Affect and action : contrasting conscious and nonconscious processes

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CHAPTER 6

FALSE RECOGNITION AND AFFECTIVE PRIMING

A correspondence between fluency and positive affect (Reber, Winkielman, & Schwarz, 1998), and between novelty and negative affect, on the other pole, is proposed. According to this hypothesis, fluency manipulations should not only influence affective evaluation (e.g., mere exposure), but affective manipulations should also influence familiarity judgments. Following the design of Jacoby and Whitehouse (1989), we primed recognition-test words by matching, non-matching, positive, or negative context words. With short presentation, both matching and positive primes increased the bias to respond 'old', irrespective of whether the test word had previously been studied, relative to non-matching and negative primes. With long presentation, this effect remained for affective primes, but reversed for matching and non-matching primes. A conscious attribution of affective feelings to subjective familiarity is contradicted by the absence of effects of consciousness manipulations on affective priming. Instead, fluency/novelty and positive/negative affect appear to correspond already at early stages.

Affective valence (Zajonc, 1980) and novelty (e.g., Phaf, den Dulk, Tijsseling & Lebert, 2001; Tulving & Kroll, 1995) have both been suggested as primary features extracted from a stimulus in the earliest stages of processing. Previously presented stimuli are, for instance, perceived and produced with greater ease than novel stimuli, even when there is no conscious stimulus recollection (e.g., Graf & Mandler, 1984; Jacoby & Dallas, 1981; Mandler, 1980). Valence is considered a basic component of emotion (Ortony & Turner, 1990) and may be evoked directly and nonconsciously (LeDoux, 1996; Murphy & Zajonc, 1993). The two features interact in the classical mere exposure paradigm (Bornstein, 1989; Kunst-Wilson & Zajonc, 1980). The phenomenon that previously presented stimuli are preferred above novel stimuli is explained alternatively as an affective phenomenon and a non-affective (i.e., memory) effect. Reber et al. (1998), however, suggested that the experience of perceptual fluency is intrinsically positive (see also, Harmon-Jones & Allen, 2001; Winkielman & Cacioppo, 2001). If they are intrinsically related, the effects of fluency and affect should be symmetric. Instead of addressing effects of previous presentation on affective responses, we assessed affective priming on old judgments in a recognition memory test (i.e., to reverse mere exposure).

Memory-oriented attribution accounts for mere exposure (Seamon, Marsh, & Brody, 1984; Whittlesea & Price, 2001) hold that processing fluency is enhanced by prior presentation and is misattributed to stimulus liking, particularly when it is not recognized consciously. Judgments other than affective preference, such as familiarity judgments (Bonnano & Stillings, 1986) and brighter and darker judgments (but see Seamon, McKenna, & Binder, 1998) have sometimes shown similar misattribution effects. Factors known to raise fluency, moreover, such as matching primes, higher figure-ground contrast, and longer presentation duration, also led to higher liking and less disliking (Reber et al., 1998), even when the stimuli were not previously presented. Particularly the finding of both higher judgments of liking in positively framed questions and less disliking in negatively framed questions (see also Seamon et al., 1998), led Reber et al. to conclude that perceptual fluency corresponds intrinsically to positive valence. This hypothesis was expressed even more strongly by Winkielman and Cacioppo (2001) on the basis of their finding (see also Harmon-Jones & Allen, 2001) that processing ease was accompanied by (electromyographical evidence for) facial muscle contractions indicative of positive affect. The facial electromyography effects do not necessarily require conscious processing because they can be elicited before, or in the absence of, an explicit affective judgment, or even when the affective stimulus does not appear to be processed consciously (e.g., Chapter 2).

The primacy of affective processing (Zajonc, 1980) followed from the observation that the mere exposure effect could be obtained when subjects failed to recognize previously exposed stimuli (Kunst-Wilson & Zajonc, 1980) and that this, apparently nonconscious, effect may even be larger than with conscious exposure (Bornstein, 1989). These results, however, can still be explained by the attribution of fluency to subjective liking (e.g., Bornstein, 1989), instead of by a direct association between fluency and affect. It has been suggested by Whittlesea and Williams (2000) that also the link between fluency and subjective familiarity is not always straightforward and depends on the discrepancy between expected and perceived fluency of processing. If fluency is, for instance, coherent with the processing context, it does not enhance subjective familiarity (e.g., Experiment 4, Whittlesea & Williams, 2000). It would be possible to incorporate affective influences in the expectancy process and also predict symmetric effects of fluency and affective manipulations, which, however, should occur particularly when participants are able to form conscious expectancies (cf. the explanation of Whittlesea and Williams for the results of Jacoby & Whitehouse, 1989). The finding that affective influences on familiarity judgments do not depend on consciousness manipulations would, however, lend support to a direct link. It cannot be excluded that affective influences also intervene at the level of the attribution process, but it seems more parsimonious, as Winkielman and Cacioppo (2001) suggest: "...that positive affect is related directly to processing ease without the mediation of the feeling of familiarity" (p.996).

Even stronger indications of direct, nonconscious, processing can be found for negative than for positive affect (e.g., LeDoux, 1996; Öhman & Mineka, 2001). Though a link between novelty and negative affect (i.e., fear) has often been suggested (e.g., Gray, 1987), we elaborated this relationship more explicitly in a connectionist model (Phaf et al., 2001) which simulated conditioning experiments in terms of the dual-route model for fear (LeDoux, 1996). An input pattern was processed fluently in this network model when it matched a previously presented and stored pattern. When a novel pattern was presented several potential representations were activated, which competed to eventually represent the pattern. The amount of competition in the network served as a measure of stimulus novelty which was reflected by the level of activation of an 'arousal' node. Interestingly, activation of the arousal node could also serve as the unconditioned stimulus (US) in the fear-conditioning simulations. The direct link between novelty and US enabled the simulation of experiments showing larger conditioning to novel than to frequently encountered stimuli (Phaf et al., 2001). The model does, of course, not implement emotion per se, but may describe some of the nonconscious processes that eventually give rise to subjective feelings of emotion. With this detailed model in mind, we want to propose an extended correspondence hypothesis here, claiming that not only fluency and positive affect, but also novelty and negative affect are co-processed at early stages.

To investigate bi-directionality of correspondence (i.e., in an attempt to reverse mere exposure), we needed a task showing fluency effects on subjective familiarity. The recognition task developed by Jacoby and Whitehouse (1989; Bernstein & Welch, 1991; Joordens & Merikle, 1992) seems very well suited for this purpose (see Whittlesea & Williams, 2000). According to the dual-process theory of recognition (Jacoby & Dallas, 1981; Mandler, 1980), both feelings of familiarity and conscious recollection of the previous presentation can contribute to recognition performance. After presenting a study list, Jacoby and Whitehouse measured recognition of test words that were immediately preceded by the same (matching) or by a new (non-matching) context word (i.e., prime). The primes were either presented so shortly that there was no later prime recognition (but see Joordens & Merikle, 1992, showing that not all conscious processing needs to be excluded), or presented sufficiently long to allow for conscious perception of the context words. Similar to the effects on liking judgments (Reber et al., 1998), short exposure of matching primes raised overall test-word familiarity, and, thus, led to both more correct recognitions of old words and more false recognitions of new words than priming by non-matching words. In terms of signal detection theory, only bias (see Whittlesea & Williams, 2000) but not sensitivity was influenced by the primes. With long presentation, the extra fluency of processing due to matching primes was coherent with the context (Whittlesea & Williams, 2000) and could be consciously discounted, so that the pattern reversed (i.e., less subjective familiarity of the test words with matching than with non-matching primes).

We added positive and negative primes to the Jacoby-Whitehouse paradigm. The design was similar to the Jacoby and Whitehouse (1989) experiments. Though we do not believe that a null effect in this test is sufficient to be able to exclude all conscious processing (Merikle, 1992), the main recognition task was followed by a second recognition test of the primes from the first recognition task, similar to the Jacoby-Whitehouse procedure. To enhance the occurrence of false recognition, twice the number of old test words were included as new test words. A matching, non-matching, positive, or negative context word was presented before the test word, either for a short or for a longer duration. Similar effects are expected for correct recognition as for false recognition, but due to higher absolute level of fluency, prime influences may be smaller in correct recognition. According to the correspondence hypothesis, both positive and matching primes should increase fluency relative to negative and non-matching primes. With short presentation, the increased fluency should be attributed to feelings of familiarity to the test words (e.g., Whittlesea & Williams, 2000) in both the Jacoby-Whitehouse and affective priming conditions. With long presentation, participants can only discount the increased fluency in the Jacoby-Whitehouse, but not in the affective, conditions. Positive primes are expected to lead to more subjective familiarity to the test words than negative words with both short and long presentation.

Method

Thirty-six first-year psychology students (30 female, 6 male, mean age 20.7, sd 2.4 years) participated for course credit. They were randomly assigned to the long or the short presentation group. The 340 affectively neutral, 70 positive, and 70 negative Dutch words had medium word-frequency (10-49 per million; Burnage, 1990) and a length of 4-6 letters. The affective words were found to be very representative of the categories 'happy' or 'sad' at minimal presentation levels in a perceptual clarification task (Ter Laak, 1992). Whereas positive and negative words were matched with respect to word length and word frequency, they were selected to differ maximally in terms of emotional valence. The study list contained two fillers at the beginning, 80 neutral words, and three fillers at the end. The practice recognition-test list consisted of the five fillers, five new neutral words, and ten non-matching neutral context words. The recognition-test list consisted of the 80 study words and 160 new neutral words, which were preceded equally by the 60 matching, 60 non-matching, 60 positive, and 60 negative primes. Old and new words were rotated in the experiment. From the remainder of the neutral words, 40 words served as non-matching primes and 40 others served as distracters in the prime-recognition test.

The experiment was conducted on a PowerMac (4400/200) with a 15 inch color screen. This computer recorded responses and latencies and determined random orders for study and test lists for every subject individually. Words were presented in the centre of the screen in black letters (lowercase Times: 5.7 x 6.6 mm) on a light background to the subject seated at approximately 70 cm. The experimental room was clearly lighted and the monitor softly tuned. The study list was presented at a one word per second rate with a one second interval. In the test list the mask was presented (seven ampersands) for 500 ms, was followed by a 31 ms (short) or 138 ms (long) presentation of the prime, and was again masked for 500 ms, after which the test word appeared until a response was given (maximally 5 s) by pressing the button labeled 'old' with the index finger of the preferred hand or the 'new' button with the index finger of the non-preferred hand. One second after response a new trial started.

Similar to Jacoby and Whitehouse (1989), different instructions were given in the long and short conditions. In the former, participants were explained that before every test-word presentation, a word would be presented briefly, which they should read silently but not respond to. They were told that sometimes the first word matched the test word. The recognition decision should be made as quickly as possible on the second word. In the short conditions, participants were not warned that another word would precede the test word. They were instructed to focus on the ampersands and to use them as a warning signal for fast response. Finally, a recognition test for the primes was administered. Only then was the short presentation group told that words had been presented between the ampersands. When asked in the exit-interview, no one from this group reported to have seen the primes. Participants were asked to indicate which of eighty words (10 old and 10 new words for each context category in a random order) printed on a sheet of paper had preceded the test words.

Results

The cross-over interaction characteristic of the Jacoby-Whitehouse effect was obtained for both correct ($F(1,34)=7.96$, $p<0.01$) and false ($F(1,34)=7.14$, $p<0.05$) recognition. Correct recognition (Table 1) was higher with short priming by matching than by non-matching words (planned comparison: $t(17)=2.5$, $p<0.05$) and this pattern was reversed with long priming ($t(17)=1.7$, $p=0.057$). For false recognition (Table 2) only short priming had a significant effect (short: $t(17)=3.2$, $p<0.005$; long: $t(17)<1$).

Table 1. *Proportion (SD) Correct Recognition as a Function of Prime and Presentation Time.*

	Match	Nonmatch	Positive	Negative
Long	0.55 (0.20)	0.62 (0.16)	0.57 (0.15)	0.54 (0.24)
Short	0.67 (0.17)	0.59 (0.19)	0.60 (0.21)	0.57 (0.19)

If the correspondence hypothesis holds, priming effects by affective words, similar to the effects of matching and nonmatching primes in the short conditions, are expected. In the absence of conscious discounting, parallel effects should, thus, occur with short and long presentation of the affective primes. False recognition was overall, irrespective of presentation condition, higher when primed by positive words (0.26) than by negative words (0.21) ($F(1,34)=10.2$, $p<0.005$). For correct recognition the main effect of valence (positive 0.59, negative 0.55) was in the expected direction but not significantly so ($F(1,34)=1.10$, ns). Though priming appeared to be somewhat smaller in the long than in the short conditions both for correct and false recognitions, neither interaction proved to be reliable ($F(1,34)<1$ and $F(1,34)=2.16$, respectively).

Table 2. *Proportion (SD) False Recognition as a Function of Prime and Presentation Time.*

	Match	Nonmatch	Positive	Negative
Long	0.21 (0.17)	0.22 (0.21)	0.22 (0.18)	0.19 (0.19)
Short	0.38 (0.17)	0.28 (0.18)	0.29 (0.13)	0.23 (0.12)

The recognition judgments were also investigated (see Table 3) in terms of the signal detection measures sensitivity (P_r) and bias (B_r), according to the two-high threshold model (Snodgrass & Corwin, 1988).

No effects of the primes on sensitivity (i.e., enhancing retrieval of test words) were expected, and were indeed found to be significant. The bias, however, to respond 'old', to both previously presented and new words, revealed clear prime effects. The cross-over interaction indicative of the Jacoby-Whitehouse effect found for both hits and false alarms, was mirrored by a similar interaction, only for bias ($F(1,34)=8.48$, $p<0.01$), but not for sensitivity ($F<1$). The main effects of presentation condition ($F(1,34)=5.93$, $p<0.05$) and of prime ($F(1,34)=4.35$, $p<0.05$) were also significant in the analysis of non-affective priming. With short prime presentation (B_r 0.47), participants appeared to be somewhat less cautious than with long presentation (B_r 0.32). Also matching primes (B_r 0.42) led overall to a larger bias to respond 'old' than non-matching primes (B_r 0.37).

Table 3. *Sensitivity P_r (SD) and Bias B_r (SD) of Recognition Performance.*

	Long		Short	
	P_r	B_r	P_r	B_r
Match	0.34	0.31	0.29	0.54
	(0.25)	(0.20)	(0.20)	(0.20)
Nonmatch	0.40	0.33	0.31	0.40
	(0.23)	(0.22)	(0.24)	(0.21)
Positive	0.35	0.31	0.31	0.45
	(0.25)	(0.20)	(0.22)	(0.21)
Negative	0.35	0.28	0.34	0.36
	(0.31)	(0.25)	(0.17)	(0.19)

In the absence of discounting, similar bias effects were expected for short and long presentation of the affective primes, and indeed only the main effect of priming proved to be significant ($F(1,34)=5.31$, $p<0.05$). Positive primes (B_r 0.38) led overall to a more liberal bias than negative primes (B_r 0.32). Though in absolute terms affective priming was larger with short than with long presentation, the interaction did not reach significance ($F(1,34)=1.41$, ns). Again participants appeared to be more conservative in responding 'old' with long (B_r 0.41) than with short (B_r 0.30) presentation, but this was not significant ($F(1,34)=2.68$, ns).

From the performance in the second recognition task (i.e., of the context words in the first recognition task) it can be deduced that the manipulation of reducing conscious prime processing by short presentation was successful. Following Joordens and Merikle (1992) we calculated a measure of sensitivity (P_r) for each participant for the three types of context words. With long prime presentation the mean values for non-matching words (0.14, one-tailed $t(17)=5.68$, $p<0.0001$), positive words (0.13, $t(17)=3.24$, $p<0.005$), and negative words (010, $t(17)=3.73$, $p<0.001$) deviated from zero. Shortly presented nonmatching (0.02, $t<1$) and positive primes (0.01, $t<1$) were not reliably recognized afterwards, but short presentation led to significant recognition performance of the negative primes (0.04, $t(17)=1.8$, $p<0.05$).

Discussion

The effects of positive and negative primes corresponded to those of matching and nonmatching primes with short presentation. With long presentation, participants did not detect a relation between affective prime and test word, such as between matching prime and target, and made no effort to discount the effects of the primes. The finding of qualitative differences (e.g., Merikle, 1992) between short and long presentation conditions (i.e., the Jacoby-Whitehouse effect) supported the conclusion that we have been successful in manipulating level of consciousness for the primes. The relatively short presentation duration, even in the long condition (138 ms), may, however, have been responsible for the limited reversal of non-affective priming in more conscious conditions. Similarly, stronger affective priming in less conscious conditions than in conscious conditions (cf. Murphy & Zajonc, 1993; Chapter 2), which was not reliable in the present experiment, may have been limited by 'suboptimal' conscious processing at 138 ms prime presentation.

Whittlesea and Williams (2000) argued that with short presentation participants perceived the extra processing fluency as being discrepant with their expectation for the test word when they could not consciously attribute it to the prime, whereas they found it coherent with the context when they could clearly see the primes. Only in a discrepant context would the fluency be attributed to subjective familiarity or feelings of liking (Whittlesea & Price, 2001). To incorporate the present results without invoking a direct correspondence between fluency and affect, some new elements would have to be added to Whittlesea's theory. Affective processing should also be possible at the same (nonconscious) level as fluency processing (i.e., not merely at the level of subjective feelings). If the affective feelings were only transformed into feelings of familiarity, one would not expect that the effects were at least as strong in less conscious conditions as in conscious conditions. Fluency and affect should, moreover, have parallel effects. Finally, similar to the attribution of fluency to subjective familiarity or liking, it should also be possible to attribute, apparently nonconscious, affect to feelings of familiarity. Though more research is needed to resolve the issue, the correspondence hypothesis eliminates two of these new assumptions and, therefore seems more parsimonious (see also Winkielman & Cacioppo, 2001).

Many more testable predictions can be derived from the correspondence hypothesis. Affective influences should, for instance, also be observed in the classical Jacoby-Whitehouse design, which does not involve any affective material. If facial-electromyography effects are also observed with short presentation of matching and nonmatching primes, this would contradict an indirect link between subjective familiarity and affective feelings (Whittlesea & Price, 2001). Because, of course, we have not exhaustively investigated all consequences of correspondence, it remains a provisional hypothesis. We have, however, already extended the effect to a different type of affective manipulation. When participants unobtrusively contracted the facial muscles associated with a smile, they showed more false recognition than with a neutral expression (Phaf & Rotteveel, Unpublished results), which was again higher than when frowning (see also, Baudouin, Gilibert, Sansone & Tiberghien, 2000; Strack & Neumann, 2000). The finding that other affective manipulations can bias recognition supports the generality of the correspondence hypothesis. They also contradict the alternative explanation that, despite our best efforts to match them, item differences between positive and negative prime words, other than their valence, may have been responsible for our results.

The finding of affective influences on (false) recognition of affectively neutral material frequently raises the question why there should be this kind of crosstalk between affective and non-affective processing. From a traditional point of view investigating human functions separately, the link seems incongruous. The question of 'why' can, of course, not be answered in any scientific discipline, but may be rephrased into the question 'how' the crosstalk came about. In our opinion, the answer lies in the fact that systems for memory and for emotions have co-evolved on the basis of similar selection pressures (e.g., LeDoux, 1996; Öhman & Mineka, 2001). For both, partly the same (e.g., limbic) brain areas have been implicated (LeDoux, 1996; Tulving & Kroll, 1995; Henson, Rugg, Shallice, Josephs & Dolan, 1999). For assessing the value of these evolutionary accounts much more work needs to be done (cf., den Dulk, Heerebout & Phaf, In press, for computer simulations of the evolution of fear behavior). If a computational analysis of evolutionary processes indeed yields the type of correspondence supported here by this 'reversed' mere-exposure effect, this would suggest that there may be more cross-connections between the traditionally separate fields of memory and emotion.