RUNNING HEAD: Associations in evaluative priming

Does sunshine prime loyal… or summer? Effects of associative relatedness on the evaluative priming effect in the valent/neutral categorization task

Benedikt Werner[1], Elisabeth von Ramin[1], Adriaan Spruyt[2], & Klaus Rothermund[1]

[1]Friedrich-Schiller-University Jena, [2]Ghent University

WORD-COUNT: 4480 (main text + footnotes)

Address correspondence to:

Benedikt Werner

Friedrich-Schiller-Universität Jena

Institut für Psychologie

Am Steiger 3, Haus 1

D-07743 Jena

Germany

E-mail: benedikt.werner@uni-jena.de

Abstract

After 30 years of research, the mechanisms underlying the evaluative priming effect are still a topic of debate. In this study, we tested whether the evaluative priming effect can result from (uncontrolled) associative relatedness rather than evaluative congruency. Stimuli that share the same evaluative connotation are more likely to show some degree of non-evaluative associative relatedness than stimuli that have a different evaluative connotation. Therefore, unless associative relatedness is explicitly controlled for, evaluative priming effects reported in earlier research may be driven by associative relatedness instead of evaluative relatedness. To address this possibility, we performed an evaluative priming study in which evaluative congruency and associative relatedness were manipulated independently from each other. The valent/neutral categorization task was used to ensure evaluative stimulus processing in the absence of response priming effects. Results showed an effect of associative relatedness but no (overall) effect of evaluative congruency. Our findings highlight the importance of controlling for associative relatedness when testing for evaluative priming effects.

(160 words)

Key words: evaluative priming; associations; encoding facilitation; response priming; feature-specific attention allocation; valent/neutral categorization;

Not long after its introduction, the evaluative priming paradigm (Fazio, Sanbonmatsu, Powell, & Kardes, 1986) became an object of discussion with regard to the mechanism(s) that drive the observed effect: A valent target stimulus is categorized faster in an evaluation task if it is preceded by a brief presentation of an evaluatively congruent prime stimulus as compared to an evaluatively incongruent prime stimulus. Due to the evaluative priming paradigm's apparent similarities to associative priming paradigms, spreading of activation—or in more general terms, encoding facilitation—was one of the first explanations for this effect (e.g., Fazio et al., 1986; see also Bargh, Chaiken, Raymond, & Hymes, 1996). This view, however, was later contested on theoretical grounds. It was argued that the activation of one valent concept must be insufficient to pre-activate the vast number of concepts that share the same valence. Indeed, the strength of pre-activation should be inversely proportional to the number of mental links (i.e., the fanning effect; Anderson, 1974) and should thus become marginal if activation is assumed to be distributed evenly across all evaluatively congruent concepts (e.g., Bargh et al., 1996; Klauer & Musch, 2001; Rothermund & Wentura, 1998).[1]

Eventually, the account of response interference became more prominent (e.g., Klauer, Roßnagel, & Musch, 1997; Wentura, 1999). According to that perspective, evaluative priming effects reflect a Stroop-like interference effect due to an overlap between prime features and the response set, at least in the classic evaluation task. It is assumed that prime and target stimuli independently elicit a tendency to respond with the corresponding key press (e.g., Eder, Leuthold, Rothermund, & Schweinberger, 2012). These responses are in conflict if the stimulus pair is evaluatively incongruent, leading to delayed responding as compared to evaluatively congruent stimulus pairs, in which prime and target evoke the same response, resulting in response facilitation.

Eliminating the confound between evaluative congruency and the overlap between the response set and the prime set, for example, by using a pronunciation task or lexical decision task, typically eliminates the evaluative priming effect (e.g., De Houwer, Hermans, Rothermund, & Wentura, 2002; Klauer & Musch, 2001; Rothermund & Wentura, 1998; Voss, Rothermund, Gast, & Wentura, 2013; Wentura, 1999). This observation is in line with the proposed Stroop-like response interference mechanism, which is further supported by the fact that variables known to influence the Stroop effect exert a similar influence on the evaluative priming effect (e.g., stimulus contingencies, negative priming; Klauer et al., 1997; Wentura, 1999; see also Spruyt et al., 2007).

Accordingly, it is widely accepted that response interference is the main source driving the evaluative priming effect in the evaluative categorization task, whereas the contribution of encoding facilitation is typically ruled out as an underlying mechanism. More recently, however, Spruyt, De Houwer, Hermans, and Eelen (2007) re-introduced the idea of encoding facilitation with the important qualification that the activation of prime valence in evaluative priming paradigms requires that attention is allocated to the dimension of valence and only then translates into a facilitated encoding of an evaluatively congruent target stimulus. In most of their studies, attention was manipulated by having a primary task, in which participants were asked to categorize targets on the crucial to-be-attended dimension in 75 % of all trials, and a secondary task, in which participants were asked to categorize targets on another semantic dimension (e.g., animal vs. object) in 25 % of all trials (in later experiments, the non-evaluative semantic task was replaced by a pronunciation/naming task, e.g., Spruyt, De Houwer, & Hermans, 2009). A crucial finding of these studies was that a facilitation effect of evaluative congruency can be obtained in a secondary task that does not contain evaluative responses if attention is allocated to the valence dimension in the primary task.

While Spruyt and colleagues remained uncommitted with regard to the processes mediating evaluative congruency effects in tasks without dimensional overlap between the prime set and the response set (e.g., Spruyt et al., 2009), they gathered substantial empirical evidence showing evaluative congruency effects in the absence of such an overlap when attention was allocated to valence, just as predicted by their account of feature-specific attention allocation (FSAA).[2] Thus, the question whether processes of encoding facilitation might be involved in evaluative priming had been raised once again.

In a recent set of studies, Werner and Rothermund (2013) directly tested the idea of valence-based encoding facilitation, taking into account that attention to valence might be a prerequisite for evaluative stimulus processing and thus for the occurrence of evaluative congruency effects in the absence of dimensional overlap between the response set and the prime set. They introduced a new task to examine evaluative priming effects (i.e., the valent/neutral-categorization task) that requires valence processing (a) without relying on a potentially interfering secondary task and (b) while still avoiding a prime-response feature overlap for the critical primes. In this task, participants are asked to classify target words as either valent (i.e., being either positive or negative) or neutral (i.e., being neither positive nor negative), thus placing stimuli of both positive and negative valence into the same response category, which eliminates the confound between evaluative congruency of prime-target pairs and response priming. In Werner and Rothermund (2013), no evaluative congruency effect emerged with the valent/neutral-categorization task, despite the fact that valence is a relevant feature in this task, thereby implying that attention allocation to the valence dimension is not sufficient to guarantee encoding facilitation for valence-congruent targets.

Spruyt (2014) and Rothermund and Werner (2014) continued to argue for and against the possibility of finding evaluative priming effects in the valent/neutral-categorization task, respectively, before Spruyt and Tibboel (2015) reported an evaluative congruency effect in the task with an experimental setup that closely resembled the task that was used by Werner and Rothermund (2013). In trying to identify the reason for this discrepancy in findings, researchers of both groups agreed that one possibly crucial difference between these two studies was the material used. Specifically, the studies differed with regard to the possible influence of non-evaluative associative relatedness. While Werner and Rothermund (2013) directly controlled for the impact of non-evaluative associative relatedness by using a fixed set of primes and targets that were associatively unrelated, prime-targets pairs were created by random assignment from a large pool of words in the study by Spruyt and Tibboel (2015). It can be argued that non-evaluative relatedness is more likely to occur within randomly selected evaluatively congruent stimulus pairs than among evaluatively incongruent primes and targets (Hermans, Smeesters, De Houwer, & Eelen, 2002; see also Klauer, Becker, & Spruyt, 2016). Semantic associations might thus have been a confounding factor in Spruyt and Tibboel (2015), possibly accounting for the evaluative congruency effect that was obtained in their study. Since Werner and Rothermund (2013) demonstrated that associative relatedness can produce facilitation effects in the valent/neutral categorization task, it seems key to further scrutinize the degree to which associative relatedness boosts the ‘evaluative’ priming effect in this task.

In order to control and check for such a possibility, we conducted another study using the valent/neutral-categorization task in which evaluative and associative relatedness were manipulated orthogonally (cf., Hermans et al., 2002). Half of the congruent and incongruent prime-target pairs consisted of associatively related words, whereas the other half of the prime-target pairs in the congruent and incongruent conditions consisted of non-associated pairs. This set-up allowed us to test the hypothesis that an evaluative congruency effect would emerge when evaluative and associative relatedness are confounded (i.e., when comparing associated pairs in the congruent condition with non-associated pairs in the evaluatively incongruent condition), but that this effect would turn into an evaluative incongruency effect when incongruent prime-target pairs are associated to a larger degree than congruent prime-target pairs (i.e., when evaluatively incongruent prime-target pairs were made up of associated word pairs that are compared to non-associated evaluatively congruent pairs). Besides these specific tests, balancing associative relatedness across evaluatively congruent and incongruent conditions also provides an unbiased overall test of evaluative congruency effects in the valent/neutral task.

Method

Sample. Participants were 91 students of various fields of study of the University of Jena, Germany, who participated for course credit and a small incentive (piece of cake) that could be achieved by good performance (more than 80 % correct and fast responses). Two of these participants did not perform well enough in the practice trials to continue to the main task. The remaining 89 participants were 21.6 years old on average (*SD* = 3.7 years) and 73 of them were female.

Materials. In order to systematically manipulate associative and evaluative relatedness, new word materials were created and validated. We generated 60 evaluatively congruent and incongruent pairs of words that were deemed to contain a high degree of associative relatedness. These pairs were combined with 56 other valent word pairs that had no obvious associative relation. In a pilot study, we asked 86 participants to rate each word pair of the list with regard to the strength of its associative relation: "You are to assess word pairs with regard to how strongly the two words of the pair are connected to each other. […] Two words are strongly connected ('associated') exactly when upon reading the first word, the second word comes to mind spontaneously (e.g., this is the case for the pairs bread–butter or heat–cold). So, this is not about judging whether the two words have the same meaning; this is neither the case for bread–butter nor for heat–cold. Instead, try to judge whether the respective second word is the first thing coming to your mind after reading the first word of the pair. Use the scale (1 = not at all connected to 7 = very strongly connected) to judge for every word pair how much the second word is activated by the first one." We then selected 36 associated pairs for the experiment in such a way that the associative strength of congruent (n = 18) and incongruent (n = 18) word pairs was comparable ($M_{\text{congruent}}$ = 5.94, $SD_{\text{congruent}}$ = 0.41 and $M_{\text{incongruent}}$ = 5.67, $SD_{\text{incongruent}}$ = 0.34).[3] Non-associated pairs for the final experiment were created by reassigning prime and target words from the associated pairs in a way that excludes (non-valent) associative relatedness. For this purpose, targets from the evaluatively congruent associated pairs were combined with prime words from the evaluatively incongruent associated pairs and vice versa. This way of constructing the non-associated pairs (a) prevented that the same prime always preceded a target of the same valence, which made it impossible to predict the target valence on the basis of the prime valence, and (b) guaranteed that the relevant comparisons for our hypothesis always referred to the same set of target stimuli (i.e., we wanted to compare associated congruent pairs to non-associated incongruent pairs and associated incongruent pairs to non-associated congruent pairs, see above). Besides valent words, the valent/neutral-categorization task requires the same amount of evaluatively neutral words. For the neutral materials, we selected a subset of the word pairs (n = 36 pairs) that were used in Experiment 1 of Werner and Rothermund (2013). In total, the material consisted of 72 primes and 72 targets. 50 % of the primes and targets were neutral (n = 36), the other half consisted of valent words (50 % positive, 50 % negative). For the experiment, every prime was paired with two valent (one positive and one negative) and two neutral targets, and each target was paired with two valent (one positive and one negative) and two neutral primes, resulting in a fully balanced design (25 % valent-valent, 25 % neutral-neutral, 25 % valent-neutral, and 25 % neutral-valent trials). Assignment of primes and targets was fixed across all participants, containing the associated prime-target pairs for the associated condition, and the non-associated combinations for the control condition. In sum, this resulted in 288 fixed pairs (see Table 1 in the Appendix for an overview of the final set of stimuli).

Procedure. Participants were instructed and tested on standard computer screens. All text was presented in white on a black background. Participants were told that on each trial of the valent/neutral categorization task, they would encounter two nouns in quick succession and that they would have to respond to the second one while the first one could be ignored. They were asked to categorize these nouns as neutral or valent (i.e., positive or negative) by pressing the according key. “Neutral” was always assigned to the left key (“D”), “positive/negative” was assigned to the right key (“K”). The two category labels were displayed in the respective top left and right corner of the screen during the entire experiment.

Each trial started with a fixation cross for 500 ms, followed by a blank screen[4] for 200 ms and the prime word for 150 ms. Another blank screen followed for 50 ms (SOA = 200 ms) before the target was presented until the participant responded. The inter-trial interval consisted of a blank screen that was presented for a duration of 250 ms. Before the main task, participants had to practice the task for 32 trials. During the practice block, a feedback screen was presented for

1000 ms immediately after each response, informing the participant whether the response was correct, incorrect, or too slow. The practice trials had to be repeated in case a participant responded incorrectly or slower than 1000 ms in more than 8 of the practice trials. If a participant failed to meet the performance criteria also during the second round of the practice block, the experiment was terminated at that point. The 288 prime-target pairs were then presented to each participant in an individually randomized order. After 144 trials (half-time), participants were allowed to take a break and could continue with the task by pressing a specified key. At the end of the experiment, participants were thanked and told whether they had fulfilled the performance criteria to receive a piece of cake.

Results

Our analyses were restricted to trials on which valent targets were preceded by valent primes because only those trials allow for an analysis of evaluative congruency effects. Reaction times were examined only for trials with a Reaction times that were either below 250 ms or that were more than 3 interquartile ranges above the 75th percentile of an individual's response time distribution (i.e., "far-out" values according to Tukey, 1977) were discarded. An inspection of the accuracy rates for specific items revealed that some of the target words were associated with very high error rates. Accordingly, targets which appeared as far-out values in terms of accuracy (less than 60 % correct categorizations) were removed from the analyses as well (three valent targets: "Strand" [beach], "Schlange" [snake], "Schlaf" [sleep]; one neutral target: "Weise" [mode, can be mistaken for the adjective wise]).[5]

Overall analyses revealed no indication whatsoever of an evaluative congruency effect, $t < 1$, with mean response latencies being identical on evaluatively congruent trials (M = 613 ms, SD = 87 ms) and evaluatively incongruent trials (M = 611 ms, SD = 81 ms). We did find, however, that responding was generally faster for associatively related pairs (M = 605 ms, SD = 86 ms) than for non-associated pairs (M = 620 ms, SD = 82 ms), $t(88) = 4.24$, $p < .001$, $d_z = 0.48$. To test the hypothesis that associative relatedness can mimic an effect of evaluative congruency if associatively related prime-target pairs are overrepresented in the congruent condition, but will feign an evaluative incongruency effect if associations are overrepresented among the incongruent pairs, we conducted two a priori planned comparisons. In a first test, we compared reaction times for evaluatively congruent, associated trials (M = 610 ms, SD = 93 ms) to evaluatively incongruent, non-associated trials (M = 624 ms, SD = 84 ms), resulting in the predicted congruency effect, $t(88) = 2.794$, $p = .006$, $d_z = 0.3$. In a second test, we compared reaction times for evaluatively incongruent, associated trials (M = 600 ms, SD = 84 ms) to evaluatively congruent, non-associated trials (M = 615 ms, SD = 86 ms), resulting in the predicted incongruency effect, $t(88) = 3.261$, $p = .002$, $d_z = 0.33$. A similar pattern of results was found for the error rates. However, the only effect reaching marginal significance was the overall effect of association, $t(88) = 1.77$, $p = .079$.

As it was a concern in Werner and Rothermund (2013) that response competition processes (i.e., the difference between response-compatible [valent-valent, neutral-neutral] and response-incompatible [valent-neutral, neutral-valent] trials) might interfere with an evaluative congruency effect (Spruyt & Tibboel, 2015), it was checked whether the magnitude of the response priming effect was correlated with either the evaluative priming effect or the association effect. In line with Werner and Rothermund (2013), we did find a highly significant response priming effect in the current study, $t(88) = 11.69$, $p < .001$, $d_z = 1.25$, but this effect was unrelated to the three priming effect variables, all $|r| < .168$, $p > .116$.

Finally, we conducted a series of post hoc power analyses to evaluate the potential robustness of null-finding for the evaluative congruency effect that was obtained in the overall analysis (all power analyses were conducted with G*Power, version 3.1.9.2, by Faul, Erdfelder, Lang, & Buchner, 2007). Given a sample-size of 89 participants, the present study had sufficient test power (i.e., $1 - \beta \geq .80$) to detect even fairly small effects ($d_z \geq 0.265$). We cannot rule out, however, that small-sized congruency effects ($d_z \leq 0.265$) might have gone undetected in our study, since the power to detect these effects was insufficient (i.e., $1 - \beta \leq .80$).

Discussion

The present study replicates the null finding for evaluative congruency that was reported by Werner and Rothermund (2013) while controlling for the impact of associative relatedness. As indicated by post hoc power-analyses, even fairly small effects would have been detected given the sample size of our study. The additional finding of a significant influence of (non-evaluative) associative relatedness among the valent prime-target pairs highlights the possibility that these associations might feign an evaluative priming effect if not properly controlled for. This was demonstrated by the significant congruency effect that was obtained for the comparison between associated congruent pairs to the non-associated incongruent condition in our experiment. Our findings thus demonstrate the possibility that effects of associations might mistakenly be attributed to effects of evaluative congruency. Since a larger degree of non-evaluative semantic overlap and/or associative relatedness is more likely to occur within evaluatively congruent word materials, such a confound provides a possible explanation for the occurrence of evaluative congruency effects in previous studies employing a design that assigns primes and targets randomly without controlling for or eliminating associated prime-target pairs. We want to note that our study did not provide positive evidence for such an influence of associations in previous studies that used such a randomized assignment. That is, we did not reanalyze the data by Spruyt and Tibboel (2015), on the basis of a post hoc classification of associative strength. Still, we did demonstrate the potential danger that such a confound might have influenced the results. Of course, the present results cannot rule out the possibility that other procedural differences between Werner and Rothermund (2013) and Spruyt and Tibboel (2015) might also contribute to the observed discrepancy between the two sets of studies (for a discussion, see Spruyt & Tibboel, 2015).

Since the inception of the hypothesis tested in this article, independent recent research also hints at its plausibility. Klauer et al. (2016) tried to replicate a study by Spruyt and Hermans (2008) in which evaluative congruency effects were originally found in a pronunciation task while controlling for associative relatedness. They also reanalyzed the data of the original study excluding highly semantically related prime-target pairs. Neither the reanalysis nor the newly conducted study provided strong evidence for evaluative congruency effects that were independent of associative relatedness. The present study goes beyond these findings by systematically manipulating the semantic relatedness of congruent and incongruent prime-target pairs and by showing that feature-specific attention allocation to valence does not seem to be sufficient to obtain evaluative priming effects when associative relatedness is controlled for (see also Becker, Klauer, & Spruyt, 2016).

We hasten to add, however, that we do not want to deny the crucial role of feature-specific attention allocation for evaluative and semantic priming paradigms. As was already argued in Werner and Rothermund (2013), it is highly probable that the extent to which participants pay attention to different aspects of a task or to different stimulus dimensions does have a strong impact on the likelihood that these aspects are actually processed and can affect the resulting priming effects. Correspondingly, the modulation of evaluative stimulus processing by feature-specific attention allocation was found with different paradigms as well, such as the affective misattribution procedure (e.g., see Everaert, Spruyt, & De Houwer, 2016). Our findings provide further evidence, however, for the fact that attention to valence alone does not in and of itself lead to evaluative congruency effects. Whether such an effect is obtained seems to depend on further attributes of the task, most likely, on the fact whether positive and negative valence is also a feature that discriminates between different responses in the task, thus allowing for valence-based response priming effects (Wentura & Degner, 2010).

The issue of the underlying processes driving evaluative priming effects has important theoretical and methodological implications. Researchers draw important inferences from these effects with regard to the mental representations of evaluations in memory, and they use evaluative priming as an implicit measurement of attitudes. If one assumes that the mere valence information of one concept suffices to activate all kinds of evaluatively congruent concepts, a myriad of different yet identically valenced evaluative judgements would be potentially triggered upon encountering a valent object. For example, a person towards whom one holds a negative attitude would tend to be perceived as sad, hostile, aggressive, disgusting, dishonest, poor, and so forth. Thus, encoding facilitation as an explanation for evaluative priming effects would imply a massive and far-reaching effect on cognition and emotion. The attribution of one negative (positive) trait would entail the attribution of many other negative (positive) traits as well. It would make negative (positive) information more accessible, coloring the interpretation of the entire situation in which the attitude object is encountered, and probably would also evoke pessimism or disappointment in case of negative information. Alternatively, the response activation account suggests that evaluating an object consists in an activation of the superordinate categories “positive” or “negative” and is accompanied by global approach or avoidance tendencies. Such a view does not suggest the activation of the whole roster of evaluatively congruent attributes upon encountering something valent, nor does it predict a general tendency to process evaluatively congruent information more readily. This view is in line with the present data, suggesting that specific valent concepts become more readily accessible only if they are preceded by associatively related primes. Activating a global valence category alone does not have a sweeping effect on evaluative processing, even if attention is directed towards the valence dimension, indicating that attitude activation does not imply an unconditional, general encoding facilitation for all information of similar valence.

Our findings also have implications regarding the implicit assessment of attitudes. If attitude activation does not imply a general encoding facilitation for all information of similar valence, then reliable implicit measurements of attitudes would profit from using a response priming paradigm that captures activation of a general evaluative tendency rather than assessing semantic associations. This does not imply, however, that evaluative associations are irrelevant for the assessment of attitudes – for instance, previous studies by Spruyt and colleagues (see, e.g., Descheemaeker, Spruyt, & Hermans, 2014; Spruyt et al., 2015; Spruyt, Hermans, De Houwer, Vandekerckhove, & Eelen, 2007) demonstrated that an implicit assessment of evaluative associations with the naming task predicted consumer choices, addiction-related behavior, and relapse. Rather than indicating general attitudes, however, these relations may be driven by more specific associations regarding goal-related objects or situations. If the aim of the researcher is to implicitly assess general evaluative tendencies, then we would recommend to use a response priming paradigm that is designed to assess exactly this tendency, independent of and without presupposing any kind of valence-based associations.

In sum, our findings suggest that it is of vital importance to control for associative links between the prime set and the target set when examining the evaluative priming effect and its underlying mechanisms. Effects of associations or semantic relatedness (independent of evaluative relations) can be easily mistaken for evaluative congruency effects, as was demonstrated in the present study. Although the present study was limited to demonstrating effects of associations for the valent/neutral categorization task, similar arguments also apply to other tasks. Previous research revealed that associations between primes and targets not only facilitate responding in standard semantic priming designs (e.g., naming task, lexical decision task), but also facilitate responding in a semantic categorization task (Voss et al., 2013, Exp. 3b). Apparently, associations have a general facilitating effect on all kinds of tasks that is probably mediated by encoding facilitation which is located at a very early stage in the processing stream. The evidence thus suggests that associations also have a likely influence on responding also in response priming paradigms, that is, when investigating evaluative congruency effects in the evaluation task (cf. Hermans et al., 2002). Investigating effects of pure evaluative congruency thus requires to carefully control for or eliminate any influence of non-evaluative semantic associations, regardless of the task or priming design that is used.

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Author Note

Benedikt Werner, Elisabeth von Ramin, Klaus Rothermund, Department of General Psychology II, Friedrich Schiller University Jena., Adriaan Spruyt, Department of Experimental-Clinical and Health Psychology, Ghent University. Preparation of this paper was supported by Methusalem Grant BOF16/MET_V/002 of Ghent University. Correspondence concerning this article should be addressed to Benedikt Werner, Department of General Psychology II, Friedrich Schiller University Jena, Am Steiger 3, Haus 1, D-07743 Jena, Germany. Email: benedikt.werner@uni-jena.de

Appendix

Table 1. Valent primes paired with associated evaluatively congruent, non-associated evaluatively incongruent, associated evaluatively incongruent, non-associated evaluatively congruent, and neutral targets (mixed pairs), as well as neutral primes paired with associated neutral, non-associated neutral, and valent targets (mixed pairs).

Prime	Target			
	Associated	Non-associated	Neutral	
	Evaluatively congruent	Evaluatively incongruent		
Geburtstag (birthday)	Geschenk (gift)	Ekel (disgust)	Pferd (horse)	Brot (bread)
Parfüm (perfume)	Duft (fragrance)	Idiot (idiot)	Nest (nest)	Füller (pen)
Hochzeit (wedding)	Feier (party)	Schlange (snake)	Kamera (camera)	Kaffee (coffee)
Mut (courage)	Tapferkeit (bravery)	Ärger (anger)	Schiff (ship)	Brei (mush)
Gold (gold)	Schatz (treasure)	Abfall (trash)	Teich (pond)	Papier (paper)
Ruhe (rest)	Gemütlichkeit (coziness)	Grausamkeit (cruelty)	Welle (wave)	Flugzeug (plane)
Urlaub (vacation)	Strand (beach)	Schaden (damage)	Gesicht (face)	Tasten (keys)
Wunsch (wish)	Traum (dream)	Verbrechen (crime)	Schrank (wardrobe)	Meter (meter)
Recht (justice)	Freiheit (liberty)	Elend (misery)	Baum (tree)	Sand (sand)
Müll (garbage)	Abfall (trash)	Tapferkeit (bravery)	Brei (mush)	Schiff (ship)

Wut (rage)	Ärger (anger)	Schatz (treasure)	Sand (sand)	Teich (pond)
Brutalität (brutality)	Grausamkeit (cruelty)	Feier (party)	Füller (pen)	Nest (nest)
Unfall (accident)	Schaden (damage)	Gemütlichkeit (coziness)	Brot (bread)	Welle (wave)
Gewalt (violence)	Verbrechen (crime)	Strand (beach)	Tasten (keys)	Gesicht (face)
Not (distress)	Elend (misery)	Geschenk (gift)	Kaffee (coffee)	Pferd (horse)
Gift (poison)	Schlange (snake)	Freiheit (liberty)	Papier (paper)	Buch (book)
Dummheit (stupidity)	Idiot (idiot)	Traum (dream)	Meter (meter)	Schrank (wardrobe)
Spinne (spider)	Ekel (disgust)	Duft (fragrance)	Flugzeug (plane)	Kamera (camera)

	Associated	Non-associated		
	Evaluatively incongruent	Evaluatively congruent		
Krieg (war)	Frieden (peace)	Pech (misfortune)	Nabel (navel)	Baum (tree)
Armut (poverty)	Reichtum (wealth)	Hitze (heat)	Streifen (stripe)	Schienen (rails)
Fluch (curse)	Segen (blessing)	Kälte (cold)	Klingel (bell)	Löffel (spoon)
Trauer (grief)	Trost (comfort)	Lüge (lie)	Teller (plate)	Auto (car)
Weinen (crying)	Lachen (laughing)	Gier (greed)	Rahmen (frame)	Herd (stove)
Krankheit (sickness)	Gesundheit (health)	Feind (foe)	Pfeffer (pepper)	Stein (stone)
Schnarchen (snoring)	Schlaf (sleep)	Verlust (loss)	Ball (ball)	Zaun (fence)
Niederlage (defeat)	Erfolg (success)	Tod (death)	Hose (trousers)	Weise (mode)

Stress (stress)	Entspannung (relaxation)	Hass (hate)	Tür (door)	Gabel (fork)
Sonne (sun)	Hitze (heat)	Segen (blessing)	Löffel (spoon)	Klingel (bell)
Wärme (warmth)	Kälte (cold)	Gesundheit (health)	Auto (car)	Pfeffer (pepper)
Gewinn (profit)	Verlust (loss)	Trost (solace)	Stein (stone)	Teller (plate)
Wahrheit (truth)	Lüge (lie)	Lachen (laughing)	Herd (stove)	Rahmen (frame)
Leben (life)	Tod (death)	Schlaf (sleep)	Zaun (fence)	Ball (ball)
Glück (fortune)	Pech (misfortune)	Entspannung (relaxation)	Gabel (fork)	Tür (door)
Liebe (love)	Hass (hate)	Erfolg (success)	Weise (mode)	Hose (trousers)
Geld (money)	Gier (greed)	Frieden (peace)	Buch (book)	Nabel (navel)
Freund (friend)	Feind (foe)	Reichtum (wealth)	Schienen (rails)	Streifen (stripe)

	Evaluatively neutral		Valent	
	Associated	Non-associated	Positive	Negative
Sattel (saddle)	Pferd (horse)	Nest (nest)	Geschenk (gift)	Feind (foe)
Vogel (bird)	Nest (nest)	Schiff (ship)	Duft (fragrance)	Gier (greed)
Fotograf (photographer)	Kamera (camera)	Pferd (horse)	Feier (party)	Hass (hate)
Matrose (sailor)	Schiff (ship)	Kamera (camera)	Tapferkeit (bravery)	Pech (misfortune)
Frosch (frog)	Teich (pond)	Gesicht (face)	Schatz (treasure)	Tod (death)
Pilot (pilot)	Flugzeug (plane)	Teich (pond)	Gemütlichkeit (coziness)	Lüge (lie)
Kinn (chin)	Gesicht (face)	Flugzeug (plane)	Strand (beach)	Verlust (loss)
Möbel (furniture)	Schrank	Streifen (stripe)	Traum (dream)	Kälte (cold)

	(wardrobe)			
Regal (shelf)	Buch (book)	Löffel (spoon)	Freiheit (liberty)	Hitze (heat)
Schere (scissors)	Papier (paper)	Schrank (wardrobe)	Entspannung (relaxation)	Abfall (trash)
Zebra (zebra)	Streifen (stripe)	Buch (book)	Erfolg (success)	Ärger (anger)
Suppe (soup)	Löffel (spoon)	Auto (car)	Schlaf (sleep)	Grausamkeit (cruelty)
Motor (motor)	Auto (car)	Pfeffer (pepper)	Gesundheit (health)	Schlange (snake)
Bild (picture)	Rahmen (frame)	Kaffee (coffee)	Frieden (peace)	Verbrechen (crime)
Salz (salt)	Pfeffer (pepper)	Brot (bread)	Trost (comfort)	Elend (misery)
Garten (garden)	Zaun (fence)	Papier (paper)	Segen (blessing)	Schaden (damage)
Gürtel (belt)	Hose (trousers)	Füller (pen)	Reichtum (wealth)	Idiot (idiot)
Haus (house)	Tür (door)	Rahmen (frame)	Lachen (laughing)	Ekel (disgust)
Butter (butter)	Brot (bread)	Hose (trousers)	Frieden (peace)	Idiot (idiot)
Tinte (ink)	Füller (pen)	Zaun (fence)	Reichtum (wealth)	Schlange (snake)
Tasse (cup)	Kaffee (coffee)	Tür (door)	Segen (blessing)	Elend (misery)
Kartoffel (potato)	Brei (mush)	Sand (sand)	Trost (comfort)	Verbrechen (crime)
Schaufel (shovel)	Sand (sand)	Brei (mush)	Lachen (laughing)	Schaden (damage)
Seegang (motion of the sea)	Welle (wave)	Baum (tree)	Gesundheit (health)	Grausamkeit (cruelty)
Klavier (piano)	Tasten (keys)	Welle (wave)	Schlaf (sleep)	Ärger (anger)
Zollstock (folding yardstick)	Meter (meter)	Tasten (keys)	Erfolg (success)	Abfall (trash)

Wald (forest)	Baum (tree)	Meter (meter)	Entspannung (relaxation)	Ekel (disgust)
Bauch (belly)	Nabel (navel)	Klingel (bell)	Traum (dream)	Hitze (heat)
Zug (train)	Schienen (rails)	Nabel (navel)	Strand (beach)	Kälte (cold)
Fahrrad (bicycle)	Klingel (bell)	Teller (plate)	Gemütlichkeit (coziness)	Verlust (loss)
Geschirr (dinnerware)	Teller (plate)	Schienen (rails)	Schatz (treasure)	Lüge (lie)
Küche (kitchen)	Herd (stove)	Ball (ball)	Tapferkeit (bravery)	Tod (death)
Felsblock (boulder)	Stein (stone)	Herd (stove)	Feier (party)	Pech (misfortune)
Kugel (sphere)	Ball (ball)	Stein (stone)	Duft (fragrance)	Hass (hate)
Art (way/manner)	Weise (mode)	Gabel (fork)	Geschenk (gift)	Gier (greed)
Besteck (cutlery)	Gabel (fork)	Weise (mode)	Freiheit (liberty)	Feind (foe)

Notes: All words are German nouns. English translations are shown in parentheses. Associations are partly specific to the German language.

Footnotes

[1] Distributed memory models (e.g., Masson, 1995) do not solve this problem, since valence itself accounts for a limited fraction of the activation pattern of a valent concept only (Spruyt, Hermans, De Houwer, Vandromme, & Eelen, 2007, Footnote 8).

[2] FSAA can be also more generally applied to semantic dimensions other than valence (e.g., Spruyt et al., 2009, 2012).

[3] We decided to use this method in order to be able to generate a large set of associated prime/target pairs that (a) are both valent, (b) contain equal numbers of same and opposite valence pairs, and (c) are of comparable associative strengths (so that quantitative indicators for associative relatedness were required). Unfortunately, a data base of information on associative strength between different word pairs does not exist for the German language. Therefore self-report data on selective items was the most promising and straightforward approach, as it allowed us to validate and equate the selection of prime/target pairs with regard to their associative strengths.

[4] "Blank screens" are always meant as "blank apart from the category labels".

[5] Using more conservative outlier criteria (exclusion of reaction times below 400 ms or above 1.5 interquartile distances above the 75th percentile of the individual response-time distributions) did not change the pattern of results. Likewise, our findings were not contingent upon the inclusion or exclusion of trials on which a target was presented that was often misclassified.