect subordinate-level name denoting a different category exemplar. This finding shows that bearing a hierarchical relation to the target word does not suffice for measurable phonological activation to occur, at least if unambiguous identification of the depicted object at the subordinate level is possible. It complements the earlier observation that category coordinates are not phonologically activated during naming either (Levelt et al., 1991; Peterson & Savoy, 1998). Rather, it appears that only such semantic competitors are being phonologically coactivated to a non-negligible degree that are viable name alternatives for the target object.

General Discussion

This article reports a series of experiments exploring context effects on lexical choice and lexical activation. Participants viewed displays composed of color photographs of two objects positioned side by side. In each display, either one object or both objects were cued as target(s), and participants named the target object(s) with a single word. If only one object was marked as the target (e.g., a Beetle), the context object could either be unrelated (e.g., a palm tree; nonconstraining context) or be drawn from the same basic-level category (e.g., a Trabi; constraining context). If both objects were marked as targets, they could either be identical (e.g., two Beetles; nonconstraining context) or be different exemplars from

the same basic-level category (e.g., a Beetle and a Trabi; constraining context). With these displays, a norming study revealed clear context effects on lexical choice. If only one name alternative was contextually appropriate, speakers produced these names almost exclusively, with very few exceptions. With these display types, Experiments 1 and 2 explored whether nonselected name alternatives are phonologically activated and whether this activation is contingent on the contextual appropriateness of the respective names. To this end, the effect from distractor words phonologically related to the name alternative was compared with the effect from unrelated distractor words. In all experiments, distractors related to the nonselected name alternative interfered with the naming response. This was true for basic-level name alternatives during subordinate-level naming (Experiment 1) as well as for subordinate-level name alternatives during basic-level naming (Experiment 2). The effect was obtained regardless of whether the name alternative was an appropriate response in the given context (Experiments 1 and 2). Experiment 3 demonstrated that inappropriate subordinate-level names (denoting a nondepicted category exemplar) were not substantially phonologically activated during basic-level naming. Figure 2 gives a summary of the results from all three experiments.

These findings show that substantial lexical coactivation at a phonological level does not occur for all hierarchically related terms alike and is compatible with the view that such coactivation might be confined to those competitors that are viable name alternatives. It is important to note that these viable name alternatives do become activated irrespective of whether the context renders them appropriate or inappropriate. Overall, then, this pattern suggests that nonselected name alternatives become phonologically activated and that context manipulations effectively constraining speakers' lexical choice are not capable of effectively preventing the phonological activation of currently inappropriate responses. Put differently, it appears that phonological coactiva-

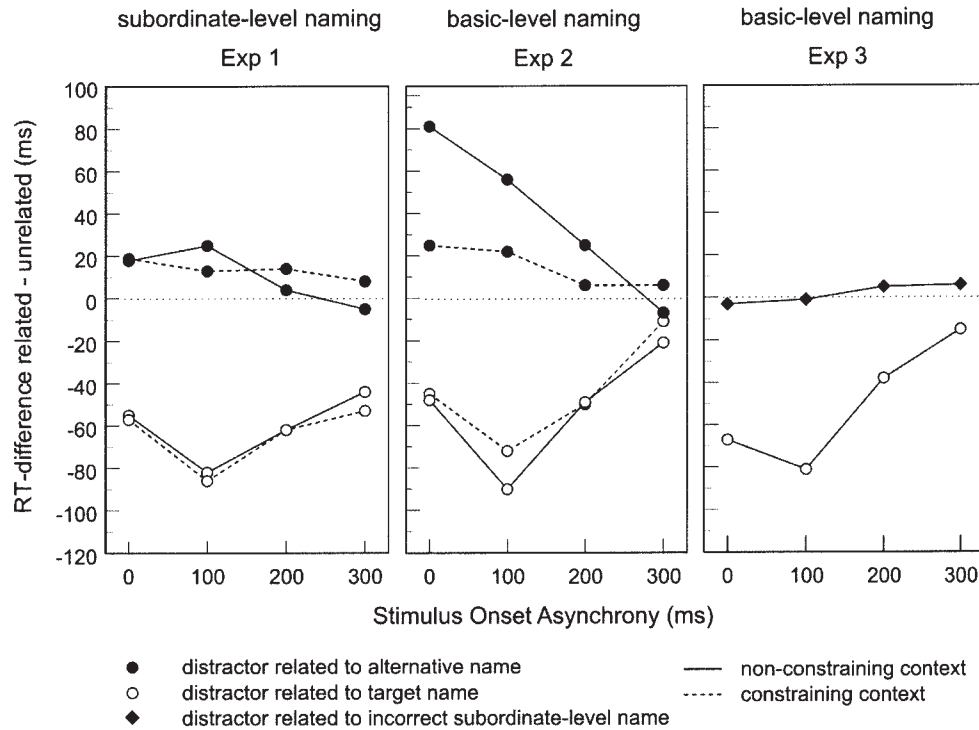


Figure 2. Mean reaction time (RT) differences (related minus unrelated; in ms) from Experiments 1–3, broken down by stimulus onset asynchrony, distractor type, and context. Exp = experiment.

tion of name alternatives is a largely automatic and context-insensitive process, driven by the to-be-named target object(s), whereas the eventual choice between alternative names is guided by contextual constraints.

Below, we relate the present results to a number of theoretical issues. A first issue relates to the actual theoretical impact of our observations. One might argue that, on some accounts of object processing, the findings from our experiments might not be too surprising given that, in all cases, the visual displays contained sufficient detail to activate conceptual representations at different levels of specificity, including subordinate-level concepts and basic-level concepts. If one assumes unconditioned cascading of activation from perceptual and conceptual representations to lexical representations (e.g., Humphreys & Forde, 2001; Humphreys, Riddoch, & Quinlan, 1988; Morsella & Miozzo, 2002), one would expect these activated conceptual representations to also become phonologically activated, as the present data in fact suggest. However, the assumption of unconditioned cascading of activation from conceptual to semantic to phonological representations has not remained unchallenged. For example, in a chronometric study of lexical retrieval, Levelt et al. (1991) found no evidence for the phonological activation of semantic category coordinates to a target (e.g., *train*, if *car* was the target), although these semantic category coordinates were shown to be strongly activated at a nonphonological lexical level (see also Jescheniak et al., 2003, for similar findings using an electrophysiological approach). Likewise, using a task requiring access to object knowledge but not to lexical information, Jescheniak, Schriefers, Garrett, and Friederici (2002) failed to obtain evidence for the phonological activation of

object names, although the objects' semantic representations were demonstrably activated. In fact, in view of some of these data (in particular, Levelt et al., 1991), proponents of interactive models of lexical access (e.g., Dell & O'Seaghdha, 1991, 1992) have proposed that the impact of cascading of activation during lexical retrieval might be limited.

A second issue concerns the direction of effects. In all experiments using distractors related to an alternative name from a different level of specificity than the target name, we observed inhibitory effects. There are only a few studies that have also explored between-level competition effects, and these studies used distractors denoting an alternative object name from a different level of specificity rather than a word phonologically similar to the alternative name, as was used in the present study (e.g., Glaser & Dünghoff, 1984; Hantsch et al., in press; Kuijpers & La Heij, 2004; Roelofs, 1992; Vitkovitch & Tyrell, 1999; Zwitserlood et al., 2004). Results from the studies focusing on possible competition effects between basic-level names and subordinate-level names are mixed. Roelofs (1992) found facilitation from subordinate-level distractors during basic-level object naming, and Vitkovitch and Tyrell (1999) obtained facilitation from basic-level distractors during subordinate-level naming. By contrast, two more recent studies reported between-level interference effects. Zwitserlood et al. (2004) found interference from subordinate-level distractors during basic-level naming. Hantsch et al. (in press) observed interference from both basic-level distractors during subordinate-level naming and subordinate-level distractors during basic-level naming and replicated this pattern with two different material sets. The present results are in line with the findings from

the latter two studies. Here, we do not provide a full discussion of possible reasons for the conflicting results in the aforementioned studies because the present study was concerned with potential context modulations of competition effects rather than the direction such competition effects take. For a detailed discussion of the factors that might contribute to between-level facilitation effects, we refer the reader to Hantsch et al. (in press).

A third issue relates to the size of our effects. Mediated priming effects of the type tested here (i.e., in which the phonological activation of a lexical competitor is being studied) must be expected to be small on theoretical grounds (Dell & O'Seaghdha, 1991, 1992; Harley, 1993) and are sometimes, if obtained at all, reliable only in cross-experiment analyses (e.g., O'Seaghdha & Marin, 1997). This fact puts the present findings into perspective. After all, reliable effects could be established in two single experiments. Moreover, as the design required a large number of item repetitions, it is likely that we have underestimated the true size of the effect. Thus, our data suggest that lexical competition between hierarchically related name alternatives at a phonological level of representation must be considered very pronounced during lexical retrieval in naming.

A fourth issue relates to the conclusions concerning contextual modulations of lexical activation patterns that can be drawn from the present findings. Our experiments have shown that name alternatives became lexically phonologically activated regardless of whether the context rendered these name alternatives appropriate. Hence, the data suggest that a context that strongly constrains speakers' lexical choice cannot effectively prevent lexical activation of currently inappropriate name alternatives. The more fine-grained question of whether contextual constraints modulate the strength of a name alternative's phonological activation might be more difficult to answer. Although similar-sized interference effects obtained in Experiment 1 suggest that they do not, differently sized interference effects obtained in Experiment 2 call this conclusion into question (see also Figure 2). We have provided a tentative account for these differential patterns in Experiments 1 and 2, but that account clearly is not conclusive.

Considering further that contextual appropriateness was manipulated in a between-participants design (for reasons given in the *Method* section of Experiment 1), one might defer a definite answer to this question to future research and limit the conclusions from the present study to the claim that multiple name alternatives become phonologically activated during naming and that contextual constraints that have a strong impact on lexical choice do not prevent the activation of name alternatives that are, in a given situation, neither appropriate nor selected for production.

Our findings also have implications for models of categorization. This is because the evidence obtained for the phonological activation of name alternatives implies that the corresponding concepts have been activated as well, as in all theories of object naming and lexical retrieval, phonological activation is assumed to be contingent on prior conceptual activation. An important aspect of the theory advanced by Jolicoeur et al. (1985) is that concepts at one level of the hierarchy (and corresponding names) can be accessed only through the prior activation of entry-level concepts at another level in the hierarchy. This feature could lead to the prediction of differential activation patterns, depending on whether a designated response coincides with an object's entry level. For objects with an entry point at the subordinate level, one would

predict the activation of subordinate-level concepts to necessarily occur during basic-level naming. This prediction was borne out in Experiment 2. By contrast, for the same objects, one would not necessarily predict the activation of basic-level concepts during subordinate-level naming, in particular, if the context renders these concepts inappropriate. This latter prediction, however, is in contrast to what was empirically observed in Experiment 1. The fact that there was substantial activation of non-entry-level as well as entry-level concepts regardless of the designated response level suggests that spread of activation within a conceptual hierarchy and the lexical system is a fast and automatic process after the entry point has been accessed and, moreover, that this spread of activation is not substantially affected by contextual constraints.

A central debate in speech production research in the past years was concerned with details of the activation flow in the mental lexicon. The serial-discrete model proposed by Levelt et al. (1991, 1999) assumed strong constraints on the spread of activation, with phonological activation being contingent on prior lexical selection at the lemma level, whereas forward-cascading and interactive models, as originally proposed by Dell and colleagues (Dell, 1986; Dell & O'Seaghdha, 1991; Dell et al., 1997), considered lemma activation and phonological activation to be more continuous processes. The question of whether evidence for the phonological activation of nonselected competitors could be found thus turned out to be a crucial issue of speech production research. Although phonological coactivation could consequently be obtained repeatedly for near synonyms to a target (Jescheniak & Schriefers, 1998; Peterson & Savoy, 1998), the interpretation of this effect remained contended. Levelt et al. (1999) considered it an exceptional case, reflecting the misselection of a strong and contextually appropriate lexical competitor. Other researchers interpreted it as evidence that (by theory, small-sized) phonological coactivation effects, as predicted by nondiscrete models, are observed only under optimum circumstances, with the strength of lexical-conceptual competition playing an important role (e.g., Peterson & Savoy, 1998).

The present study adds to this discussion in several ways. First, in line with the hypothesis advanced by Levelt et al., it shows that the phonological coactivation of strong lexical competitors, in particular, words denoting an entity at different levels of specificity (i.e., basic-level names during subordinate-level naming and subordinate-level names during basic-level naming), does in fact exist. Second, and in contrast to that hypothesis, it shows that this phenomenon is not contingent on the appropriateness of the alternative names. It is also obtained under conditions that render use of a particular name alternative contextually inappropriate, as indexed by speakers' actual lexical choice in free naming. Thus, our study challenges the assumption of a highly constrained lexical retrieval process according to which phonological activation is restricted to the selected target word and eventually misselected appropriate name alternatives as maintained by a modified serial-discrete model. At the same time, our study reaffirms the previous observation that lexical competitors that are generally inappropriate (i.e., incorrect object names) are not activated at the phonological level to a substantial degree, putting strong constraints on the maximum amount of cascading that is permissible in nondiscrete models. This overall pattern sets important constraints for future theorizing about and modeling of lexical retrieval in speaking. Future approaches will have to take into account that contextual appropriateness constrains the eventual lexical choice but

cannot prevent phonological activation of contextually inappropriate name alternatives.

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Appendix

Subordinate-Level and Basic-Level Names of the Objects Used in Experiments 1–3 and Corresponding Distractors

SUB name	BAS name	Distractor	
		SUB-REL	BAS-REL
Käfer (Beetle)	Auto (car)	Käfig (cage)	Aula (assembly hall)
Trabi (Trabi)	Auto (car)	Trafo (transformer)	Aula (assembly hall)
Palme (palm tree)	Baum (tree)	Paste (paste)	Bauer ^a (farmer)
Tanne (fir)	Baum (tree)	Tasche (bag)	Bauer ^a (farmer)
Rose (rose)	Blume (flower)	Rodel (sledge)	Bluse (blouse)
Tulpe (tulip)	Blume (flower)	Tunnel (tunnel)	Bluse (blouse)
Gondel (gondola)	Boot (boat)	Gockel (rooster)	Bogen (bow)
Kanu (canoe)	Boot (boat)	Kabel (cable)	Bogen (bow)
Aal (eel)	Fisch (fish)	Ader (vein)	Finger (finger)
Hai (shark)	Fisch (fish)	Heizung (heating)	Finger (finger)
Dackel (dachshund)	Hund (dog)	Dattel (date)	Hunger (hunger)
Pudel (poodle)	Hund (dog)	Puder (powder)	Hunger (hunger)
Bube (knave)	Karte (card)	Bude (stall)	Kante (edge)
Dame (queen)	Karte (card)	Datum (date)	Kante (edge)
Barbie (Barbie)	Puppe (puppet)	Barke (bark)	Pudding (pudding)
Matroschka (Russian puppet)	Puppe (puppet)	Matte (mat)	Pudding (pudding)
Füller (fountain pen)	Stift (pen)	Fürstin (princess)	Stimme (voice)
Kuli (ball pen)	Stift (pen)	Kuchen (cake)	Stimme (voice)
Möwe (seagull)	Vogel (bird)	Möbel (furniture)	Foto ^b (foto)
Specht (woodpecker)	Vogel (bird)	Spende (donation)	Foto ^b (foto)

Note. Approximate English translations are shown in parentheses. SUB = subordinate-level object name; BAS = basic-level object name; SUB-REL = distractor related to subordinate-level name; BAS-REL = distractor related to basic-level name.

^a Replaced by *Beule* (buckle) in Experiments 2 and 3. ^b Replaced by *Fötus* (fetus) in Experiments 2 and 3.

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