The "meddling-in" of affective information: Evidence for negative priming and implicit judgment tendencies in the affective priming paradigm

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Abstract

The affective priming effect, i.e., shorter response latencies for affectively congruent prime-target pairs in variants of the standard sequential priming paradigm, was often interpreted in terms of a spread of activation from the prime to affectively congruent targets. The present study emphasizes the view that the automatic processing of the prime obtrusively meddles with the formation of a response to the target, thereby producing different effects in different tasks. For the evaluation task (i.e., the target is evaluated as positive or negative), affective incongruency between prime and target impedes the formation of a response to the target. Therefore, a negative priming effect is hypothesized, i.e., response conflicts in trial n-1 will result in an inhibition in the n-th trial if the target is affectively congruent to the prime of trial n-1.

This hypothesis was confirmed in Experiment 1 (N = 35). In the lexical decision task (i.e., the target is classified as a word or a pseudo-word), the prime-target configuration (at least for noun-adjective pairs) will be implicitly evaluated as a question of the form “Is (prime) (target)?” (e.g., “Is death wise?”). According to the judgmental tendency model of Klauer (1991), there will be a tendency to affirm in cases of affective congruency, to negate in cases of incongruency. Therefore, after establishing the affective priming effect with the lexical decision task in Experiment 2 (N = 45), in Experiment 3a, b (N = 91, N = 45) the assignment of yes-responses to words and pseudo-words was varied. For the word=yes condition the affective priming effect emerged, whereas the data pattern was reversed for the word=no condition. This pattern of findings fits the judgmental tendency model but not the spreading activation account.
Recently, there has been a growing interest in the processing of affective-evaluative information within the cognitive system. Fazio, Sanbonmatsu, Powell, and Kardes (1986) were instrumental in stimulating research on what can be called affective priming (e.g., Bargh, Chaiken, Govender & Pratto, 1992; Bargh, Chaiken, Raymond; & Hymes, 1996; Greenwald, Klinger, & Liu, 1989; Hermans, 1996, Hermans, De Houwer & Eelen, 1994; Kemp-Wheeler & Hill, 1992; Klauer, Roßnagel & Musch, 1997; for related approaches see also Hill & Kemp-Wheeler, 1989; Klauer, 1991; Klauer & Stern, 1992; for an overview cf. Klauer, in press). Based upon the tradition of social psychological research on attitudes, Fazio et al. (1986) sought to confirm the attitude accessibility hypothesis (Fazio, 1986), according to which the mere presentation of highly valenced objects or words automatically increases the accessibility of the corresponding affective evaluation. To show that, they construed an experimental paradigm based on the research tradition of semantic priming (e.g., Neely, 1977). They presented their participants valenced adjectives (e.g., repulsive; appealing) on a CRT screen and asked them to classify these target words as positive or negative as quickly as possible (evaluation task). Shortly before each target (300 ms), they presented a valenced prime word (e.g., death; gift). In accordance with their hypothesis, the authors showed that the decision latency for the target words was shorter when the prime and target were congruent in terms of valence.

Theoretically, there are two foci of attention in affective priming research. The first refers to the question of automatic extraction of the affective connotation upon mere presentation of words. Though there is a considerable
debate about this topic (cf. Bargh et al. 1992; Chaiken & Bargh, 1993; Fazio, 1993; Fazio et al., 1986; Hermans, 1996; Klauer, in press), this will not be the point of main interest in the following text. The second focus of affective priming research concerns the mediating mechanisms by which target evaluation is influenced by prime presentation. This point was somewhat neglected in earlier studies but has recently gained in importance (Bargh et al., 1996; Hermans, De Houwer, & Eelen, 1994; Klauer et al., 1997; Wentura, 1994, in press) and lies at the very heart of this text.

Methodologically, the domain of affective priming research can be structured along three dimensions. The first one relates to the task which is used for assessing the affective congruency effect. Besides the evaluation task, which is only employed in this research area, two other tasks, well-known from semantic priming research, have been used. Participants have been required either to make a word/nonword decision regarding the target (the lexical decision task) or to say the target aloud (the pronunciation task). The second dimension refers to the materials used as primes and targets. Coming from the tradition of social psychological research on attitudes, most studies on affective priming employed nouns (referring to attitude objects) as primes and adjectives as targets. Some studies used adjective-adjective pairs (Klauer et al., 1997), noun-noun pairs (Bargh et al., 1996, Experiment 3), mixtures of nouns and adjectives (Greenwald et al., 1989), a picture-picture variant (Hermans et al., 1994) or odors as primes (Hermans, 1996), emphasizing the supposed generalizability of the mechanisms underlying affective priming effects. A third dimension is the stimulus onset asynchrony (SOA) of prime and target. In order to limit the complexity of this
exposition, further discussion here is restricted to short SOA-conditions (300 ms or less). It is known from research on semantic priming that effects emerging under longer SOA-conditions may be affected by slow-acting intentional processes, i.e., that given the prime word, the subject anticipates the target word (cf. Neely, 1977; for an overview Neely, 1991). These processes are only of minor interest.

To give a rough synopsis (see Klauer, in press, for a more extensive review), affective priming effects emerged in most studies using the evaluation task. This applies especially to studies using noun-adjective pairings (Fazio et al., 1986; Bargh et al., 1992; Chaiken & Bargh, 1993; Wentura, 1994) as well as to the picture-picture experiment of Hermans et al. (1994). Using only adjectives or a mixture of nouns and adjectives seem to result in effects only for very short SOAs (up to 100 ms) (Greenwald et al., 1995; Klauer et al., 1997; but see Greenwald et al., 1989). For the two other tasks, lexical decision and pronunciation, mixed results were obtained. Hill and Kemp-Wheeler (1989; Kemp-Wheeler & Hill, 1992) provided some evidence for affective priming in the lexical decision task with noun-noun pairs. Unfortunately, these authors compared only negative to neutral primes with respect to their effect on negative targets. Using adjective-adjective pairs, Klauer et al. (1995) obtained no effects. Recently, the pronunciation task was used by Bargh et al. (1996), Hermans et al. (1994), Hermans (1996) and Klauer et al. (1995). Bargh et al. (1996; Experiments 1 and 2) and Hermans et al. (1994) obtained affective priming effects using noun-adjective pairs. In two attempts to replicate the Hermans et al. (1994) result, Hermans (1996) showed the effect to be somewhat restricted. In one experiment there
was no affective priming, in the other the congruency effect emerged only at a very short SOA (150 ms). Using adjective-adjective pairs, Klauer et al. (1995; Klauer, in press) failed to obtain affective priming effects with the pronunciation paradigm whereas Bargh et al. (1996; Experiment 3) found an effect with noun-noun-pairs.

There are to date two global theoretical models to account for affective priming effects, the spreading activation model (SPAM), and the “meddling-in” model (MIM). One of the models, SPAM focuses on within memory processes of access facilitation, whereas MIM locate the mediating processes more at a level of response facilitation or inhibition. SPAM integrates affective priming effects into the class of semantic priming effects, i.e., the effects are nothing but a result of positive, as well as negative stimuli making up an extensive semantic category. Conversely, MIM states that due to their affective connotation, stimuli have the tendency to meddle with the ongoing processes of behavior formation. At first glance, SPAM can easily accommodate results from all tasks and all materials, whereas MIM has to be enriched with additional assumptions bound to the evaluation task and the lexical decision task. In terms of parsimony, this seems to favor SPAM, but for both tasks I will present data which support MIM.

The spreading activation model (SPAM)

Drawing upon the similarity of affective priming to semantic priming, the concept of spreading activation in a semantic network has been used as a principle of explanation for affective priming effects. According to this theory (e.g., Anderson & Pirolli, 1984; Collins & Loftus, 1975), priming effects are explained through the mechanism of spreading activation
operating on a network of nodes (symbolizing concepts) and links (symbolizing associations or semantic relations). Thus, presentation of the word butter, for example, activates the corresponding node; activation spreads to related nodes (e.g., bread) and this activation makes the information more accessible for further processing (e.g., reading bread). Similarly, Fazio et al. (1986) argue that ...

...presentation of an attitude object would automatically activate any strong association to that object. Such activation is assumed to spread along the paths of the memory network, including any evaluative associations. Consequently, the activation levels of associated evaluations are temporarily increased. If a target word that corresponds in valence to one of these previously activated evaluations is subsequently presented for judgment, then less additional activation is required for the activation level of the target word to reach threshold and, consequently, for a judgment to be made. (p. 231; emphasis added)

Garnering empirical support for this assumption would be of enormous help in understanding the mental representation of affective information. For example, an often cited representational approach in the field of cognition and emotion is the associative network theory of emotions by Bower (1981). Essentially, Bower (1981) added emotion nodes to the semantic network. The triggering of cognitive, physiological, and experiential aspects of emotion are all accounted for by the mechanism of spreading activation (for revised formulations, see Bower & Cohen, 1982; Bower, 1987, 1991). Thus, Hill and Kemp-Wheeler (1989; Kemp-Wheeler and Hill, 1992), arguing in the same spirit as Fazio et al. (1986), classify affective priming effects as

According to this theory, nodes representing positive or negative concepts are connected to global positivity and negativity nodes, respectively. Thus, presentation of a positive or negative word activates the corresponding node; activation spreads via the global positivity or negativity node to all nodes with the same evaluation. Therefore, those concepts are more accessible, so that a corresponding word will be processed faster.

According to this model, processing of the target is necessary only for assessing its heightened accessibility. The underlying process -- spread of activation -- is assumed to have taken place whether there is a target or not. In principle, therefore, SPAM can account for affective priming effects in all three tasks, because to assess the altered memory state, it is merely necessary to apply a task which demands semantic processing of the target. In this respect, SPAM makes no difference between processing affective and non-affective stimuli. “Affective” means nothing more than belonging to the semantic category of positive or negative information.

The “meddling-in” model (MIM)

Instead, the proposal can be made that affective priming effects are a result of a specific feature only characterizing affective stimuli. Since it lies at the heart of affective and emotional processing to fulfill the function of signaling chances and risks for an organism (e.g., Frijda, 1988; Lang, 1995;
Simon, 1967), affective stimuli have the power to "meddle" with ongoing processes. One may assume that the valence of stimuli indicates the general relevance of stimuli for the individual. Information processing is not geared simply towards the acquisition of knowledge, but enables the organism to act in an environment full of opportunities and risks. Thus, the "meddling-in" of affective stimuli should cause interference with ongoing processes if these are unrelated to the stimulus; "meddling-in" will mean an integration with other information if the affective component is useful in this context. Two examples will illustrate this point.

An example of the interference potential is given by Pratto and John (1991), who showed interference effects of negative social information, i.e., negative trait words, in a Stroop color-naming task (see also Pratto, 1994). Naming the relevant feature of the stimulus, i.e., its color, was disturbed by the irrelevant feature, i.e., the negative value of the stimulus. Pratto and John (1991) argued that their result reflects a rather general automatic vigilance to undesirable stimuli -- one that entails certain evolutionary advantages (i.e., enables the organism to react swiftly to threats). Meanwhile, other studies made it questionable whether this attention-grabbing effect is restricted to the negative valence category (cf. Roskos-Ewoldsen & Fazio, 1992; Wentura, Rothermund, & Bak, 1997). Wentura et al. (1997), e.g., provided evidence that negative trait terms associated with avoidance as well as positive trait terms associated with approach produced Stroop-interference.

An example for the integration potential is the study by Posner and Snyder (1975). Sentences were presented to subjects which attributed certain traits to a fictional person (e.g., "James is honest, loyal, mature."). Following
presentation, participants had to decide as quickly as possible whether a
target adjective (e.g., foolish) was part of the sentence or not. Varying the
affective relation of sentence attributes and target as well as the list length,
the results suggested that subjects automatically used an integrated affective
"halo" of the sentence information for their judgment.

What does that mean for the affective priming paradigm? The answer
according to MIM is somewhat more complex than it was for SPAM. If the
hypothesis is correct that presentation of an affective prime does not subtly
change the accessibility of all members of a semantic category, but instead
meddles with ongoing processes and the formation of actual behavior, the
experimental task at hand has to be taken into consideration. Different
mechanisms could be operative in the evaluation and lexical decision tasks,
respectively. This mechanisms must be described in detail.

MIM and the evaluation task: Stroop-like interference processes
Drawing an analogy between affective priming and semantic priming
overlooks the fact that the evaluation task differs in an important respect
from the tasks typically used in semantic priming paradigms. Take, for
example, the lexical decision task (Neely, 1991). The task here is to classify
stimuli as words or pseudowords, i.e., senseless letter strings resembling
words in their vowel-consonant sequence. The primes presented are
semantically related or semantically unrelated to the targets -- semantic
congruency between prime and target leads to faster reaction times.

Even this brief analysis shows that the lexical decision task is very
different from the evaluation task: Whereas the primes and targets in the
evaluation task vary according to only one dimension (i.e., positive vs
negative), the primes and targets in the lexical decision task vary according to two dimensions (i.e., primes are semantically related vs semantically unrelated, targets are pseudowords vs words).

Therefore, since the primes in the evaluation task can be classified as positive or negative just as easily as the targets, the affective congruency effect can also be explained by interference processes. In other words, in the evaluation task, presentation of a prime might trigger a response process due to its affective value. Therefore, when prime and target are affectively congruent, facilitation of the correct response may occur. An even more likely event is interference in cases of incongruency (cf. Bargh et al., 1996; Klauer et al., 1997; Wentura, 1994).

Therefore, the evaluation task has much more in common with the Stroop interference paradigm (Stroop, 1935; MacLeod, 1991) than with the semantic priming paradigm. This comparison might appear surprising, but it can be defended on the basis of the existing studies on Stroop interference. The classical Stroop task demands for naming of the color of a stimulus. In cases where this stimulus is a color word which is incongruent to the to-be-named color, reaction times are slowed down. Since the original work of Stroop (1935), many studies have been published which show the phenomenon to be generalizable (cf. MacLeod, 1991). By designating the to-be-named dimension of the stimulus configuration as the target and the to-be-ignored dimension as the distractor, the type, modality, local and temporal discriminability of target and distractor can be varied (cf. Glaser & Glaser, 1989). For example, typical Stroop interference effects emerge in cases where targets as well as distractor are color words, separated by a SOA
(Glaser & Glaser, 1982, 1989). Moreover, La Heij, van der Heijden, and Schreuder (1985) demonstrated interference effects with other types of distractors (e.g., day as distractor for night, uncle for aunt).

To sum up, there are some reasons to believe that affective congruency effects in the evaluation task are the result of Stroop-like processes. But, as mentioned above, there is some evidence of affective priming effects in the lexical decision task. Interference mechanisms cannot be used to explain the priming effects in the lexical decision task. Since the primes and targets in that task each vary with respect to different dimensions, different primes are not associated with different responses. Therefore, another model must be assumed to account for the lexical decision task.

**MIM and the lexical decision task: Judgmental tendency mechanisms.** As should be clear from the preceding considerations, interference mechanisms can neither be applied to the lexical decision task nor to the pronunciation task. At least for noun-adjective pairings, however, an alternative account can be made for affective priming effects in the lexical decision task. Klauer and Stern (1992, Klauer, 1991) proposed a model of affective-cognitive links in judgment processes as an explicit alternative to the spreading activation account. According to this model, when judging statements of the form (noun) is (adjective) (e.g., Einstein is fond of animals), a process with three components -- two automatic and one controlled -- will take place. First, the affective components of both the noun and the adjective are activated. Second, the affective components are compared with respect to affective consistency. Both processes are supposed to be automatic. The result of the second process is an *a priori hypothesis* about the correct answer and
therefore a judgmental tendency to affirm (in cases of affective congruency) or to reject (in cases of incongruency) the relation in question will be established. Third, in a controlled process relevant information will be recalled to form an adequate answer on the basis of the a priori hypothesis and the available information. Note, that in the context of judgmental processes the meddling-in character of affective stimuli does not cause an interference or an interruption of ongoing processes; instead the automatic evaluation of stimuli will be used to solve the judgmental task.

An experimental procedure to test the hypothesis of an automatic comparison of affective components was constructed as follows: participants were required to classify pairs of stimuli (either the name of a politician paired with a trait word, two names or two traits; pairs were presented simultaneously) according to some formal characteristic ("Does this pair consist of a person and a trait?") requiring a yes/no response (actually, Klauer & Stern, 1992, used the labels 'correct' and 'false'). Politicians as well as traits were evaluated as positive or negative so that affective congruency could be varied. In accordance with the model, response latencies for person/trait pairs were facilitated in cases of affective congruency and inhibited in cases of incongruency. But, by reversing the question so that person/trait pairs required a no-response ("Does this pair consist of either two persons or two traits?"), the pattern of latencies was reversed (Klauer & Stern, 1992). This second order interaction was critical in supporting the theory.

It should be obvious that the theory can be applied to the lexical decision paradigm. The affective congruency effect in the lexical decision task may be
a mere by-product of the judgmental tendencies caused by the compound of prime and target, given the assumption that the lexical decision task is implicitly coded as requiring yes (word) and no (nonword) responses (see West and Stanovich, 1982, for this assumption).

The main purpose of the experiments reported here is to derive and test hypotheses that discriminate between SPAM and MIM, i.e. to provide evidence that affective priming effects in the evaluation task are a result of interference processes whereas in the lexical decision task, they are the result of judgmental tendencies.

It will soon become evident that the nature of both tasks permits derivation of strong hypotheses. Later it will become equally evident that the pronunciation task is rather ambiguous concerning interference and judgmental tendencies. So let us forego the pronunciation task for the moment, but return to it in the general discussion.

Overview

Interference processes in the evaluation task. Given the analogy between the evaluation task and the Stroop interference task, a very distinctive hypothesis concerning the effects of the interference processes can be made. The conflict of trial n-1 in a Stroop-like task results in an inhibition of the suppressed information in the n-th trial, a phenomenon called negative priming (cf. Neill, 1977; Lowe, 1979, 1985; Tipper, 1985; for overviews see Fox, 1995; May, Kane, & Hasher, 1995; Neill, Valdes & Terry, 1995). Specifically, the naming latency for the color RED, e.g., will be slowed down if in the preceding trial participants had to name the color (e.g., GREEN) of the stimulus word red (cf. Neill, 1977; Lowe, 1979, 1985).
To apply this to the evaluation task it can be hypothesized that in trials with incongruent prime and target valences the irrelevant affective component triggered by the prime will be suppressed. This suppression may lead to a higher evaluation latency in the following trial in cases where the target valence matches that of the pre-trial prime. To test this hypothesis a full factorial combination of pre-trial and probe trial prime and target valences was realized in Experiment 1. Note, that this hypothesis follows from reconstructing the evaluation task as an Stroop-like interference task, but not from the semantic priming analogue and the associated spreading activation account. It is essential to emphasize that the affective priming paradigm constructed by Fazio et al. (1986) duplicated the semantic priming paradigm in all but one respect: They presented prime and target at the same location of the CRT screen, separated by a temporal delay, and they used a rather large set of different stimuli, split into disjunct sets of primes and targets (all of which are not standard features of interference or negative priming paradigms). The only feature they did not transfer concerns the tasks most commonly used in the standard semantic priming paradigm. In the following Experiment 1 all essential features of the affective priming paradigm as introduced by Fazio et al. (1986) will be maintained.

Judgmental tendencies in the lexical decision task. Up to now, the evidence for affective priming effects in the lexical decision task is somewhat sparse. Therefore, in Experiment 2 a factorial variation of prime and target valence was realized within the word list of the lexical decision task to establish this variant of affective priming. Experiment 3a and 3b, finally, were the crucial test for the judgmental tendency version of MIM. In a between-
subjects factorial variation the word targets in the lexical decision task were assigned to the yes or no response. SPAM would predict no second order interaction (i.e., no dependency of the affective congruency effect on response assignment), whereas the affective congruency effect should hold only under the yes-condition but be reversed under the no-condition according to MIM.

Experiment 1 - Negative Affective Priming

First, some terms have to be explained. A complete trial in negative priming paradigms consists of two stimulus-reaction successions, a pre-trial and a probe trial (see Table 1). In each, a distractor and a target are presented; to stay in line with other reports on affective priming, I will continue to call the distractor stimulus prime, distinguishing between the pre-trial prime and the probe trial prime, as well as between pre-trial target and probe trial target. Only reaction times to probe trial targets will be analyzed to test the hypothesis of negative priming, but note that participants can in no way distinguish between pre-trial and probe trial. Negative priming paradigms vary the relationship between pre-trial prime and probe trial target. In the experimental condition there is some sort of correspondence between those stimuli: Depending on the study, the stimuli can be identical, semantically related, or require the same response from the subject. In the control condition there is not such correspondence between them. Inhibition of the pre-trial prime results in a larger reaction time in the former probe trials compared to control conditions.

To apply this logic onto the affective priming paradigm, one must distinguish between conflict trials and non-conflict trials. Conflict trials are
configurations with affective incongruency of prime and target; non-conflict trials are comprised of prime and target with congruent valences. In Table 1 all possible combinations of conflict and non-conflict trials (as the pre-trial configuration) with the valence of probe trial targets are shown.

— Insert Table 1 about here —

To understand the design, it is sufficient to focus on the negative test-target conditions (left side of Table 1); the positive test-target conditions are only a reflection of those. In the following, conditions are indicated by the pre-trial examples given in Table 1; note, however, that hypotheses always refer to probe trial reaction times. In the upper left cell ("DEATH - wise"), the pre-trial is a conflict trial: To press the positive key is the correct answer to the pre-trial target (e.g., wise); therefore the tendency to react to the prime of opposite valence (e.g., DEATH) must be inhibited. This inhibition results in a heightened reaction time (RT) for the probe trial target (which calls for pressing the negative key; e.g., lonely). Note, that pre-trial prime and probe trial target are different stimuli which only share the same valence. One cell to the right ("PEACE - wise"), there is the same sequence of target reactions but the adequate probe trial reaction isn’t inhibited because the pre-trial is a non-conflict trial. Therefore, the two conditions as well as the correspondent conditions for positive probe trial targets (see Table 1, upper right quadrant, cells "SUMMER - dull" and "POISON - dull") can be compared to test the hypothesis of negative affective priming (experimental trials).
The Affective Priming Effect

To rule out two alternative hypotheses, the conditions named control trials have to be taken into consideration. Getting a significant difference between the reaction times corresponding to the cells “DEATH - vicious” and “PEACE - vicious” (as well as between “SUMMER - optimistic” and “POISON - optimistic”) doesn’t fit the negative priming hypothesis, entailing different interpretations depending on the sign of the difference. That is, if the negative priming in the experimental condition is merely due to subjects being slower following conflict trials than following non-conflict trials, then reaction times in the condition “PEACE - vicious” (“POISON - optimistic”) will be greater than those in the “DEATH - vicious” (“SUMMER - optimistic”) condition. If, on the other hand, the negative priming in the experimental condition is merely due to the pre-trial prime matching the probe trial target (according to valence), then reaction times in the condition “DEATH - vicious” (“SUMMER - optimistic”) will be greater than those in the “PEACE - vicious” (“POISON - optimistic”) condition.

Up to now, nothing has been said about the probe trial prime. In accordance with the typical negative priming paradigm, this stimulus shouldn’t be of any relevance to the inhibition process initiated in the pre-trial and assessed in the probe trial. Therefore the best choice will be a neutral prime condition like the one used by Fazio et al. (1986); i.e., senseless letter strings like AAAAA or HHHH (cf. Table 1).

Method

Participants. Thirty-five students (twenty-six women; nine men) at a German university participated in partial fulfillment of course requirements. Age median was 20.0 years; the data of one other person were excluded.
because of extremely high response latencies and an extreme standard deviation of raw latencies.

Design. To test the hypothesis of negative affective priming, a factorial combination of pre-trial prime valence (positive vs. negative), pre-trial target valence (positive vs. negative) and probe trial target valence (positive vs. negative) was established; for these trials neutral probe trial primes were used (i.e., letter combinations like AAAA).

In order to make pre-trials and probe trials indistinguishable to the participants, this design was embedded into a full factorial combination of pre-trial prime valence (positive vs. negative vs. neutral), pre-trial target valence (positive vs. negative), probe trial prime valence (positive vs. negative vs. neutral) and probe trial target valence (positive vs. negative). With respect to Table 1, this means (a) a supplementation of the basic design with neutral pre-trial primes (cf. cells "AAAAA - wise", "AAAAA - vicious", "BBBBBB - dull", "BBBBBB - optimistic") to get indications of inhibition and facilitation and (b) a triplication of the basic design (by replacing the neutral probe trial prime with positive and negative stimuli, respectively) to get any hint as to whether negative affective priming will be observed in cases of conflict probe trials and non-conflict probe trials.

For each probe trial prime condition (negative, positive, or neutral), a given probe trial target was presented only once per subject. A latin-square design comprised of six samples of participants and six sets of probe trial targets was used to guarantee that each probe trial target was presented equally often across subjects in each combination of pre-trial prime and target valences.
Materials. There were two target sets, one for pre-trials and one for probe trials, each comprised of 30 positively and 30 negatively valenced German adjectives. Adjectives were selected on the basis of their pleasantness values (absolute values above 49 on a scale ranging from -100 to +100) according to a norm list comprising of 908 adjectives (Hager, Mecklenbräuker, Möller & Westermann, 1985, and Möller & Hager, 1991).

Within each valence condition, pre-trial targets and probe trial targets were matched for mean length and mean pleasantness. To balance the design (see above), the probe trial target list was divided into six sets comprised of five positive and five negative words each, also matched for mean length and mean pleasantness.

Prime stimuli were forty positive nouns, forty negative nouns and forty neutral letter strings. Selection and classification of prime words with regards to valence were a priori but also validated in addition in a rating task carried out after the evaluation task by the participants. Positive and negative words had a mean rating of 2.77 (sd = .48) and -2.98 (sd = .63), respectively, on a scale from -4 to +4. For the neutral primes, twenty letters (A through U excluding Q) were combined into two strings of different length for each letter (e.g. BBBB and BBBB) so that they matched the positive and negative primes in length.

Like the target items the prime stimuli were separated in a pre-trial prime list and a probe trial prime list, matched for length. Thus, each pre-trial prime stimulus was presented three times to each subject, but only once in each probe trial prime condition; each probe trial prime was used three times as well. (Note that the trials critical for evaluation of the hypothesis, see
Figure 1, involved only the neutral probe trial condition. Prime stimuli were presented in upper-case letters.

Procedure. Participants were seated in front of an IBM-compatible microcomputer and received instructions about the task on a CRT screen. They were told that they had to classify common words with regard to their valence. Both speed and accuracy were emphasized. On every trial, a prime was presented for 200 ms, followed by a 100-ms-interval before onset of the target. Therefore, the stimulus onset asynchrony (SOA) was 300 ms. Choice of these parameters was in accordance to Fazio et al. (1986). The target disappeared as soon as the subject pressed a key. The interval between response and the beginning of the next trial was 1000 ms.

There were 180 double-trials (pre-trial plus probe trial) per subject divided into five blocks. Within each block there were 36 double-trials (one in each of the 36 conditions formed by crossing the four independent variables). For each subject (a) the assignment of primes to targets, (b) the assignment of a double-trial to a block and (c) the sequence of double-trials within blocks were determined randomly.

To practice the evaluation decision, ten warm-up trials (single trials) without priming were given with a feedback message on the screen whenever an error was made ("*** mistake! ***"). If the response was slower than 1000 ms, the following message was added: "Your reaction time was (RT) ms. Please try to respond more quickly! " Then, the priming was explained and also practiced over ten trials (single trials). The main phase started with twenty warm-up trials (single trials). In the main phase there was no feedback.
Results

Mean reaction times were derived from correct responses only. The average error rate across subjects was 6.83 % for probe trials and 8.03 % for pre-trials, respectively. Reaction times which could be considered far out values (Tukey, 1977) with respect to the individual distribution or were below 300 ms were discarded as well (0.84 % of all values for probe trials; 0.97 % for pre-trials).

Pre-trials: The affective priming effect. Mean reaction times (RT) and error rates of pre-trial targets corresponded to the hypothesis of an affective congruency effect. Mean RTs for positive targets were 632 ms (6.95 % errors) following positive primes and 649 ms (8.48 %) following negative primes (635 ms [7.43 %] following neutral primes); mean RTs for negative targets were 671 ms (9.62 %) following positive primes and 667 ms (8.86 %) following negative primes (665 ms [6.86 %] following neutral primes).

For a 2 (target valence: positive vs. negative) x 3 (prime valence: positive vs. negative vs. neutral) analysis of variance, the prime factor was split into two planned orthogonal contrasts: Positive vs. negative prime valence and neutral prime vs. the mean of the two valenced conditions. For the reaction times the interaction (contrast: positive vs. negative) was significant, $F(1,34) = 4.15$, $\text{MS}_e = 932.92$, $P < .05$ for subjects as the random variable and $F(1,58) = 4.47$, $\text{MS}_e = 881.98$, $P < .05$ for targets as the random variable, all other Fs < 2.33. For the error data, the congruency pattern was somewhat less pronounced, $F(1,34) = 1.59$, n.s., for subjects and $F(1,58) = 2.84$, $P < .10$ for targets, all other Fs < 2.32 except for the main
effect of prime valence (contrast: positive, negative vs. neutral), $F(1,34) = 3.30, P < .10$ for subjects and $F(1,58) = 3.81, P < .10$ for targets.

Probe trials: The negative affective priming effect. Mean reaction times and error rates for the conditions of interest are shown in Table 1.

The major result is clear. The experimental trials revealed the pattern of negative affective priming, whereas the control trials didn’t. In a 2 (trial type: experimental vs. control trials) x 2 (pre-trial type: conflict trials vs. non-conflict trials) x 2 (probe trial target valence: positive vs. negative) analysis of variance, there was a two-way interaction of trial type and pre-trial type, $F(1,34) = 4.19, MS_e = 5676.13, P < .05$ for subjects as the random variable and $F(1,58) = 5.10, MS_e = 2290.61, P < .05$ for targets as the random variable, qualifying a main effect of pre-trial type, $F(1,34) = 5.35, MS_e = 4576.35, P < .05$ for subjects and $F(1,58) = 6.95, MS_e = 3455.36, P < .05$ for targets; all other $F$s < 1.48. This interaction is due to the significant difference between conflict trials and non-conflict trials for experimental trials (i.e., the negative priming effect), $F(1,34) = 9.23, MS_e = 5224.56, P < .01$ for subjects and $F(1,58) = 11.70, MS_e = 2958.53, P < .01$ for targets, whereas the difference is not significant for the control trials, both $F$s < 1. Neither for experimental trials nor for control trials was a significant interaction with probe trial target valence, all $F$s < 1.08.

For two reasons, a second analysis of variance was performed. The previous analysis indicated that it is not the conflict trial per se which slows down the following response time. But, as mentioned earlier, the negative affective priming effect has to be secured against a second alternative hypothesis, namely, that the slowing down of response times is merely due to
the pre-trial prime matching the probe trial target according to valence. A
second analysis should realize the appropriate control, replacing the pre-trial
type factor (conflict trial vs. non-conflict trial) with a factor of pre-trial prime
valence, so that -- the second reason -- the neutral pre-trial prime condition
could be incorporated. For this analysis, this factor was split into two
planned orthogonal contrasts. The contrast of major interest is the difference
between the positive and negative pre-trial prime valence. Of secondary
importance was the contrast between the neutral condition and the mean of
the two valenced conditions. There were two main results: (1) There was a
significant three-way interaction for the first contrast (positive vs. negative),
$F(1,34) = 5.35, P < .05$ for subjects and $F(1,58) = 6.95, MS_E = 3455.36, P <$
.05 for targets, which is the analogue of the two-way interaction of the first
analysis. (2) The second contrast had no significant contribution, neither as a
main effect nor in combination with other factors, all $F$s < 2.44.

The error data did not show any significant effects. In the analysis with
pre-trial type (conflict trial vs. non-conflict trial) all $F$s < 1.97 for subjects
and all $F$s < 2.57 for targets; in the analysis with pre-trial prime valence
(positive vs. negative vs. neutral) all $F$s < 2.53 for subjects (with the
exception of the main effect of trial type, $F[1,34] = 3.19, P < .10$) and all $F$s <
2.57 for targets.

Additional analyses. For exploratory reasons negative priming effects
were analyzed for the remaining probe trial prime conditions in addition to
the neutral condition. Preliminary analyses showed that the most
comprehensible pattern will be obtained by collapsing the factor of probe trial
target valence and rearranging the factor probe trial prime valence (neutral
vs. positive vs. negative) into a factor type of probe trial (neutral vs. conflict vs. non-conflict). Naturally, the neutral condition is identical for the old and the new factor and refers to the data analysed above. The conflict condition refers to positive probe trial primes for negative probe trial targets and to negative primes for positive targets; for the non-conflict condition the arrangement is the other way around. In condensed form, the results are displayed in Table 2.

--- Insert Table 2 about here ---

Four remarks concerning these results should be made: (1) For the condition conflict probe trial, there is a negative priming effect whereas it is absent in cases of non-conflict probe trials. Contrasting the negative priming effects of the neutral and the conflict probe trial condition yielded a non-significant result, \( t(34) = .48, \text{n.s.} \), whereas there is a hint of a difference for the comparison of the neutral and the non-conflict probe trial condition, \( t(34) = 1.61, P = .12 \). (2) But, the validity of this asymmetry is questioned by the respective error data. (3) Surprising at first sight is the positive value for the control trials in the conflict condition, countered by a negative value (though not significant) in the non-conflict condition. But, note that these conditions cannot provide an adequate control for their counterparts in the row ‘experimental trials’ of Table 2. For these columns of Table 2, the transition from row ‘experimental trials’ to row ‘control trials’ is not solely characterized by a change of pre-trial target valence (as is the case for the neutral type; see Table 1) since it implies a comparison of conditions with
and without a complete repetition of prime-target combination. To make this point somewhat clearer, take the significant effect in the cell ‘control trials - conflict probe trial’ for negative targets, e.g., the effect results from subtracting mean RT of the ‘+/−’ followed by ‘+’ trials (e.g., PEACE - vicious followed by MUSIC - lonely) from the ‘−/−’ followed by ‘+/−’ trials. The subtrahend refers to a repetition of the prime-target combination (i.e., ‘+/−’ from pre-trial to probe trial. Note, that there is nothing comparable in the respective experimental trials (here, the effect results from subtracting mean RT of the ‘+/+’ followed by ‘+/−’ trials from the ‘−/+’ followed by ‘+/−’ trials). In the cell ‘control trials - non-conflict probe trial’ the effect -- though not significant -- changes sign. Here, e.g., for negative targets, the effect results from subtracting mean RT of the ‘+/−’ followed by ‘−’ trials from the ‘−/−’ followed by ‘−’ trials. Here, the minuend refers to a repetition of the prime-target combination (i.e., ‘−’). Again, this feature is absent in the respective experimental trials (here, the effect results from subtracting mean RT of the ‘+/+’ followed by ‘−’ trials from the ‘−/+’ followed by ‘−’ trials).

Given the results, it seems that the repetition of a prime-target combination from pre-trial to probe trial led to shorter response times. When both pre-trial and probe trial are conflict trials, the difference might be especially pronounced due to solving the reaction conflict in the pre-trial (see Lowe, 1979, and Tipper & Cranston, 1985, for indications). (4) The last point to mention is that t-Tests for the comparison of positive and negative probe trial-targets concerning the negative priming effects displayed in Table 2 yielded only one nearly significant result. The overall negative priming effect (for experimental trials) is somewhat more pronounced for positive targets.
"Meddling-in" of affective information

(M = 37 ms) than for negative targets (M = 13 ms), t(34) = 1.94, P = .06. Since the negative priming effects for negative and positive targets in the critical neutral condition are highly comparable, t(34) = 0.37, n.s. (cf. Table 1), this result is mainly due to an asymmetry in the conditions conflict and non-conflict (t[34] = 1.51, n.s. and t[34] = 1.49, n.s., respectively).

Discussion

The main result of this experiment is the finding of a substantial negative priming effect in the evaluation task. Following affective incongruency between prime and target in the pre-trial, the evaluation of a probe trial target which is affectively congruent to the pre-trial prime was slowed down. There are two main lines of reasoning about the results.

First of all, the results support the idea that the evaluation task is better conceptualized as a variant of Stroop interference tasks than as a variant of the semantic priming paradigm. Negative priming effects are only known from paradigms in which participants are explicitly instructed to ignore the distractor or are implicitly made to do this because the distractor obviously impedes processing of the target. This seems to be the case in the evaluation task.

Therefore the view should be abandoned (at least for the evaluation task) that processing of the prime shifts activation states of a certain class of memory representations so that processing of target stimuli fitting this class will be facilitated. Instead, the Stroop-analogy suggests that in cases of incongruency, prime and target presentation activate competing pathways from perception to response. Resolving the conflict leads to longer response latencies. However, this model does not preclude the possibility that in cases
of affective congruency the adequate pathway is facilitated through activation of a compatible prime pathway. Therefore it is not surprising that Fazio et al. (1986) as well as Bargh et al. (1992) observed facilitation and inhibition effects, taking their neutral prime condition of letter strings (e.g., BBB) as a baseline. Although one might have serious doubts concerning the validity of this neutral condition (cf. Fazio et al., 1986, Bargh et al., 1996), Hermans et al. (1994) observed facilitation as well as inhibition in their picture-picture experiment using neutral pictures as a baseline.

Incidentally, Klauer et al. (1997) detected another clue to the Stroop-like nature of the evaluation task. They varied the proportion of congruent to incongruent prime-target pairs thereby getting a variation in the affective priming effect at short SOAs. A comparable data pattern is known from Stroop-like tasks but not from semantic priming tasks (cf. Logan & Zbrodoff, 1979).

The second point of discussion concerns the inhibition effect itself. The negative affective priming effect shown in Experiment 1 fits in a larger body of studies which shows negative priming effects with a multitude of materials and tasks (for overviews see Fox, 1995; May et al., 1995; Neill et al., 1995). One of the most interesting points of this research concerns the location of the inhibition effect. Most studies used identical stimuli as distractor and target to establish negative priming effects, thereby leaving unanswered the question whether the inhibition occurs at an early or late stage of processing the distractor. Most relevant to this point, however, are experiments showing negative priming effects with a mere categorical relationship between distractor and target. Allport, Tipper and Chmiel (1985; cf. also Tipper,
1985) presented simple line drawings to their participants and instructed them to name the represented object. In each trial, the to-be-named figure was in red superimposed over a to-be-ignored line drawing in green. Naming latencies in probe trials were significantly slower (compared to a control condition) in cases of distractor-target repetition (i.e., when the green pre-trial drawing of a hammer was presented in red in the probe trial), but, more importantly, were prolonged, too, in cases of a mere categorical relationship between those stimuli (i.e., when the green pre-trial drawing of a hammer was followed by a picture of a wrench in red in the probe trial). So, stimulus identity seems not to be necessary for negative priming effects. Rather, inhibition can operate at a more conceptual level (see also Yee, 1991, but compare Chiappe & MacLeod, 1995). The present results make a further contribution to this research area. Here, the sole relation of the to-be-ignored distractor (i.e., the pre-trial prime) and the probe trial target is given by a match in valence. To my knowledge, no other study has shown negative priming effects for such an extensive category of word-stimuli.

Surely, what remains an open question for negative affective priming is the distinction between inhibition at a conceptual level of "positivity" and "negativity", respectively, and inhibition at a response level, which cannot be decided on the basis of the present results. But, other evidence in this research area suggests that the inhibition of specific responses cannot explain negative priming effects (cf. Neill et al., 1995). Using word materials, Chiappe and MacLeod (1995) varied the task (naming vs categorizing) between pre-trial and probe trial and still found negative priming effects (see also Fox, 1994; Yee, 1991). Tipper, MacQueen, and Brehaut (1988), as well
as Neill, Lissner, and Beck (1990) found comparable results using less complex stimuli (i.e., letters).

A further topic of negative priming research to which the present results might be related concerns the type of probe trial. Lowe (1979) presented probe trials which either consisted of a target-distractor display or nothing but a target. Whereas negative priming effects were observed in the former case, positive priming (i.e., facilitation) was found in the latter case. It should be added, however, that this phenomenon wasn’t obtained in all studies relevant to this point (cf. Fox, 1995; Neill et al. 1995). Some studies found a reversal like that reported by Lowe (1979) (e.g., Tipper & Cranston, 1985), some studies found a null effect for conditions without conflicting distractor in the probe trial (Tipper, Brehaut, & Driver, 1990, Exp. 5), and others found negative priming effects even in the absence of a distractor stimulus (e.g., Neill, Terry, & Valdes, 1994; Yee, 1991; see May et al., 1995, for possible determinants of these conflicting findings). These findings are of special importance to the theoretical explanation of negative priming effects. Tipper and Cranston (1985) proposed that negative priming is due to an activation of the memory representation of the pre-trial distractor which is then uncoupled from response systems. This activation-plus-blocking model afforded a neat solution to their own results and to those reported by Lowe (1979). Houghton and Tipper (1994) tried to develop and formalize the interplay between activation and inhibition in a connectionist simulation model of selective attention. This inhibition model is based on opponent-process circuits, i.e., each property unit (representing the presence of some feature in the input) is connected via forward and backward excitatory and
inhibitory links to gain-control units ("on"- and "off"-cells). In negative priming tasks, the target as well as the distractor will thus activate corresponding property units, creating an initial activation state for those units. The match and mismatch, however, between the externally driven activation and internally driven inputs, i.e., the representation of current goals and plans, causes activation of the target units and inhibition of the distractor units through backward links. Due to this backward process, interference, i.e. the initial activation of both the target and distractor, will vanish, and -- following offset of the external input -- activation of the distractor's property units will diminish to below resting levels. If the current distractor is the target of the next trial, this initial inhibition will produce a somewhat prolonged dissolving of the interference. The remarkable feature of the model is the fact that this inhibition will not cause problems if there is no distractor in this follow-up trial; it thus predicts a null effect which in fact was observed by Tipper et al. (1990). Based on Logan's (1988) instance theory of automatization, Neill and Valdes (1992; Neill, Valdes, Terry & Gorfein, 1992) proposed an alternative account of negative priming named episodic retrieval theory, attributing the effect dominantly to processes in the probe trial. With increasing familiarity of a stimulus, subjects might base their response process on a fast retrieval of past processing episodes including this stimulus, instead of slow-acting algorithmic processing. In the experimental condition of a negative priming study, the last processing episode for a target stimulus contains the feature "do not respond" since the stimulus was a distractor in the foregoing trial. This mismatch might cause either automatic response conflicts or a switch to slow algorithmic processing; in both cases
responding will be prolonged. For this model, type of probe trial -- i.e., presence or absence of a probe trial distractor -- should make no difference. Therefore it is congruent with the results of Neill et al. (1994) and Yee (1991).

What contribution has negative affective priming to this theoretical debate? Surely not a decisive one, since the experiment was not designed for that purpose. But, the manipulation of type of probe trial in Experiment 1 might be related to this point. Substantial negative priming effects in the RT-data were found for neutral and conflict types of probe trial, but not for non-conflict probe trials. (Note that this comparison should be regarded with caution since the error data show a different pattern and inferential tests only reveal a marginal significant result for the comparison of neutral to non-conflict probe trials.) This result might pose a problem for the episodic retrieval theory because it will not predict a difference for type of probe trial. Besides, episodic retrieval theory is well suited for all negative priming tasks with identity repetition of stimuli, i.e., if the distractor of the pre-trial is identical with the probe trial target, since it is highly plausible that a stimulus will trigger the retrieval of its last occurrence's representation. For tasks with a mere categorical relationship of pre-trial distractor and probe trial target, it seems more questionable as to whether the actual target will cause an automatic retrieval of the pre-trial episode. Models based on inhibition processes seem to be better candidates for explaining the negative affective priming effect. Refering, e.g., to the Houghton and Tipper (1994) model, ‘positivity’ and ‘negativity’ might be conceptualized as special property
units, whose activation levels might be suppressed. I will come back to this in the general discussion.

After analyzing the Stroop-like character of the evaluation task, the question remains whether there is an affective priming effect besides interference processes. Hill and Kemp-Wheeler (1989; Kemp-Wheeler & Hill, 1992, but see Klauer et al., 1995) found some indications of affective priming in the lexical decision task. Obviously such effects cannot be reduced to interference processes (in the Stroop-sense) because the critical variations are all within one response mode. Unfortunately, Hill and Kemp-Wheeler (1989; Kemp-Wheeler & Hill, 1992) compared only negative to neutral primes with respect to their effect on negative targets thereby leaving open the question whether the effect reflects a specific facilitation of the target decision in the negative prime condition or an unspecific influence of prime type to targets of whatever type.

Experiment 2 - Affective Priming in the Lexical Decision Task

If there is an affective congruency effect besides interference, the same interactional pattern of prime and target valences which was observed in the evaluation paradigm should emerge in the lexical decision paradigm. To establish this phenomenon unequivocally, Experiment 2 was conducted.

Method

Participants. Fifty-five students (thirty-seven women; eighteen men) at a German university participated in the experiment in partial fulfillment of course requirements. Age median was 23.0 years (19 to 28 years); the data of three other persons were excluded because of extremely high error rates.
Design. Central to the hypothesis of affective congruency is the factorial combination of target valence (positive vs. negative) and prime valence (positive vs. negative). A neutral condition was added as a third priming condition, realized through neutrally valenced words (see materials). For exploratory reasons, a fourth prime condition was established, realized through pseudo-nouns (see materials). The four prime conditions were crossed with four groups of participants (thirteen to fourteen per group) and four sets of stimuli (see materials) in a latin-square design to ensure that each prime and target was presented only once to each subject. Each type of prime (positive, negative, neutral, or pseudo-word) was equally often followed by a word or pseudo-word to prevent effects of expectancy.

Materials. Four sets of ten positive and ten negative German adjectives each were selected as targets according to pleasantness norms collected by Hager et al. (1985). Criteria for selection were high mean pleasantness rating and, secondly, low standard deviation in this rating. Each set included twenty pseudo-words which were pronounceable and had endings like German adjectives (e.g., pargnant and kriftagnich). Prime stimuli were forty positive, forty negative and forty neutral nouns as well as forty pseudo-nouns (e.g., SIRTAI, VELMEN). The positive and negative stimuli were the same as in Experiment 1; selection and classification of neutral prime words were a priori but also validated in a rating task carried out after the lexical decision task by the participants. Positive, negative, and neutral prime words had mean ratings of 2.14 (sd = .40), -1.95 (sd = .61) and .31 (sd = .36), respectively, on a scale from -3 to +3. The assignment of positive, negative, neutral and pseudo-word primes to target stimuli was fixed to guarantee
semantic or associative unrelatedness\textsuperscript{5}. Target categories and sets, as well as prime categories and sets, were balanced according to stimulus length. Due to coding errors, one positive target from each set had to be removed; there were thus nine instead of ten values to be aggregated in the positive target conditions.

Procedure. The procedure was essentially the same as in Experiment 1 with the following significant exception: Participants were instructed to classify the target stimuli as quickly as possible (without loss of accuracy) as legitimate words or pseudo-words. Word and pseudo-word decisions were assigned to the right and left index finger, respectively. After twenty warm-up trials, forty positive, forty negative and eighty pseudo-word targets were presented, randomized for each subject. Prime stimuli were presented in upper-case letters. SOA was the same as in Experiment 1 (300 ms); the intertrial interval was set to 2500 ms. Following the lexical decision task, participants were asked to rate the affective connotation of the prime words (see materials).

Results

Mean reaction times were derived from correct responses only. The average error rate across subjects was 2.68 % and 3.89 % for words and pseudo-words, respectively. Reaction times which could be considered far out values (Tukey, 1977) with respect to the individual distribution or were above 2000 ms were discarded as well (1.51 % and 2.70 % of all word and pseudo-word decisions, respectively).

Affective congruency hypothesis. Results for the target-valence-x-prime-valence conditions are shown in Table 3.
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—— Insert Table 3 about here ——

The pattern of means is in line with the affective priming effect found by Fazio et al. (1986). For the analysis of variance, the prime factor was split into two planned orthogonal contrasts. The contrast of major interest is the difference between the positive and negative prime valence. Of secondary importance was the contrast between the neutral condition and the mean of the two valenced conditions. There was a target-valence-x-prime-valence (contrast: positive vs. negative) interaction, corresponding to the affective congruency hypothesis, $F(1,54) = 8.32$, $MSE = 1167.45$, $P < .01$ for subjects and $F(1,74) = 4.62$, $MSE = 1452.16$, $P < .05$ for targets. Tests for simple effects showed the difference between positive and negative primes to be significant for the negative targets, $t(54) = 2.28$, $P < .05$ for subjects and $t(39) = 1.70$, $P < .05$ (one-sided) for targets, as well as -- marginally -- for positive targets, $t(54) = -1.78$, $P < .05$ (one-sided) for subjects and $t(36) = -1.35$, $P = .09$ (one-sided) for targets. For the second contrast (neutral vs. positive/negative), there was no difference at all, both F-values < 1.

There was no indication of a main effect for prime valence, both F-values < 1 for both contrasts. However, there was a main effect for target valence, $F(1,54) = 78.42$, $MSE = 2990.96$, $P < .001$ for subjects and $F(1,74) = 13.28$, $MSE = 12332.56$, $P < .001$ for targets.

The error data showed a similar, but weaker pattern (target valence: $F[1,54] = 11.07$, $MSE = 30.75$, $P < .01$ for subjects and $F[1,74] = 4.40$, $MSE = 53.18$, $P < .05$ for targets; prime valence [contrast pos. vs. neg.]: both F-
values < 1; interaction [contrast pos. vs. neg.]: F[1,54] = 1.11, n.s. for
subjects and F[1,74] = 1.66, n.s. for targets; prime valence and interaction
[contrast neutral vs. pos./neg.]: all F-values < 1.85, n.s.

Discussion

The results are straightforward. The hypothesis of affective priming in
the lexical decision task was confirmed: After presentation of negative
primes (compared to positive primes), the responses to negative targets are
facilitated; the pattern is reversed for positive targets. The means for the
neutral prime condition are in between, with a slight resemblance to the
positive prime condition which, incidentally, corresponds to the distance of
the mean rating from zero for the neutral primes (see materials).

After showing a significant affective congruency effect in the lexical
decision task, we can now make the experimentum crucis between a
spreading activation account (SPAM) and the judgmental tendency version
of MIM: Varying the assignment of word targets in the lexical decision task
to either the yes and no response should make no difference according to
SPAM, whereas the affective congruency effect should hold only under the
yes-condition but be reversed under the no-condition according to MIM.

Experiment 3a - Judgmental Tendencies in the Lexical Decision Task

The spreading activation account (SPAM) of affective priming and the
judgmental tendency version of MIM make the same prediction in cases
where the factorial combination of prime and target valences are realized
under an affirmative response mode; they diverge, however, in cases where
they are realized under a no response mode. Assigning word stimuli to either
yes- or no-responses in the lexical decision task would be the critical test.
Method

Ninety-one students (sixty-seven women, twenty-four men) at a German university participated in the experiment in partial fulfillment of course requirements. Age median was 21.0 years (19 to 39 years); the data of two other persons were excluded because of extremely high response latencies and/or error rates.

Materials, design and procedure were essentially the same as in Experiment 2, except that a between-subjects factor was added. In one condition \((N = 47)\), participants were asked to respond with \textit{yes} to word targets (\textit{word=yes} condition), in the other \((N = 44)\) with \textit{no} (\textit{word=no} condition). Note that all subjects had to respond with the right hand key to words, with the left hand key to pseudo-words.

Instructions emphasized the respective \textit{yes} category (“You have to respond with \textit{YES} to words [or to pseudo-words], with \textit{NO} otherwise”). To practice this assignment, ten warm-up trials without priming were given with feedback after each trial (e.g., “Right! It was a pseudo-word. You responded correctly with \textit{YES}!” or “Wrong! It was a pseudo-word. You had to respond with \textit{YES}!”). If the response was slower than 1000 ms, the following message was added: “Your reaction time was (RT) ms. Please try to respond more quickly!” Then, the presentation of prime stimuli was explained and also practiced over ten trials. The main phase started with twenty warm-up trials as in Experiment 2. The procedure was conducted without the rating task.
Results

Mean reaction times were derived from correct responses only. The average error rate across subjects was 4.76% and 6.20% for words and pseudo-words, respectively. Reaction times which could be considered far out values (Tukey, 1977) referring to the individual distribution or were above 2000 ms were discarded as well (1.13% and 1.16% of all word and pseudo-word decisions, respectively).

Spreading activation or judgmental tendency. The results of major interest from Experiment 3a are shown in Table 3. Focusing on the last column of the reaction time data, it is easy to see that the data correspond to the judgmental tendency version of MIM. In the word=yes condition, the standard affective congruency effect emerges whereas in the word=no condition the reverse is true. Mean differences, however, are very small. In order to achieve the full statistical power of one-sided tests in answering this crucial question, planned comparisons were conducted. An index of affective congruency was built for each person, consisting of the mean of the difference negative minus positive prime (for positive targets) and the difference positive minus negative prime (for the negative targets). The index's overall negative mean of -2 ms (SE 4 ms), which, incidentally, doesn't differ significantly from zero, t(90) = -0.40, n.s. (two-tailed), is inconsistent with the spreading activation prediction. On the other hand, however, the means of the two response groups differ significantly, t(89) = 1.80, P < .05, as predicted by the judgmental tendency model. For the word=yes condition, the index took on a value of 6 ms (SE = 4 ms), which differed from zero with marginal significance, t(46) = 1.28, P = .10; for the word=no condition the
index had a value of -10 ms ($SE = 8$ ms), which differed likewise from zero with marginal significance, $t(43) = -1.30, P = .10$.

For the analysis by targets, a corresponding index for target adjectives was computed by subtracting the priming effects (i.e., the difference between the negative and positive priming conditions) of the two response categories from each other. As in the analysis by subjects, the index didn't differ from zero, $t(78) = -0.43, n.s.$ (two-tailed), but the contrast of the two target valences was significant, $t(78) = 1.93, P < .05$. For positive target adjectives, the index differed significantly from zero, $t(39) = 1.80, P < .05$, but failed the conventional level of significance for negative targets, $t(39) = -.99, n.s.$ (but, $t[38] = -1.69, P < .05$, by removing the item with the highest error rate).

Additional analyses. The results of the overall analysis showed main effects for target valence, $F(1,89) = 90.07, MS_e = 1605.54, P < .001$ for subjects and $F(1,78) = 11.29, MS_e = 13006.02, P < .001$ for targets, and for response mode, $F(1,89) = 14.10, MS_e = 31840.59, P < .001$ for subjects and $F(1,78) = 349.16, MS_e = 1144.37, P < .001$ for targets. Responses to negative targets as well as reactions in the word=no condition were slower than their respective counterparts. Additionally, there is marginally significant interaction between these two factors, $F(1,89) = 3.10, MS_e = 1605.54, P = .08$ for subjects and $F(1,78) = 4.33, MS_e = 1144.37, P < .05$ for targets, meaning that the slowing of responses from the word=yes to the word=no condition was more pronounced for positive targets.

Finally, there was a main effect for the prime contrast neutral vs. positive/negative, $F(1,89) = 5.76, MS_e = 1387.58, P < .05$ for subjects and $F(1,78) = 4.81, MS_e = 1465.34, P < .05$ for targets; responses after neutral
primes were slower than those after valenced primes. Splitting this contrast in an a posteriori analysis showed this result to be consistent with the judgmental tendency model. More precisely, the mean of the neutral conditions differed significantly from the mean of those of the valenced conditions in which the response mode is consistent with the affective congruency status (i.e., word=yes, positive target, positive prime; word=yes, negative target, negative prime; word=no, positive target, negative prime; word=no, negative target, positive prime), $t(90) = 2.87, P < .01$ for subjects and $t(79) = 2.86, P < .01$ for targets, but it does not differ from the remaining conditions, $t(90) = 1.14$, n.s. for subjects and $t(90) = 1.03$, n.s. for targets, indicating that the judgmental tendency effect is more likely due to facilitation in the consistent conditions than to inhibition in the inconsistent conditions.

To give a condensed report for the error rates, there were only two significant effects, one for target valence, $F(1,89) = 27.73, MS_e = 41.26, P < .001$ for subjects and $F(1,78) = 5.38, MS_e = 192.73, P < .05$ for targets, in the same direction as for the response latencies, and one for the target valence x prime valence interaction (contrast positive vs. negative), $F(1,89) = 6.83, MS_e = 41.21, P < .05$ for subjects and $F(1,78) = 5.63, MS_e = 48.14, P < .05$ for targets, indicating a reversed affective congruency effect for both response modes. This last result is somewhat surprising in that it corresponds to neither prediction.

**Discussion**

The results of Experiment 3a are compatible with the judgmental tendency version of MIM (Klauer, 1991; Klauer & Stern, 1992) but not with
the spreading activation account by Fazio et al. (1986). There seems to be no way of explaining the second-order interaction by means of unidirectional prime-to-target processes of facilitation or inhibition.

But there are some caveats which call for a replication before discussing any further consequences of the results. First of all, the effect is rather small, statistically significant only in a one-sided t-test. The second caveat refers to the error data with its indication of a speed-accuracy-tradeoff for the word=yes condition. Finally, one may speculate whether the result in the word=no condition might be caused by a twofold violation of expectancies: Subjects not alone had to respond with “no” to words, they also had to press the right hand key in those cases. Supposing that most subjects would naturally assign affirmative answers to the right hand key, this might be a disturbing fact. Therefore, the assignment of response mode to right and left hand key should be varied independently of the word=yes vs. word=no factor.

Experiment 3b

Experiment 3b was performed to replicate the results of Experiment 3a. To enhance the effect, some minor changes were introduced (see the Method section). Above all, a second between subjects factor was added, varying the assignment of response mode to right and left hand key, respectively.

Method

Forty-five participants (mainly students; thirty-one women; fourteen men) were recruited with the requirement of having not taken part in a lexical decision experiment before. Students of psychology participated in partial fulfillment of course requirements; the others were paid DM 5,- (DM
10,- for those who were not at place). Age median was 21.0 years (18 to 32 years); the data of one other person were excluded because of the high standard deviation of raw latencies.

Materials were essentially the same as in the foregoing experiments. To enhance effect size, material sets were increased in size from 10 to 12 stimuli, totaling 196 trials (instead of 160). The two target adjectives with the highest amount of error responses in Experiment 3a were replaced.

Instructions concerning the assignment of words to the yes- and no-response, respectively, were somewhat intensified to counteract the natural tendency of restructuring the task as the standard lexical decision task in which supposedly words are taken as “figure” and pseudo-words as “ground”. To give them a Gestalt-like character, pseudo-words were now named “Siwobs” (a German acronym for “senseless wordlike string”) in the word=no-condition; some more examples were given and fast and easy detection of “Siwobs” was emphasized. (Instructions in the word=yes-condition were of course an exact reflection.) For the practice trials, participants were encouraged to accompany key presses with “yes!” and “no!” responses in inner voice.

Results

Mean reaction times were derived from correct responses only. The average error rate across subjects was 3.31 % and 4.65 % for words and pseudo-words, respectively. Reaction times which could be considered far out values (Tukey, 1977) referring to the individual distribution or were above 2000 ms were discarded as well (1.85 % and 1.88 % of all word and pseudo-word decisions, respectively).
Spreading activation or judgmental tendency. The results of major
interest from Experiment 3b are shown in Table 3. Data were subjected to a
2 (word=yes vs. word=no) x 2 (word=right hand key vs. word=left hand
key) x target valence (positive vs. negative) x prime valence (positive vs.
negative vs. neutral) analysis of variance. As above, the prime factor was
split into two planned orthogonal contrasts (positive vs. negative and
positive/negative vs. neutral). Main result is the triple interaction of yes/no-
assignment x target valence x prime valence (contrast positive vs. negative),
corresponding to a switch of an affective congruency effect in the word=yes
condition into an incongruency effect in the word=no condition, $F(1,41) =
5.17, MS_e = 903.47, P < .05$ for subjects and $F(1, 92) = 3.79, MS_e =
5251.66, P = .05$ for targets. This replicates the result of Experiment 3a and
enhances the support for the judgmental tendency model. This result wasn’t
moderated by key assignment, both $Fs < 1$.

Additional analyses. There were main effects of yes/no-assignment,
$F(1,41) = 12.61, MS_e = 27184.56, P < .01$ for subjects and $F(1, 92) =
334.12, MS_e = 4736.81, P < .001$ for targets, of target valence, $F(1,41) =
103.33, MS_e = 1411.40, P < .001$ for subjects and $F(1, 92) = 21.03, MS_e =
28528.60, P < .001$ for targets and -- restricted to the target analysis -- of
key assignment, $F(1,41) < 1, n.s.$ for subjects and $F(1, 92) = 5.92, MS_e =
5623.02, P < .05$ for targets (right hand responses to words are somewhat
faster). Additionally, there is a significant interaction between yes/no-
assignment and target valence, $F(1,41) = 6.00, MS_e = 1411.40, P < .05$ for
subjects and $F(1,92) < 7.29, MS_e = 4736.81, P < .01$ for targets; the slowing
of responses from the word=yes to the word=no condition is more
pronounced for negative targets. This effect runs counter to the corresponding (marginally significant) interaction in Experiment 3a. All other effects proved to be insignificant, all Fs < 2.06.

As in Experiment 3a, an index of affective congruency was built for each person (the mean of the difference negative minus positive prime, for positive targets, and the difference positive minus negative prime, for the negative targets). For the word=\text{yes} condition, the index took on a value of 6 ms (SE = 5 ms), thereby missing the conventional level of significance, \( t(21) = 1.23, P = .12 \); for the word=\text{no} condition, the index had a value of -15 ms (SE = 7 ms), which significantly differed from zero, \( t(22) = -1.99, P < .05 \).

The corresponding index for target adjectives (i.e., subtracting the difference between the negative and positive priming conditions of the yes- and no-responses from each other; see above) failed the conventional level of significance for positive targets, \( t(47) = 1.03, P = .15 \), but was marginally significant for negative targets, \( t(45) = -1.63, P = .06 \).

The error data reveal the same pattern as the response times; inferential statistics, however, show the effects to be somewhat smaller. The triple interaction of yes/no-assignment x target x prime (contrast positive vs. negative) just misses the conventional level of significance in the subjects analysis, \( F(1,41) = 3.50, MS_e = 22.80, P = .07 \) (\( F[1, 94] = 2.22, \text{n.s.} \) for targets). Above that, there was a marginally significant main effect of yes/no-assignment, \( F(1,41) = 3.39, MS_e = 46.22, P < .10 \) for subjects and \( F(1, 94) = 9.24, MS_e = 87.81, P < .01 \) for targets, as well as a main effect of target valence, \( F(1,41) = 11.50, MS_e = 33.83, P < .01 \) for subjects and \( F(1, 94) = 7.68, MS_e = 190.91, P < .01 \) for targets. Concerning direction, both main
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effects correspond to the reaction time data. Additionally, there is a significant main effect of prime (contrast positive/negative vs. neutral), \( F(1,41) = 4.54, \text{MS}_\text{e} = 35.64, P < .05 \) for subjects and \( F(1, 94) = 7.33, \text{MS}_\text{e} = 100.12, P < .01 \) for targets, with a higher error rate following neutral primes. All other effects proved to be insignificant, all Fs < 2.07.

Combined analyses of Experiment 3a and Experiment 3b. To get a final clue to the reliability of the reported results, the data of Experiment 3a and 3b were merged. For the analysis by subjects, the congruency index (see above) was analysed in an ANOVA with yes/no-assignment and experiment as factors. There was a main effect of yes/no-assignment, \( F(1,132) = 6.80, \text{MS}_\text{e} = 1428.74, P < .05 \), but no main effect of experiment, \( F(1,132) < 1, \text{n.s.} \), and no interaction, \( F(1,132) < 1, \text{n.s.} \). For the word=yes condition, the index took on a value of 6 ms (SE = 3 ms), which is significantly above zero, \( t(68) = 1.70, P < .05 \); for the word=no condition the index had a value of -11 ms (SE = 6 ms), which is significantly below zero, \( t(66) = -2.07, P < .05 \). For the analysis by targets, the “yes vs. no” index (see above) differed significantly between valence categories, \( F(1,73) = 6.51, \text{MS}_\text{e} = 9439.10, P < .05 \), but not between experiments, \( F(1,73) = 1.60, \text{n.s.} \); there was no interaction of valence categories and experiment, \( F(1,73) < 1, \text{n.s.} \). For positive targets, the index was only marginally significant above zero, \( t(38) = 1.35, P = .09 \), whereas for negative targets, the index was significantly below zero, \( t(35) = -2.16, P < .05 \).

Discussion

Experiment 3b replicates the result of Experiment 3a. Again, the pattern of means conforms to the prediction of the judgmental tendency model but
not to the one of the spreading activation model. Above that, Experiment 3b shows the result to be independent from assessment mode: Sampling right hand responses reveals the same pattern as sampling left hand responses. The only result of Experiment 3a which couldn’t be replicated was the somewhat strange speed-accuracy trade off in the word=yes condition: Now, the error data mirror the response times to a great extent.

In both experiments, however, the effect is rather small. But, for a correct evaluation of this fact, one has to take into consideration the a priori probability of the data pattern which was predicted from the judgmental tendency version of MIM. Note that the crucial test corresponds to a specific form of the three-way interaction of prime valence, target valence and response assignment. The pattern of means fits this form perfectly in both experiments.

The judgmental tendency version of MIM can be added to the family of post-lexical priming mechanisms which have been proposed in the field of semantic priming (cf. Neely, 1991). Common to those mechanisms is the assumption that it is not a process beginning upon prime presentation which causes priming effects and which is therefore merely assessed by processing a target (like SPAM). Rather they suppose that the relevant process depends on the presentation of the target (and processing it according to some task); therefore the essential part of the process does not start until the beginning of the target presentation. I will discuss those mechanism very briefly to point out things in common with the judgmental tendency version of MIM and differences to it (for an overview see Neely, 1991).
Ratcliff and McKoon (1988) proposed the so-called *compound-cue-theory* of semantic priming. According to this theory, prime and target form a compound cue to memory. Associative, semantic or episodic relatedness between prime and target heightens the familiarity of the compound cue, resulting in decreased latencies. However, note that according to MIM, prime and target will be evaluated separately; affective congruency or incongruency is supposed to influence only the response process.

In their *retrospective semantic matching model*, Neely and Keefe (1989; Neely, Keefe, & Ross, 1989) made the suggestion that after lexical access to the target, the relation of the target to the prime is checked for relatedness to speed up the decision. The rationale lies in the fact that in the standard lexical decision experiment, nonwords are construed by substituting some letters of a legal word (e.g., *timato*). Thus, words as well as nonwords will activate word representations. But, normally prime-target assignment for the nonwords precludes an associative or semantic relation between the prime and the source word (e.g., *tomato*) of the target. Therefore, participants might use relatedness to bias a word response since relatedness is only a feature of word trials. In comparison with the judgmental tendency version of MIM, the *retrospective semantic matching model* would not make the prediction that varying the assignment of yes- and no-responses would alter the effect. According to this model, participants use certain contingencies between prime-target relation and correct response mode; labeling of response mode should make no difference. Above that, assuming that the pseudo-words used in Experiment 2 and 3a,b do not have any strong affective component, participants susceptible to contingencies should realize
that affective congruent as well as affective incongruent prime target pairs will predict a word target. Therefore a congruency effect will not obviously follow from the model.

The most similar theoretical supposition to the judgmental tendency version of MIM was made by West and Stanovich (1982; see also Stanovich & West, 1983) in the context of sentence priming, i.e., paradigms with complete or fragmented sentences as a prime context for target words. They supposed that incongruent sentence target pairs will trigger a tendency to negate (in the sense of "This is a wrong statement!"); conversely, congruent pairs might trigger a tendency to affirm. The authors claimed that the lexical decision task might be implicitly coded as requiring yes- (it is a word) and no- (it is not a word) responses; match or mismatch between judgmental tendency and required response will then produce priming effects. De Groot (1984, 1985) transferred this explanation to the standard word prime paradigm and called the supposed mechanism post-lexical coherence checking or meaning integration (see Holender, 1992, for an incorporation of those suggestions into a larger framework for explaining congruity effects in response latency paradigms). But note that MIM is more specific to the processing of affective stimuli. From a MIM-perspective it is easily understandable that Klauer et al. (1995) found no affective priming effects with the lexical decision task. They used adjective-adjective pairs instead of noun-adjective pairs. Whereas noun-adjective pairs fit the standard form of a judgmental inquiry (e.g., "Is DEATH wise?") this is not the case for adjective-adjective pairs (compare "Is lonely wise?"). Therefore the latter
would certainly evoke an automatic judgmental tendency to a lesser degree than the former.

General Discussion

To summarize, the main line of results and arguments is as follows.

(1) The evaluation task, commonly used in affective priming research, has much more in common with Stroop-like tasks than with the semantic priming paradigm: It confounds response categories with factorial combinations. Therefore, affective priming effects in the evaluation task might be due to interference and, possibly, facilitation processes concerning competing or concurrent pathways from stimulus to response.

(2) To explore this possibility, the hypothesis of negative priming effects in the evaluation task was formulated according to the Stroop-analogue (but not the semantic priming analogue). According to this hypothesis, response conflicts in trial n-1 will result in an inhibition of the target response in the n-th trial if the valence of the target matches the valence of the to-be-ignored pre-trial prime. As the results clearly showed, the hypothesis of a negative affective priming effect stood the test.

(3) In the lexical decision task, priming effects cannot be explained by response conflicts because the crucial factorial variations are all within one response mode. Experiment 2 provided additional evidence for affective priming effects in the lexical decision task.

(4) However, for affective priming effects in the lexical decision task the judgmental tendency model of Klauer (1991; Klauer & Stern, 1992) can be applied. This model was confirmed in Experiment 3a and 3b. Presentation of prime and target creates a tendency to answer the question "Is (prime)
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(target)?” (e.g., “Is DEATH wise?”), at least in cases where primes are nouns and targets are adjectives. Accordingly, match or mismatch of prime and target evaluation triggers an automatic tendency to answer in an affirmative or negative way, respectively.

Overall, the results from the experiments converge on the conclusion that in both paradigms, presentation of an affectively laden to-be-ignored prime has obtrusive effects on processing the target. It seems that there is a strong tendency for affective information to “meddle” with the formation of responses. Depending on frame of reference, this gives rise to a narrower and yet broader view of affective processing than suggested by the spreading activation account. According to the spreading activation account processing of the prime leads to a flow of activation from the prime node via a corresponding affect node to all other nodes whose concepts are evaluatively congruent. Thus, prime presentation alters the state of memory by shifting the accessibilities of concepts. This process is rather unobtrusive, noticeable at a behavioral level only through changed probabilities of using facilitated and non-facilitated concepts. Instead, the present data suggest that affective priming effects are based on the independent and automatic extraction of the affective component of both primes and targets. Depending on task, different processes of facilitation and interference are triggered by these components. In the evaluation task, automatic extraction of prime valence may trigger the corresponding response, thus producing interference with or facilitation of processing the target. In the lexical decision task, however, there is a tendency to judge the prime-target relationship as true or false according to a match or mismatch of valences.
In conclusion, to state it with a spatial metaphor, the prime influences information processing in a narrow "vertical" channel from perception to response. The spreading activation model, however, suggests the view of a broad "horizontal" influence, i.e., spreading of activation, solely on a representational level. Whereas the latter view reveals nothing about the special character of affective information processing, the former one finds more agreement with other studies in this domain (e.g., Pratto & John, 1991; Roskos-Ewoldsen & Fazio, 1992; Wentura et al., 1997).

Let us now move beyond the "meddling-in" metaphor to examine the functional organization of cognitive processes involved in affective priming. The framework established by Houghton and Tipper (1994) for their connectionist model of selective attention, supplemented with mechanisms for processing affective information, might be a good starting point. Houghton and Tipper (1994) postulate four highly interrelated subsystems: (1) The object field, containing the units representing external world objects, which is connected to (2) the response system, containing basic response schemata (like grasping, naming etc.); (3) a target field, representing the properties of an internally generated attentional target, i.e., the specification of the properties of to-be-selected objects with regard to a current goal (e.g., color of a stimulus in a Stroop task); (4) a match/mismatch detector, integrating inputs from both the object field and the target field and linked through backward channels with the object field to enhance relevant and inhibit irrelevant object representations.

At a more fine-grained level of analysis, the object field contains opponent-process circuits, i.e., each property unit (representing the presence
of some feature in the input) is linked to gain-control units ("on"- and "off"-cells). Relevant as well as irrelevant stimuli will activate corresponding property units. In a parallel cascade-like process, activated property units compete for activation of response schemas, filling the variable slots of these schemas. To channel this process and to prevent chaotic behavior, the object field is coupled through parallel forward and backward links to the match/mismatch system. Above the forward activation from the property units of the object field, this system gets activation from internally driven inputs, i.e., from the representation of current goals and plans in the target field. In the match/mismatch-field, activation of the unit representing a discriminating feature of relevant and irrelevant stimuli (e.g., color or locality) will cause the initiation of backward activation for the corresponding "on"-cell of the relevant property unit and the "off"-cell of the irrelevant unit. Due to the high interrelatedness of property units corresponding to the same stimulus, a settling process will transform this kernel asymmetry into an activation of all property units corresponding to the relevant stimulus and into a suppression of all units corresponding to the irrelevant stimulus. Interference, i.e., the initial activation of both the relevant and irrelevant information, will vanish, and only the relevant information will get access to the response system.

Now, an affective vigilance subsystem can be added, connected with forward and backward links to the object field and with forward links to the response system. Affective connotation of stimuli corresponds to excitatory links from the property units representing the stimulus to units either representing the positive or the negative connotation within the affective
subsystem. Backward links will strengthen activation of the property units of the object, thereby reflecting the unspecific relevance of the stimulus. (Note that this does not necessarily imply that the representations of all objects being affectively congruent to the one presented are activated; see for example the interplay of bottom-up and top-down processes in the model of Grossberg, 1987; Grossberg & Stone, 1986).

Above that, the affective subsystem has access to the response system. As Houghton and Tipper (1994) point out, there is a "competitive variable binding" of property units to slots in action schemas. Above that, it can be assumed that there is a competition between the schemas themselves. The affective subsystem might be linked to various action schemas, from rather unspecific approach (e.g., grasping) or avoidance (e.g., pushing) schemas to more specific, linguistic forms (e.g., judgments, evaluations).

In the evaluation task, the relevant action schema has two variable slots: The word which is to be evaluated (the object slot) and the evaluation as positive or negative itself (the evaluation slot). The affective subsystem will deliver the evaluation information whereas the cascade process from the object field to the response system will result in filling the object slot. Due to one or more features (temporal sequence, noun vs adjective, upper case vs lower case letters), one stimulus is task-relevant (the target), the other task-irrelevant (the prime). In cases of a neutral prime, the match/mismatch-system will create the necessary imbalance at a fast rate because the units representing the prime will get only inhibitory signals. The affective subsystem has no conflicting input and therefore will provide the response system with the adequate activation at a fast rate. Now take the case of
affective congruency. Concerning the object slot, the match/mismatch-system will solve the conflict as usual, maybe somewhat prolonged due to the additional activation of the irrelevant stimulus from the affective subsystem. But, in the affective subsystem only the positive or the negative component will be activated. Therefore the variable binding for the evaluation slot of the action schema will be provided easily. In the context of a response time experiment with its instruction for fast responding, conflict solving concerning the object slot has not been waited for. In contrast to this, in cases of incongruency there is a conflict in the object field as well as in the affective subsystem. The slots of the action schema cannot be filled until the backward process from the match/mismatch-system has created an imbalance of activation for relevant and irrelevant properties including the components of the affective subsystem. This slows down the response in the actual trial and will lead to negative priming in the following trial, since following presentation of the irrelevant stimulus activation levels of associated property units (including the corresponding positivity or negativity unit) will go below resting levels, as Houghton and Tipper (1994) have shown (see discussion section of Experiment 1).

In the lexical decision task, the affective components are not relevant to the task. The action schema has only one slot: Since a word -- compared to a nonword -- will produce more "resonance" in the object field (i.e., will activate more property units), the decision will largely be based on this flow of activation to the response system. (In more introspectively couched terms: The decision will largely be based on "familiarity".) This reconstruction does not explain why affectively congruent and incongruent prime-target pairs
should make a difference on response times since it is a conflict in the object field which has to be resolved. The match (in cases of congruency) or mismatch (in cases of incongruency) in the affective subsystem does not matter. But, the judgmental tendency version of MIM would predict the following scenario. An alternative action schema is largely supported by a series of features: Pairs of words (feature one) consisting of a noun and an adjective (feature two) which are affectively connotated (feature three) were presented in close succession (feature four), thereby triggering a judgmental action schema. Response generation in this schema is susceptible for signals of the affective subsystem in the way it is outlined above: Affective congruency is transferred into a tendency to respond with "yes", affective incongruency to respond with "no". The blending of the two action schemas will be supported by the fact that the lexical decision task requires -- implicitly -- a yes/no-decision.

As mentioned in the introduction, some evidence for affective priming effects in the pronunciation task were found as well (Bargh et al., 1996; Hermans et al., 1994). In semantic priming research the pronunciation task is reputed to be a means for assessing "pure" automatic activation processes instead of "post-lexical" processes (see Neely, 1991). Therefore SPAM seemed to be the most parsimonious explanation for affective priming effects in this task, and I cannot rule out this possibility. But, there are some arguments suggesting that this is not a strong challenge to the position advocated in this text. First, there are some studies failing to show the affective-priming effect in the pronunciation task (Hermans, 1996; Klauer et al., 1995; Klauer, in press). Second, even in semantic priming research there
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is some evidence of priming effects which can only be attributed to the production stage of the pronunciation task (Balota, Boland, & Shields, 1989), thereby giving some doubts on the reputation described above. Last, as was shown in Experiment 3a,b for the lexical decision task, it may be questionable whether the logic of processing neutral stimuli could be applied to the field of affective information processing. Thus, it might be allowed to give some speculations with regard to the pronunciation effects in light of the present results and theories. Although there are obvious discrepancies, the pronunciation task resembles both the evaluation task and the lexical decision task in some respect, and thus any results obtained using this task will remain somewhat ambiguous. However, assume for a moment, that in the pronunciation task there is essentially the same rivalry between prime and target as in the evaluation task. It might be assumed that there are some basic differences in the way positive and negative words (taken as a whole) are typically pronounced (see Gardner, 1985, for indications), i.e. -- in terms of the model -- some variable slots of the corresponding action schema are connected to the affective subsystem. In cases of affective incongruency this will result in an interference. On the other hand, looking at the pronunciation task from the perspective of the jugmental tendency version of MIM, one might speculate whether speaking aloud the attribute in question in a jugmental context is something like an affirmative answer. Then, we will get the same blending of action schemas as was described above.

In this framework, even the results of related experimental tasks can be easily accommodated. In the emotional stroop task, for example, affective stimuli are presented in different colors, which are to be named (Pratto &
John, 1991; Pratto, 1994; Wentura et al., 1997). The heightened interference for (certain types of) affective stimuli might be explained by the working of the affective subsystem. In contrast with neutral words, the affective words will get not only inhibitory signals from the match/mismatch-system but also activation from the affective vigilance mechanism. Therefore, establishing the required imbalance between relevant (i.e., color) and irrelevant (i.e., content) features of the stimulus will take longer. Moreover, action schemas other than the (color-)naming schema might be activated by the affective subsystem and will produce interference in the response system as well. This last point is especially suited to explain the finding of Wentura et al. (1997), according to which not valence in itself causes interference in the emotional Stroop-task, but certain subtypes of valence. Namely, the effect was restricted to those stimuli tied more-or-less directly to approach or avoidance in social contexts. In terms of the model, it might be assumed that the content of these words fit more easily approach or avoidance schemas triggered by the affective subsystem, thereby causing more interference in the response system.
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Footnotes

1 Far out are those values which are three interquartile ranges above the third quartile.

2 This procedure was chosen throughout the text due to the following rationale. Reports of “overall” effects of the prime factor (i.e., tests with two degrees of freedom for the numerator due to the three conditions) are not informative: An “overall” effect might be significant due to the deviation of the neutral condition from the valent ones - a result which hardly is implied by any model; or the “overall” effect might be only near-by significant due to the fact that all systematic variance is bound to the contrast of interest (being significant with one df). In any case, the most meaningful test contrasts the positive and negative prime conditions. Thus a second orthogonal contrast has to be ‘neutral prime vs. the mean of the two valenced conditions’. Due to the notorious problems with neutral prime conditions (e.g., Jonides & Mack, 1984; de Groot, Thomassen, & Hudson, 1982), I don’t want to put much emphasis on the neutral primes (e.g., a neat analysis of costs and benefits). But, the second contrast might indicate whether it is absolute valence of a prime which causes effects.

3 Except, of course, for the main effect of test-trial target valence. This effect of faster (and less error-prone) decisions for positive targets was significant in almost all analyses of Experiment 1 (at least for subjects as the random variable) and will not be mentioned in the following.

4 Adding this condition establishes an additional 2 (word targets vs. pseudo-word targets) x 2 (word primes vs. pseudo-word primes) design.
(Note that the pseudo-word target type is already an essential part of the lexical decision task.) In Experiment 2 as well as in Experiment 3, there were slower latencies following the pseudo-noun primes compared to noun-primes. This effect wasn’t moderated by target type (i.e. word targets vs. pseudo-word targets) and might be due to the attention-grabbing effect of these unfamiliar items. Because this effect doesn’t add anything to the main line of argument, I have not discussed this point further.

5 A random assignment of primes to targets may result in a certain rate of semantic related pairs per subject, with the consequence of a moderate semantic priming effect.

6 Further pilot work suggested this step since “naive” participants seem to be more willing to adopt the explicit yes/no-assignment instruction in the lexical decision task.

7 Experiment 8. In a follow-up study (Experiment 9), the affective priming effect was found at a SOA of 150 ms, but not at 300 ms.
### Table 1

#### Design, Sample Items and Results of Experiment 1

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<th>Test-Target Valence</th>
<th>Negative</th>
<th>Positive</th>
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<tbody>
<tr>
<td><strong>Experimental Trials</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-trial Prime:</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Prime:</td>
<td>(DEATH)</td>
<td>(PEACE)</td>
</tr>
<tr>
<td>Target:</td>
<td>(wise)</td>
<td>(wise)</td>
</tr>
<tr>
<td>Probe trial Prime:</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Prime:</td>
<td>(HHHH)</td>
<td>(HHHH)</td>
</tr>
<tr>
<td>Target:</td>
<td>(lonely)</td>
<td>(lonely)</td>
</tr>
<tr>
<td>Hypothesis:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT (ms)</td>
<td>677</td>
<td>645</td>
</tr>
<tr>
<td>(Error, %)</td>
<td>(10.3)</td>
<td>(7.9)</td>
</tr>
<tr>
<td><strong>Control Trials</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-trial Prime:</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Prime:</td>
<td>(DEATH)</td>
<td>(PEACE)</td>
</tr>
<tr>
<td>Target:</td>
<td>(vicious)</td>
<td>(vicious)</td>
</tr>
<tr>
<td>Probe trial Prime:</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Prime:</td>
<td>(HHHH)</td>
<td>(HHHH)</td>
</tr>
<tr>
<td>Target:</td>
<td>(lonely)</td>
<td>(lonely)</td>
</tr>
<tr>
<td>Hypothesis:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT (ms)</td>
<td>660</td>
<td>660</td>
</tr>
<tr>
<td>(Error, %)</td>
<td>(5.6)</td>
<td>(9.2)</td>
</tr>
</tbody>
</table>

**Note:** The signs stand for word stimuli with the designated affective connotation (• stands for neutral primes; sample stimuli in parentheses (see text for further explanations).
Table 2
Results from Experiment 1 (Negative Priming Effects\textsuperscript{a} for Type of Probe Trial)

<table>
<thead>
<tr>
<th>Type of Probe Trial</th>
<th>Neutral</th>
<th>Conflict</th>
<th>Non-conflict</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaction times (ms)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental Trials\textsuperscript{b}</td>
<td>37**</td>
<td>28*</td>
<td>10</td>
<td>25***</td>
</tr>
<tr>
<td>Control Trials\textsuperscript{c}</td>
<td>0</td>
<td>27**</td>
<td>-19</td>
<td></td>
</tr>
<tr>
<td>Error rates (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental Trials\textsuperscript{b}</td>
<td>0.4</td>
<td>-3.4*</td>
<td>4.3*</td>
<td>0.4</td>
</tr>
<tr>
<td>Control Trials\textsuperscript{c}</td>
<td>-3.0</td>
<td>4.4**</td>
<td>1.1</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a}Negative minus positive pre-trial prime condition for negative probe trial targets and positive minus negative pre-trial prime condition for positive probe trial targets.

\textsuperscript{b}Probe trial target with opposite valence as the pre-trial target.

\textsuperscript{c}Probe trial target with same valence as the pre-trial target.

*** $p < .001$, ** $p < .01$, * $p < .05$. 
Table 3
Results from the Lexical Decision Experiments 2, 3a, 3b

<table>
<thead>
<tr>
<th>Target Valence</th>
<th>Prime Valence</th>
<th>Affective Priming&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td>Positive</td>
<td>617</td>
<td>630</td>
</tr>
<tr>
<td>Neutral</td>
<td>553</td>
<td>561</td>
</tr>
<tr>
<td>Neutral</td>
<td>522</td>
<td>523</td>
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<tr>
<td>Neutral</td>
<td>626</td>
<td>617</td>
</tr>
<tr>
<td>Neutral</td>
<td>594</td>
<td>584</td>
</tr>
<tr>
<td>Neutral</td>
<td>6 (3)</td>
<td></td>
</tr>
<tr>
<td>Standard Instructions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experiment 2</td>
<td>1.2</td>
<td>2.2</td>
</tr>
<tr>
<td>Experiment 3a</td>
<td>3.2</td>
<td>2.3</td>
</tr>
<tr>
<td>Experiment 3b</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Experiment 3a</td>
<td>5.9</td>
<td>3.0</td>
</tr>
<tr>
<td>Experiment 3b</td>
<td>3.6</td>
<td>1.4</td>
</tr>
<tr>
<td>Word = yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experiment 3a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experiment 3b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exp. 3a and 3b combined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Word = no</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experiment 3a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experiment 3b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exp. 3a and 3b combined</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Mean of negative minus positive prime condition (for positive targets) and positive minus negative prime condition (for negative targets); standard errors in parentheses.