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Semantic context effects in word production : the role of message congruency

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Semantic context effects in word production:

The role of message congruency

Jan-Rouke Kuipers

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Contents

Summary

The main question that the research presented in this dissertation is focused on, is why compared to unrelated context words, related context words induce interference in basic level picture naming but facilitation in picture categorization (Glaser & Düngelhoff, 1984). One possible explanation for this observation is that basic-level words do compete for selection in basic-level naming tasks, but they do not compete for selection in category level naming tasks (Roelofs, 1992). This account, in which lexical competition is restricted to words that are part of the set of permitted responses, was discarded due to the criticism it has received in the literature (Caramazza & Costa, 2001, 2002; but see Roelofs 2001).

A second explanation for the polarity of the semantic context effect is the semantic selection account (Costa et al., 2003) in which it is assumed that conceptual representations can be prioritized for further processing on the basis of their semantic properties (e.g., their level of categorization). This account was refuted by the results of Experiments 2a and 2b in Chapter 2, because semantic interference was also observed across levels of categorization. Thus, even distractors at a different level of categorization than the required response can induce semantic interference. We argued that because related context words induce lexical interference compared to unrelated context words in both basic-level picture naming and category-level picture naming, another strongly facilitating semantic context effect must be present in the categorization task in order to account for the semantic facilitation that is observed in this task.

This hypothetical effect labeled “message congruency” was assumed to arise when the automatic processing of the context leads to the activation of the concept that is required for the verbal response. To outweigh the lexical interference induced by a

semantically related context word, the facilitation due to message congruency must be substantial.

In Chapter 3 the message congruency account was tested by investigating whether the facilitation by message congruency is indeed large enough to outweigh lexical interference. To measure the message congruency effect, a paradigm was used that involved two tasks: one in which message congruency was present and one in which it was not present. It was reasoned that if we would observe a difference in the semantic context effect between the tasks, this would be due to message congruency. The results showed a reliable difference in the semantic context between the tasks, and it was concluded that the message congruency effect is large enough to outweigh a semantic interference effect at the lexical level.

With the establishment of the message congruency effect in Chapter 3, the goal in Chapter 4 was to determine the cause of this effect. I have discussed two mechanisms that could underlie the facilitation by message congruency. The first mechanism was proposed by Glaser and Düngelhoff' (1984). They assumed that the unrelated context (context picture in the word categorization task and context word in the picture categorization task) activates a category concept which name was part of the set of responses in their experiments. A categorically related concept word does not activate a wrong response alternative; hence, the semantic facilitation effect in the categorization task was attributed to the interference at the lexical level induced by the unrelated context. The second approach to explain the message congruency effect stresses that the effect is purely facilitatory. The proposed mechanism responsible for the facilitation effect is the co-activation of the sought-for concept by the message congruent context.

These two accounts of the message congruency effect were tested in Chapter four. No evidence for the competition account was found; hence, the co-activation of the sought-for concept is currently the best explanation for the message congruency effect.

In the model of word production that is proposed, a context word can induce semantic facilitation due to spreading of activation, facilitation due to message congruency and semantic interference in lexical selection. With this model, the polarity of the semantic context effect in various tasks can be explained.

1. Introduction

In this Chapter I briefly discuss the historical background and the research method that is at the basis of the research I present in this dissertation. Four models of single word production are discussed. Next, I argue that an important phase in word production, the process of conceptualizing, is ignored or greatly simplified in these models. How the discussed models may possibly be adapted to accommodate a conceptualizing process is discussed and evaluated. A brief outline of the research presented in this dissertation is given. The experiments address the question of why and how the semantic context effect is modulated by the task that is applied to the target.

Brief historic background

The unique and highly developed human skill of producing language and speech has been the focus of countless researchers for over a century. Throughout this time there have been two main approaches to study spoken language. One tradition has developed theories and models based on corpora of speech errors. The other tradition involved chronometric measurements of producing words or word lists. Although these traditions differ in their research methods, they address the same processes and they have put forward models that are similar. The research presented in this dissertation belongs to the chronometric tradition, so the methods and models that will be discussed mainly belong to this tradition.

In the late nineteenth century when the first psycho-physiological and psychometrical research laboratories emerged, pioneers like Wilhelm Wundt, James Cattell, and William James, measured the time taken by various mental processes. One proposal of that period can be traced back as important and still relevant for some of today's views on language and speech production. This is the interpretation by Cattell (1886) of his finding that colors and pictures are perceived faster but named slower than letters and words. His words: "*I have made show that we can recognise a single colour or picture in a slightly shorter time than a word or letter, but take longer to name it. This is because in the case of words and letters the association between the idea and name has taken place so often that the process has become automatic, whereas in the case of colours and picture we must by a voluntary effort choose the name.*" (p 65). The reason this interpretation is still relevant today will become clear in the course of this Chapter.

Much later in 1935, Stroop conducted color and word naming experiments that only became influential some three decades later, which they still are today. His main aim was to investigate whether a context color or color word induces interference on naming a target color word or color respectively. Using color words printed in different colors, he found interference of color words in the color naming task, but no interference of the colors in the word naming task. An explanation of this finding in line with the above automaticity rule of Catell is as follows: In the color naming task, the color word has automatically activated its name, while the color's name has to be retrieved with effort. Thus the color word that is readily available is the wrong color word, which causes the delay in producing the correct color word. In the word naming task, the color does not automatically activate its name, so no interference will be observed when producing the word.

Taking another leap in time brings us to a paradigm that is related to Stroop's (1935) task. The picture-word interference (PWI) task, first conducted by Hentschel in 1973, has proved to be of great value for the research on speech production. In this task, a participant is required to name a picture as quickly as possible while ignoring a context word that is superimposed on the picture. This task was embraced by researchers due to its similarity to the Stroop task, while one is not restricted to the small set of possible target colors and color words that are available in the Stroop task. The two tasks are also similar in the interference and facilitation effects that they exhibit (Ehri, 1976, Glaser & Düngelhoff, 1984; Lupker & Katz, 1981; Smith & Magee, 1980), so it seems that similar mental processes are involved in these tasks. The extensive use of the PWI task has led to a number of findings which are the basis for models of word production. A robust and very often replicated finding is the semantic interference induced by a context word that is categorically related to the target picture compared to an unrelated context word (e.g., Glaser & Düngelhoff, 1984; La Heij, 1988; Lupker, 1979; Rosinski 1977; Underwood, 1976). For example, when the picture of a car is presented with the word "train" superimposed, the picture is named slower than when an unrelated word (e.g.,"apple") had been superimposed. This semantic interference effect is generally attributed to the process of lexical selection (Glaser & Glaser, 1989; Humphreys, Lloyd-Jones and Fias, 1995; Levelt, Roelofs and Meyer, 1999; Roelofs, 1992; Starreveld and La Heij, 1995, 1996; but see Mahon, Costa, Peterson & Caramazza, 2007). According to this view, selecting a word for production is a competitive process that is based on the relative activation this word has compared to other words. Thus, the more an irrelevant word is activated, the more it interferes with selection of the appropriate word. I will not discuss this position in detail here, as the relevant observations will be discussed in the next chapters. Instead I will focus on some of the word production models that have been developed and which I will refer to in the next chapters.

Models of speech production

Within the development of models of speech production, two issues that have led to an ongoing disagreement among researchers are: (1) the number of processing levels involved in producing the name of a picture, (2) the mechanism that is responsible for the exchange of information between these levels. The models that have been developed to explain the findings in the Stroop or PWI tasks have different points of view on these issues.

The first model I discuss is the model of Glaser and Glaser (1989). These authors presented a box-and-arrow model to account for Stroop and Stroop-like effects in picture naming and word reading. There are two main components of the model, one is the semantic memory and one is the lexicon (see Figure 1). The semantic memory consists of concepts in an interconnected network. Concepts that are semantically related are connected and they activate each other by means of spreading of activation (Collins & Loftus, 1975). The lexicon consists of words and their linguistic properties.

Each main system, the semantic memory and the lexicon, has its own executive systems for input and output. A schematic representation of how a picture-word compound is processed according the Glaser and Glaser (1989) model, is presented in Figure 1. A picture is perceived by the semantic executive system, which leads to activation of its semantic representation (concept). This concept spreads activation to related concepts. Each activated concept sends activation to its lexical representation. The concept that belongs to the target picture receives the most activation, which enables the selection of the corresponding word at the lexical level. A perceived word enters the system at the grapheme executive system, which causes the activation of a lexical entry in the lexicon. This word will in turn send activation to its semantic representation, where activation is further spread to related concepts.

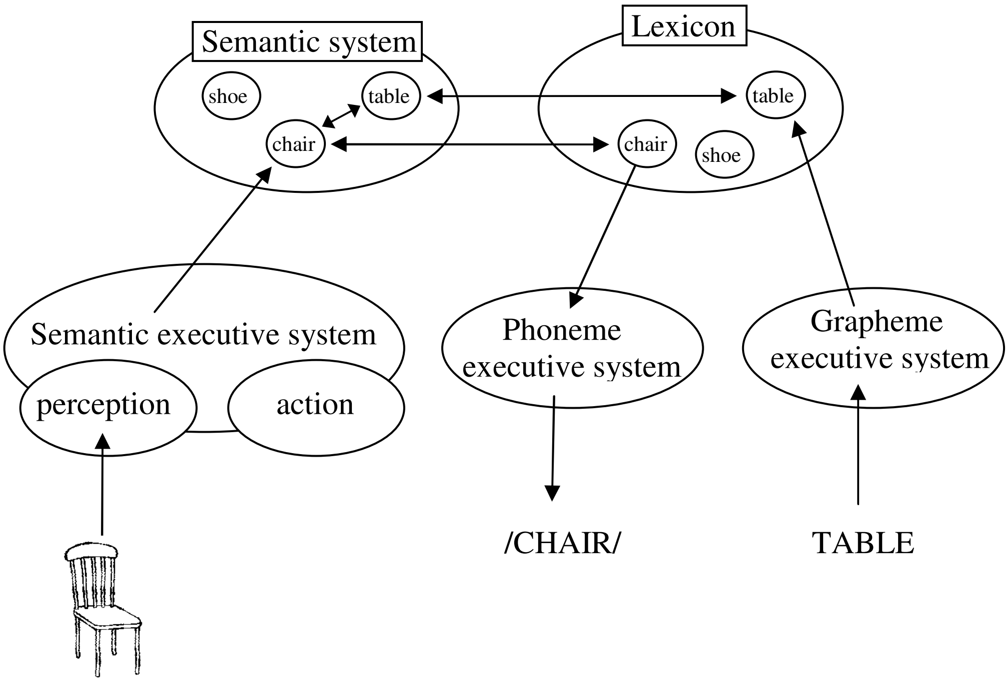

Figure 1. A schematic representation of the Glaser & Glaser model (1989). The input to the system is the picture of a chair and the word “table”. The verbal output is the word “chair”.

Distinctive features of this model with respect to other models are: (1) There are four levels of representation for an identified and named picture: a perceptual, a semantic, a lexical and a phonological level; (2) Lexical representations do not contain semantic information; (3) Each semantic node automatically activates its lexical representation when activated and (4) this activation automatically flows to its phonological representation. Stroop interference or interference of a context word on naming a picture arises in this model due to the different entry levels of a word and a picture. A picture has privileged access to the semantic system and a word to the lexical system. Interference of a context stimulus on processing a target can be observed when the context has privileged access to the subsystem that is crucial for producing a response to the target; and more interference can be observed when the context is semantically related to the target, but not congruent with the required response to the target. Thus, a context word can interfere with naming a picture, because it has privileged access to the lexical subsystem, and a related context word will interfere more than an unrelated word, because its lexical representation also receives activation from the conceptual system.

The second model I discuss was presented by Caramazza (1997) who primarily based his theory on the study of speech errors of speech impaired patients. He argued for a two-stage representation of lexical access in which the first stage involves the selection of the lexical semantic forms and syntactic features (see Figure 2). The second stage involves the selection of a phonological or an orthographical lexeme. This model, the Independent Network model, differs from other models in a number of respects.

First, concepts in the semantic network are assumed to be decomposed into semantic features. Second, there are independent systems for orthographic and phonological representations. The semantic features are mapped on the entries of each lexical system and only some features are weakly mapped onto syntactic features. The semantic interference as observed in the PWI task is explained in this model as follows. The picture activates its semantic features which in turn activate the phonological and orthographical lexemes they are linked to. The lexemes representing the picture receive most activation because they receive activation from all active lexical-semantic nodes. The context graphical lexeme “table” also activates the lexical-semantic nodes it is linked to, which in turn activate all the phonological lexemes they are linked to. Since a table and a chair share features (only one displayed in Figure 2), the phonological lexeme of the context receives activation from both the context and the target. In comparison, an unrelated phonological lexeme will not receive activation from the target, which makes it a less strong competitor for production than the related one.

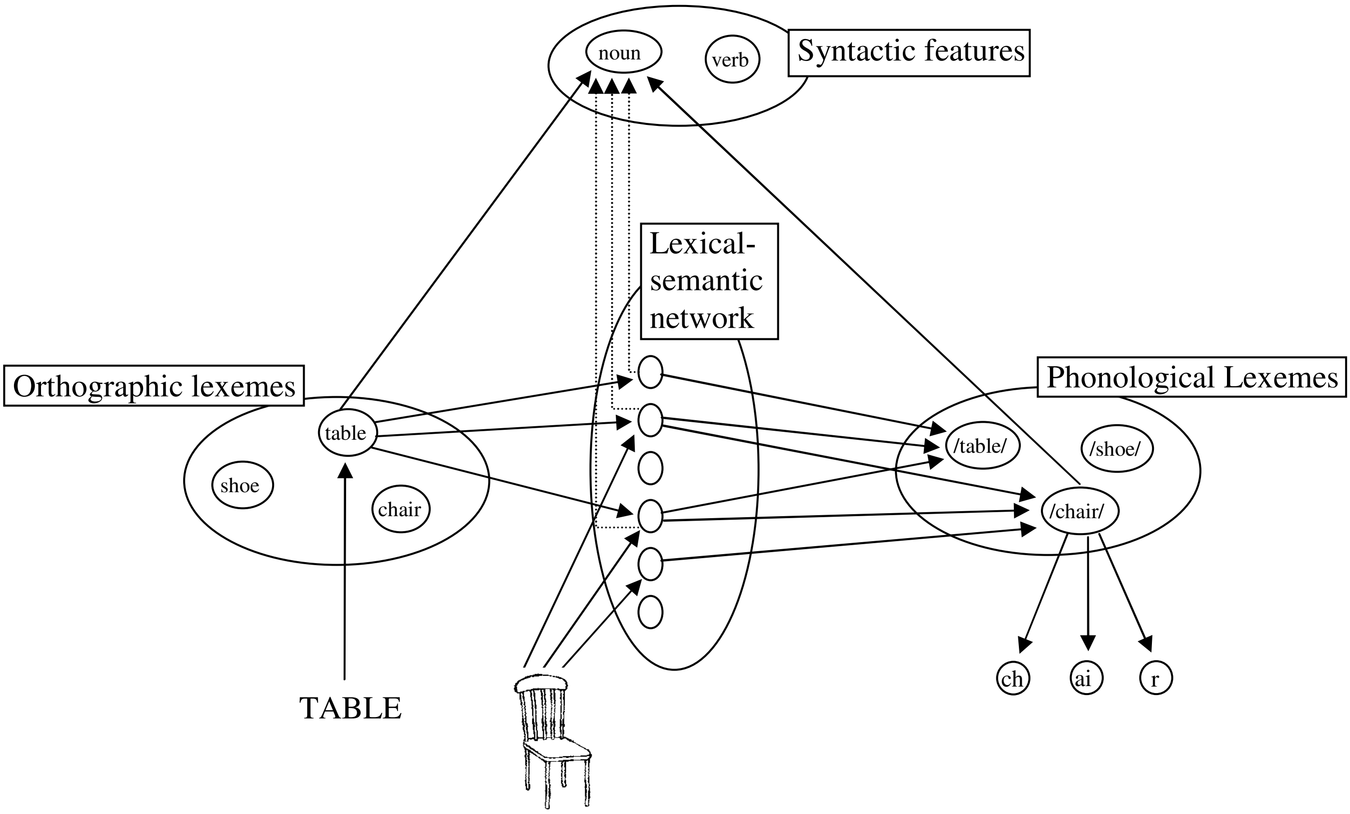

Figure 2. A schematic representation of the Independent Network model (Caramazza, 1999). The input to the system is the picture of a chair and the word “table”. The verbal output is the word “chair”. The connections from the lexical semantic nodes to the orthographical nodes are omitted for clarity.

One important difference between the model of Glaser and Glaser (1989) and the model of Caramazza (1997) is that the unitary concepts in the Glaser and Glaser model are replaced by decomposed semantic representations (semantic features) in the model of Caramazza. A second difference is that phonological and orthographical representations have a common lexical node in the Glaser and Glaser model, while in the Caramazza model these representations are lexically independent.

In contrast to the models I will discuss below, the above models are not computational, that is, they are not implemented to allow for simulations of reaction time data as obtained in, for instance, a PWI task. The computational models I discuss next are based on the model of Glaser and Glaser (1989), which is clearly visible in their structural layout.

The third model I discuss has been most influential ever since its presentation. Levelt, Roelofs and Meyer (1999) presented a model that aims to account for a broad range of findings in speech production and comprehension. A schematic representation of its implemented version, WEAVER++ (Roelofs 2003) is presented in Figure 3.

The model has two functionally different components. One is the network model of which a schematic representation is displayed in Figure 3. The second part is a (non-displayed) shell of production rules that regulates the flow of information through the model. When a picture-word compound is presented in this model, the picture activates its semantic representation which spreads activation to related concepts. All activated concepts send activation to their syntactic representations (lemmas; Kempen & Huijbers, 1983), however, only the lemma that is selected for production will activate its phonology. The context word will activate both its representation in the orthographical/phonological system and its lemma. This lemma will activate the semantic representation it is linked to; there is no feedback of activity from phonological representations to lemmas.

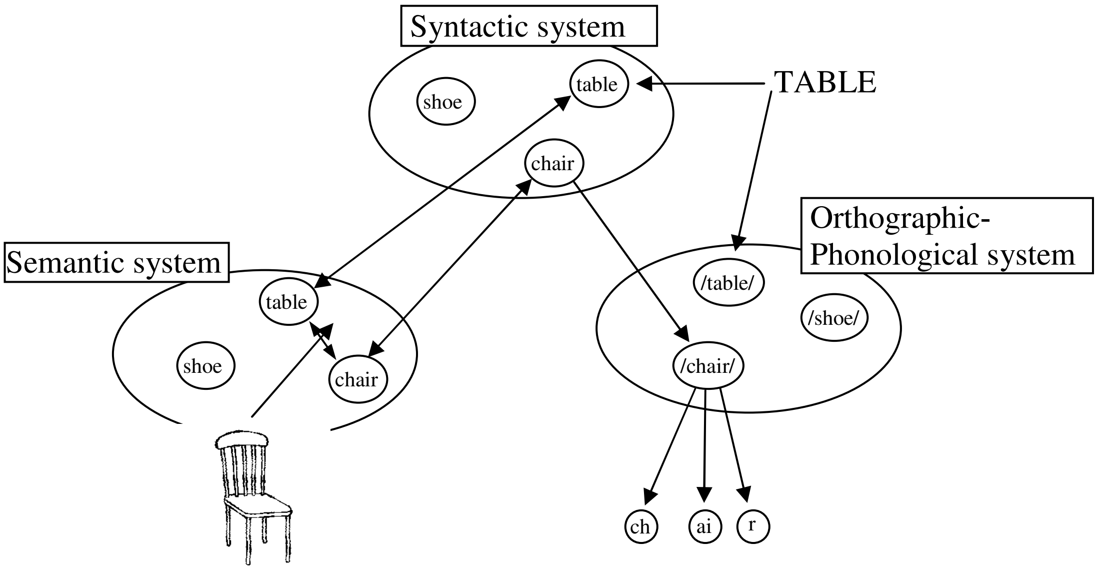

Figure 3. A schematic representation of the WEAVER++ model (Roelofs, 2003). The input to the system is the picture of a chair and the word "table". The verbal output is the word "chair".

To ensure that the picture is named and that the word is not read, production rules act upon the active representations. Production rules are statements with the form: IF (conditions are met) THEN (execute statements). For example, a production rule ensures that the concept that is activated by the target receives a flag to indicate it is selected for production and that its activity is enhanced. Another production rule ensures that only one phonological representation is activated by the syntactic system. The essence of this rule can be stated as follows:

IF (the activity of a syntactic node, which belongs to the set of permissible responses, has reached a critical difference compared to all other permissible response nodes in the sub-system)

AND IF (this node is linked to the concept that has been selected for production)

THEN (activate the linked phonology).

According to this model, the interference induced by a semantically related context word, as observed in the PWI task, is due to the activation that its lemma receives from the target concept. Since the triggering of the production rule for lemma selection is based on the activation values of all lemmas, any activation that a non-target lemma receives, delays triggering of the production rule that is attached to the target lemma.

The last model I discuss is the Conceptual Selection Model (CSM, Bloem & La Heij, 2003; Bloem, Van den Boogaart & La Heij, 2004). This model has many similarities with the WEAVER ++ model I discussed above, but there are some crucial differences which I will point out below.

The CSM does not assume separate lexical and phonological systems. More importantly, it has no outer shell of production rules. This has led to some unique features of the model, because problems that are taken care of by production rules in the WEAVER ++ model, are solved within the network of the CSM (see Figure 4). One of these features is that concepts in the semantic system do not automatically activate their lexical representations. Only when a concept reaches a threshold in activity will it activate a cohort of semantically related words of which the target word receives the most activation. Another assumption of the CSM is that lexical representations have a quicker decay in activity than conceptual representations.

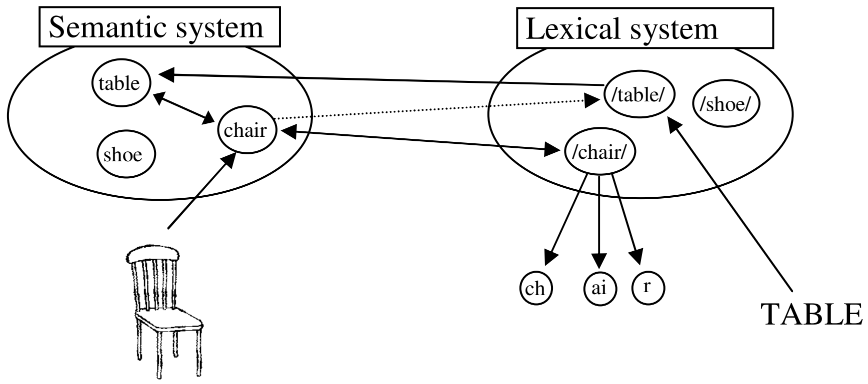

Figure 4. A schematic representation of the Conceptual Selection Model, Bloem & La Heij (2003). The input to the system is the picture of a chair and the word "table". The verbal output is the word "chair".

A picture-word compound is processed in this model as follows. The picture activates its semantic representation, which spreads activation to related concepts. The context word activates its orthographical-phonological representation, which sends activation to its semantic representation. Because the picture is to be named, its conceptual representation receives the most activation. Its activity is pushed over a threshold after which it sends activation to a semantic cohort of lexical representations. The lexical representation that has the highest level of activation will be verbalized. In this model, semantic interference arises, because a semantically related lexical representation receives activation from the context word and from the concept that has reached the activation threshold, since it is part of the semantic cohort. The extra activation the related lexical representation receives makes it a stronger competitor for the target word than an unrelated lexical representation. This explanation of semantic interference is similar to the proposal of Catell (1886) I discussed above, because in both proposals it is assumed that a speaker has control over which concept is lexicalized, unless the stimulus (e.g., a word) has automatic access to the lexicon due to practice.

The missing level: conceptualizing

In the above models, the presentation of a picture of the chair always activates the concept CHAIR and subsequently the word “chair”, which seems correct when this basic-level representation needs to be verbalized. (Throughout this dissertation I will capitalize concepts.) However, one can also refer to this picture with the word “furniture”. Obviously, simply activating the concept CHAIR will not let these models (and any other model) produce the word “furniture”. To simulate such a categorization task, one could assume that for some reason in this task, the picture of a chair activates the concept FURNITURE stronger than the concept CHAIR. With this assumption, the mental process of retrieving the semantic category concept of the picture of a chair is reduced to shifting the location that most activity flows to, even though the same stimulus is used. It is clear that such a simplification of the conceptualizing process does not teach us a lot about how this process actually works.

This process of, for example, retrieving the category of a given stimulus, the action associated with a stimulus, or determining the relative size of a stimulus are examples of “conceptualizing” (or reasoning), which can be defined as: the process of applying the intention of the speaker (the task instruction in an experiment) to the conceptual representation of the stimulus in order to activate the concept that should be verbalized. Despite its central role in producing speech, conceptualizing is simplified or even neglected in many speech production models.

WEAVER ++ is thus far the only model of word production that attempts to capture the conceptualizing process. A difference in the conceptualizing processes between basic-level naming and categorization is represented by a difference in the production rule that selects the concept for production. For example, the rule for selecting the category concept of the target would be: IF (the node is the category concept of the target) THEN (select the concept for production). What is clear from this example is that any task (or intention of the speaker) is a rather straightforward process of modifying the IF-statement such that the desired conceptual node is selected. Besides this adjustment of the IF-statement, the categorization task also requires another response set; hence, the category-level lemmas that are used in the experiment will receive a response-set flag. Thus, the model needs measures at both the conceptual level and the lexical level to account for the data. In Chapter 2 I will discuss and evaluate this solution of WEAVER++.

The other models that I have described above do not address different naming tasks such as picture categorization or action naming. I will now look at how these models could possibly be adapted to capture these tasks. As opposed to the solution chosen in WEAVER++, one can assume that in the Glaser and Glaser model a task instruction only has its effect at the semantic system. For example, higher level processes may pre-activate a set of semantic nodes that are relevant in the task. When the task is category-level naming, all category-level concepts will be pre-activated. The result is that all category level representations will have a higher activation level than representations at other levels of categorization. When the target sends additional activation to its category-level concept, this will become the most strongly activated concept, which ultimately results in the selection of the corresponding lexical representation.

Caramazza (1997) does address category-level naming, because he describes additional assumptions that make the IN model account for category-level responses.

However, he does not specify how a category-level lexeme is selected when the input is at the basic-level. One can assume that this processing step requires higher level input similar to the adaptation I suggested for the Glaser and Glaser (1992) model. If, for example, a semantic feature representing "category level" were assumed, strong top-down activation of this feature could ensure that the category-level lexeme of the target receives the most activation. Selection of the category-level lexeme of the target would then be rather straightforward.

How viable are these possible implementations of a categorization task? Both solutions predict that – irrespective of the task to be performed - a basic-level context word that is categorically related to the target will induce interference compared to an unrelated context word. This is because the lexical representation of the related context word receives (extra) activation from the target via spreading activation at the conceptual level. As any extra activation of an alternative lexical representation makes it a stronger competitor for selection than an unrelated one, semantically related context words induce interference compared to unrelated context words. The typical empirical observation in category-level naming task is, however, that categorically related context words induce semantic facilitation (Glaser & Düngelhoff, 1984). Thus, without additional assumptions, the above implementation of a conceptualizing process in the Glaser and Glaser model and the IN model does not provide a satisfactory account for semantic facilitation in category- and action naming.

Since the above shows that an implementation of a conceptualizing process in word production models is not so straightforward, I postpone a discussion of how the Conceptual Selection Model of Bloem et al. (2004) may be adapted to include a conceptualizing process to the next chapters. The experiments I report in Chapter 2 are aimed at providing an explanation for the results of the seminal study of Glaser and

Düngelhoff (1984). Chapters 3 and 4 build upon, and test, a theory of conceptualizing that is presented in Chapter 2. The motivation behind the research I present in this dissertation is that a better understanding of the semantic context effect in various tasks hopefully brings us closer to understanding the process of conceptually preparing an utterance.

2. Context effects in language production: The role of response congruency[1]

Most current models of speech production predict interference from related context words in picture naming tasks. However, Glaser and Düngelhoff (1984) reported semantic facilitation when the task was changed from basic-level naming to category-level naming. The authors explore two proposals to account for this change in polarity of the semantic context effect: the semantic selection account by Costa, Mahon, Savova and Caramazza (2003) and a response-congruency account. Experiments 1a and 1b show that category names induce semantic interference in basic-level naming, a finding that disproves the semantic selection account and is in line with the response-congruency account. Experiment 2 reveals that response congruency is probably a major contributor to the overall facilitation effect in categorization tasks. Finally, Experiment 3 tests and confirms a prediction of the response-congruency account in basic-level naming with subordinate-level distractors. The authors conclude that the available evidence support the response-congruency account and suggest that this congruency effect is localized at the stage of constructing a preverbal message.

1. This chapter is based on the article: Kuipers, J. R., La Heij, W., & Costa, A. (2006). A further look at semantic context effects in language production: the role of response congruency. *Language and Cognitive Processes, 21*, 892-919.

Introduction

In the last two decades, variants of the Stroop task have become increasingly popular in the study of speech production. In these tasks, researchers examine the effect of context stimuli on response latencies in picture naming (Schriefers, Meyer & Levelt, 1990), definition naming (La Heij, Starreveld & Steehouwer, 1993) and word translation (La Heij, Hooglander, Kerling & Van der Velden, 1996). An often replicated finding in these studies is the semantic interference effect: when a target has to be named in the context of a distractor word, naming latencies are longer when the distractor word is semantically related to the picture than when it is unrelated.

This effect has played an important role in the development of models of speech production. In fact one of the basic tenets of several models of speech production, the existence of lexical competition, is largely based on the explanations given to the semantic interference effect (e.g., Glaser & Glaser, 1989; La Heij, 1988; Roelofs, 1992). A generally accepted explanation of the effect (see, e.g., Bloem and La Heij, 2003; Humphreys, Lloyd-Jones & Fias, 1995; Levelt, Roelofs & Meyer, 1999; Starreveld & La Heij, 1996) is as follows: When a target picture of, for instance, a dog is presented for naming, (a) this picture activates the representation DOG at the conceptual level, (b) activation spreads from this target concept to related concepts (e.g., CAT and HORSE), (c) activation spreads – dependent on the model - either directly from the target concept DOG or indirectly via the related concepts like CAT and HORSE, to semantically related words at the lexical level (e.g., “cat”, “horse”, etc.) and (d) these activated words compete in a process of lexical selection with the correct response word “dog”. Thus, when participants are required to name the picture of a dog that is accompanied by the context word CAT, the lexical representation of the word cat receives activation from two sources: from the word recognition system and from the target concept. In contrast, an unrelated context word only receives activation from the word recognition system and will, for that reason, induce less interference than a semantically related context word.

This account of semantic interference predicts an interference effect whenever target and distractor are semantically related. This prediction, however, is clearly at odds with experimental results obtained in variants of the picture-word interference task in which the target is not named at a basic level of categorization. For instance, Glaser and Düngelhoff (1984) reported the results of a categorization task in which the target picture (e.g., the picture of a cat) had to be named at the super-ordinate level (e.g., "animal"). They used four context conditions: a "concept-congruent condition", in which the context word was the basic-level name of the picture (e.g., "cat"), a semantically related condition (e.g. dog), an unrelated condition (e.g., "glass") and a neutral condition. Although with simultaneous presentation of target and distractor a small semantic interference effect was obtained, at several stimulus-onset latencies (SOAs) close to zero the correct basic-level names and the related context words did not induce interference. In fact, at SOAs -400 ms, -300 ms, -200 ms and +100 ms facilitating effects were found. More recently, Costa, Mahon, Savova and Caramazza (2003) found a significant semantic facilitation of 56 ms with simultaneous presentation of target picture and distractor word in a picture categorization task.

This change in the polarity of the effects produced by semantically related distractors clearly asks for a reconsideration of simple models of semantic interference in terms of lexical competition. These models should be extended to accommodate semantic facilitation in categorization tasks or – if that turns out to be impossible – be replaced by an alternative model that is able to account for the complete pattern of results. The main objective of the present study is to gather more information about the contribution of several factors to semantic context effects in this paradigm. Specifically, we explore the conditions for between categorization-level interference and facilitation and consider the necessary adaptation for models of speech production[2].

Previous explanations for semantic facilitation in categorization tasks

In the literature, three proposals have been put forward to account for the change in the polarity of the semantic context effect in basic-level and category-level naming. Firstly, Roelofs (1992) proposed that only words that belong to a predefined "response set" compete for selection at the lexical level. In a categorization task, these words are the category names in use in the experiment (e.g., "animal", "fruit" and "vehicle"). Basic-level names do not belong to this set and hence do not induce interference. This approach, however, has been refuted by experimental results showing that context words that do not belong to the response set do induce lexical interference (Caramazza & Costa, 2000; 2001, Starreveld & La Heij, 1999; but see Roelofs, 2001). That is, although response set membership may exert some effects in this paradigm, it cannot account for both the presence of semantic facilitation in categorization tasks and the presence of semantic interference in basic-level naming.

Secondly, in a proposal of Costa, Mahon, Savova and Caramazza (2003) it is assumed that the cognitive system can make use of several semantic dimensions to decide which semantic representation to prioritize for further processing (see also Costa, Alario and Caramazza, 2005 for a further discussion of this issue). It is assumed that the level of categorization of a given stimulus can be used by the semantic system to tease apart the semantic representation corresponding to the target and that

[2] In this study we focus on categorizing tasks, which have yielded rather consistent results across many studies. At this stage, no attempt will be made to account for sub-ordinate level naming, a task that has yielded rather inconsistent findings (Hantsch, Jescheniak & Schriefers, 2005; Vitkovitch & Tyrrell, 1999)

corresponding to the distractor. Thus, when the two stimuli belong to different levels of categorization (e.g., the target picture of a dog that is accompanied by the word ANIMAL), the semantic system easily discards the semantic representation of the distractor for further processing, thereby reducing the chances for observing lexical interference. At the same time, however, the semantic representation of the distractor will enhance the activation of the semantic representation of the target, making it more available and leading to semantic facilitation. In this framework, when the level of categorization of target and distractor is the same (the target picture of a dog accompanied by the word CAT), the semantic system cannot use category-level information to tease apart the two representations, and as a consequence a semantic relation between the two stimuli will increase the chance for observing semantic interference.

This account predicts that facilitation should not only be observed in categorization tasks with basic-level distractors, but also in basic-level naming tasks with category-level distractors, a prediction that will be tested in Experiments 1a and 1b. This account of Costa et al. will be referred to as the "semantic selection account".

The third proposal explaining semantic facilitation in categorization tasks is derived from observations by Lupker and Katz (1981). They argued that semantic interference is obtained when the two following conditions are met: a) the context word is semantically related to the picture --- similar but not the same as the picture, and b) applying the task instruction to the target and distractor leads to an incompatible result. In other domains, this second principle is often referred to as "response congruency". In the flanker task, for instance, Eriksen and Eriksen (1974) observed facilitation when a target letter (e.g., K) was flanked by a distractor letter (e.g., H) that was associated with the same overt response (e.g., pressing a lever to the left).

Application of the response congruency principle to picture categorizing with basic-level distractors leads to the prediction of facilitation when target and context stimuli are categorically related. For instance, in a categorization task in which the target picture of a car is presented for naming, the context word 'bike' will result in facilitation compared to the context word ‘apple’, because ‘bike’ is response congruent and ‘apple’ is not. However, when the task is basic-level naming, the result of applying the task instruction to both stimuli will lead to different responses ('bike ' and 'apple'). The proposal that the semantic facilitation effect in categorization tasks is due to the convergence of target and context on the same response, will be referred to as the "response congruency account".

The response-congruency account predicts semantic facilitation in picture categorizing, but for different reasons than the semantic selection account. Therefore, the picture-categorizing paradigm is not appropriate to distinguish the two. To adjudicate between the two proposals, we need to examine a different experimental condition. Therefore, in Experiments 1a and 1b, we examine the effect of category-level distractors on basic-level naming. That is, participants are asked to name the picture of a dog (as 'dog'), while ignoring a semantically related category-level distractor (“animal”) or an unrelated one (“vehicle”). In this condition, Costa et al.'s (2003) semantic selection account predicts semantic facilitation because target and distractor differ in their level of categorization. In contrast, the response congruency account predicts semantic interference. The reason is that applying the task instruction (‘name at basic level’) to the target picture (e.g. of a dog) and a category distractor (e.g., ‘animal’) does not lead to the same response.

Experiment 1a

In this experiment participants were asked to name target pictures using basic-level names. The pictures were accompanied by distractor words that could be (a) semantically related or unrelated to the target and (b) basic-level names or category-level names[3]. For example, the target picture of a couch (response "bank") was presented with the four distractor words: TAFEL ("table"; basic-level, related), TOMAAT ("tomato"; basic-level, unrelated), MEUBEL ("furniture"; category-level, related) and VOERTUIG ("vehicle"; category-level, unrelated).

The predictions of this study are clear. If a difference between the level of categorization of target and distractor is enough to produce semantic facilitation, as proposed by Costa et al. (2003), then semantically related category-name distractors should lead to semantic facilitation, while semantically related basic-level distractors should lead to semantic interference. Thus, an interaction between the variable “semantic relatedness” and “level of categorization” should be present. In contrast, if the change in the polarity of related distractors is due to response congruency, then we should observe semantic interference from related distractors regardless of their level of categorization. The reason is that applying the task instruction ("provide the basic-level name") to target (e.g., the picture of a couch) and distractor (e.g., the word FURNITURE) does not lead to the same response.

[3] A similar experiment was conducted by Roelofs (1992), who failed to find an effect of semantic similarity in a picture-naming task with category-level distractors. However, in that experiment the classical semantic interference effect from basic-level distractors in basic-level naming was also absent. Therefore, we refrain from interpreting these findings.

Method

Participants

Eighteen participants from Leiden University took part in the experiment. They all had normal or corrected to normal vision and received 3.50 euro for their participation.

Materials

Three line drawings of familiar objects or animals were selected from each of ten categories, resulting in a total number of thirty target pictures. Most of the pictures used came from the Snodgrass and Vanderward (1980) picture set. The targets were paired with four different distractors: related and unrelated words from the basic-level and category-level. For example: the picture of a car was accompanied with the Dutch words “trein” (train), “voertuig” (vehicle), “banaan” (banana), and “fruit” (fruit). The basic level and category level distractors were matched as far as possible with respect to length (in letters and in syllables) and familiarity (deVries, 1986). Familiarity ratings were not available for one of the basic level words and four of the category level words. The mean familiarity ratings of the remaining basic- and category level words were 8.1 and 7.9, respectively (values on a 9-point scale). The mean length of the words of the basic level words was 5.4 letters and 1.6 syllables. The corresponding values in the category level words were 6.2 and 1.9, respectively. Although no perfect match between category levels was achieved, it should be noted that the calculation of the semantic interference effect was conducted within each category level, which yields a comparison between identical word sets (related and unrelated). While constructing the picture-word pairs, care was taken to prevent a phonological relation between the names of the target pictures and the distractor words. The complete list of targets and distractors is presented in Appendix 1a.

Apparatus

The experiment was programmed in MEL Professional software (version 2.0d; Schneider, 1988) on a TARGA Pentium PC. The stimuli were presented on a 17" Iiyama monitor, the correct answers and reaction times appeared on a 15" monochrome monitor. The reaction times were measured by means of a voice key.

Procedure

The participants were run individually in a dimly lit room. At the start of the session they were given a written instruction and a list containing the 30 pictures and their Dutch basic level name. They were instructed to inspect this list of stimulus materials. Next, all pictures were presented individually on the computer screen for naming. In the experimental series, which were preceded with 5 practice trials randomly drawn from the trial list, each trial involved the following sequence. First, a fixation point was presented in the center of the display for 500 ms. The target picture and the distractor word appeared simultaneously in black centered at the point of fixation and remained on the screen until the voice key triggered or an interval of 2000 ms had elapsed. The height and width of the target and context words were $1.4^{o} \times 2^{o}$ of visual angle for 3-letter words up to $1.4^{o} \times 5^{o}$ of visual angle for 8-letter words. The maximum size of the pictures was 7^{o} x 7^{o} degree visual angle. A white edge around the distractor words ensured their legibility against the picture background. Viewing distance was approximately 80 cm. The experimenter judged the response for correctness and entered a code into the computer. Malfunctioning of the voice key could also be indicated. The order of presentation of the stimuli was random, with the restriction that a target picture was not repeated within a series of six trials. The total number of experimental trials was 120 (30 target pictures x 4 distractor conditions).

Table 1a.

Reaction times in ms, percentage of error and semantic interference effects in the different conditions of Experiment 1a.

Distractor Type	Related		Unrelated		Semantic interference	
	RT	%e	RT	%e	RT	%e
Basic-level	816	2.6	764	1.3	52	1.3
Category-level	811	2.2	764	2.2	47	0.0

Results and Discussion

The following reaction times (RTs) were excluded: RTs of incorrect responses (including failures to respond; a total of 2.1%), RTs of trials in which the voice key malfunctioned (0.83%) and RTs exceeding a cut-off criterion of 1500 ms (1.5%). The mean RTs and percentages of incorrect responses are shown in Table 1a.

Analyses of Variance (ANOVAs) were performed on both the participant means (F_1) and on the item means (F_2), with the category level of the distractor word (basic level versus category level) and the relation between target and distractor (semantically related or unrelated) as within-participant variables. Variability is indicated by the 95% confidence intervals (CI) of the mean differences, which means that the CI is the difference in ms that is required to reach a significance level of .05 (after Loftus & Masson, 1994). The main effect of semantic relatedness was significant, $F_1(1,17) = 33.1$, $p < .001$, CI = 17.8, $F_2(1,29) = 36.7$, $p < .001$, CI = 16.7.

The main effect of level of categorization was not significant, $F_1 < 1$, $F_2 < 1$. Importantly, the interaction between these two variables was not significant $F_1 < 1$, $F_2 < 1$. In an identical ANOVA on the error percentages there were no significant effects, semantic relatedness, $F_1(1,17) = 1.06$, $p = 0.32$, CI = 0.5, and all other Fs < 1.

The results of this experiment are clear: Semantically related distractors led to longer naming latencies than unrelated distractors regardless of their level of categorization (52 ms and 47 ms for basic and category-level distractors, respectively). The important new finding here is that semantically related category-name distractors induce semantic interference (rather than facilitation) in basic-level picture naming. Because of the importance of this finding for adjudicating between contrasting explanations of the contextual effects in this paradigm, it is appropriated that we replicate it in another paradigm in which context words can induce semantic interference and facilitation, the word translation task (cf. Bloem & La Heij, 2003; Bloem, van den Boogaard & La Heij, 2004).

Experiment 1b

The goal of this experiment is to establish whether the main finding of Experiment 1a can be replicated using a different language-production task: translation of a second-language (L2) target word into the first language (L1). It is often assumed that this backward translation task, like picture naming, is conceptually mediated (Bloem & La Heij, 2003; see, however, Kroll and Stewart, 1993). The main argument in favor of this assumption is the presence of semantic context effects in backward translation. When, for example, Dutch-English bilinguals are asked to translate the L2 word DOG into the Dutch equivalent “hond”, the semantically related distractor word PAARD (horse) delays responding in comparison to an unrelated distractor word (La Heij, de Bruyn et al., 1990) and the semantically related distractor picture of a horse speeds up responding in comparison to an unrelated distractor picture (Bloem & La Heij, 2003; La Heij et al., 1996).

For very different reasons, Bloem and La Heij (2003) already examined the effect of category-level distractors on basic-level naming in a backward translation task. The results of their experiment seem to confirm the observation of our Experiment 1a in that basic-level distractors and category-level distractors induced similar amounts of semantic interference. However, for our present purposes, the interpretation of Bloem and La Heij's finding is somewhat troublesome, given a difference in the number of repetitions of the two types of distractors in their experiment. Therefore, Experiment 1b reexamined the effect of basic-level and category-level distractors in a word-translation task. To induce maximum impact of the distractor on target processing, target and distractor were presented in the same display position, separated by an SOA interval of 150 ms (see Bloem et al., 2004, for a similar procedure).

Method

Participants

Twenty Leiden University students participated in the experiment. They all were Dutch native speakers and had sufficient command of English to participate in the experiment. They all had normal or corrected to normal vision and received 3.50 euro for their participation.

Materials

Three English basic-level words (non-cognates) were selected from each of 10 different semantic categories. Each of these 30 words was presented with a semantically related and an unrelated distractor word from both the basic-level (BL) and the category level (CL). For example the stimulus “car”, that had to be translated into the Dutch word “auto”, was accompanied by the Dutch distractor words “fiets” (bike; related BL), “tomaat” (tomato; unrelated BL), “voertuig” (vehicle; related CL) and “groente” (vegetable; unrelated CL). For two categories, the target words and the category distractors had a part-of relation (e.g., leg-body and window-house). The unrelated-word condition was created by re-pairing the target words and the semantically related context words. In re-pairing the words, care was taken to prevent a phonological relation between the distractor and the correct response word. The basic-level and category-level distractors were matched as far as possible with respect to length (in letters and in syllables) and familiarity (de Vries, 1986). Familiarity ratings were not available for four of the category level words. The mean familiarity ratings of the remaining basic level and category level distractor words were 8.4 and 8.3, respectively (values on a 9-point scale). The mean length of the basic-level words was 4.4 letters and 1.4 syllables. The corresponding values of the category-level words were 6.0 and 1.6, respectively. So, with respect to length in letters no perfect match was achieved.

In total, the participants were presented with 120 experimental trials. The complete set of stimuli is shown in Appendix 1b. The to-be-translated English target word was always presented in black lower-case letters against a white background. The height and width of the target and context words were $1.4^{o} \times 2^{o}$ of visual angle for 3-letter words up to $1.4^{o} \times 5^{o}$ of visual angle for 8-letter words. The target words were positioned such that the second letter appeared at the point of fixation. The context words were presented in red letters, 1.4^{o} degree of visual angle (center to center) below the target word. Viewing distance was approximately 80 cm.

Apparatus

The apparatus was the same as the one used in Experiment 1a.

Procedure

The participants were run individually in a dimly illuminated room. At the start of the session they were given a written instruction and a list containing the 30 English target words and their Dutch translations. The correct responses to the stimulus words were practiced by presentation on the screen before the sessions started. The experimental series were preceded by 10 practice trials that were randomly selected from the experimental materials. Each trial involved the following sequence. First, a fixation point was presented in the centre of the display for 500 ms. The stimulus appeared in black at the point of fixation for 150 milliseconds and was immediately replaced by the red context word. The context word remained on the screen until the voice-key was triggered. The presentation of the stimuli was randomized with the restriction that a target word was not repeated within a series of six consecutive trials. The experimenter judged the response for correctness and entered a code into the computer. Malfunctioning of the voice-key could also be indicated.

Results

RT's were treated in the same way as in Experiment 1a. Excluded were: 3.8% incorrect responses, 0.08% voice key errors and 2.6% exceeding the 1500 ms cutoff criterion. The mean RTs and percentages of incorrect responses are shown in Table 1b.

Table 1b.

Reaction times in ms, percentage of error and semantic interference effects in the different conditions of Experiment 1b.

Distractor Type	Related		Unrelated		Semantic interference	
	RT	%e	RT	%e	RT	%e
Basic-level	882	3.7	850	3.0	32	0.7
Category-level	872	5.2	840	3.3	32	1.9

An ANOVA with category level (basic level versus category level) and relatedness (semantically related versus unrelated) as within-participant variables showed a significant main effect of relatedness, $F_1(1,19) = 32.6$, $p < .001$ CI = 11.7, $F_2(1,29) = 23.4$, $p < .001$, CI = 13.9. The effect of Level failed to reach significance $F_1(1,19) = 2.4$ p > .1, CI = 20.5, $F_2(1,29) = 2.7$, $p > .1$, CI = 12.5. Most importantly, the interaction between both factors was far from significant $F_1 < 1$, $F_2 < 1$. In fact, the semantic interference effects produced by category-level and basic-level distractors were numerically identical (32 ms).

In the error analysis, the effect of semantic relatedness was nearly significant, $F_1(1,19) = 3.7$, $p = 0.07$, CI = ± 0.5, $F_2(1,29) = 3.3$, $p = 0.08$, CI = ± 0.4. The effect of Level was not significant $F_1(1,19) = 2.1$, $p = 0.16$, CI = ± 0.2, $F_2 < 1$, and the interaction was far from significant, $F_1 < 1$, $F_2 < 1$.

Discussion

In this experiment we replicated the finding that in a word-translation task related basic-level names induce semantic interference compared to unrelated basic level names (cf. La Heij, de Bruyn et al., 1990; La Heij et al., 1996). More important for our purposes is the observation that in a word-translation task, just as in the picture-naming task of Experiment 1a, category-level distractors induce semantic interference. This finding indicates semantic interference across levels of categorization. This result contrasts sharply with the presence of semantic facilitation when pictures need to be categorized and distractors are basic-level names (e.g., Glaser & Düngelhoff, 1984). That is, our study in combination with related observations allows for the following empirical generalization: a difference between the level of categorization of the distractor and that of the target leads to semantic facilitation when the response is given at the category level and to semantic interference when the response is given at the basic level.

This empirical generalization is at odds with the predictions derived from the semantic selection account. In contrast, the response congruency account predicted the outcome of these experiments correctly. As discussed above, this account predicts semantic facilitation when (a) target and distractor are semantically related and (b) target and context are response congruent. In the basic-level naming task employed in Experiments 1a and 1b, however, the target (e.g., couch) and the semantically related context word (e.g., FURNITURE) clearly do not converge on the same response. Hence, the account predicts semantic interference instead of facilitation. In conclusion, the results obtained in Experiments 1a and 1b suggests that response congruency is an important determinant of the polarity of the semantic context effect in picture naming and word translation. In Experiment 2 we set out to investigate whether response congruency is a *major* contributor to this effect in categorization tasks.

Experiment 2

Glaser and Düngelhoff's (1984) observation of semantic facilitation in picture categorization can be accounted for in terms of response congruency, but it cannot be excluded that part of the effect is due to facilitation at the level of target identification (concept activation). For example, in the situation in which the picture of a dog has to be categorized as "animal", the context word CAT may (a) a facilitate target processing due to response congruency (the word CAT also leads to the correct response "animal" in a categorization task) but may also (b) facilitate target processing due to a process of spreading activation from the concept CAT to the concept DOG[4].

To assess the relative contribution of response congruency and facilitation of target-concept activation, in Experiment 2 participants were asked to produce the category name (e.g., "meubel", furniture) of a target while ignoring three types of distractor: (a) the correct basic-level name of the target (e.g., BANK, couch), (b) a semantically related basic-level name (e.g. TAFEL, table), and (c) an unrelated basic-level name (e.g., HOND, dog). In the first of these conditions, the semantically related context word is both response congruent and "concept congruent". That is, the context word and target converge on the same response but also on the same conceptual representation. In the second of these conditions, the semantically related context word is response congruent and may add to the activation of the target concept via a process of spreading activation. In the unrelated condition, the context word is not response congruent and does not speed up target identification. If a difference between the first

[4] Because the concept used in the process of lexicalization is “animal”, it seems unlikely that the context words CAT and DOG differentially affect the process of lexical selection.

two conditions is observed, this indicates that facilitation of concept activation may play a role in the overall semantic facilitation effect in categorization tasks. If, however, the first two conditions show similar results, it seems likely that response congruency is the major contributor to the overall facilitation effect.

To our knowledge, there are two studies in which the results of these three conditions are reported. In the study of Glaser and Düngelhoff (1984) in which a picture-categorization task was used, the facilitation effects induced by "concept-congruent distractors" (correct basic-level words) and "category-congruent distractors (basic-level words from the same semantic category) were, averaged across the SOA conditions close to zero (-200 ms, -100 ms, 0 ms and +100 ms), 13 ms and 18 ms respectively. Although this finding suggests that there is no substantial effect of concept congruency, the facilitation effects varied too strongly across the SOA range to draw a firm conclusion. For instance, at SOA = -100 ms, the facilitation effect induced by category-congruent distractors was larger than the facilitation effect induced by concept-congruent distractors (29 ms and 4 ms respectively).

Glaser and Glaser (1989; Experiment 6) reported the results of a word-categorization task with word distractors. Because it is generally assumed that word-categorization is conceptually mediated, the results of this task are relevant for our current issue. Averaged across the two SOA values close to zero (-50 ms and + 50 ms), the facilitation effects induced by correct basic-level words and words from the same semantic category (in comparison to the unrelated-word condition) were 127 ms and 79 ms, respectively. These findings suggest a concept-congruency effect of approximately 50 ms. However, as discussed by Damian and Bowers (2003) and La Heij, Heikoop, Akerboom and Bloem (2003), Glaser and Glaser's results are difficult to interpret, because of the use of the "sequential discrimination task". In this task, target and context are presented above or below the central fixation point and the participants are instructed to react to the first or second stimulus that appears on the display. As has been shown by La Heij et al. (2003), this task is difficult to perform and incorrect selections are easily made. Clearly, target selection will be much easier when target and distractor are identical words, as in Glaser and Glaser's concept-congruent condition. So, this "selection effect" alone may account for the 50 ms difference observed between the concept-congruent and category-congruent conditions.

To increase the sensitivity of the task for facilitation effects at the level of target identification, in Experiment 2, like in Experiment 1b, L2 words were presented as targets (see Bloem, van den Boogaart & La Heij, 2004, for a further discussion of this issue). In the experiment these L2 words (e.g., the English word COUCH) had to be responded to by their category names in Dutch ("meubel", furniture).

Method

Participants

Twenty students from Leiden University took part in the experiment. They all had sufficient command of English to participate in the experiment, had normal or corrected to normal vision and received 3.50 Euro for their participation.

Materials

The same target words were used as in Experiment 1b. For most target words, the correct response was the category name (e.g., “voertuig”, vehicle), sometimes abbreviated for ease of responding (e.g., “lichaam”, body, was used instead of “lichaamsdeel”, body part). For two sets of three target words a part-of relation was used: the words “room”, “wall” and “window” had to be responded to with “house” and the words “leg”, “chest” and “face” had to be responded to with “body”. None of the participants reported problems with this type of categorization and the results obtained with these categories were not different from the results obtained in the other categories. Four sets of distractor words were used (examples are given for the target word “bike”): (1) the correct Dutch translation equivalents of the target words (“fiets”, bike), (2) the same set of words as under (1) re-paired with the target words to obtain unrelated pairs (“kast”, cupboard), (3) basic-level words denoting objects from the same semantic category as the target word (“trein”, train), and (4) the same set of words as under (3) re-paired with the targets to obtain unrelated pairs (“rood”, red). Thus, the total number of trials in the experiment was 120 (30 target words times four sets of context words).

For the two sets of distractor words used, the correct Dutch basic-level names and the semantically related Dutch basic-level names were matched as far as possible with respect to length (in letters and in syllables) and familiarity (de Vries, 1986). Familiarity ratings were not available for two of the words in the semantically-related list. The mean familiarity ratings of the remaining distractor words in the correct and semantically-related lists were 8.22 and 8.20, respectively (values on a 9-point scale). The mean length of the words in the correct basic-level names list was 5.0 letters and 1.4 syllables. The corresponding values in the semantically related word list were 5.3 and 1.4, respectively. The complete set of stimuli is presented in Appendix 2.

Apparatus

The apparatus was the same as the one used in Experiments 1a and 1b.

Procedure

The procedure was identical to the one in Experiment 1b, with the only difference that the participants were instructed to produce the Dutch category name of the English target word.

Results and Discussion

The following RTs were excluded: 10.0% incorrect responses and 0.8% voice key errors. The upper limit was set to 2000 ms (eliminating 0.5% of the data), because the response latencies in this categorization task proved to be larger than those in the basic-level naming tasks of Experiments 1a and 1b. The mean reaction times and percentages of incorrect responses are shown in Table 2. ANOVA's were performed on these data with type of relation (correct versus semantically related) and relatedness (related versus unrelated) as within-participants factors. The effect of relatedness was significant $F_1(1.19) = 7.5$, $p < .05$, CI = ± 20.9, $F_2(1,29) = 8.8$, $p < .01$, CI = ± 23.7. The type of relation and the interaction were not significant, all Fs < 1. The error analysis did not yield any significant effects: relatedness, $F_1(1.19) = 2.4$, $p = 0.14$, CI = ± 0.8, $F_2(1,29) = 2.0$, $p = 0.17$, CI = ± 0.6, type of relation, $F_1(1.19) = 2.4$, $p = 0.14$, CI = ± 0.7, $F_2(1,29) = 2.0$, $p = 0.17$, CI = ± 0.5 and the interaction was far from significant, $F_1 < 1$, $F_2 < 1$.

Table 2.

Reaction times in ms, percentages of error and facilitation effects in the various conditions of Experiment 2.

Concept and Response Congruent		Unrelated		Facilitation	
RT	%e	RT	%e	RT	%e
1098	10.0	1121	11.8	23	1.8

Response Congruent		Unrelated		Facilitation	
RT	%e	RT	%e	RT	%e
1093	8.0	1126	10.2	33	2.1

The results of this experiment are in line with the picture-naming results reported by Glaser and Düngelhoff (1984). At SOA +150 ms, correct basic-level names facilitate categorization responses. For instance, categorizing the word "bike" as "voertuig" (vehicle) was facilitated by the Dutch translation equivalent "fiets" (bike) in comparison to an unrelated Dutch context word (e.g., "kast", cupboard). Most importantly, a similar amount of facilitation was observed when instead of the correct translation equivalent a different word from the target's semantic category was presented as context. For instance, categorizing the word "bike" was facilitated to the same degree by the context words "fiets" (bike) and "trein" (train). Since the two sets of context words only differed in the aspect "concept congruency" and this difference did not influence the size of the facilitation effect, concept congruency does not contribute substantially to the facilitation effect induced by correct basic-level names in categorization tasks. We conclude that response congruency is most probably a major contributor to semantic facilitation effects in categorization tasks.

Up to now we have explored the contribution of response congruency in category-level and basic-level naming. We argued that such a principle seems to capture nicely the various results observed with semantically related distractors in these two tasks. A further test of this principle can be gathered if we consider a third level of categorization, namely the subordinate level. At present, however, the findings regarding the effects of semantically related distractors in subordinate naming and in basic-level naming with subordinate distractors are rather inconsistent.

Vitkovitch and Tyrell (1999) observed semantic facilitation from basic-level distractors in subordinate naming. For instance, the naming of the picture of a cobra as "cobra" was facilitated by the related basic-level word "snake" in comparison with the basic-level word "table". However, in a similar experiment, Hantsch, Jescheniak and Schriefers (2005) observed semantic interference, a finding that is in line with our response congruency account. Unfortunately, in this latter study subordinate distractors induced semantic interference in basic-level naming, a result that runs counter the prediction derived from a response congruency interpretation.

Both in the Vitkovitch and Tyrrell (1999) study and in the Hantsch et al. (2005) study, the conventional picture-word paradigm was used. A potential problem with this paradigm is that a picture may be rather ambiguous with respect to level of categorization. For example, it is not completely clear what the response should be in a basic-level naming task to the pictures of a crow, a cobra, a shark or a chicken. Most likely, participants spontaneously use the names, "bird", "snake", "shark" and "chicken", respectively. The first two of these responses are often categorized as basic-level names, and the latter two as sub-ordinate level names. Clearly, in this situation one of the defining characteristics of the basic level of categorization, the preferred name of an object (Rosch, Mervis, Gray, Johnson & Boyes-Bream, 1976), does not result in the same label as a definition based on the object's position in a natural hierarchy.

These problems can be resolved by using word targets (cf. Glaser & Glaser, 1989) since there is less doubt on what the level of categorization a word is. More specific, with words there is little doubt whether two words are on the same level or on different levels of categorization. For instance, the words shark and sparrow are on the same, subordinate level of categorization, with as corresponding basic-level names fish and bird, respectively. To prevent problems with the categorization level of pictures, in Experiment 3 we used a word categorization task with context words to investigate whether the response congruency effect can also be found in lower levels of categorization.

Experiment 3

In this experiment we further test the "response congruency" hypothesis, by inspecting the effects of semantically related subordinate distractors in basic-level naming. In this experiment participants were asked to name subordinate level words (e.g., TULIP) using their most common basic-level name ("flower"), while ignoring a related subordinate level distractor (e.g., ROSE) or an unrelated subordinate level distractor (e.g., VOLVO). Because there is no need for using L2 words in the present experiment, stimuli and responses were presented in Dutch (L1).

Unless additional assumptions are made (like Roelofs', 1992, response set mechanism), current models of language production predict semantic interference in the present task. The reason is that - because of its semantic similarity to the correct response - the distractor word ROSE will induce more lexical interference in responding "flower" to the word TULIP than the distractor word VOLVO. The response-congruency account, however, predicts semantic facilitation, because target and distractor converge on the same response when the task instruction – provide the basic-level name – is applied to both of them.

Method

Participants

Twenty Dutch University students participated in this experiment and received 4 Euros. They all had normal or corrected to normal vision.

Materials

Twenty-one Dutch target words were selected from different basic level categories. These words were paired with another member of the same basic level for the related condition. The unrelated condition was made by re-pairing the related distractor words. Care was taken to prevent phonological or associative relations between target and context words. The resulting 42 target-distractor pairs were presented twice, thus each participant received a total of 84 experimental trials.

Apparatus

The experiment was programmed in E-Prime (Schneider, Eschman & Zuccolotto, 2002) using a Pentium 4 computer and two monitors with a refresh rate of 100MHz. Response latencies were measured by means of a voice key.

Procedure

The experiment took place in a dimly lit room with seating for two. The participant received an instruction on the monitor and was then presented with a sheet that contained the 21 target words and the corresponding basic level names. The participant was required to study the list and indicate when their preferred basic level name did not match the basic-level name provided. None of the participants reported such a problem. Next, the target words were presented one by one the display in isolation and the participants were required to produce the corresponding basic-level name as fast as possible. In a second practice series the participants were familiarized with the target-context stimuli. To that end, five stimuli were randomly chosen from the experimental materials. The presentation sequence in each of these trials and in the experimental series was identical to the one in Experiments 1b and 2. So, SOA was again set at +150 ms. The complete list of 42 stimuli was presented twice in a different randomized order. Target words were not repeated within a series of three consecutive trials.

Results and Discussion

The reaction times were treated the same way as in Experiment 2. The excluded data were 2.6% wrong or long responses and 4.3% voice key errors. The mean RTs and errors are presented in Table 3. The data were analyzed with an ANOVA with semantic relatedness as a within-participants factor. The effect of relatedness (30 ms) was significant: $F_1(1,19) = 8.4$, $p < .01$, CI = ± 21.4, $F_2(1,20) = 9.3$, $p < .01$, CI = ± 26.0. In the error analysis, the effect of relatedness was far from significant, all Fs < 1.

Table 3.

Reaction times in ms, percentage of error and semantic interference effects in the different conditions of Experiment 3.

Distractor Type	Related		Unrelated		Semantic facilitation	
	RT	%e	RT	%e	RT	%e
Subordinate-level	912	2.7	942	2.5	30	-0.1

The finding of a semantic facilitation effect is clearly in line with the response congruency account and shows that response congruency also plays an important role in categorization tasks in which sub-ordinate levels of categorization are involved. The present result is at variance with the recently reported findings of Hantsch et al. (2005), who obtained semantic interference in basic-level picture naming when using a subordinate, response congruent distractor word. For instance, the word SHARK hampered the naming of the picture of a shark as "fish". One possible explanation for this discrepancy is the fact that the participants in the Hantsch et al. (2005) study did not receive the instruction to respond to the pictures at a certain level of categorization. Instead, they were simply instructed to respond to the target pictures with the verbal labels provided by the experimenter. It is conceivable that in that situation, the word "fish" in response to the picture of a shark was not perceived as a categorization response.

A point that we want to discuss here is the fact that, with picture stimuli, preferred names do not always coincide with their basic-level names (see also Hantsch et al., 2005). The preferred name may depend on the context (participants will prefer "cobra" when pictures different snakes are used in the experiment, but will prefer "snake" when no other snakes are present) and amount of detail in combination with the participant's familiarity with the object (some participants will prefer "Porsche" as the name for a Porsche, whereas others will use the word "car"). If there is uncertainty about the entry level of categorization of the various pictures, some context words may be message congruent while others may not be, inconsistencies in results may appear.

This issue was addressed in a study by Mädebach, Hantsch and Jescheniak (2007). In a picture-word interference task, these authors used target pictures that can either be named at the basic-level or at the subordinate-level. In one experiment participants were trained to name the pictures at the basic-level and in a second experiment, participants were trained to name the pictures at the subordinate level. In both experiments was a basic-level naming response required. Thus, participants that were trained to name the target pictures at the subordinate-level performed a categorization task, while participants that were trained to name the pictures at the basic-level performed a naming task. The results showed that, in the basic-level naming task, semantically related context words induced semantic interference, while in the categorization task these context words induced facilitation. Thus, only when the context words were message congruent they induced semantic facilitation.

General Discussion

Glaser and Düngelhoff (1984) and Costa et al. (2003) reported that picture categorization is facilitated by semantically related, basic-level words in comparison to unrelated words. In the introduction we argued that models of language production provide no, or unsatisfactory explanations for this semantic facilitation effect. To account for the effect, we distinguished three possible approaches. The 'response set' account (Roelofs, 1992) was discarded on the basis of rather compelling evidence that distractors that are not part of the response set do compete for lexical selection. In the semantic-selection account, proposed by Costa et al. (2003) it is assumed that category-level information is embedded in the conceptual representations and that speakers can make use of this information to tease apart target and context information. This account predicts semantic facilitation in a categorization task with basic-level distractors, but also semantic facilitation in a basic-level naming task with category distractors. This latter prediction was tested and disproved in Experiments 1a and 1b. Instead of facilitation, category names induced semantic interference, both in a picture-naming and in a word-translation task. The third account was phrased in terms of "response congruency" and stated that semantic facilitation will occur in naming tasks whenever target and distractor converge on the same response, given the current task instruction. This account correctly predicted the results of Experiments 1a and 1b.

Glaser and Düngelhoff (1984) have shown that categorization is not only facilitated by semantically related basic-level words, but – not surprisingly - also by the correct basic-level name of the target. For example, categorizing the picture of a dog as "animal" is not only facilitated by the word CAT but also by the word DOG. Experiment 2 investigated the relative contribution of response congruency and concept congruency to this latter finding. The results show that semantically related basic-level words and the correct basic-level names induce a comparable amount of facilitation, a finding that suggests that response congruency is a major determinant of the facilitation effects observed in categorization tasks.

In Experiment 3 we tested the response congruency account in a situation in which targets and distractors are on the subordinate level and responses on the basic level of categorization. We argued that the rather inconsistent results obtained in studies using the sub-ordinate level of categorization may have been due to differences in instruction: the instruction to name pictures at a certain level of categorization versus the instruction to use predefined verbal labels in response to these pictures. In addition, we mentioned a potential problem in using pictures in categorization tasks, given the fact that the preferred level of categorization of other pictures seems to depend on the amount of detail provided and the specific set of stimuli used. Whereas the picture of a codfish is spontaneously named as "fish", the picture of a shark is most often named as "shark". To eliminate the ambiguity in the level of categorization of the targets, in Experiment 3 a word-categorization task was used. In this experiment we tested and confirmed the prediction of the response-congruency account that a semantically related subordinate-level distractor word (e.g., ROSE) should facilitate the naming of a subordinate-level target (e.g., TULIP) at the basic level (response: "flower").

The response congruency account predicts that semantic facilitation will occur in all situations in which the context and target converge on the same response. This prediction is in line with a number of other findings. First, naming the picture of an object in a second language (L2) is facilitated by the picture’s name in the first language (L1) (Costa, Miozzo and Caramazza, 1999; Costa and Caramazza, 1999). Here, the instruction “provide the English name of…”, leads to the same response when applied to the target picture (e.g., of a dog) and when applied to the context word (e.g., the Dutch translation equivalent of the word dog: HOND). A semantically related L1 context word (e.g., kat, “cat”) should not induce facilitation, because it does not lead to the same response as the target. Indeed, reported semantic interference effects of L1 basic-level words in L2 picture naming have been reported (Costa, et al., 1999; and Hermans, Bongaerts, de Bot and Schreuder (1998).

Second, the response-congruency account also predicts facilitation effects in a function-naming task with distractors that are associated with the same or a different function. For instance, the response "to wear” to the target word TROUSERS should be facilitated by the context picture of a shirt in comparison to the unrelated picture of a tree. Recently, Kuipers and La Heij (2008a) tested and confirmed this prediction.

Finally, effects of response congruency are also observed in Stroop-like color categorization tasks. Glaser and Glaser (1989; Footnote 5) briefly mentioned the results of a Stroop task in which the participants were required to categorize color words and colors as "warm" (red and yellow) or "cold" (blue and green). In line with our response congruency principle, they observed a complete reversal of the usual asymmetry in Stroop interference: words hardly interfered with color categorization whereas the categorization of words (e.g., the categorization of the word GREEN as "cold") was hampered by the response-incongruent color yellow in comparison to the response-congruent color blue.

To conclude, current models of lexical access are able to account for semantic interference effects in basic-level naming, but have difficulty in accounting for semantic facilitation effects in category naming. Our present results indicate that the response congruency of target and distractor is a major factor in accounting for the polarity of semantic context effects in naming tasks. If this conclusion is correct, it is interesting to speculate about the locus of the response congruency effect in language production. On the basis of our present findings and those of Bloem and La Heij (2003) and Bloem, van den Boogaard and La Heij (2004), we propose that the effect is localized at a processing level that Kempen (1977; see also Levelt, 1989) referred to as "conceptualizing"; the level at which a "preverbal message" is constructed on the basis of (a) the stimuli presented and (b) the current task instruction. If this interpretation is correct, context stimuli may affect target processing in at least three processing stages. First, semantic facilitation may occur in a stage of target identification. Through, for instance, a process of spreading activation, a semantically related context may facilitate the activation of the target concept. Semantic facilitation induced by context pictures in a word-translation task (Bloem & La Heij, 2003; La Heij et al., 1996) may largely be localized at this processing level.

Second, context effects may be localized at a stage of conceptualization. Context stimuli may facilitate this process when – given the task instruction – target and context converge on the same preverbal message. This process may underlie facilitation in categorization tasks, including the "warm-cold" color-classification task briefly discussed by Glaser and Glaser (1989). If this interpretation is correct, the term "response congruency" may better be replaced by "message congruency", to avoid confusion with later processing stages.

Finally, interference effects may arise at the level of lexical selection. Most models (but see Costa et al., 2003) assume that this is the level at which context words induce semantic interference. We suggest that semantically related context words may always induce lexical interference, but that this effect can be outweighed by larger facilitation effects at the earlier two processing stages. Indeed, Kuipers and La Heij (2008b) report results indicating that the effects of message congruency are larger than the semantic interference effects usually obtained in picture-word interference tasks.

It should be stressed that in our proposal one and the same context stimulus may – to some degree - affect each of these three processing stages. As discussed above, in a picture-categorization task with word context (e.g., the target picture of a dog with the distractors CAT or PEN), a semantically related context word may facilitate target identification, facilitate the construction of a preverbal message and hamper lexical selection. In this task the former two effects may outweigh the latter (see Navarrete and Costa, 2005 for a similar argument). In a word-translation task with picture context (e.g., the L2 target word DOG with the distractor pictures of a CAT or a PEN), a semantically related context picture may strongly facilitate target identification, and have little effect on conceptualization and lexical selection (see Bloem et al., 2004), resulting in an overall semantic facilitation effect.

To summarize, in this article we set out to provide an explanation for the semantic facilitation effect in categorization tasks. We conclude that this effect is most probably not due to the elimination of lexical interference (Roelofs, 1992) nor to the facilitation of selection at a semantic level (Costa et al., 2003). Instead, the effect may result from facilitation at the level of conceptualization: the preparation of a preverbal message. It should be noted that the reintroduction of this processing level not only provides an attractive explanation for semantic facilitation in category naming, but may also provide a useful starting point for future studies on executive control in naming tasks.

Appendix 1a.

Stimulus materials used in Experiment 1a.

Picture	Response	Related Distractors		Unrelated Distractors	
		BL	CL	BL	CL
car	auto	trein (train)	voertuig (vehicle)	banaan	groente
bicycle	fiets	trein (train)	voertuig (vehicle)	tafel	meubel
motorbike	motor	trein (train)	voertuig (vehicle)	tomaat	insect
onion	ui	tomaat (tomato)	groente (vegetable)	fabriek	kleding
carrot	wortel	tomaat (tomato)	groente (vegetable)	geweer	gebouw
lettuce	sla	tomaat (tomato)	groente (vegetable)	tafel	vogel
couch	bank	tafel (table)	meubel (furniture)	tomaat	voertuig
closet	kast	tafel (table)	meubel (furniture)	banaan	wapen
chair	stoel	tafel (table)	meubel (furniture)	geweer	sieraad
lemon	citroen	banaan (banana)	vrucht (fruit)	trein	sieraad
pear	peer	banaan (banana)	vrucht (fruit)	vlieg	meubel
cherry	kers	banaan (banana)	vrucht (fruit)	fabriek	wapen
dress	jurk	sok (sock)	kleding (clothes)	kraai	vrucht
trousers	broek	sok (sock)	kleding (clothes)	trein	voertuig
coat	jas	sok (sock)	kleding (clothes)	fabriek	insect
owl	uil	kraai (crow)	vogel (bird)	sok	kleding
duck	eend	kraai (crow)	vogel (bird)	trein	groente
vulture	gier	kraai (crow)	vogel (bird)	oorbel	sieraad
ant	mier	vlieg (fly)	insect (insect)	sok	meubel
mosquito	mug	vlieg (fly)	insect (insect)	trein	kleding

Appendix 1a (continued)

spider	spin	vlieg (fly)	insect (insect)	oorbel	wapen
church	kerk	fabriek (factory)	gebouw (building)	tomaat	vogel
house	huis	fabriek (factory)	gebouw (building)	kraai	groente
castle	kasteel	fabriek (factory)	gebouw (building)	vlieg	vrucht
necklace	ketting	oorbel (earring)	sieraad (jewellery)	tafel	gebouw
watch	horloge	oorbel (earring)	sieraad (jewellery)	banaan	voertuig
ring	ring	oorbel (earring)	sieraad (jewellery)	vlieg	insect
canon	kanon	geweer (rifle)	wapen (weapon)	sok	vrucht
knife	mes	geweer (rifle)	wapen (weapon)	kraai	vogel
pistol	pistool	geweer (rifle)	wapen (weapon)	oorbel	gebouw

Appendix 1b.

Stimulus materials used in Experiment 1b.

stimulus	response	Related Distractors		Unrelated Distractors	
		BL	CL	BL	CL
car	auto	trein (train)	voertuig (vehicle)	tomaat	groente
bike	fiets	trein (train)	voertuig (vehicle)	tafel	meubel
plane	vliegtuig	trein (train)	voertuig (vehicle)	banaan	beroep
onion	ui	tomaat (tomato)	groente (vegetable)	bakker	kleding
carrot	wortel	tomaat (tomato)	groente (vegetable)	trein	kleur
lettuce	sla	tomaat (tomato)	groente (vegetable)	tafel	dier
couch	bank	tafel (table)	meubel (furniture)	tomaat	vrucht
closet	kast	tafel (table)	meubel (furniture)	banaan	lichaam
chair	stoel	tafel (table)	meubel (furniture)	bakker	huis
grape	druif	banaan (banana)	vrucht (fruit)	bakker	beroep
lemon	citroen	banaan (banana)	vrucht (fruit)	trein	meubel
cherry	kers	banaan (banana)	vrucht (fruit)	rood	dier
dress	jurk	sok (sock)	kleding (clothes)	arm	vrucht
trousers	broek	sok (sock)	kleding (clothes)	kat	voertuig
coat	jas	sok (sock)	kleding (clothes)	dak	huis
yellow	geel	rood (red)	kleur (color)	kat	voertuig
black	zwart	rood (red)	kleur (color)	arm	lichaam
purple	paars	rood (red)	kleur (color)	sok	meubel
horse	paard	kat (cat)	dier (animal)	arm	beroep
lion	leeuw	kat (cat)	dier (animal)	dak	vrucht

Appendix 1b (continued)

pig	varken	kat (cat)	dier (animal)	rood	kleding
lawyer	advocaat	bakker (baker)	beroep (occupation)	tomaat	groente
teacher	leraar	bakker (baker)	beroep (occupation)	banaan	huis
dentist	tandarts	bakker (baker)	beroep (occupation)	rood	meubel
leg	been	arm (arm)	lichaam (body)	sok	voertuig
chest	borst	arm (arm)	lichaam (body)	tafel	kleur
face	gezicht	arm (arm)	lichaam (body)	dak	huis
room	kamer	dak (roof)	huis (house)	trein	groente
wall	muur	dak (roof)	huis (house)	kat	dier
window	raam	dak	huis (house)	sok	kleding

Appendix 2.

Stimulus materials used in Experiment 2.

Stimulus	Response	Congruent distractors	Related Distractors	Unrelated Distractors	
car	voertuig	auto	bus (bus)	geel	rok
bike	voertuig	fiets	trein (train)	kast	rood
plane	voertuig	vliegtuig	brommer (moped)	wortel	tafel
onion	groente	ui	erwt (pea)	muur	enkel
carrot	groente	wortel	tomaat (tomato)	druif	douche
lettuce	groente	sla	spruitje (sprout)	borst	kapper
couch	meubel	bank	tafel (table)	jas	hond
closet	meubel	kast	bed (bed)	jurk	bakker
chair	meubel	stoel	kruk (stool)	auto	hemd
grape	vrucht	druif	peer (pear)	ui	trui
lemon	vrucht	citroen	aardbei (strawberry)	vliegtuig	vogel
cherry	vrucht	kers	pruim (plum)	leeuw	oranje
dress	kleding	jurk	hemd (shirt)	sla	trein
trousers	kleding	broek	trui (sweater)	raam	aardbei
coat	kleding	jas	rok (skirt)	fiets	groen
yellow	kleur	geel	rood (red)	broek	peer
black	kleur	zwart	groen (green)	leraar	deur
purple	kleur	paars	oranje (orange)	advocaat	spruitje
horse	dier	paard	vogel (bird)	stoel	knie
lion	dier	leeuw	hond (dog)	paars	kruk
pig	dier	varken	kip (chicken)	tandarts	bus

lawyer	beroep	advocaat	piloot (pilot)	kers	pruim
teacher	beroep	leraar	kapper (barber)	kamer	brommer
dentist	beroep	tandarts	bakker (baker)	citroen	tomaat
leg	lichaam	been	hand (hand)	paard	kip
chest	lichaam	borst	knie (knee)	bank	erwt
face	lichaam	gezicht	enkel (ankle)	varken	gang
room	huis	kamer	gang (hall)	gezicht	hand
wall	huis	muur	douche (shower)	zwart	bed
window	huis	raam	deur (door)	been	piloot

Appendix 3.

Stimulus materials used in experiment 3.

Target	Response	Related Distractor	Unrelated Distaractor
roos (rose)	bloem (flower)	tulp (tulip)	forel (trout)
volvo (idem)	auto (car)	skoda (idem)	adder (idem)
merrie (mare)	paard (horse)	hengst (stallion)	heineken (idem)
cobra (idem)	slang (snake)	adder (viper)	ijssel (idem)
poedel (poodle)	hond (dog)	tekkel (idem)	telegraaf (idem)
villa (idem)	huis (house)	flat (idem)	kraai (crow)
bordeaux (idem)	wijn (wine)	bourgonje (idem)	konmar (idem)
mus (sparrow)	vogel (bird)	kraai (crow)	sloep (cutter)
grolsch (idem)	bier (beer)	heineken (idem)	elstar (idem)
parool (idem)	krant (newspaper)	telegraaf (idem)	sinas (idem)
c1000 (idem)	supermarkt (supermarket)	konmar (idem)	tulp (tulip)
detective (idem)	boek (book)	roman (novel)	gorilla (idem)
goudreinet (idem)	appel (apple)	elstar (idem)	bourgonje (idem)
elle (idem)	tijdschrift (magazine)	story (idem)	berk (birch)
eik (oak)	boom (tree)	berk (birch)	fokker (idem)
maas (idem)	rivier (river)	ijssel (idem)	story (idem)
kano (canoe)	boot (boat)	sloep (cutter)	roman (novel)
boeing (idem)	vliegtuig (airplane)	fokker (idem)	hengst (stallion)
bonobo (idem)	aap (monkey)	gorilla (idem)	skoda (idem)
zalm (salmon)	vis (fish)	forel (trout)	flat (idem)
cola (idem)	frisdrank (soda)	sinas (idem)	tekkel (idem)

3. Semantic facilitation in category and action naming: Testing the message-congruency account[5]

Basic-level picture naming is hampered by the presence of a semantically related context word (compared to an unrelated word), whereas picture categorization is facilitated by a semantically related context word. This reversal of the semantic context effect has been explained by assuming that in categorization tasks, basic-level distractor words (e.g., "dog") do not compete with the selection of the correct category label (e.g., "animal"). In this article, we test an alternative account in terms of a congruency effect ("message congruency"), which arises at the conceptual level when target (e.g., the picture of a cat) and context (e.g., the word "dog") converge on the same to-be-verbalized concept (e.g., "animal"). In four experiments we observed a substantial message congruency effect in categorization and action naming. Implications for models of spoken-word production are discussed.

Introduction

A person that has the intention to verbalize a concept in mind has the goal to produce the word that captures the meaning of this concept best. In speech production research, selecting the correct verbal translations of thoughts is referred to as lexical access. This process has been the topic of research in which the picture-word interference task – a variant of the Stroop color-word task - is frequently used (e.g.,

[5] This chapter is based on the article: Kuipers, J. R., & La Heij, W. (2008). Semantic facilitation in category and action naming: Testing the message congruency account. *Journal of Memory and Language, 58,* 123-139.

MacLeod, 1991). In the picture-word interference paradigm, the participant is presented with a picture which has a word printed on it, and is asked to name the picture and to ignore the word. It is generally assumed (see, however, Costa, Mahon, Savova & Caramazza, 2003; Finkbeiner and Caramazza, 2006) that this context word affects the duration of components of lexical access. In manipulating the relation between context word and picture, it is observed that compared with unrelated words, categorically related words slow down picture naming. For example when one has to name the picture of a car, the context word "train" delays the naming response compared to the unrelated context word "apple". Although this interference effect seems to be confined to categorical relations and is not obtained with, for instance, parts-of relations (Costa, Alario & Caramazza, 2005), we will use the common term "semantic interference" to refer to this effect.

Models of word production (e.g., Caramazza, 1997; Levelt, Roelofs, & Meyer, 1999; Starreveld & La Heij, 1996) explain the semantic interference effect by assuming that when a person wishes to verbalize a concept, several semantically related lexical representations become activated, and that these activated words compete for selection. When one of the competitors of the correct word receives extra activation (e.g., by presenting it as a context word) the competition will be stronger than when an unrelated context word is presented, which leads to longer naming latencies.

Interestingly, a semantic relation between a target picture and a context word does not always result in semantic interference. This is, for instance, the case when the task is not to name the picture by its basic-level name (e.g., car), but by its category-level name (e.g., vehicle). For example, when the picture of a car is named as "vehicle", the related context word "train" does not induce interference. In fact, it may even induce facilitation in comparison with the unrelated context word "apple" (Costa et al., 2003; Glaser & Düngelhoff, 1984).

The only current model of word production that is able to simulate this reversal of semantic interference into semantic facilitation is implemented in WEAVER++ (Levelt, Roelofs & Meyer, 1999; Roelofs, 1992). However, this model has been criticized on a central assumption – the response set assumption - that enables it to simulate both effects (Caramazza & Costa, 2000, 2001; but see Roelofs, 2001, 2006). In this article we first discuss present models of word production and discuss why the response set assumption is untenable. Next, we test an alternative account recently proposed by Kuipers, La Heij and Costa (2006).

Shared principles of word production models

In all speech production models at least two levels of processing are assumed: a conceptual level and a lexical level. At the conceptual level concepts are represented as nodes in a semantic network (Collins & Loftus, 1975). Related concepts are linked and activate each other by means of spreading activation. For example, when the concept CAR becomes activated after presentation of the picture of a car, concepts like TRAIN, BIKE and VEHICLE also become activated. Semantic facilitation effects resulting from this spread of activation at the conceptual level will be referred to as "conceptual facilitation".

Conceptual representations are able to activate their corresponding representations at the lexical level. In most models, activation at the conceptual level is assumed to cascade to the lexical level (see Bloem and La Heij, 2003, for an alternative proposal). At this lexical level, nodes are assumed to compete for selection. In the Starreveld and La Heij (1996) model, for instance, a lexical node is selected when its activation level exceeds the activation levels of all other lexical nodes by a certain (fixed) amount. As explained above, semantic interference in the picture-word interference task is attributed to the fact that a semantically related lexical alternative is a stronger competitor for selection than an unrelated one.

The problem faced by this general framework is that it does not provide an explanation for semantic facilitation in picture categorization. When, for instance, the picture of a car has to be categorized as “vehicle”, a related context word like “train” will be a stronger competitor in lexical selection than an unrelated word like “bottle” and should therefore induce semantic interference. To account for semantic facilitation effects additional assumptions have to be made.

The WEAVER++ account of semantic facilitation

WEAVER++ contains two separate lexical levels. One is a lemma level where syntactic information is represented and the second is a word-form (lexeme) level, which is the locus of morphological, phonological and phonetic information. Lexical selection is assumed to take place on lemmas. A lemma can be selected for production when it meets the following three criteria: (1) the lemma must be flagged as part of the response set (the set of permissible responses in a specific task), (2) the lemma’s activation must exceed a critical difference in activity compared to other lemmas within the response set and (3) the concept the lemma is linked to must be flagged as the concept that needs to be verbalized (the “goal concept”; Roelofs, 2003).

The main reason why WEAVER++ is able to account for both semantic interference in basic-level naming and for semantic facilitation in category-level naming is in its response-set assumption: the assumption that competition between lexical alternatives is confined to words that are flagged as part of the response set.

Words that are not part of a predefined response set do not enter the competition. Thus, when in a categorization task the set of response alternatives is, for example, "fruit", "animal", "tool" and "vehicle", context words that are not part of that set (like the category-level context words "clothes" or "furniture" or the basic-level context words "train" or "apple") will not interfere at the lexical level. The observed semantic facilitation effect (a target picture of a car is categorized faster in the context of the word "train" than in the context of the word "apple") then results from (a) a facilitation effect at the conceptual level (due to spreading activation from the concept TRAIN to the concept VEHICLE) and (b) an interference effect at the lexical level induced by the word "fruit", activated (via the conceptual system) by the unrelated context word "apple" (given that "fruit" is one of the response alternatives, Levelt et al., 1999).

In recent years, however, WEAVER++'s response set assumption has been criticized, both on theoretical and on empirical grounds. At a theoretical level, La Heij (2005) criticized the all-or-none character of the response-set assumption (for an interpretation of response-set effects in terms of graded differences in baseline activation, see La Heij and Vermeij, 1987). In addition, Costa and Caramazza (2001) questioned the suggested relation between the maximum size of the response set and the maximum capacity of the phonological loop in working memory. At an empirical level, Costa and Caramazza (2000; 2001) showed that context words that are not part of the response set do induce semantic interference, even when "indirect" interference effects (due to the priming of a word in the response set; Roelofs, 2001) are precluded. In addition, Bloem, Van den Boogaard and La Heij (2004) showed that – contrary to what is predicted by WEAVER++ - identical sets of target-context pairs can produce semantic facilitation and semantic interference, dependent on the time interval between the presentation of context and target.

The message-congruency account of semantic facilitation

The fact that the response set assumption - that is so critical for WEAVER++'s account of semantic facilitation in categorization tasks – seems to be falsified, warrants the search for an alternative account. One possible approach was suggested by Kuipers et al. (2006). On the basis of an analysis of the relevant literature, these authors concluded that semantic facilitation in word production is always obtained when – given the task instruction - target and context converge on the goal concept. For instance, when the task is to categorize the picture of a car in the context of the word "train" (or to categorize the word "car" in the context of the picture of a train; Glaser & Düngelhoff, 1984), target and context both lead to the goal concept VEHICLE. Likewise, in a task in which colors have to be categorized as "warm" or "cold", the target color yellow and the context word "red" converge on the goal concept WARM (Glaser & Glaser, 1989). Kuipers et al. (2006) proposed that the semantic facilitation effects, as observed in these tasks, can be attributed to a relatively large facilitation effect in the process of conceptualizing: the activation and selection of the goal concept. They referred to this facilitation effect as "response congruency". Because the effect is assumed to be localized at the conceptual level (where the goal concept is retrieved), henceforth the term "message congruency" will be used instead.

In our message-congruency account we propose that (a) also in categorization tasks context words induce semantic interference at the lexical level (for example, the selection of the correct word "vehicle" is hampered more by the context word "train" than by the context word "apple") and that (b) this semantic interference effect at the lexical level is outweighed by a relatively large semantic facilitation effect at the level conceptualizing. Figure 1 - an adaptation of Levelt's (1989) "blueprint of the speaker" –illustrates our proposal. The figure depicts (a) a conceptual/semantic system, containing conceptual representations, (b) a conceptualizing process that – on the basis of the task instruction - acts upon the contents of the semantic system and selects a goal concept and (c) a lexicon containing word representations. In a picture-naming task with word distractors, the following processes are assumed to occur: (a) the target picture activates its (basic-level) concept in the semantic system and this activation spreads to related concepts, (b) the context word activates its lexical representation, which sends activation to the corresponding concept and, (c) if target and context are semantically related, both concepts increase each other's activation due to the process of spreading activation.

Next, we assume that in the conceptualizing process a goal concept is selected on the basis of the task instruction and the activated conceptual information. In this process, the instruction is applied both to the concept activated by the target and (to a certain degree) to the concept activated by the context. This proposal is in line with Glaser and Glaser's (1993) "instruction rule", saying that the distractor in Stroop-like tasks is processed according to the instruction concerning the target: "the instruction to categorize a picture tends to cause the distractor (be it a word or a picture) to be categorized as well" (p. 7; see also Lupker and Katz, 1981). Finally, following proposals by Levelt (1989), Bloem and La Heij (2003) and Bloem, Van den Boogaard and La Heij (2004), we further assume that in the tasks that we use (a) the goal concept is the only input to the lexicon and (b) the goal concept activates a cohort of semantically related lexical representations. However, the lexical item that represents the goal concept best receives most activation.

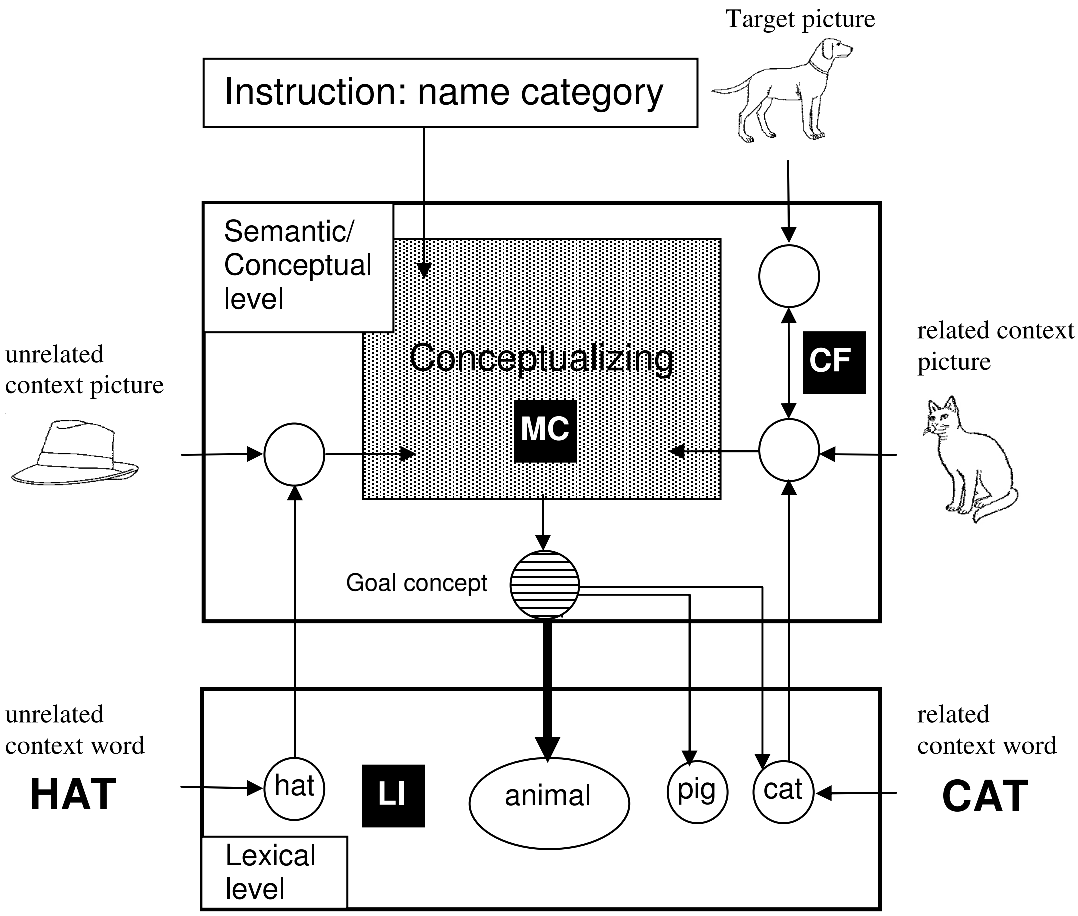

Figure 1. Schematic representation of processing stages and context effects in picture categorization. CF = conceptual facilitation, MC = message congruency, LI = lexical interference.

According to the proposal depicted in Figure 1, a context word may affect picture processing in at least three stages: (a) it may facilitate the activation of the target concept through spreading activation (conceptual facilitation; "CF" in Figure 1), (b) it may facilitate conceptualizing when target and distractor converge on the same goal concept (message congruency; "MC" in Figure 1), and finally (c) it may compete for selection with the correct response at the lexical level (lexical interference; "LI" in Figure 1). Our proposal differs from WEAVER++ in a number of respects. Most importantly, it does not contain a response-set assumption. That is, at the lexical level all activated words compete for selection, including words that are not part of a predefined response set. Semantic facilitation in categorization tasks is accounted for by assuming that the lexical interference effect induced by semantically related context words is outweighed by a relatively large effect of message congruency. Important features of our approach are that the task instruction only affects the process of conceptualizing and that lexical selection is assumed to be a simple, "underground" process that is based on activation values and is impervious to executive control (see also La Heij, 2005; Levelt, 1989; van der Heijden, 1981).

Testing the message-congruency account

To test whether the message-congruency account is a viable alternative for Roelofs' response-set approach, we have to establish whether in categorization tasks (and other tasks in which target and context converge on the same goal concept) a sizable message-congruency effect is present. To that end, four experiments were designed. In Experiments 1-3 the message-congruency effect is estimated by comparing the semantic context effects in two tasks. The subtraction method that is used in the estimation and its underlying assumptions are discussed below. In Experiment 4 the contribution of a message congruency effect is determined within a single task.

The subtraction method used in Experiments 1-3 will be elucidated with the help of Figure 1. In a basic-level picture-naming task, the effect of a semantically related context word (compared to an unrelated context word) is commonly attributed to a combination of conceptual facilitation (CF in Figure 1) and lexical interference (LI in Figure 1). According to the proposal in Figure 1, no facilitation effect of message congruency is present in basic-level naming tasks, because even semantically related target and context concepts (e.g., DOG and CAT), do not converge on the same goal concept (e.g., DOG). In a categorization task, however, the target and context may converge on the same goal concept (e.g., the concepts CAT and DOG converge on the goal concept ANIMAL, whereas CAT and HAT do not). Therefore, the semantic context effect in a categorization task can be argued to result from the combined effects of conceptual facilitation, message congruency and lexical interference. Given two assumptions that we discuss below (and the fact that identical materials are used in the two tasks), the effect of message congruency can be estimated by subtracting the semantic context effect in a basic-level naming task from the semantic context effect in a categorization task.

For this subtraction method to be valid, the effects of conceptual facilitation and lexical interference should be similar in basic-level naming and categorization. We discuss these two assumptions in turn. First, conceptual facilitation will be equal in these tasks when they require the same process of target identification. Although we do not know of compelling evidence against this assumption, one could argue that categorization may not always require basic-level target identification. For instance, in a categorization task with fruits and vehicles as categories, picture categorization may be achieved on the basis of the presence or absence of a global visual feature (e.g., sharp edges) that may be available before the target picture is fully identified. To prevent such a possibility in Experiments 1 and 2, instead of target pictures, second-language (L2) words were used as target stimuli. Clearly, the global shape of a word does not provide any information about the referent's semantic category. Moreover, word translation has been used in the past as an alternative to picture naming (e.g., Jescheniak & Levelt, 1994), because both tasks are thought to be conceptually mediated (La Heij, Hooglander, Kerling and Van der Velden, 1996; but see Kroll &

Stewart, 1994) and indeed show very similar context effects (Bloem & La Heij, 2003; Kuipers et al., 2006; La Heij et al., 1990). Thus, in Experiments 1 and 2 we assume that both the translation of the English word “dog” (into the Dutch “hond”) and the categorization of the word “dog” (into the Dutch “dier” – animal) requires the identification of the word “dog” at the basic-level of categorization. As a consequence, the effect of concept facilitation is assumed to be very similar in both tasks.

The second assumption underlying the subtraction method is that basic-level naming and categorization do not differ in the amount of semantic interference at the lexical level. To that end, we decided to use context pictures instead of context words. Bloem and La Heij (2003) and Bloem, Van den Boogaard and La Heij (2004) reported converging evidence that in a word-translation task (the tasks that we use in Experiments 1 and 2), context pictures do not activate their names, or do not activate them strongly enough to induce lexical effects. This conclusion was recently supported by Navarrete (2007), who failed to find reliable phonological effects of context pictures in a word-translation task. Moreover, even if context pictures induce small effects at the lexical level, these effects are probably very similar in the two tasks and will cancel each other out in the subtraction procedure. Evidence in favor of this assumption was provided by Kuipers et al. (2006), who reported identical semantic interference effects across levels of categorization. In their basic-level naming task, category-level distractors (e.g., “animal” versus “fruit”) induced the same amount of semantic interference as basic-level distractors (e.g., “cat” versus “apple”). Given these considerations, the use of a subtraction method to determine the presence of an effect of message congruency seems warranted. We will use this method in Experiments 1-3.

Experiment 1

In Experiment 1, fluent (but unbalanced) Dutch-English bilinguals were presented with English (L2) target words. They were asked to perform two tasks. In the translation task they had to produce the Dutch (L1) translation equivalent and in the categorization task, they had to produce the Dutch category label. The target words were accompanied by semantically related or unrelated context pictures. For example, the target word “cherry” had to be named as “kers” (the Dutch translation equivalent) in the translation task or as “fruit” (the Dutch category label) in the categorization task, while accompanied by the context pictures of a pear (semantically related condition) or a ring (unrelated condition).

Given the assumptions discussed above, a semantic (facilitation) effect in the translation task can be fully attributed to facilitation at the level of target identification (conceptual facilitation). A semantic (facilitation) effect in the categorization task can be attributed to two effects: conceptual facilitation and an effect of message congruency. By comparing the semantic context effects obtained in the two tasks, the presence and magnitude of a message congruency effect can be established.

Method

Participants

Twenty Leiden University students participated in the experiment. They all had received at least 4 years of high school education in English, had normal or corrected to normal vision and received 4.50 Euros or a course credit for their contribution. No participant took part in more than one experiment reported in this paper.

Materials

Fifteen English target words were selected from the same number of semantic categories (e.g., the word “car” was selected from the category vehicles). Each of these words was paired with a picture of a member of the same category (e.g., train, the related condition), an unrelated picture (e.g., anvil) and a square (neutral condition). The latter condition was added to get an unbiased measure of a possible difference in difficulty between the translation task and the categorization task. Most of the pictures were taken from the Snodgrass and Vanderwart (1980) picture set. To obtain a rather conservative measure of the message-congruency effect, the context pictures used in the unrelated condition were selected from categories that were not used as target categories. In this way an interference effect induced by unrelated pictures, due to the priming of a (possibly) competing category concept was prevented.

To ensure legibility of the target word against the background of the black context picture (10 cm x 10 cm), the word was printed in red (18 pts) within a white text-box (6 cm x 0.7 cm). The complete list of targets, required responses and context pictures is presented in Appendix 1.

Apparatus

The experiment was programmed in E-Prime (Schneider, Eschman & Zuccolotto, 2002) using a Pentium 4 computer and two monitors with a refresh rate of 100MHz. The voice onset was measured with a microphone and SR-box (Schneider, 1995).

Procedure

The participants were run individually in a dimly lit room. At the start of the session they received instructions, a list containing the target words with their Dutch translation equivalents and, when the task was to categorize the words, a list containing the target words and their Dutch category name. The list with the correct translation of the target words was also given in the practice session of the categorization task to ensure that the participants knew the correct translation of the target. The order of tasks was balanced across participants. After the participant had studied the materials, a practice series was run in which the target words were presented in isolation in a random order. Both in the practice series and the experimental series, a response deadline of 2 seconds was used. Subsequently, a second practice series of five trials was presented to familiarize the participant with the target-distractor presentation. The target words used in this practice series were included in the practice list, but were not reused as targets in the experimental trials. The context pictures used in this series were unrelated to the targets and also not reused in the experimental trials. Each trial had the following sequence. First a fixation point appeared in the center of the screen for 1000 ms, then target and distractor were presented simultaneously in the center of the screen for 2000 ms or until voice onset. The viewing distance was approximately 80 cm. Next, the correct answer and response time appeared on the monitor of the experimenter. The experimenter judged the response for correctness and entered a code into the computer indicating a correct response, an incorrect response (including failures to respond within the 2000 ms deadline) or a voice key error.

The list of stimuli, 45 in total, was randomized and presented twice for each task, so in the experiment each target and each picture was presented 12 times and 4 times respectively. In the randomization procedure, care was taken that the same target word was not repeated within three consecutive trials.

Results

The following reaction times (RTs) were excluded: RTs of incorrect responses (3.5%) and RTs of trials in which the voice key malfunctioned (including RTs below 400 ms, 5.8%). The mean RTs and error percentages are shown in Table 1.

Table 1.
Reaction times in ms and percentage of error in the different conditions of Experiment 1.

	Related		Unrelated		Square		Semantic Effect	
	RT	%e	RT	%e	RT	%e	RT	%e
Translation	817	1.7	832	1.7	807	1.2	15	0.0
Categorization	1056	5.5	1117	6.3	1059	4.8	61	0.8

A t-test on the RTs of the control conditions of both tasks (the target word printed inside a square) showed that the two tasks differed in mean RT, $t(19) = 10.2$, $p < .001$. This finding makes the interpretation of differences in semantic context effects in the two tasks less than straightforward. That is, the larger semantic facilitation effect in the categorization task in comparison with the translation task may reflect a proportional increase of this context effect with task difficulty. Therefore, we performed identical analyses on the z-score transformations of the RTs. With this method the difference in the base-line RT of the tasks becomes irrelevant, because for each task, the difference between conditions is expressed in the number of standard deviations of the mean. This method proved superior over others (e.g. a logarithmic transformation) in its power (Bush, Hess & Wolford, 1993) and in its characteristic that the transformation is linear so that the shape of the distribution is not affected (see also Faust, Balota, Spieler & Ferraro, 1999).

For each participant and each task, the RTs of the correct trials were transformed into their z-score. The mean z-scores per condition and subject were subsequently used in the analyses. In the ANOVAs on the participant means (F_1) and the item means (F_2; the min *F'* statistic, Clark, 1973, is also reported), Task (translation vs. categorization) and Relatedness (related context vs. unrelated context) were the two within-participants factors. The ANOVA statistics are displayed in Table 2.

Table 2.

Analyses of Variance for Semantic Relatedness Effects of Experiment 1.

Source	df	F_1	p	df	F_2	p	df	minF'	p
Mean RT's									
Task	19	169	0.001	14	106	0.001	29	65	0.001
Relatedness	19	36	0.001	14	13	0.003	25	10	0.004
Task X Rel.	19	9	0.007	14	10	0.006	35	5	0.03
Z-scores									
$Task_z$	19	2.6	0.1	14	0.01	0.9	18	0.1	1
$Relatedness_z$	19	27	0.001	14	11	0.005	26	8	0.008
Task X $Rel._z$	19	7	0.01	14	7	0.02	34	4	0.05
Errors									
Task	19	18	0.001	14	8.8	0.02	28	6	0.02

Each mean difference below is accompanied by its 95% confidence interval (CI) to indicate the smallest difference between condition means that is required to reach a .05 significance level (after Loftus & Masson, 1994). This analysis showed that the categorization task took longer (262 ms, CI 42 ms) to perform than the translation task. The error percentages showed the same pattern: 4.5% errors in the categorization task versus 3.2% errors in the translation task. As expected, the task effect was eliminated in the analysis on the z-score transformations. The effect of semantic relatedness (38 ms, CI 13 ms), indicates that in these tasks, a related context picture induces facilitation compared to an unrelated context picture. Of most importance was the interaction (also observed in the conservative min *F'* statistic), revealing that the semantic facilitation effect in the categorization task was larger (46 ms, CI 23 ms) than in the translation task. The analysis of the z-transformed data showed the same results, so the difference in the semantic context effect between the two tasks is not just proportional to the difference in overall task RT.

Paired samples T-tests on participant means (t_1) and item means (t_2) revealed that only in the categorization task, the related condition differed from the unrelated condition, t_1 (19) = 6.3, $p < .001$, t_2 (14) = 4.3, $p < .005$.

Discussion

In the word-translation task semantically related context pictures induced some facilitation (15 ms) in comparison with unrelated pictures. Although not statistically significant, the direction of this difference is in line with the semantic facilitation effect in word translation reported by La Heij, Hooglander, Kerling and Van der Velden (1996), Bloem and La Heij (2003) and Navarrete (2007). Most importantly, the semantic facilitation effect was much larger in the categorization task. The corresponding interaction reached significance both the RT analysis and in the analysis of the z-transformed RTs, which renders an interpretation of this difference between tasks in terms of task difficulty unlikely.

In the introduction, we discussed our assumption that both in the translation task and in the categorization task, the L2 target word must be identified at the basic level. The semantic facilitation effect of 15 ms observed in the translation task was taken to reflect facilitation of this process (conceptual facilitation in Figure 1).

According to the rationale presented in the introduction, we assume that the same conceptual facilitation effect of 15 ms is also present in the categorization task. Consequently, the additional facilitation effect of 46 ms observed in the categorization task is attributed to an effect of message congruency.

To further substantiate the message congruency account, it seems important to show that a message congruency effect is not confined to categorization, but also surfaces in other word production tasks. Therefore, in Experiment 2, the possible role of message congruency is addressed in an action-naming task.

Experiment 2

The message congruency account predicts that naming the action associated with a target stimulus will be facilitated by a context stimulus that is associated with the same action. For example, naming the action associated with "car" should be facilitated by the context picture of a truck compared to the context picture of a knife. Both car and truck would lead in this task to the goal concept TO DRIVE, whereas knife may lead to the concept TO CUT. Similar to Experiment 1, the message congruency effect is estimated by employing two tasks: translation and action naming. In both tasks conceptual facilitation could be observed, but the message congruency hypothesis predicts that the facilitation in the action-naming task should be substantially larger than in the translation task. In contrast to Experiment 1, in this experiment no "neutral" condition was used.

Method

Participants

Twenty participants of the same pool of students used in Experiment 1 contributed. They received 4 Euros or course credit.

Materials

Fifteen English target words, which refer to concepts having an obvious associated function or action, were selected from fifteen different categories. For instance, the target "airplane" had to be responded to with the Dutch word "vliegen" (to fly). Some targets did have more than one unique associated action (e.g., story: to tell or to listen to), but the participants reported having no problems in adopting the selected action words in the practice list. The message-congruent context pictures were associated with the same action as the target word. For example, the picture of a helicopter accompanied the target word "airplane". The unrelated condition consisted of pictures that were unrelated and response incongruent. For example, the target "airplane" was coupled with the picture of an anvil. The context pictures in the unrelated condition were not associated with the actions associated to any of the targets. The complete set of targets, required responses and context pictures are shown in Appendix 2.

Apparatus and procedure

The apparatus and procedure were the same as in Experiment 1. The total number of stimuli was 30, the complete list was randomized and presented three times in each task, so in the experiment each target word and each context picture was presented 12 times and 6 times, respectively.

Results

The data were treated the same way as in Experiment 1. The mean RTs and error percentages are displayed in Table 3. The error percentage was 2.6%. The percentage of voice key errors was 6.0%. The ANOVA statistics are displayed in Table 4.

Table 3.

Reaction times in ms and percentage of error in the different conditions of Experiment 2.

	Related		Unrelated		Semantic Effect	
	RT	%e	RT	%e	RT	%e
Translation	810	3.0	837	3.5	27	0.5
Action naming	903	4.0	960	5.0	57	1.0

Table 4

Analysis of Variance for Semantic Relatedness Effects of Experiment 2

Source	df	F_1	p	df	F_2	p	df	minF'	p
Mean RT's									
Task	19	35.6	0.001	14	20.1	0.001	30	13	0.001
Relatedness	19	22.7	0.001	14	20.5	0.001	34	11	0.001
Task X Rel.	19	8.2	0.01	14	5.4	0.04	31	3	0.09
Z-scores									
$Task_z$	19	2.6	0.1	14	0.1	0.1	15	0.1	1
$Relatedness_z$	19	30	0.001	14	25	0.001	33	14	0.01
Task X $Rel._z$	19	12	0.003	14	6.2	0.03	29	4	0.05

Overall, the latencies in the translation task were shorter than in the action-naming task (108 ms, CI 38 ms), which prompted an identical analysis on the z-transformed data. The semantic effect of 42 ms CI 18 ms, showed again that related context pictures facilitate the naming response in these tasks compared to unrelated context pictures. Most importantly, the semantic facilitation effect was larger in the action-naming task than in the word-translation task (a difference of 30 ms, CI 15 ms), both in the RT analyses and in the analyses on the z-transformed data.

Paired samples T-tests on participant means (t_1) and item means (t_2) revealed that the relatedness effect was significant in both the translation task, t_1 (19) = 2.2, p < .04, t_2 (14) = 2.2, p < .05 and the action-naming task, t_1 (19) = 6.9, p < .001, t_2 (14) = 4.9, p < .001. Thus in contrast to Experiment 1, a semantic facilitation effect was observed in both tasks. No significant effects were obtained in the error analyses.

Discussion

The two tasks (translation and action naming) differed in overall RT, although this difference (108 ms) was smaller than in Experiment 1. Within the model that we proposed in the introduction, the semantic facilitation effect in the translation task can be attributed to conceptual facilitation (facilitation of target identification). The important finding of this experiment is that the semantic facilitation effect was larger in the action-naming task (57 ms) than in the translation task (27 ms). This difference in facilitation of 30 ms can, as argued in the discussion of Experiment 1, be attributed to an additional facilitating effect of message congruency. Apparently, the message-congruency effect observed in the categorization task of Experiment 1 generalizes to an action-naming task.

An important assumption of the approach taken in Experiments 1 and 2 is that the amount of conceptual facilitation is similar in the two tasks used (translation and categorization in Experiment 1 and translation and action naming in Experiment 2). Although this assumption seems reasonable – it is likely that both tasks require the conceptual identification of the English target word – it seems worthwhile to examine a situation in which the contribution of conceptual facilitation is probably very small. In Experiment 3 we attempted to achieve that situation by using Dutch (L1) target words instead of English (L2) target words. Because the identification of a L1 target word proceeds most likely (much) faster than the identification of a L2 word, the use of L1 targets probably reduces the conceptual facilitation effect. Ideally, this change would reduce the conceptual facilitation such that the semantic facilitation effect can solely be ascribed to message congruency. To measure message congruency, the subtraction procedure used in the previous experiments was again employed. The tasks in this experiment were action naming and categorization. The materials were constructed in such a way that message congruency was absent in the action naming task and present in the categorization task. On the basis of the results of Experiments 1 and 2 these tasks could have an additional advantage of being rather similar in mean RT. A second motivation for using L1 words as targets in Experiment 3 was to determine the generalizability of our findings to word categorization; a task that shows context effects that are very similar to those found in picture categorization (Glaser & Düngelhoff, 1984).

Experiment 3

In Experiment 3, the method for estimating the message congruency effect was similar to the one in Experiments 1 and 2, with the exception that the present experiment is monolingual Dutch and the tasks are categorization and action naming. Dutch target words were paired with categorically related and unrelated pictures that were both unassociated with the action associated with the target concept. In this way, the related context pictures were message congruent in the categorization task, but message incongruent in the action-naming task.

Method

Participants

Eighteen participants of the same pool as used in Experiments 1 and 2 contributed and received 4 Euro or a course credit.

Materials

Twelve Dutch basic-level words were selected that were to be named with a category level name (a noun) or an action name (a verb). For example, the target “hamer” (hammer) had to be named as “gereedschap” (tool) or “slaan” (to hit). In the related condition, the target words were paired with pictures that were from the same category but different in associated action. For example, target “hamer” was paired with the picture of a screwdriver. The unrelated condition was created by using pictures of objects from other categories and with different associated actions than any of the target words. For example, the target “hamer” was accompanied by the picture of a whistle. The complete list of targets and distractors is presented in Appendix 3.

Apparatus and procedure

The apparatus and procedure were similar to the ones of Experiment 2. In Experiment 3 the total list of 24 stimuli was presented 3 times in each task, so each target word and context picture was presented 12 times and 6 times respectively.

Results

The RT data were treated the same way as in Experiments 1 and 2. The percentage of errors was 3.2% and the percentage of voice key errors was 6.4%. The mean RTs and error percentages are displayed in Table 5. The ANOVA statistics are displayed in Table 6.

Table 5.

Reaction times in ms and percentage of error in the different conditions of Experiment 3.

	Related		Unrelated		Semantic Effect	
	RT	%e	RT	%e	RT	%e
Action naming	927	3.0	916	2.6	-11	0.4
Categorization	1071	6.3	1145	7.6	74	1.3

Table 6.

Analyses of Variance for Semantic Relatedness Effects of Experiment 3.

Source	df	F_1	p	df	F_2	p	df	minF'	p
Mean RT's									
Task	17	48	0.001	11	35	0.001	27	20	0.001
Relatedness	17	13	0.02	11	9.7	0.01	27	6	0.02
Task X Rel.	17	30	0.001	11	22	0.001	26	13	0.001
Z-scores									
$Task_z$	17	0.7	0.4	11	0.1	0.9	12	0.1	1
$Relatedness_z$	17	13	0.002	11	7.0	0.02	24	5	0.03
Task X $Rel._z$	17	31	0.001	11	22	0.001	26	13	0.001
Errors									
Task	17	8.6	0.009	11	3.8	0.07	22	3	0.09

Contrary to what was expected, the two tasks differed in their mean RT, with action naming 187 ms CI 56 ms faster than categorization. Overall, the related context pictures induced a facilitation effect of 31 ms CI 18 ms compared to unrelated context pictures. However, the difference in the semantic context effect between the tasks, 85 ms CI 23 ms, was large. In the categorization task the effect (74 ms) was substantial, whereas semantic facilitation was absent in the function naming task (-11 ms). The analyses on the z-transformed data showed the same results as the normal RT analyses, thereby corroborating the interpretation that this difference is not due to a proportional increase in context effect with task difficulty. Paired samples T-tests revealed that the relatedness effect was significant in the categorization task, t_1 (17) = 5.1, $p < .001$, t_2 (11) = 7.7, $p < .001$, but not in the action-naming task (both $p > .1$).

In line with the RT data, Table 6 shows that participants made more errors in the categorization task than in the action-naming task.

Discussion

The main objective of Experiment 3 was to reduce an effect of conceptual facilitation by using L1 target words instead of the L2 words used in Experiments 1 and 2. In addition, the experiment tested whether an effect of message congruency can be obtained in (L1) word categorization, a task that shows a pattern of results that is very similar to picture categorization (Glaser & Düngelhoff, 1984). The results show that in the action-naming task context pictures induce no semantic facilitation. Under the assumption, discussed in the introduction, that the context pictures did not activate their names, we can conclude that with simultaneous presentation of target and context, conceptual identification of a L1 target word is so fast and efficient that it is unaffected by a related context picture (in comparison to an unrelated picture). This leads to the conclusion that the facilitation effect observed in the categorization task (74 ms) can be fully attributed to an effect of message congruency. This observation also shows that our findings of Experiments 1 and 2 generalize to tasks in which L1 words are presented as target stimuli.

In Experiments 1 to 3, the message congruency effect was observed in the task that turned out to be most difficult to perform. Although the analyses of the z-transformed data indicate that the increase in semantic facilitation is larger than what can be expected by the increase in overall mean RT, it is useful to demonstrate a message congruency effect in a situation that is not subject to this criticism.

Experiment 4

In the approach taken in Experiments 1-3, two tasks were used. In one task (e.g., categorization) we measured the combined effect of message congruency and conceptual facilitation, in the other task (e.g., translation) we measured the effect of conceptual facilitation. Message congruency was then estimated by subtracting the two semantic facilitation effects obtained. As discussed above, a somewhat problematic aspect of this approach is that the two tasks used differed in overall mean RT.

A new approach was used in Experiment 4. Here, the goal was to establish a message congruency effect within one task. For this purpose we used an action-naming task. For instance, participants had to react to the Dutch word “auto” (car) with the response “rijden” (to drive). The following three context stimuli were used in combination with this target: (a) the picture of a motorbike (same category and same action; in Dutch cars and motorbikes are associated with the action “rijden”- to drive), (b) the picture of a helicopter (same category, different action: “vliegen” - to fly) and (c) an anvil (different category, different action). Of these context pictures, the motorbike and the helicopter may induce conceptual facilitation, but only the motorbike can induce an additional effect of message congruency. Thus, the effect of message congruency will be reflected in the difference in semantic facilitation of the two related conditions.

It could be argued that context pictures that are both semantically and action related to the target are conceptually “nearer” than context pictures that are only semantically related. Therefore, the former set of pictures may induce a larger conceptual facilitation effect than the latter. We employed a categorization task to control for that possibility. In this task, a Dutch target word (e.g., “auto”, car) had to be categorized (e.g.,“voertuig”, vehicle) using the same context pictures (e.g., a motorbike and a helicopter). Both pictures are semantically related to the target and message congruent (they are both vehicles), thus the context effect induced by these pictures comprises concept facilitation and message congruency. A possible semantic distance effect will reveal itself as a difference in RT between these conditions. In short, in the current experiment the effect of message congruency can be estimated within a single task (action naming), while controlling for a possible semantic distance effect (categorization).

Method

Participants

Eighteen students of the previously used pool participated and received 4 Euros or course credit for their contribution.

Materials

The materials for this experiment are similar to those in Experiment 3. In fact, half of the items of Experiment 3 were reused. Twelve Dutch target words of as many different categories were presented in three conditions. As explained above, in the first condition, the context pictures were categorically and action related to the target word, in the second condition, the context pictures were only categorically related, and in the third condition the context pictures were categorically and action unrelated to the target. The target-context pairs are listed in Appendix 4.

Apparatus and procedure

The apparatus and procedure were the same as in Experiments 2 and 3, with the exception that the total number of stimuli was 36. The complete list was randomized and presented three times in each task, so each target word and each context picture was presented 18 times and 6 times, respectively.

Results

The RT data were treated the same way as in the previous experiments. The percentage of errors was 3.0%, the percentage of voice-key errors was 5.0%. The mean RTs and error percentages are displayed in Table 7. The ANOVA statistics are displayed in Table 8.

Table 7.

Reaction times in ms, error percentages and semantic context effects in the various conditions of Experiment 4.

	Related		Related		Unrelated		Semantic effect	
	C + A		C		C + A		C	
	RT	%e	RT	%e	RT	%e	RT	RT
Action naming	779	1.2	822	2.6	825	1.1	46	3
Categorization	928	4.0	926	3.5	968	5.2	40	43

Note: C = categorically related, A = related in action.

Table 8.

Analyses of Variance for Semantic Relatedness Effects of Experiment 4.

Source	df	F_1	p	df	F_2	p	df	minF'	p
Mean RT's									
Task	17	38	0.001	11	16	0.002	22	11	0.003
Relatedness	34	17	0.001	22	9.6	0.001	26	6	0.007
Task X Rel.	34	2.5	0.1	22	5.7	0.01	30	3	0.06
Z-scores									
$Task_z$	17	0.1	1	11	0.1	0.1	29	0.1	1
$Relatedness_z$	34	26	0.001	22	9.3	0.001	20	7	0.004
Task X $Rel._z$	34	5.1	0.01	22	3.4	0.05	26	2	0.1
Errors									
Task	17	13	0.005	11	1.8	0.2	15	2	0.17
Task X Rel.	34	5.6	0.01	22	3.4	0.05	25	2	0.15

Although in this experiment no subtraction method was used and the categorization task was taken up as a control for semantic-distance effects, we decided to analyze the combined results in an ANOVA with the two tasks and the three context conditions as within-participant variables. This analysis showed that action-naming was faster (118 ms CI 28 ms) than categorization and that the three context conditions differed in mean RT (action related 853, categorically related 874 ms, unrelated 896 ms, CI 13 ms). The interaction between task and context condition failed to reach significance in the participant analysis (means in table 8, CI 32 ms), but did reach significance in the item analyses and –importantly – in both the participant and items analyses on the z-transformed data. The results were further examined with paired-samples t-tests. In the action naming task, the categorically-and-action related condition differed from the unrelated condition, $t_1(17) = 4.2$, $p < .001$, $t_2(11) = 3.4$, $p < .01$, while the categorically-but-not-action related condition did not differ from the unrelated condition, $t_1(17) = 0.3$, $p > .7$, $t_2(11) = 0.09$, $p > .9$. Thus, in the action naming task, of the two related conditions, only the condition that is also message congruent induces facilitation.

A possible criticism to the design is that category-and-action related pictures are semantically "closer" to the targets than the pictures that were only categorically related. Such a semantic distance can have effect on the semantic context effect. The categorization task was included to examine that possibility. In this task the categorically-and-action related condition differed from the unrelated condition, $t_1(17) = 2.5$, $p < .03$, $t_2(11) = 2.9$, $p < .02$, while the two related conditions did not differ $t_1(17) = 0.2$, $p > .8$, $t_2(11) = 0.5$, $p > .6$. This finding shows that the two related conditions induce the same amount of conceptual facilitation.

The error analysis showed that participants made more errors in the categorization task and that in this task most errors were made in the unrelated condition, while in the action-naming task somewhat more errors were made in the categorically-but-not-action related condition.

Discussion

The results of Experiment 4 provide clear evidence for the presence of an effect of message congruency in the action-naming task. First, in the categorization task, the two types of related context pictures (same category vs. same category and same action) induced virtually identical facilitation effects (of 43 ms and 40 ms, respectively). This indicates that the possible effect of semantic distance between the two related conditions (e.g., the target APPLE may be more closely related to the context PEAR than the context STRAWBERRY) is negligible. In the action-naming task, the related but message incongruent condition induced no facilitation at all, whereas the related and message congruent condition induced a facilitation effect of 46 ms. Given the results of the categorization task, this effect can be fully attributed to message-congruency.

The size of the message-congruency effect in the present experiment is of the same magnitude as in Experiments 1 and 2. However, the effect was clearly smaller than the effect observed in Experiment 3; an experiment that resembled the current experiment in many respects. The reason for the difference in may be that the participants were slower in Experiment 3 and especially so in the categorization task, because the materials included related response categories like “cutlery” and “tea service”. The relatively large effect of message congruency in Experiment 3 may then be attributed to an increase of this effect with an increase in time needed or taken to perform the task.

General discussion

In the picture-word interference task, the semantic interference effect, obtained when a target picture is named at the basic level of categorization, is eliminated or even reversed into semantic facilitation when the participants are required to produce the pictures’ category name (e.g., Costa et al., 2003; Glaser & Düngelhoff, 1984). The experiments reported in this article are aimed at understanding this reversal of semantic interference into semantic facilitation with a change in task. The message-congruency account for the polarity of the semantic context effect was proposed by Kuipers et al. (2006) as an alternative for the account by Roelofs (1992) that hinges on the disputed response-set assumption.

In the message-congruency account no response-set mechanism is assumed. That is, all activated words compete for selection at the lexical level: basic-level context words are assumed to compete with category-level names, just as category-level names have been shown to compete with basic-level names (Kuipers et al., 2006). Thus, when a picture of a car has to be categorized, the distractor word “train” is assumed to delay the selection of the correct response word “vehicle” at the lexical level. The observed semantic facilitation effect is attributed to a relatively large message-congruency effect in the earlier process of conceptualizing. This effect surfaces when the application of the task instruction (e.g., to categorize) on target and context converges on the same (goal) concept. For example, in a categorization task, the target concept CAR and the context concept TRAIN converge on the goal concept VEHICLE.

To determine the presence of a message-congruency effect, in Experiments 1-3 a paradigm was employed that involved the use of the same set of stimuli in two different tasks. The materials were chosen such that message congruency was present in one task and absent in the other task. The observed difference in the semantic facilitation effect between the two tasks was attributed to an effect of message congruency. In Experiment 1, translation and categorization of English target words yielded a message-congruency effect of 45 ms. In Experiment 2, the categorization task was replaced by an action-naming task which resulted in a message-congruency effect of 30 ms.

In an attempt to minimize an effect of semantic similarity on target identification (conceptual facilitation), in Experiment 3 Dutch L1 target words were used as targets and the participants were required to name their category name or their associated action. In the action-naming task we obtained no semantic effect. For example, the response “to drink” to the word “kopje” (cup) was not differentially affected by a semantically related picture (a dinner plate) or an unrelated picture (a swing). This finding indicates that with simultaneous presentation, a semantically related context picture most probably does not affect the conceptual identification of a L1 target word. Therefore, we conclude that the substantial semantic facilitation effect of 74 ms observed in the categorization task of Experiment 3 can be fully attributed to an effect of message congruency.

One problematic aspect of the results of Experiments 1-3 is that the increase in semantic facilitation that we attributed to message congruency was always observed in the task that had the longest mean response latencies. Although the relevant differences in semantic facilitation effect were also obtained after a z-transformation of the RT data, it could not be fully excluded that task difficulty played a role. Therefore, we decided to examine this issue again in Experiment 4, using a modified paradigm in which the effect of message congruency could be established in a single task (action naming). The size of the obtained effect (46 ms) was remarkably similar to the estimations obtained in Experiments 1 and 2.

Taken together, the experiments reported clearly show that a message congruent distractor facilitates performance in comparison with a message incongruent one. In the introduction, we propose that this context effect is localized in a process that Levelt (1989) referred to as “conceptualizing” and that he defined as “conceiving of an intention, selecting the relevant information to be expressed for the realization of this purpose, ordering this information for expression, keeping track of what was said before, and so on.” (p. 9). The question is, how exactly message congruency affects this conceptualizing process.

Glaser and Düngelhoff (1984) found interference induced by an unrelated context picture on word categorization (compared to a neutral condition), while the category congruent condition did not differ from the neutral condition. Glaser and Düngelhoff interpreted this result as arising from the "priming" or "preparation" (p. 650) of a false response in the incongruent condition. The results of Experiment 1 seem in line with this interpretation, because the neutral condition and the message congruent condition did not differ, while in the unrelated condition the longest response latencies were observed. However, we do not believe that Glaser and Düngelhoff's explanation can account for our results.

First, when the neutral stimulus that we used in Experiment 1 (a picture of a square) was presented with the target, it formed a frame around the word. It is questionable whether this neutral stimulus was an adequate baseline, because it probably engaged different processing demands than the picture distractors. For instance, unlike the picture distractors, the neural stimuli were identical in all trials, were visually less complex than pictures and may have induced less lateral visual masking (due to a large inter-contour distance). In fact, it may be impossible to find an appropriate "neutral" condition (see Jonides and Mack, 1984).

Second, in our experiments, the context pictures in the unrelated condition did not belong to categories that were used as possible responses, which was the case in Glaser and Düngelhoff's (1984) experiments. Moreover, the pictures that we used in the unrelated condition did not belong to well defined categories. For example, an ashtray, a robot or a safety pin are unlikely to suggest any category level response. Thus, the materials that we used are unlikely to suggest an alternative response that can compete with the category concept of the target. This issue is investigated in Chapter3 in which we systematically manipulate the ease with which the context invokes a response in the task that is applied to the target.

If the message congruency effect is not due to interference induced by an incongruent context stimulus, how to account for the facilitation induced by the congruent stimulus? There are at least two possible mechanisms that can explain message congruency as purely facilitating in our experiments. The first makes use of the existing (semantic) links at the conceptual level.

Since related concepts activate each other by means of spreading activation, two active concepts of the same category spread activation to each other, but also to their category label. Thus when the task is to name the category of one of those concepts, the goal concept will be activated by two concepts, which would make selection of this concept easier than when two unrelated concepts were activated (assuming that such a selection process is based on activation values).

The results of the categorization task, and possibly also the action naming task that we used, can be explained with such a mechanism. However, there are many tasks conceivable where this mechanism does not predict facilitation due to message congruency. For example, Seymour (1977) presented participants with colored month names and asked them to name the season, or opposite season, that is associated with the color of the word. He found that compared with the word “May”, the word “October” printed in brown facilitated the color response “autumn”, but it also facilitated the response “spring” in the opposite naming task. It may be that that the concepts OCTOBER and BROWN spread to the goal concept AUTUMN, but it cannot be the case that OCTOBER and BROWN spread in a similar fashion to the goal concept SPRING. In particular because in the opposite naming task, “October” induced facilitation compared to “May” even though “May” is associated with to the goal concept (SPRING). Thus, the assumption that the message congruency effect is due to (semantically based) spreading of activation at the conceptual level seems to fall short to explain the full range of conditions in which message congruency facilitation can be observed.

Another way to conceive of message congruency as a facilitating effect on conceptualizing is to see this situation as a memory search in which two retrieval cues are used: the target and (probably inadvertently) the context stimulus. Compared to the unrelated (message incongruent) condition, in which only the target provides information to retrieve the goal concept, the advantage of having multiple retrieval cues is clear. Related to this is the notion of co-activation of the sought-for concept by presenting the target in different modalities (see, e.g., Miller, 1982). The advantage of this approach over the explanation of message congruency in terms of spreading of activation is that it is not limited to situations in which target, context and the goal concept are semantically related.

In conclusion, we propose that the facilitation effect due to message congruency is localized at the process of conceptualizing, and that it is due to the advantage of having multiple cues to retrieve the goal concept from memory. Thus, to account for semantic facilitation in categorization tasks, we do not need to assume processes at the lexical level to prevent lexical interference. The consequence (and in our view advantage) of our proposal is that lexical selection is a process that makes its decision on the basis of locally available activation values (see La Heij, Starreveld and Kuipers, in press) and the task instruction *only* affects the conceptualizing process.

Appendix 1.

Stimulus materials used in Experiment 1.

Target	Response		Distractor pictures	
	Translation	Categorization	Related	Unrelated
car	auto	voertuig (vehicle)	train	safety pin
carrot	wortel	groente (vegetable)	potato	clock
chair	stoel	meubel (furniture)	couch	ashtray
cherry	kers	fruit (fruit)	pear	ring
coat	jas	kleding (clothes)	shoe	rolling pin
duck	eend	vogel (bird)	pelican	bottle
ant	mier	insect (insect)	spider	watering can
church	kerk	gebouw (building)	barn	robot
doll	pop	speelgoed (toy)	ball	bathtub
rifle	geweer	wapen (weapon)	revolver	candle
spoon	lepel	bestek (cutlery)	fork	lamp
nurse	zuster	beroep (profession)	fireman	mousetrap
shark	haai	vis (fish)	puffer fish	umbrella
drum	trommel	instrument (instrument)	piano	smoking pipe
drill	boor	gereedsachap (tool)	hammer	sailboat

Appendix 2.

Stimulus materials used in Experiment 2.

Target	Response		Distractor pictures	
	Translation	Action	Related	Unrelated
airplane	vliegtuig	vliegen (to fly)	helicopter	anvil
scissors	schaar	knippen (to cut)	prune shear	phone
spoon	lepel	eten (to eat)	fork	tree
story	verhaal	luisteren (to listen)	radio	anchor
trousers	broek	aantrekken (to wear)	shirt	snail
pencil	potlood	schrijven (to write)	pen	ironing board
lake	meer	zwemmen (to swim)	pool	mousetrap
horse	paard	berijden (to ride)	camel	windmill
chair	stoel	zitten (to sit)	couch	umbrella
car	auto	rijden (to ride)	bicycle	feather
tub	bad	wassen (to wash)	douche	snowman
dog	hond	uitlaten (to walk)	cat	bell
ruler	lineaal	meten (to measure)	tape measure	dinosaur
broom	bezem	vegen (to sweep)	dustbin	birdcage
cup	beker	drinken (to drink)	glass	horse shoe

Appendix 3.

Stimulus materials used in Experiment 3.

Target	Response		Distractor pictures	
	Action	Category	Related	Unrelated
auto (car)	rijden (to drive)	voertuig (vehicle)	airplane	anvil
vork (fork)	prikken (to prod)	bestek (cutlery)	spoon	phone
broek (trousers)	aantrekken (to wear)	kleding (clothing)	hat	tree
stoel (chair)	zitten (to sit)	meubel (furniture)	lamp	lock
hond (dog)	aaien (to pet)	huisdier (pet)	goldfish	toilet
huis (house)	wonen (to live)	gebouw (building)	barn	watering can
bal (ball)	gooien (to throw)	speelgoed (toy)	doll	toaster
hamer (hammer)	slaan (to hit)	gereedschap (tool)	screwdriver	whistle
koe (cow)	melken (to milk)	vee (livestock)	pig	scales
appel (apple)	schillen (to peel)	fruit (fruit)	strawberry	swing
kopje (cup)	drinken (to drink)	servies (tea service)	dinner plate	mushroom
neus (nose)	ruiken (to smell)	lichaamsdeel (body part)	ear	lantern

Appendix 4.

Stimulus materials used in Experiment 4.

Target	Response		Distractor pictures		
	Category	Action	Same Category Same Action	Same Category Different Action	Unrelated
appel (apple)	fruit (fruit)	schillen (to peel)	pear	strawberry	toaster
auto (car)	voertuig (vehicle)	rijden (to drive)	motorbike	helicopter	anvil
bad (bath)	sanitair (sanitary)	wassen (to wash)	shower	toilet	mushroom
beker (cup)	servies (tea service)	drinken (to drink)	glass	plate	swing
broek (trousers)	kleding (clothing)	aantrekken (to put on)	shirt	hat	telephone
cavia (guinea pig)	huisdier (pet)	aaien (to pet)	dog	goldfish	weighing scale
huis (house)	gebouw (building)	wonen (to live in)	flat	church	book
koe (cow)	vee (cattle)	melken (to milk)	goat	pig	watering can
pistool (pistol)	wapen (weapon)	schieten (to shoot)	cannon	sword	anchor
racket (racket)	sportartikel (sports utensil)	slaan (to hit)	baseball bat	baseball glove	piggybank
stoel (chair)	meubel (furniture)	zitten (to sit)	couch	lamp	lock
trompet (trumpet)	instrument (instrument)	blazen (to blow)	horn	piano	lantern

4. The facilitating nature of Message Congruency[6]

We present four experiments aiming at understanding how the facilitating effect by a categorically related context in a categorization task (the message congruency effect, Kuipers & La Heij, 2008a) comes about. Two mechanisms were proposed and tested. In one proposal it is assumed that due to automatic context processing, an unrelated context activates a category concept that competes with the category concept of the target. In the alternative account it is assumed that the categorically related context co-activates the information needed to retrieve the target's category concept, so that the time taken by this conceptual process is reduced. In Experiment 1, target words were categorized in the context of pictures that are instances of a semantic category and pictures that do not belong to any well-established semantic category. In Experiments 2a and 2b, words were again categorized, but the context pictures were either from the same semantic category, from a semantically related category, or unrelated. In Experiment 3 we used a function naming task and manipulated the stimulus onset asynchrony. In no experiment did we find evidence for competition between ready-to-verbalize concepts, which refutes the competition account. It is concluded that the alternative account, the co-activation account, best captures the facilitation by message congruency.

[6] This chapter is based on the article: Kuipers, J. R., & La Heij, W. (2008b) On the facilitating nature of Message Congruency. Paper submitted for publication.

Introduction

The picture-word Interference (PWI) task is, since its introduction by Hentschel in 1973, a popular tool to study the process of word production (Macleod, 1991). In this task, the participant is presented with a picture that has to be named, while a superimposed word has to be ignored. A typical finding in this paradigm is the semantic interference effect: when a picture of a car is presented for naming, a categorically related context word (e.g., “train”) hampers naming a picture of a car more than an unrelated context word (e.g., “tree”). However, when the task is changed into picture categorization, the related context word no longer interferes compared to the unrelated condition, but facilitates naming the category of the picture (Glaser & Düngelhoff, 1984; Costa, Mahon, Savova and Caramazza, 2003).

In most models of speech production (Humphreys, Lloyd-Jones & Fias, 1995; Levelt, Roelofs, Meyer 1999; Starreveld & La Heij, 1996; but see Finkbeiner & Caramazza 2006; Mahon, Costa, Peterson, Vargas & Caramazza, 2007) it is assumed that lexical representations compete for selection. The semantic interference that is observed in basic-level picture naming is explained in these models as follows. The context word will activate its lexical representation which activates its conceptual representation. The target picture activates its conceptual representation and, from there, activity flows to its lexical representation and related concepts. These co-activated concepts will also activate their lexical representation to some extent. Hence, when the context word is semantically related to the target, its lexical representation receives activation both from the context word via the visual input system, and from the target via the semantic system. The lexical representation of an unrelated context word only receives activation from the context word. The extra activation the related context lexical representation receives makes it a stronger competitor for selection than an unrelated lexical representation.

The semantic facilitation that is observed in categorization tasks cannot be accounted for with the above mechanism unless additional assumptions are made. For example, Levelt, Roelofs and Meyer (1999) assume that only the lexical representations that are flagged as part of the set of permissible responses in an experiment can compete for selection. This response set account has, however, proved untenable both on theoretical grounds as well as on empirical grounds (Caramazza & Costa, 2000, 2001; Kuipers, La Heij & Costa, 2006; Kuipers and La Heij, 2008a).

As an alternative for the response set assumption, Kuipers, et al. (2006) and Kuipers and La Heij (2008a) proposed that under certain circumstances a facilitatory context effect coined "message congruency" arises that is large enough to outweigh the lexical-semantic interference. Kuipers et al. (2006) argued that message congruency has its effect in the conceptualizing stage, that is, the stage in word production in which the conceptual information provided by the stimulus and the task instruction is converted into a single concept (the goal concept) that needs to be verbalized (Levelt, 1989). The conditions for message congruency are met when, for example, the target is the picture of a car, the context word is "train" and the task is categorization. In this case, the target concept CAR and the context concept TRAIN converge on the goal concept VEHICLE. Likewise, in an action naming task, a target concept CAR and a context concept MOTORBIKE converge on the goal concept TO DRIVE. Indeed in both conditions facilitation is observed compared to a context that is not message congruent (Kuipers and La Heij, 2008a).

The mechanism underlying the facilitation by message congruency is, so far, not well understood. We discuss two possible explanations for the effect. First, Glaser and Düngelhoff (1984) found in a categorization task that compared to a neutral condition, the unrelated context induced interference while the related (message congruent) context induced no effect. They reasoned that the semantic facilitation is therefore due to the interference induced by the unrelated condition, because the unrelated context stimuli were associated with a competing category response in the experiment. This account, in which message congruency is explained by assuming that a message incongruent context activates a competing response alternative will be referred to as the "competition account".

A second view on how message congruency comes about is to see it as purely facilitatory. The most straightforward implementation of this view is to assume that the links between semantically related concepts are also responsible for the facilitation by message congruency. As two categorically related concepts spread activation to each other, and also to their category representation, the category concept of the target will receive more activation with a categorically related context than when with an unrelated context. With this mechanism, the message congruency facilitation in the categorization and action naming tasks reported by Kuipers and La Heij (2008a) can, in principle be explained, because in these tasks the target, context and goal concept are semantically related. There are however, other tasks conceivable in which the goal concept is unrelated to the target and context, but in which facilitation by message congruency can be observed (e.g., Seymour, 1977, as discussed in Kuipers & La Heij, 2008a) or expected. Another example is a task in which the participants are required to judge the size of a depicted object (e.g., a car) relative to a given standard (e.g., a shoebox) with responding "larger" or "smaller". A context stimulus (e.g., a house) may affect the decision process by biasing it towards the response alternative "bigger". However, the concept HOUSE cannot spread activation to the concept BIGGER by a semantic link. Thus, the assumption that the mechanism of a semantically based spreading of activation is responsible for the facilitation by message congruency seems to fall short to explain the full range of situations in which facilitation by message congruency can be observed or expected.

A second, more general view on facilitation by message congruency is that the information provided by the context is an extra cue to search in semantic memory for the goal concept. In the model Kuipers and La Heij (2008a) propose, it is assumed that the target, context and the task instruction are input to the conceptualizing process. In the conceptualizing process, a message congruent context and the target will converge on the goal concept given the task instruction. This account of message congruency will be referred to with the "co-activation account", since two sources activate the same conceptual representation (cf. Miller, 1982).

It is the goal of this paper to test which of the above accounts of the message congruency effect describes the effect best. In Experiment 1, the competition account is directly tested by manipulating the ease with which a semantically unrelated context picture can evoke a potential response in a word categorization task. In Experiments 2a and 2b, a word categorization task is again used, and it is tested whether pictures from a related category induce more interference than pictures from an unrelated semantic category. In Experiment 3 it is tested whether categorically related context pictures that are associated with a competing response (in a function naming task) induce more interference than unrelated context pictures. Three different stimulus onset asynchronies (SOAs) were used.

Experiment 1

The competition account predicts that the amount of interference induced by a message incongruent context is proportional to the ease with which this context can activate a competing category concept. In Experiment 1 we test this hypothesis.

Dutch target words were to be categorized in the context of pictures. Two sets of context pictures were selected: pictures that are easy to categorize, and pictures that are very difficult to categorize. In the word-categorization task we used, a Dutch target word “auto” (car) will activate the concept VEHICLE and the context picture of an apple could activate the concept FRUIT. By contrast, a context picture of a totem pole is not an instance of a well-defined semantic category, so it cannot activate a category concept. As argued above, the competition account predicts interference of a categorizable context picture compared to a context picture that is not categorizable.

The choice for the use of target words and context pictures was to prevent the possibility that participants could categorize the targets on the basis of a global visual feature (e.g., the presence of four legs) without fully identifying the target. Pictures were chosen for the context conditions, because of their quick access to the semantic system (e.g., Glaser, 1992) which increases the chance that the context activates its category concept when available. Kuipers and La Heij (2008a) used the same target and context modality in categorization and action naming tasks in which they found a reliable the message congruency effect. Thus, the choice for target words and context pictures instead of the more standard situation of target pictures and context words is warranted given the goal of this study.

Method

Participants Twenty undergraduate students from Leiden University participated in this experiment. They had normal or corrected to normal vision and received 4.50

Euros or a course credit for their contribution. No subject participated in more than one of the experiments reported here.

Materials To obtain two picture sets, one that is very easy to categorize and one that is hard to categorize, we presented 160 pictures, most from the Snodgrass and Vanderwart (1980) picture set, to 12 Leiden University students with the task to provide a category name for that picture if possible. Selected for the different conditions of Experiment 1 were the 15 pictures that were most often named with the same category name and the 15 pictures that created most difficulty in the categorization task (none, or not more than 1 response with a category name). The easy to categorize picture set had a mean familiarity of 3.5 and a name frequency of 83 (De Vries, 1986). Of the pictures included in the difficult to categorize set of which the familiarity was available (6 out of 15), the mean familiarity was 2.6, and the mean frequency of the pictures' names (available for all pictures) was 5.9.

As targets, 45 easy to categorize Dutch words were selected from 15 different categories, 3 words per category. The target words were paired with one exemplar of each picture set. None of the context pictures belonged to, or were related to any of the categories used for the target words to prevent the priming of a category concept of the target set. The target words, their category name, and the context pictures that were selected for the two context conditions are shown in Appendix 1.

Apparatus The experiment was programmed in E-Prime (Schneider, Eschman & Zuccolotto, 2002) using a Pentium 4 computer and two monitors with a refresh rate of 100MHz. The voice onset was measured with a microphone and SR-box (Schneider, 1995).

Procedure Participants were run individually in a dimly lit room. At the start of the experiment the participant received instructions on the monitor and a list of the target words and their category names. They were requested to use the category names as shown. After the participant was familiarized with the materials, they were asked to verbally categorize the words in a practice series in which the target words were presented in isolation in a randomized order. Before the experimental trials started there were 5 warm-up trials with (practiced) target words and context pictures that were both not reused in the experimental trials. Each trial had the following sequence: first a fixation point appeared in the center of the screen for 1000 ms, then target and distractor were presented simultaneously in the center of the screen for 2000 ms or until voice onset. At voice onset or when there was no triggering of the voice key, the correct answer and, if applicable, the response time appeared on the monitor of the experimenter. The experimenter judged the response for correctness and entered a code into the computer representing a correct response, a false response or a voice key error. To ensure legibility of the target word against the background of the black context picture (10 cm X 10 cm), the word was printed in red within a white text-box (6 cm X .7 cm). The participant sat approximately 80 cm from the monitor.

Following the experimental trials there were two control series. In the first control series it was checked whether the context pictures were correctly placed in the easy or difficult to categorize condition. The participants were presented with the pictures of both sets and were asked to name their category if they could think of one. A second control series was administered to ensure whether the participant could identify the pictures. They were asked to name each picture with its basic-level name. The pictures were presented in isolation in a randomized order for a maximum of 2 seconds in both control sessions.

Results

In the first control series, some pictures that were in the difficult to categorize condition were named with a very general category name (e.g., tools or thing). For each participant individually, the data of the pictures that were not named according the condition they were in were removed from the analysis (12.8%). The remaining pictures were also correctly named with their basic-level name in the second control series. Trials in which the voice key malfunctioned and RTs below 300 ms were discarded (6.1%). The total percentage of discarded experimental trials was 18.9%. The resulting number of experimental trials was 810 in the categorizable condition with a mean RT of 938 ms and an error percentage of 4.0%. In the un-categorizable condition, there were 649 trials suited for analysis with a mean RT of 932 ms and an error percentage of 5.3%. T-tests on these participant means (t_1) and the item means (t_2) showed that the two conditions did not differ, $t_1(1,19) = .5$ $p > .6$, $t_2(1,44) = .8$ $p > .4$. In the corresponding error analyses, the difference between the two conditions also failed to reach significance, $t_1(1,19) = 1.8$ $p < .09$, $t_2(1,44) = 1.7$ $p < .1$.

In the second post–test, in which the pictures were named (unpracticed) with their basic-level name, the difference between picture sets was significant in the participant analysis, $t_1(1,18) = 2.5$ $p < .03$, but not in the item analysis $t_2(1,14) = .7$ $p > .1$. This means that the participants named the pictures that they were able to categorize 56 ms quicker than the pictures that they were not able to categorize. This was probably due to a difference in the familiarity of the pictures and the frequency of their basic-level name.

Discussion

Due to the strict filtering criteria that we used, many trials were discarded, but enough data remained for a meaningful analysis. The results showed no effect of the categorizability of a context picture on categorizing a word. This finding goes against the competition account which predicts more interference from easy to categorize pictures.

There are, however, alternative explanations of the results of Experiment 1. First, it may be that the participants covertly activated some sort of default category concept like “thing” or “unit” for the difficult to categorize pictures. The result would be that in both conditions of Experiment 1 an alternative category concept could have been competing for selection with the target’s category concept. However, none of the participants gave the pictures such a category name in the categorization task on the context pictures, thus we discard this possibility.

Second, if the context pictures automatically activated their lexical representation, the two pictures sets would induce different lexical interference effects, because their names differed in lexical frequency. Miozzo and Caramazza (2003) have shown that highly frequent words interfere less than low frequent words. Thus, the representations of the difficult to categorize picture set would induce less competition at the lexical level, while they possibly induced more interference at the conceptual level. Although unlikely, if this were the case, these effects would cancel each other out, which would result in the observed lack of a difference between the two conditions. We will return to this issue in the General Discussion, and in the meantime we will assume, according to the findings of Bloem and La Heij (2003) and Bloem et al. (2004), that in the tasks that we use, context pictures do not automatically activate their lexical representation.

Third, it is also possible that the context concept activated a category concept that competed with the target category concept, but this competition was not strong enough to surface in the RTs. It may be, for instance, that the competition between category concepts is strong when they are semantically related, but not very strong when they are unrelated. This scenario is predicted by the model of Lupker & Katz (1981) who argued that interference at a conceptual level arises when the information provided by the context is semantically related to the target's, and that this information leads to a different decision (response) to be made. In the following experiments we introduce a semantic relation between the target category and the context category to test this scenario.

Experiment 2a

In Experiment 2a, the participants' task was the same as in Experiment 1 (word categorization), but changes were made in the context conditions. In one condition the context picture was categorically related and thus message congruent. For example, the target "apple" was paired with the picture of a pear. As has been shown by Kuipers et al. (2006) and Kuipers and La Heij (2008a) such a message congruent context picture facilitates compared to an unrelated context picture (e.g., a car). In the second context condition, the context picture was chosen from a related category. For example, the target "apple" was paired with the picture of lettuce. In the third condition the context pictures were instances of an unrelated category, for example, the target word "apple" was paired with the picture of a sheep.

If the lack of interference by categorizable pictures in Experiment 1 was due their lack of a semantic relation to the target, interference should be observed when the context pictures are instances of a related category. Thus, if the competition account were true, target-context pairs chosen from related categories (e.g., fruit-vegetable) compete more strongly than instances chosen from unrelated categories (e.g., fruit-vehicle). Thus, the message congruent condition is predicted to facilitate compared to the unrelated message incongruent condition, and to facilitate more strongly compared to the related message incongruent condition.

Alternatively, the co-activation account predicts no difference between the related and the unrelated message incongruent conditions, because neither of these conditions contain semantic cues that can facilitate the conceptualizing process. Thus, the message congruent pictures are predicted to facilitate to an equal amount compared to both the related and unrelated pictures.

Method

Participants Sixteen students from the same population used in Experiment 1 took part in the experiment.

Materials Twenty Dutch target words were selected from the same number of semantic categories. Each target word (e.g., vork, fork), was paired with a picture from the same semantic category (e.g., a knife; related, message congruent condition), a picture from a semantically related category (e.g., a cup; related, message incongruent condition) and an unrelated picture (e.g., lizard; unrelated, message incongruent condition). Each of the 20 context pictures appeared in each condition.

Apparatus The apparatus was the same as used in Experiment 1.

Procedure The training and experimental procedure were similar to Experiment 1 with the exception that there were no control series on the context pictures after the experimental trials.

Results and discussion

The following RTs were excluded: RTs of incorrect responses (4.8%), RTs of trials in which the voice key malfunctioned and RTs below 300 ms and failures to respond within the 2000 ms deadline (total 11.6%). The mean RTs and percentages of incorrect responses are shown in Table 1.

Table 1.

Mean reaction time in ms and percentage of error in the different conditions of Experiments 2a and 2b.

Condition	Related, Message Congruent RT (%)	Related, Message Incongruent RT (%e)	Unrelated, Message Incongruent RT (%e)
Experiment 2a	986 (3.4)	1039 (4.5)	1030 (4.1)
Experiment 2b	938 (3.8)	1011 (6.4)	1012 (3.4)

Variability is indicated by the 95% confidence intervals (CI) of the mean differences, which means that the CI is the difference in ms that is required to reach a significance level of .05 (after Loftus & Masson, 1994). The ANOVA on mean reaction times in the different conditions showed that the effect of relatedness was significant, $F_1(2,30) = 6.0$, CI = 17, $p < .01$, $F_2(2,38) = 6.1$, CI = 15, $p < .01$. Paired samples t-tests on participant means (t_1) and item means (t_2) showed that RTs in the related message congruent condition were shorter (53 ms) than in the related condition, $t_1\,(15) = 4.3$, $p < .002$, $t_2\,(19) = 3.9$, $p < .002$, and shorter (44 ms) than in the unrelated condition, $t_1\,(15) = 2.7$, $p < .02$, $t_2\,(19) = 2.3$, $p < .04$ (note although that the Bonferroni corrected significance level is $p < .016$). Thus the facilitation by message congruency (Kuipers & La Heij, 2008a) is replicated. The related message congruent condition and the unrelated message incongruent did not differ (both $p > .4$), thus a semantic relation between the target category and the context category had no effect on the word categorization task. An identical ANOVA on the error percentages yielded no significant effect.

These results go against the notion that the competition between concepts at the conceptual level is only visible when related category concepts are activated by the target and the context. The co-activation account is supported by these results, because the RTs in the two message incongruent conditions did not differ, while they were shorter in the message congruent condition.

However, the conditions to observe a semantic effect between message incongruent context pictures may not have been optimal in this experiment. Perhaps the semantic relation between the selected categories was not strong enough to induce any semantic competition. For example, the categories fruit and vegetable are more closely related than the categories fish and bird. Another concern may be that the association between the context picture and its category was not strong enough. Although this seems unlikely because the message congruent context picture did facilitate, which shows the context pictures did activate their category concept. To remedy these concerns, in Experiment 2b, we modified the experiment such that the probability of interference between semantically related category concepts would increase.

Experiment 2b

In Experiment 2b, the task was again word categorization, but now the words representing the context pictures were included in the target list. This is expected to increase the interference they induce (La Heij, 1988). In addition, with this modification, each participant has explicitly made the association between the context concept and its category name. Thus, the chance that the context pictures activate the lexical representation of their category concept is also increased, which could lead to interference at the lexical level. The second modification was that only closely related categories such as fruits and vegetables were used.

Method

Participants Sixteen students from the same population as used in Experiments 1 and 2a took part.

Materials The response categories were selected from those used in Experiment 2a. The 8 selected categories were made up of 4 closely related pairs (e.g., fruit and vegetables), and of each category, two instances were selected as target words. The 16 Dutch target words were all paired with three pictures: an instance of the same category, (related, message congruent condition), an instance of a related category (related, message incongruent condition) and an instance of an unrelated category (unrelated, message incongruent condition). See appendix 2b for a list of the materials.

Apparatus and Procedure The apparatus and procedure were the same as used in Experiment 2a.

Results and discussion

The data were treated the same way as in Experiment 2a. The following RTs were excluded: RTs of incorrect responses (5.0%), RTs of trials in which the voice key malfunctioned and RTs below 300 ms and responses exceeding 2000 ms (total 7.0%). The mean RTs and percentages of incorrect responses are shown in Table 2.

The ANOVA on mean RTs showed a significant effect of relatedness, $F_1(2,30) = 21.9$, CI = 14, $p < .001$, $F_2(2,30) = 2.0$, CI = 14, $p < .001$. Paired samples t-tests revealed that the related, message congruent condition differed from the related message incongruent condition, $t_1(15) = 5.7$, $p < .001$, $t_2(15) = 4.5$, $p < .001$. The related message incongruent condition did not differ from the unrelated message incongruent condition, both $p > .7$. The analyses on the errors did not yield any significant effects (both $p > .1$).

Despite that compared to Experiment 2a, the likelihood of observing an effect of semantic relatedness was increased, the related and the unrelated message incongruent conditions did not differ. Thus, when the context is not message congruent, it seems that a semantic relation between the target category and the context category has little influence. Thus, so far no competition between concepts has been observed, which is a clear lack of support for the competition account.

There is, however, one aspect of the Experiments 2a and 2b that could invalidate the above conclusion. It could be that with the presentation of related context pictures there are two context effects present that cancel each other out. One would be the semantic facilitation due to spreading of activation at the conceptual level. The other would be the interference due to competition between ready-to-verbalize-concepts. However, two observations in the literature showed that the facilitation due to spreading of activation has no contribution to the facilitation by categorically related context words (or pictures) in a categorization task.

The first are the results of Kuipers et al. (2006) Experiment 2, in which Dutch participants named English words (e.g., “car”) with their Dutch category name (e.g., “voertuig”). Dutch context words were presented that were either the correct translation of the target (e.g., “auto”) or the Dutch name of a categorically related object (e.g., “trein”, train). Compared to an unrelated Dutch context word, (e.g., “appel”, apple), the facilitation induced by the translation of the target and the categorically related context word was the same, which shows that the extra activation of the target concept (CAR) has no contribution to the observed facilitation effect.

The second are the results of Experiment 4 of Kuipers and la Heij (2008a). In this experiment we asked Dutch participants to name Dutch words (e.g., auto, car) to name the function associated with its concept (e.g., rijden, to drive). A categorically related context picture that has the same function as the target (e.g., a bicycle) facilitates responding compared to an unrelated picture (e.g., an apple), while a categorically related context picture that is associated with a different function, (e.g., a boat) had no effect compared to an unrelated picture. Thus, the spreading of activation from a context concept to the target concept has no influence in activating the goal concept when the goal concept is not the same as the target concept (in e.g., categorization or function naming tasks).

In Experiment 3 it is tested whether this observation holds when different stimulus onset asynchronies (SOAs) are used. With a pre-exposure of the context (negative SOA), it is likely that a semantically related context (picture or word) primes the target via spreading of activation (e.g., Meyer & Schvaneveldt, 1971). Therefore, semantic facilitation can be expected in this condition. However, the context may also activate its function concept before the target does. If the context is semantically related, its concept and its function concept will be reactivated upon the presentation of the target, which would lead to more competition compared to an unrelated context that will not be reactivated by the target. Therefore, in assuming that both effects exist, the facilitation (due to spreading of activation) and the interference (due to competition for selection) both increase, thus it is likely that also at the negative SOA, the two effects cancel each other out.

With a post-exposure of the context picture (positive SOA), the target is already processed to some extent at the time the context picture is presented. Compared to the negative SOA and the simultaneous presentation of the target and context, the processing of the target will not benefit from a semantically related context, because the target concept does not receive activation from the context concept until the process of activating and lexicalizing its function concept is well underway. Thus, semantic facilitation at the conceptual level is reduced or even eliminated. At the same time, the target may prime a semantically related context concept. This would result in semantic interference, because an unrelated context will not be primed by the target, assuming that there is competition for selection at the conceptual level. Similarly, it is shown that priming an unrelated context increases the interference it induces (Henik et al. 1983, Merril et al. 1981; Warren, 1972, 1974).

Experiment 3

Experiment 3 was identical to Experiment 2 except for two modifications. First, the categorization task was replaced by a function naming task. With this change we examined whether the findings of Experiments 2a and 2b generalize to another task, and we created the opportunity to use categorically related context pictures that are message incongruent. For example, an eye and an ear are categorically related, but they have different functions. The second modification was the use of three SOAs to inspect whether spreading of activation and competition for selection processes can be distinguished within the conceptualizing process. Another goal of the SOA manipulation is to examine whether the message congruency effect is stable over different SOAs.

Method

Participants Eighteen students from the same population used in the previous experiments took part.

Materials Of four semantic categories, two instances were selected that did not have the same function, for example, an eye (to see) and an ear (to hear) of the category “senses”. These eight target words were coupled with the picture representing the target (identical, message congruent condition), a picture of the other target of the same category (related, message incongruent condition) and a picture of an unrelated target word (unrelated, message incongruent condition).

Apparatus The apparatus was the same as in Experiments 1 and 2.

Procedure The procedure was similar to Experiments 1 and 2, except that for the target-context presentation, three different SOAs were used. In the negative SOA condition, the context picture was presented 200 ms in advance of the target word and remained on the screen when the target word presented for a maximum of 2000 ms. In the SOA 0 ms the presentation was the same as in Experiments 1 and 2. In the positive SOA condition, the target word preceded the context picture by 200 ms and remained on the screen when the context picture was presented for a maximum of 1800 ms.

Results and discussion

The data were treated the same way as in experiments 1 and 2. The following RTs were excluded: RTs of incorrect responses (4.3%), RTs of trials in which the voice key malfunctioned and RTs below 300 ms and failures to respond within the 2000 ms deadline (total 2.1%). The mean RTs and percentages of incorrect responses are shown in Table 2.

Table 2.

Mean reaction time in ms and percentage of error in the different conditions of Experiment 3.

Condition	Identical, Message Congruent RT (%)	Related, Message Incongruent RT (%e)	Unrelated, Message Incongruent RT (%e)
SOA -200 ms	812 (1.2)	837 (3.9)	870 (3.2)
SOA 0 ms	838 (2.1)	919 (7.6)	920 (7.4)
SOA +200 ms	826 (2.8)	914 (7.4)	884 (3.9)

The ANOVA on mean RTs showed a significant effect of relatedness, $F_1(2,34) = 31.3$, CI = 17, $p < .001$, $F_2(2,14) = 45.3$, CI = 16, $p < .001$. The effect of SOA was also significant, $F_1(2,34) = 4.3$, CI = 33, $p < .03$, $F_2(2,14) = 24.7$, CI = 15, $p < .001$. Finally, the interaction between relatedness and SOA was significant, $F_1(4,68) = 3.5$, CI = 8, $p < .02$, $F_2(4,28) = 4.0$, $p < .02$, CI = 8. Paired samples t-tests revealed that at SOA – 200 ms the identical (message congruent) condition facilitated (58 ms) compared to the unrelated condition, $t_1(17) = 3.3$, $p < .01$, $t_2(7) = 5.5$, $p < .05$, but not compared to the related condition (both $p > .08$). The related (message incongruent) condition also facilitated (33 ms) compared to the unrelated condition, $t_1(17) = 2.4$, $p < .03$, but approaching significance in the item analysis, $t_2(7) = 2.3$, $p < .06$. As expected, a context picture that represents the target facilitated compared to an unrelated context picture. However, contrary to the results of experiments 1 and 2, the related context picture also facilitated compared to an unrelated context picture. This semantic facilitation can be attributed to the priming of the target concept (and perhaps its function concept) by means of spreading activation. Thus, again, no interference induced by a message incongruent context was observed. The competition account is not supported by these results, because the function concept of the context (and perhaps its lexical representation) was activated before the target function concept, which according to the competition account, would lead to more competition between two related concepts (to see and to hear) than between two unrelated concepts (to see and to drive). Given the fact that we observe semantic facilitation instead of semantic interference (or no effect) between the related and the unrelated condition, and no effect between the identical and the related condition, the facilitation due to spreading of activation is the strongest context effect acting at the conceptual level when the context is message incongruent.

At SOA 0 ms, the identical condition facilitated (82 ms) compared to the related condition, $t_1(17) = 5.3$, $p < .001$, $t_2(7) = 4.8$, $p < .005$, and also facilitated (81 ms) compared to the unrelated condition, $t_1(17) = 5.8$, $p < .001$, $t_2(7) = 9.0$, $p < .001$. The related and unrelated conditions did not differ (both $p > .8$). This result is a replication of the findings of experiments 2a and 2b, in which with simultaneous presentation of target and context, message congruency facilitated and a semantic relation between message incongruent context pictures had no effect. Thus, again no evidence for interference between semantically related concepts was found with simultaneous presentation of target and context.

Finally, at SOA + 200 ms, the identical condition facilitated (88 ms) compared to the related condition, $t_1(17) = 5.1$, $p < .001$, $t_2(7) = 7.2$, $p < .001$, and also facilitated (58 ms) compared to the unrelated condition, $t_1(17) = 3.7$, $p < .005$, $t_2(7) = 6.1$, $p <$

.001. Thus, even with post–exposure of the context did an identical picture facilitate the processing of the target word. Most striking was that the related condition had a tendency to interfere compared to the unrelated condition. The 30 ms semantic interference was however not significant in the analysis by participants, $t_1(17) = 1.8$, $p = .09$, and approached significance in the analysis by items, $t_2(7) = 2.3$, $p < .06$. Thus, when presented after the target, did a related context picture tended to interfere compared to an unrelated context picture. This result shows that only when the conceptual facilitation is reduced or eliminated, a semantic interference effect due to competition for selection at the conceptual level becomes visible.

Similar results were obtained in the analysis of the error percentages: the effect of relatedness was significant, $F_1(2,34) = 13.0$, CI = 0.4, $p < .001$, $F_2(2,14) = 6.5$, CI = 1.3, $p < .02$. The effect of SOA was also significant, $F_1(2,34) = 8.0$, CI = 0.3 $p < .02$, $F_2(2,14) = 5.5$, CI = 0.9, $p < .02$. Paired samples analyses showed that at SOA – 200 ms, in the identical condition marginally less errors were made compared to the related condition, $t_1(17) = 2.2$, $p < .05$, $t_2(7) = 2.2$, $p < .07$ and also compared to the unrelated condition by participants, $t_1(17) = 2.5$, $p < .05$, but in the analysis by items, $t_2(7) = 1.9$, $p = .094$. The related condition did not differ from the unrelated condition (both $p > .6$). At SOA 0 ms, fewer errors were made in the identical condition compared to the related condition, $t_1(17) = 4.0$, $p < .005$, $t_2(7) = 3.5$, $p < .01$, and compared to the unrelated condition, $t_1(17) = 3.6$, $p < .005$, $t_2(7) = 2.6$, $p < .05$. Again, the related and the unrelated condition did not differ (both $p > .9$). Finally, at SOA + 200 ms, fewer errors were made in the identical condition compared with the related condition, $t_1(17) = 2.5$, $p < .03$, $t_2(7) = 4.7$, $p < .005$, but not compared to the unrelated condition (both $p > .2$). The difference between the related and unrelated condition was nearly significant, $t_1(17) = 1.7$, $p < .07$, $t_2(7) = 2.3$, $p < .06$. In line with the results of the RT analysis, the only trend of semantic interference between message incongruent context pictures was observed when the context was presented 200 ms after the target.

In conclusion, the results of Experiment 3 show that when compared to unrelated pictures, (1) identical context pictures reliable facilitated in all three SOA conditions, (2) a semantically related, but message incongruent picture facilitated in the negative SOA condition, had no effect at SOA 0 ms, and induced some interference at a positive SOA. The interpretation of these results is: (1) the message congruency effect is stable over different SOAs, (2) the conceptualizing process can be subjected to semantic facilitation due to spreading of activation, and (3) the competition between ready-to-verbalize concepts is a weak effect that is only observable when the context is semantically related, included in the set of targets, and the effect of spreading of activation is eliminated.

General discussion

The message congruency account was presented by Kuipers et al. (2006) and Kuipers and La Heij (2008a) to explain the facilitating effect a semantically related context (picture or word) has on naming the category or function of a target. Two mechanisms were discussed to explain how this message congruency facilitation comes about. In both accounts it is assumed that the context is automatically processed according to the task instruction. In the first account, this is assumed to lead to the activation or preparation of an alternative concept for responding when the context is message incongruent. This alternative concept is assumed to compete for selection with the concept that is activated by the target. When the context is message congruent, the target and the context activate the same concept (the goal concept); hence, there will be no concept competing for selection with the concept activated by the target, and the response latencies in the message congruent condition will be shorter.

The second account for the facilitation by message congruency was presented as the co-activation account. In this account it is assumed that the conceptualizing process (the search in long-term memory for the goal concept) can be speeded up when multiple retrieval cues are presented. A message congruent context is assumed to be such an extra search cue, because it leads to the activation of the goal concept when processed according to the task instruction.

In Experiment 1, the competition account was tested in a word categorization task with context pictures. Two sets of pictures were used. One set pictures of instances of well defined semantic categories and one set of pictures that do not belong to well defined semantic categories. According to the competition account, the difficult-to-categorize pictures should induce less interference than the easy-to-categorize pictures, because they do not activate a category concept which could compete for selection with the category concept activated by the target. The results show that there is no effect of the categorizability of a context picture in a word categorization task. This suggests that there is no competition between category concepts in selecting the category concept of the target. It was reasoned, however, that category concepts may compete for selection, but that this competition is stronger (and therefore visible as a context effect) when the categories are semantically related, a proposal that is in accordance with the account by Lupker and Katz (1981).

In Experiment 2a, a semantic relation between the target category and the context category was introduced to address this possible cause of the lack of interference induced by message incongruent context pictures in experiment 1. A word categorization task was again used and the context pictures were either categorically related, instances of a related semantic category, or instances of an unrelated category. The results showed that context pictures of instances of semantically related categories did not affect word categorization stronger than pictures of instances of unrelated categories. Furthermore, related message congruent pictures induced the same amount of facilitation compared to the related and unrelated message incongruent pictures, which is completely in accordance with the co-activation account.

The main change in Experiment 2b was that pictures representing the target words were included in the set of context pictures. This was to increase the chance to observe interference induced by these pictures (La Heij, 1988). The results were identical to those of Experiment 2a. Thus, in Experiments 2a and 2b, semantically related context pictures did not induce interference compared to unrelated context pictures irrespective of whether the names of the context pictures are in the set of targets. Thus, the results did not support the competition account of message congruency, while they did support the co-activation account.

If, as mentioned in the discussion of Experiment 1, the context pictures had activated their lexical representations in these experiments, the results of Experiments 2a and 2b would have been different. First, semantically related context words induce interference, even across levels of categorization (Kuipers et al. 2006), compared to unrelated words. Since we did not observe such a semantic interference effect, it seems that the context pictures did not activate their lexical representation in Experiment 2a. Second, in Experiment 2b, the names of the context pictures were included in the set of targets. The inclusion of the context words in the set of targets has shown to result in a larger semantic interference effect compared to when to context words are not in the set of responses (see MacLeod, 1991). However, even with the inclusion of the context pictures, no semantic interference effect was observed between the message incongruent context conditions in Experiment 2b. Thus, given the clear absence of semantic interference in Experiments 2a and 2b, it can also be concluded that the context pictures did not automatically activate their lexical representation nor the lexical representation of their category in these experiments. This conclusion is in accordance with the findings by Bloem and La Heij (2003), and Bloem et al. (2004), that context pictures do not automatically activate their lexical representation.

In Experiment 3, the SOA was manipulated to examine whether semantic facilitation due to spreading activation and a possible interference due to competition between ready-to-verbalize concepts can be teased apart. A second modification was the change of the categorization task into an action naming task to examine the condition of a categorically related context picture that is message incongruent and whether the results of Experiment 2a and 2b generalize to another task. The results show that, compared to the unrelated condition, the identical (message congruent) context reliably facilitated in all tested SOAs, which underlines the conclusion of Kuipers and La Heij (2008a) that the message congruency effect is a robust effect.

It was reasoned, that at a negative SOA, both the facilitation due to spreading activation, and a possible interference effect due to competition between function concepts are larger compared to the simultaneous presentation of target and context. If one of these effects were stronger than the other (or absent), the polarity of the observed (net) effect would be affected accordingly. The results showed that the categorically related context pictures induced facilitation. Consequently, the spreading of activation is the strongest effect, and again no effect of competition between ready-to-verbalize (function) concepts was observed. The results of the simultaneous presentation of target and context were the same as in Experiments 2a and 2b, showing that the findings of the categorization task generalize to a function naming task.

Finally, at the positive SOA, a tendency of interference by the semantically related context pictures was observed. Although the effect is not significant, we may speculate a bit about the possible cause of such an effect – if it is reliably obtained. At this SOA, semantic facilitation due to spreading of activation from context to target cannot affect response latencies, because the target is already processed to some extent at the time a (related) context is presented. By contrast, at this SOA the target will prime a related context concept; hence, when the context is presented, its concept (and maybe its function concept) will be activated more strongly than the (function) concept of an unrelated context picture. The extra activation of the context concept may lead to semantic interference due to competition between ready-to-verbalize (function) concepts. However, this scenario is unlikely, mainly because La Heij, Heikoop, Akerboom and Bloem (2003) found a non-significant 11 ms semantic *facilitation* effect by context pictures at an SOA of +100 ms.

In conclusion, the current set of experiments was aimed at understanding how the facilitating effect of a message congruent context comes about. The results provide clear evidence against the view that the message congruency effect is largely due to the interference induced by a message incongruent context (the competition account). Alternatively, the co-activation account was supported by the results in that a context that co-activates the concept activated by the target (the goal concept), facilitated in all examined conditions.

Assuming that the co-activation account of message congruency is correct, we believe that the conceptualizing process of a categorization task with a picture-word compound as stimulus is best described as: a process in which the conceptual representations of the target and the context are both subjected to the categorization task. This leads either to the activation of different conceptual representations when the context is not message congruent, or to the extra activation of one conceptual representation when the context is message congruent. This co-activation of the sought-for concept(s) considerably reduces the time needed to select a concept for production.

This conclusion leads to the following explanation of the observation of Glaser and Düngelhoff (1984) that in a picture categorization task, a categorically related context word can induce facilitation compared to an unrelated context word. With simultaneous presentation of target and context, a categorically related context induces a substantial effect of message congruency, a small or no effect of conceptual facilitation (spreading of activation), and an interference effect at the lexical level. The facilitation effect(s) at the conceptual level are large enough to outweigh the lexical interference effect.

Appendix 1.

Stimulus materials used in experiment 1.

Target	Response	Distractor pictures	
	Category name	Categorizable	Un-categorizable
kopje (cup)	servies (cutlery)	trumpet	spinning-wheel
schotel (saucer)	servies	train	totem pole
bord (plate)	servies	jack	camera
hoed (hat)	hoofddeksel (headwear)	piano	mouse trap
kroon (crown)	hoofddeksel	guitar	fire hose
pet (cap)	hoofddeksel	hammer	vlag
hond (dog)	huisdier (pet)	harp	whip
kat (cat)	huisdier	strawberry	funnel
cavia (ginny pig)	huisdier	pineapple	envelope
vlieg (fly)	insect	bread	well
spin (spider)	insect	hamburger	weathercock
mier (ant)	insect	pear	umbrella
stoel (chair)	meubel (furniture)	hand	camera
bank (couch)	meubel	wrench	barrel
kast (closet)	meubel	sweater	fan
bad (bath)	sanitair (sanitary fittings)	pear	spinning wheel
douche (shower)	sanitair	hammer	barrel
toilet	sanitair	hand	dip net
ring	sieraad (ornament)	guitar	envelope
oorbel (earing)	sieraad	train	weathercock
armband (bracelet)	sieraad	bread	dip net

Appendix 1 (continued)

koe (cow)	vee (cattle)	sweater	totem pole
schaap (sheep)	vee	hamburger	fire hose
varken (pig)	vee	piano	well
pistool (pistol)	wapen (weapon)	strawberry	mousetrap
kanon (canon)	wapen	wrench	fan
zwaard (sword)	wapen	pineapple	funnel
voetbal (football)	sport	jack	umbrella
hockey	sport	harp	flag
tennis	sport	trumpet	whip
oom (uncle)	familielid (relative)	hammer	well
tante (aunt)	familielid	pineapple	fire hose
neef (nephew)	familielid	wrench	umbrella
tandarts (dentist)	beroep (profession)	trumpet	barrel
bakker (baker)	beroep	guitar	dip net
leraar (teacher)	beroep	strawberry	fan
diamant (diamand)	edelsteen (gem)	harp	mousetrap
robijn (ruby)	edelsteen	bread	camera
saffier (saphire)	edelsteen	jack	spinning wheel
uur (hour)	tijdseenheid (time unit)	piano	whip
seconde (second)	tijdseenheid	train	envelope
minuut (minute)	tijdseenheid	hand	wheathercock
slang (snake)	reptiel (reptile)	hamburger	flag
hagedis (lizard)	reptiel	pear	totem pole
krokodil (crocodile)	reptiel	sweater	funnel

Appendix 2.

Targets, required responses and context pictures used in Experiment 2a

Target	Response	Same category	Related category	unrelated category
peer (pear)	fruit (fruit)	apple	lettuce	cat
wortel (carrot)	groente (vegetable)	lettuce	apple	sheep
vork (fork)	bestek (cutlery)	knife	cup	lizard
bord (plate)	servies (service)	cup	knife	beetle
roos (rose)	bloem (flower)	flower	tree	packet
eik (oak)	boom (tree)	tree	flower	bread
hond (dog)	huisdier (pet)	cat	sheep	guitar
koe (cow)	vee (cattle)	sheep	cat	hammer
duif (pigeon)	vogel (bird)	parrot	pufferfish	knife
zalm (salmon)	vis (fish)	pufferfish	parrot	cup
piano (piano)	(musical) instrument	guitar	hammer	apple
zaag (saw)	gereedschap (tool)	hammer	guitar	lettuce
mug (mosquito)	insekt (insect)	beetle	lizard	sporthelmet
krokodil (crocodile)	reptile (reptile)	lizard	beetle	doll
kano (canoo)	vaartuig (vessel)	sailboat	car	flower
trein (train)	voertuig (vehicle)	car	sailboat	tree
neus (nose)	zintuig (sense)	ear	brain	parrot
hart (hart)	organ (organ)	brain	ear	pufferfish
racket (racket)	sport (sport)	sporthelmet	doll	ear
puzzle (puzzle)	spel (game)	doll	sporthelmet	brain
melk (milk)	drinken (drink)	drinking packet	bread	sailboat

Appendix 2 (continued)

koekje (cookie)   eten (food)   bread   drinking packet car

Appendix 3.

Targets, required responses and context pictures used in Experiment 2b.

Target	Response	Same category	Related category	unrelated category
mes (knife)	bestek (cutlery)	fork	dinner plate	lungs
vork (fork)	bestek	knife	cup	heart
bord (dinner plate)	servies (service)	cup	fork	nose
kopje (cup)	servies	dinner plate	knife	ear
appel (apple)	fruit (fruit)	banana	carrot	dinner plate
banaan (banana)	fruit	apple	lettuce	cup
sla (lettuce)	groente (vegetable)	carrot	banana	knife
wortel (carrot)	groente	lettuce	apple	fork
bij (bee)	insect (insect)	beetle	eagle	nose
kever (beetle)	insect	bee	duck	ear
arend (eagle)	vogel (bird)	duck	bee	heart
eend (duck)	vogel	eagle	beetle	lungs
hart (heart)	orgaan (organ)	lungs	nose	eagle
longen (lungs)	orgaan	heart	ear	duck
neus (nose)	zintuig (sense)	ear	heart	bee
oor (ear)	zintuig	nose	lungs	beetle

Appendix 4.

Stimulus materials used in experiment 3.

Target word	Response Function	Distractor pictures identical	related	unrelated
neus (nose)	ruiken (to smell)	nose	eye	bed
oog (eye)	kijken (to look)	eye	nose	boat
auto (car)	rijden (to drive)	car	boat	book
boot (boat)	varen (to sail)	boat	car	chair
stoel (chair)	zitten (to sit)	chair	bed	eye
bed (bed)	liggen (to lay)	bed	chair	pen
boek (book)	lezen (to read)	book	pen	auto
pen (pen)	schrijven (to write)	pen	book	nose

5. Conclusions and discussion

In this Chapter I summarize the main findings reported in this dissertation and discuss their implications for models of word production. Finally, I present possible directions for future research.

Summary of the main findings

Chapter 1

In Chapter 1, I discussed four models of word production that were developed to describe the processes involved in producing a word, from conceiving a message, to producing the verbal output that represents this message. The box-and-arrow model of Glaser and Glaser (1989), that was developed to capture context effects in Stroop and Stroop-like tasks, has two main components: a semantic system and a lexicon that have separate executive systems. It is assumed that pictures have privileged access to the semantic system and that words have privileged access to the lexicon. Interference in this model is predicted when the context stimulus has privileged access to the subsystem that is crucial for the response that has to given and it is not congruent to this required response. This model has been the basis for two computational models that I also discussed: WEAVER++ (Roelofs, 1992, 2003) and the Conceptual Selection Model (CSM, Bloem & La Heij, 2003; Bloem et al., 2004).

In WEAVER++, a network model is combined with a shell of production rules. This combination gives it a great explanatory power, although one of its main features (the response set rule) has been seriously criticized (Caramazza & Costa, 2000, 2001; Kuipers et al., 2006).

The research presented in this dissertation is built upon the CSM of Bloem and La Heij (2003). The main feature of this model is that all functional aspects are implemented within the network. Examples of these aspects are the connection strength between nodes, activation-based selection criteria, and selective cascading of information. Thus, contrary to WEAVER++ in which many problems are solved by network-external production rules, in the CSM all solutions are implemented within the structure of the network.

The fourth model I discussed in Chapter 1 was the Independent Network Model by Caramazza (1997). This model was developed in the research tradition that focuses on speech error data of speech impaired patients. The result is a model that diverges from the other models I discussed in many ways. The most important aspects of this model are: the distinction between an orthographical lexicon and a phonological lexicon, a semantic network with decomposed semantic representations (semantic features), and an automatic flow of information through the network (full cascading).

The observation that current models of speech production have difficulty in explaining the observed semantic context effects in naming and categorizing pictures was the motivation for the research presented in this dissertation. While keeping the stimulus materials the same, it has been found that a categorical relation between the target and the context leads to interference in a basic-level naming task, while it leads to facilitation in a categorization task (Glaser & Düngelhoff, 1984). In the approach that is taken in this dissertation, the cause of this phenomenon is sought in the difference between the tasks that are applied to the target. In the basic-level naming task, it is the concept that represents the target picture that needs to be verbalized. In the category-level naming task, the target also activates its conceptual representation, but a different concept needs to be retrieved and verbalized.

Current models of word production greatly simplify or ignore the conceptualizing process, and they have difficulty in explaining the semantic facilitation observed in the categorization task. It was reasoned that different tasks require different conceptualizing processes, so it was this process that was experimentally manipulated to find an explanation for why the polarity of the semantic context effect is modulated by the task that is applied to the target.

Chapter 2

In Chapter 2, two accounts for the polarity of the semantic context effect in basic-level and category-level picture naming were discussed. The first was the "semantic selection" account of Costa et al. (2003), which assumes that concepts can be distinguished from each other by means of a semantic dimension (e.g., their level of categorization). This category-level information is subsequently used to prioritize a concept for further processing. For example, a basic-level context word does not induce lexical interference in a categorization task, because its conceptual representation is not selected for further processing. However, this related concept can spread activation to the target, thus semantic facilitation will be observed in the picture categorization task.

The second proposal was the "response congruency account", which was renamed "message congruency account" in Chapter 3. In this account it is assumed that semantic facilitation is observed in the categorization task because, given the task, the target and a categorically related context converge on the concept that needs to be verbalized. For example, the application of a categorization task to a picture of a car and to the context word “train” leads in both cases to the activation of the concept VEHICLE.

In Experiments 1a and 1b of Chapter 2, these proposals were tested in a paradigm in which they make different predictions. The task was either basic-level picture naming (e.g., a picture of a car; Experiment 1a) or word translation (from the English word “car” to the Dutch word “auto”; Experiment 1b) with related or unrelated context words at the basic-level (e.g., “train” or “apple”) or at the category level (e.g., “vehicle” or “fruit”). The prediction of the semantic selection account in these experiments is that category-level distractors do not induce semantic interference, while the semantic selection account predicts that they do induce semantic interference. The results showed similar semantic interference effects for basic-level distractors and category level distractors, which goes against the prediction of the semantic selection account and supports the message congruency account.

Next we argued that the semantic (message congruency) facilitation effect in categorization tasks may be due to the spreading of activation from the context concept to the target concept. In Experiment 2, it was tested whether this extra activation of the target concept contributes to the semantic facilitation effect. Participants were asked to categorize English target words (e.g., “car”) while ignoring Dutch context words which were either the translation of the target (e.g., “auto”), categorically related, (e.g., “trein”, train) or unrelated (e.g., “appel”, apple) to the target. If the extra target concept activation were the major component of the message congruency effect, the identical context word should induce more facilitation than the categorically related context word, because the former will activate the target concept stronger than the latter. The results showed that the identical and the categorically related context induced the same amount of semantic facilitation. This was taken as evidence that the extra activation of the target concept due to spreading of activation does not contribute much to the facilitation effect of message congruency. Instead, it was argued that the major contribution to the semantic facilitation effect is the extra activation of the goal concept due to the processing of the context.

In Experiment 3, the message congruency account was tested in a variant of the categorization task. Subordinate-level Dutch words (e.g., “roos”, rose) were named at the basic level of categorization (e.g., “bloem”, flower). The context words were either (Dutch) words that belong to the same basic-level category (e.g., “tulp”, tulip) or to a different basic-level category (e.g., “forel”, trout). The message congruency account correctly predicted the semantic facilitation by context words that belong to the same basic-level category compared to context words that belong to a different basic-level category.

It was concluded that the context stimulus of a picture-word combination may affect processing of a target in three ways: it may facilitate conceptual identification by spreading activation at the conceptual level, it may facilitate the conceptualizing process when it is message congruent, and it may interfere in the process of lexical selection when it is a categorically related word.

Chapter 3

In Chapter 3, a word production model is presented in which the possible role of the three above mentioned context effects is included. It was argued that all conceptually active representations enter the conceptualizing process, including a representation of the task (or intention) of the speaker. In this model, a facilitating effect due to spreading of activation may be observed when context and target are semantically related. An additional facilitation effect of message congruency in the conceptualizing process can be observed when the processing of the context leads to the activation of the goal concept. The goal concept that is the output of this process is assumed to activate a cohort of semantically related words (Bloem & La Heij, 2003); the word that captures the intended message best receives most activation.

Four experiments were reported that were aimed at testing the message congruency account. The paradigm that was used in Experiment 1 was developed to determine the presence and size of the message congruency effect. English target words were either translated to Dutch (e.g., target "car", response "auto") or categorized to Dutch (e.g., target "car", response "voertuig"). The context pictures were either categorically related (e.g., a train) or unrelated (e.g., an apple) to the target. In the translation task, the context picture of a car is semantically related but message incongruent. In the categorization task, this context picture is semantically related and message congruent. So, the observed difference in the semantic context effect between the two tasks (about 40 ms in favor of the categorization task) was argued to arise due to message congruency of the context. In Experiment 2, the categorization task was replaced with a function naming task (e.g., target "car", response "rijden", to drive) which yielded a similar result as in Experiment 1.

To reduce the contribution of spreading activation to the overall facilitation effect, in Experiment 3, Dutch target words were used instead of English target words. The Dutch words were named by their category or their function. The results showed again a large facilitating effect due to message congruency.

In Experiment 4, instead of using a subtraction method involving different tasks, the message congruency effect was estimated within a single task. Dutch target words were named with their function (e.g., target "auto", named as "rijden", to drive), and the message congruency effect was measured by comparing the influence of categorically related message congruent context pictures (e.g., a bicycle, associated with “rijden”) with categorically related message *incongruent* context pictures (e.g., a boat). The result showed a large facilitation by the message congruent pictures compared to the message incongruent pictures. A categorization task on the same materials controlled for a possible semantic distance effect. The results showed identical message congruency facilitation effects in the two conditions, which shows that that the difference in semantic distance between the two relevant conditions (car-bicycle versus car-boat) was negligible. It was concluded that the message congruency account is a viable explanation for the semantic facilitation effect observed in categorization tasks.

Chapter 4

In Chapter four, two proposals were discussed for how the message congruency effect might come about. In the first account, derived from Glaser and Düngelhoff’s (1984) conclusions, the effect is attributed to the competition between ready-to-verbalize concepts when the context is message incongruent (the competition account).

In the second account of message congruency, it is assumed that the major cause of the message congruency effect is the speeding-up of the conceptualizing process by the co-activation of the goal concept (in a categorization task this is the category concept of the target). Two possible mechanisms were discussed that could underlie this extra activation of the goal concept. One was the (semantically based) spreading of activation from both the target concept and the context concept to the goal concept. The second possible mechanism is the processing of the context along with the target according to the task instruction, which in case of a message congruent context, leads to the co-activation of the same concept as the target (the co-activation account). The spreading of activation account is, in principle, able to explain the effect of message congruency as measured in the experiments in Chapter three, because the target, context and goal concept were semantically related in all cases. However, it was argued that this explanation falls short in situations in which the target, context and goal concept are not semantically related, as for example in the experiments reported by Seymour (1977), which were discussed in Chapter 3. Therefore, this spreading of activation account of message congruency was not further discussed.

The prediction of the competition account, that a context that can easily lead to a (verbal) response in the task applied to the target should interfere more than a context that cannot, was tested in Experiment 1. Context pictures that belong to or do not belong to well defined semantic categories were presented in a word categorization task. For example, the target word “appel” (apple) that was to be named with its category name “fruit” was paired with a picture of a car (category “vehicle”) and a picture of a totem pole (no obvious category). The results showed no difference between the two sets of context pictures, which goes against the above prediction of the competition account.

The chance to observe interference by a message incongruent context was increased in Experiment 2a by including a semantically related, but message incongruent context (e.g., the word apple was also accompanied by a picture of lettuce, belonging to the related category “vegetables”), and in Experiment 2b by using the names of the context picture as targets. The results showed no semantic interference effect. However, a message congruent context picture again induced a reliably facilitation effect compared to both the related message incongruent pictures and the unrelated message incongruent pictures.

In Experiment 3, a function-naming task was used with categorically related, but message incongruent context pictures and unrelated context pictures. For example, the target word “auto” (car) was to be named with “rijden” (to drive) and the context pictures of a boat (related message incongruent condition) and a knife (unrelated message incongruent condition) were presented at three stimulus onset asynchronies (SOAs). The different SOAs were used to examine whether two possible semantic effects, facilitation by spreading of activation and interference due to message incongruency, could be teased apart. The results showed that with a pre-exposure of the context (negative SOA), the related message incongruent context induced facilitation compared with the unrelated context. At SOA 0 ms, the results of Experiment 2a and 2b were replicated, i.e., no competition between ready-to-verbalize concepts was found. With a post-exposure of the context (positive SOA), again no evidence for competition between ready-to-verbalize concepts was found.

On the basis of these findings, the co-activation account of the message congruency effect was argued to fit the data best. In this proposal, conceptualizing is a process in which target and context are both processed according to the task instruction, which leads to the activation of different conceptual representations when the context is message incongruent, or to a strong activation of the sought-for conceptual representation(s) when the context is message congruent. The latter causes a significant reduction of the time taken by the conceptualizing process.

Conclusions

The main conclusion that can be drawn from the research I have presented in this dissertation is that the conceptual process in producing an utterance can be the source of two context effects. One is the well established semantic facilitation effect due to spreading activation, the new effect is the facilitation due to message congruency of the context. With the establishment of the message congruency effect, one further step is taken in understanding what processes underlie the verbal production of a word. The model that was proposed in Chapter 3 states that, upon presenting a picture-word compound for naming, a semantically related context, be it the picture or the word, can compared to an unrelated context (1) induce facilitation in identifying the target due to spreading of activation, (2) induce facilitation in the conceptualizing process when it is message congruent, and (3) induce lexical interference when it is a word. Although not discussed in the context of this model, a context word can also induce phonological facilitation when it is phonologically related to the target (e.g., Briggs & Underwood 1982; Starreveld & La Heij, 1996). Thus, in our model it is assumed that, besides the target concept, the context concept also enters the conceptualizing process, in which both are processed according to the task instruction. Whether facilitation by message congruency is obtained depends on the task and the context: Only if processing of the context leads to the activation of the same goal concept as the target will the facilitation effect be obtained. As observed in Chapter 3, this effect is of such a magnitude that it seems likely that it can outweigh the lexical interference that this context induces at the lexical level. It should be noted, however, that by using context pictures in our experiments, the conditions were optimal for observing a sizable congruency effect. The message-congruency effect induced by context words is most likely somewhat smaller, but probably large enough to still outweigh a lexical interference effect.

With this conclusion I have arrived at an answer to the question posed in the in the introduction of this dissertation: Why is it that, compared to an unrelated context word, a categorically related context word induces interference in a basic-level picture naming task, while the same word induces facilitation when the picture is named at the category level? The answer is that the categorically related context word induces lexical interference in both tasks, but that in the categorization task this effect is outweighed by the facilitation effect of message congruency. This message congruency effect is probably due to the processing of the context according to the task instruction, which leads to the co-activation of the category level concept of the target.

Future research

In the research tradition that I have built upon, new mechanisms are usually implemented in a connectionist network (e.g., the CSM) to yield a proof of existence for the proposed solutions. An implementation of the mechanisms proposed in Chapter 3 is, however, beyond the scope of the research I presented here. If one were to undertake such a project, the main problem encountered would be that even very simple tasks, such as naming the category of an object, require higher order information. For example, one needs to specify that one concept is the category concept of a given other one. Such information can be represented by using labeled links between concepts (Collins & Loftus, 1975). For example, the concept CAR can be assumed to have an "is a" link with the concept VEHICLE. In fact, WEAVER++ (Roelofs, 2003) as described in Chapter 1 makes use of such links.

The main problem with the labeled links approach, however, is that it takes countless labeled links between concepts to model the different ways a speaker can address an object. For example, the same picture of a car can be addressed to by "car", "vehicle", "Porsche", "driving", "red", "voiture", "fast", "beautiful", "man made", or when asked to evaluate its size relative to a shoebox, by "larger". Even if one assumes that all the concepts that these words represent are connected with labeled links, the question is how these labels are read to select the appropriate concept. It is clear that to gain understanding of the conceptualizing process, the approach of using labeled links has its limitations. Besides these limitations, it is unclear how message congruency can be accounted for with a labeled links approach. The reason is that the process of finding the link between the target concept and the goal concept can probably not be aided by the link a context concept has with the goal concept. Thus, it is probably a major challenge for future models to include a conceptualizing process in which different tasks can be represented and where message congruency can play a role in a word production model.

Another direction that future research on this issue could take is to search for neurological evidence of the message congruency effect. It can be assumed that, at a general level, a message congruent context reduces the top-down control that is needed to give the correct response. A picture-word stimulus is somewhat ambiguous as to which part of it has to be responded to, so top-down control will be required to verbalize the required response. Any help in retrieving the correct response (e.g., message congruency) can be assumed to reduce the required top-down control. As has been shown with functional Magnetic Resonance Imaging (fMRI), the activity of the Anterior Cingulate Cortex (ACC) is a measure of top-down control (Botvinick, Nystrom, Fissell, Carter, & Cohen, 1999). These authors showed that the ACC is more active when a person has to react to a stimulus that provides conflicting information as to which response should be given than when a stimulus was presented that does not provide such conflicting information. Thus, it may be worthwhile to investigate whether the activity of the ACC is less when the context is message congruent than when it is message incongruent.

To sum up, in this dissertation I have proposed an explanation for the direction of the semantic context effect in categorization and function naming tasks that does not rely on measures taken at the lexical level, such as the exclusion of groups of words for the lexical selection process. Instead, the explanation takes the conceptual preparation phase in producing a word to be the only locus of an effect of differences between naming tasks. Within the proposed model, the conceptual stage in producing a word may be affected by spreading activation between related concepts and by message congruency of context stimuli. Although it may prove hard to implement these aspects in a computational model of word production, ignoring the conceptualizing process does not seem justified given the important role it plays in producing speech.

It may come as a surprise that the basic finding that the research in this dissertation is built upon was published more than twenty years ago. In our opinion, the results of this highly seminal work reported by Glaser and Düngelhoff in 1984 have never been explained in a satisfactory way. Our message congruency account can be viewed as a first step towards a better understanding of the processes underlying lexical access. More specific, it gives some insight in the processes that underlie the activation and selection of the message speakers want to convey. The proposals I have presented in this dissertation hopefully initiate other research that goes beyond basic-level word production to do justice to a speakers' flexibility of naming responses, even in a simple task such as object naming.

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Nederlandse samenvatting

In het onderzoek dat in dit proefschrift wordt gerapporteerd is de centrale vraag welke processen ten grondslag liggen aan het op verschillende manieren benoemen van één en hetzelfde object, zoals met de basic-level naam (bijvoorbeeld *koe*) of met de categorienaam (*dier*). Voor het onderzoek in de gerapporteerde experimenten wordt voornamelijk gebruik gemaakt van varianten van de plaatje-woord-interferentietaak. In de standaardversie van deze taak wordt een plaatje ter benoeming aangeboden (bijvoorbeeld een plaatje van een koe, te benoemen als *koe*), waarbij een te negeren contextwoord in het plaatje wordt afgedrukt (bijvoorbeeld het woord *geit*).

In hun toonaangevende artikel uit 1984 hebben Glaser en Düngelhoff laten zien dat bij het benoemen van een plaatje op op "basic-level" niveau (bijvoorbeeld een plaatje van een koe benoemen met het doelwoord *koe*), een gerelateerd contextwoord het benoemen van zo'n plaatje VERTRAAGT, vergeleken met een ongerelateerd contextwoord (bijvoorbeeld het woord "appel"; dit wordt "semantische interferentie" genoemd). Als echter het plaatje op categorieniveau moet worden benoemd (bijvoorbeeld het plaatje van een koe als "dier"), dan FACILITEERT een gerelateerd contextwoord, vergeleken met een ongerelateerd contextwoord ("semantische facilitatie"). De meest geaccepteerde verklaring voor deze standaardconditie gaat ervan uit dat het contextwoord zijn lexicale representatie activeert. Deze lexicale representatie gaat vervolgens in competitie met het doelwoord (de basic-level naam van het plaatje) in het selectieproces voor verbale productie. De volgende twee extra aannames verklaren waarom een gerelateerd contextwoord de selectie van het doelwoord meer hindert dan een ongerelateerd contextwoord. De eerste extra aanname is spreidende activatie op het conceptuele niveau. Volgens deze aanname zullen concepten die gerelateerd zijn (bijvoorbeeld de concepten KOE en GEIT) een deel van hun activiteit aan elkaar doorgeven. Dus, als het concept KOE wordt geactiveerd door de presentatie van een plaatje van een koe, zal het concept GEIT ook activiteit ontvangen. De tweede extra aanname is parallele verwerking ("cascading"): alle geactiveerde concepten activeren hun lexicale representaties (zie voor een alternatief Bloem en La Heij, 2003). De lexicale representatie van een gerelateerd contextwoord zal dus activiteit ontvangen vanuit het contextwoord én vanuit het conceptuele systeem. Omdat verder wordt aangenomen dat de selectie voor verbale productie gebaseerd is op de activatiewaarden van lexicale representaties, zal een gerelateerd contextwoord door de dubbele activatie meer interferentie veroorzaken op het benoemen van een doelplaatje dan een ongerelateerd contextwoord.

De hierboven geschetste verklaring is echter niet toereikend voor het verklaren van de geobserveerde contexteffecten bij het benoemen van een plaatje op categorieniveau. Volgens deze verklaring zou immers ook in de categoriseertaak semantische interferentie moeten optreden. In het invloedrijke model WEAVER++ (Roelofs, 1992, 2003) wordt een extra aanname gedaan om de semantische facilitatie te verklaren: de "responsset" aanname. Deze stelt dat alleen de lexicale representatie die deel uit maken van de responsset (de toegestane responswoorden in een experiment) met elkaar in competitie kunnen gaan, ongeacht de activiteit van lexicale representaties die buiten deze set vallen. De implicatie van deze aanname is dat in een categorie-benoemingstaak met vijf antwoordcategorieën (bijvoorbeeld *kleding*, *fruit*, *dier*, *voertuig* en *meubel*), alleen deze vijf lexicale representaties interferentie kunnen veroorzaken. Een basic-level distractiewoord als *tafel* zal daardoor geen competitie veroorzaken bij het benoemen van een stoel als *meubel*. Deze responsset-hypothese achten we echter verworpen, onder andere doordat Caramazza en Costa, (2001, 2002) hebben laten zien dat woorden die niet in de responsset zitten, toch interferentie kunnen veroorzaken (zie echter Roelofs, 2001).

Een andere verklaring voor de bevindingen van Glaser en Düngelhoff (1984) is dat alleen woorden op hetzelfde niveau van categorisatie als het doelwoord semantische interferentie kunnen veroorzaken (Costa, Mahon, Savova en Caramazza, 2003). Bijvoorbeeld, als een plaatje op categorieniveau moet worden benoemd, zullen gerelateerde woorden op het basic-level niveau niet met het doelwoord in competitie kunnen gaan, omdat deze niet in beschouwing worden genomen voor een verbale respons. Deze verklaring wordt weerlegd in Experiment 1 van Hoofdstuk 2 waarin we laten zien dat gerelateerde contextwoorden op een ander niveau van categorisatie dan het doelwoord ook semantische interferentie kunnen veroorzaken.

In Hoofdstuk 2 wordt een nieuwe verklaring gepresenteerd voor de omslag in polariteit van het semantische contexteffect in plaatje-benoemingstaken, zoals in de experimenten van Glaser en Düngelhoff (1984). In deze verklaring wordt aangenomen dat gerelateerde contextwoorden op het lexicale niveau altijd in competitie gaan met het doelwoord (er is dus geen responsset-aanname), maar dat deze interferentie gecompenseerd kan worden door een contexteffect op een eerder, conceptueel niveau. Dit effect wordt geacht op te treden als de toepassing van de taak (bijvoorbeeld “categoriseren”) op de conceptuele representatie van de context leidt tot de activatie van hetzelfde te verwoorden (doel)concept als de toepassing van de taak op de conceptuele representatie van het doelplaatje. Bijvoorbeeld, wanneer de taak “categoriseren” wordt toegepast op het doelplaatje van een koe en op het contextwoord *geit*, dan leiden beide acties de activatie van het doelconcept DIER. Het idee is dat deze situatie van “message-congruency” tot een zodanige versnelling van het activeren van het doelconcept kan leiden dat de semantische interferentie op het lexicale niveau gecompenseerd wordt.

In Experiment 2 van Hoofdstuk 2 laten we zien dat het “message-congruency” effect een groot aandeel heeft in het semantische effect in categoriseertaken. In Experiment 3 van Hoofdstuk 2 laten we zien dat de situatie van “message-congruency” ook faciliteert als het doelplaatje op basic-level benoemd moet worden en de context van het "subordinate" categorieniveau is (bijvoorbeeld een roos benoemen als *bloem*, met het gerelateerde contextwoord *tulp*).

Het doel in Hoofdstuk 3 is te testen of het message-congruency effect groot genoeg kan zijn om semantische interferentie op het lexicale niveau te compenseren. De gevolgde methode bestaat uit het uitvoeren van twee woord-benoemingstaken met plaatjes als context. De plaatjes zijn semantisch gerelateerd of ongerelateerd aan de doelwoorden, waarbij in één van de taken het semantisch gerelateerde contextplaatje ook message-congruent is. In Experiment 1 wordt gevraagd om Engelse woorden (a) te vertalen naar het Nederlands (bijvoorbeeld *auto*) en (b) met hun Nederlandse categorienaam te benoemen (bijvoorbeeld *voertuig*). In Experiment 2 zijn de twee taken: Engelse woorden vertalen naar het Nederlands, en van dezelfde woorden de Nederlandse functie benoemen (bijvoorbeeld het woord *car* benoemen als *auto* of als *rijden*). In Experiment 3 zijn de taken: Nederlandse doelwoorden benoemen met hun categorienaam of hun functie (bijvoorbeeld het woord *auto* benoemen als *auto* of als *rijden*).

In beide taken van elk van deze experimenten kan een semantisch facilitatie-effect verwacht worden, omdat een semantisch gerelateerd plaatje de conceptuele identificatie van het doelwoord door middel van spreidende activatie versnelt. In slechts één van de taken kan ook facilitatie door message-congruency optreden, omdat het semantisch gerelateerde plaatje daarin message-congruent is. (Bijvoorbeeld, bij het benoemen van de functie van *auto* leidt de toepassing van de taak op een contextplaatje van een motorfiets tot extra activatie van het doelconcept RIJDEN.) Wij beargumenteren dat het verschil in grootte tussen de semantische contexteffecten in beide taken een schatting oplevert van het message-congruency effect. De resultaten van de Experimenten 1, 2 en 3 van Hoofdstuk 3 wijzen op het bestaan — onder deze condities — van een substantieel “message-congruency” effect.

In het Experiment 4 van Hoofdstuk 3 wordt de grootte van het message-congruency effect geschat onder gebruikmaking van slechts één taak. Dit is een functie-benoemingstaak met woorden als doelstimulus en plaatjes als context, waarbij per doelstimulus twee semantisch gerelateerde plaatjes aangeboden worden, waarvan slechts één plaatje ook message-congruent is (bijvoorbeeld het woord *auto* benoemen als *rijden* met de plaatjes van een motorfiets — gerelateerd en message-congruent — en van een boot – gerelateerd maar niet message-congruent). Daarnaast worden ook ongerelateerde plaatjes aangeboden (bijvoorbeeld een plaatje van een appel). De op deze wijze verkregen schatting van de grootte van het message-congruency effect lijkt sterk op die verkregen in de voorafgaande experimenten. Wij concluderen dat het message-congruency effect inderdaad een substantieel effect is, dat daardoor waarschijnlijk in staat is om een lexicaal interferentie-effect onzichtbaar te maken.

In Hoofdstuk 4 wordt onderzocht hoe het message-congruency effect tot stand komt. De eerste hypothese (de “competitieverklaring”) is dat in een categoriseertaak een ongerelateerde context een alternatief categorieconcept activeert, dat vervolgens in competitie voor selectie gaat met het categorieconcept van het doelwoord/plaatje. Het resultaat is dat de categoriseertijden van het doelwoord/plaatje in de message-incongruent conditie langer zullen zijn dan in de message-congruent conditie, waarin geen concurrerend alternatief categorieconcept wordt geactiveerd.

De alternatieve hypothese houdt in dat, door de toepassing van de taak op de conceptuele contextrepresentatie, een message-congruent context het doelconcept co-activeerd (de “co-activatie verklaring”). In deze verklaring wordt aangenomen dat er geen competitie tussen categorieconcepten plaatsvindt en dat de extra activatie van het doelconcept voldoende verklaring is voor een snellere selectie van het doelconcept .

In Experiment 1 werd de competitieverklaring getoetst door in een woord-categoriseertaak twee categorieën van ongerelateerde contextplaatjes aan te bieden. In één conditie zijn de contextplaatjes eenvoudig te categoriseren (bijvoorbeeld een plaatje van een koe), terwijl in de andere conditie de contextplaatjes zeer moeilijk te categoriseren zijn (bijvoorbeeld een plaatje van een vlag). Als het message-congruentie effect inderdaad door de activatie van een alternatief categorieconcept zou worden veroorzaakt, dan zouden de makkelijk te categoriseren plaatjes meer interferentie moeten veroorzaken dan de moeilijk te categoriseren plaatjes. De resultaten tonen geen verschil tussen de twee condities, waarmee er geen ondersteuning voor de competitieverklaring is gevonden.

In Experiment 2 van Hoofdstuk 4 worden weer doelwoorden gecategoriseerd, waarbij contextplaatjes worden aangeboden uit (a) dezelfde semantische categorie als het doelwoord, (b) een gerelateerde categorie (bijvoorbeeld het plaatje van een vrucht bij een doelwoord uit de categorie groente) en (c) een ongerelateerde categorie. Als de competieverklaring juist is lijkt het aannemelijk dat contextplaatjes van objecten uit een sterk gerelateerde categorie meer zullen interfereren dan plaatjes van objecten uit een ongerelateerde categorie. De resultaten wijzen echter uit dat er tussen deze twee gerelateerde condities er geen verschil is, terwijl plaatjes in de “message-congruent” conditie weer facilitatie veroorzaken in vergelijking met de plaatjes in de andere condities. De conclusie luidt dat er ook nu geen ondersteuning voor de competitiehypothese is gevonden .

In Experiment 3 wordt de “stimulus onset asynchrony” (SOA) in een woord-functie-benoemingstaak gevarieerd, waarbij wederom message-congruente, semantisch gerelateerde, en ongerelateerde contextplaatjes aangeboden worden. De twee SOA’s worden toegepast om te testen of er wel semantische interferentie te observeren is wanneer het contextplaatje voorafgaat aan het doelwoord. In die situatie zou de context zijn categorieconcept mogelijk sterker activeren, waardoor dit categorieconcept sterker in competitie voor selectie kan gaan. De conditie van een positief SOA (contextplaatje na het doelwoord) dient om te testen of een message-congruente context ook een faciliterende invloed kan hebben als deze na het doelwoord wordt gepresenteerd. De resultaten wijzen uit dat de gerelateerde message-incongruente contextplaatjes bij geen van de gebruikte SOA’s interfereren ten opzichte van ongerelateerde contextplaatjes, en dat de message-congruente plaatjes altijd faciliteren ten opzichte van ongerelateerde contextplaatjes. Er wordt geconcludeerd dat de co-activatieverklaring in overeenstemming is met de resultaten van alle drie de experimenten. In Hoofdstuk 5 wordt geconcludeerd dat de resultaten verkregen in de voorafgaande hoofdstukken evidentie opleveren voor een faciliterend effect op het conceptuele niveau, dat ontstaat wanneer de toepassing van de taak op doelwoord/doelplaatje en context leidt tot co-activatie van het doelconcept.

Het doel van deze studie was een verklaring te vinden voor de omslag van semantische interferentie naar semantische facilitatie wanneer in een plaatje-woordtaak de instructie wordt veranderd van “basic-level” benoeming (*koe*) naar categoriebenoeming (“dier”). In eerdere verklaringen werd aangenomen dat een semantisch gerelateerd contextwoord (*geit*) facilitatie veroorzaakt op het conceptuele niveau, maar geen interferentie op het lexical niveau (de “responsset” aanname). Op basis van de resultaten besproken in dit proefschrift geven wij als alternatieve verklaring dat het contextwoord (*geit*) in beide taken op een lexical niveau interferentie kan veroorzaken, maar dat er in de categoriseertaak een extra, faciliterend context effect op het conceptuele niveau werkzaam is. Het is dit extra “message-congruency” effect dat verantwoordelijk is voor de omslag van semantische interferentie naar semantische facilitatie met verandering van taak. Wij zien als belangrijk voordeel van deze verklaring dat er geen ingrepen op het lexicale niveau nodig zijn: lexicale competitie is en blijft louter gebaseerd op activatieniveaus.

Curriculum vitae

Jan Rouke Kuipers werd op 17 maart 1973 geboren te Voorst. Hij begon het voortgezet onderwijs aan het Geert Grote College te Deventer en behaalde in 1991 zijn HAVO diploma aan de Alexander Hegius Scholengemeenschap te Deventer. Het VWO diploma haalde hij in 1993 aan de Scholengemeenschap Midden-IJssel Deventer. In 1993 ging hij Mijnbouwkunde en Petroleumwinning studeren aan de Technische Universiteit Delft. Deze studie werd in 1997 gestaakt en verruild voor de deeltijdopleiding Psychologie in Leiden. In 2003 behaalde hij zijn doctoraal examen in de Cognitieve Psychologie. Bij deze vakgroep werd hij promovendus waarvan het onderzoek in dit proefschrift wordt gerapporteerd. Thans is hij als Research Officer verbonden aan Bangor University, Wales, bij het Centrum voor onderzoek naar tweetaligheid, het ESRC Centre for Research on Bilingualism in Theory and Practice.