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Subliminal Affective Priming Resists Attributional Interventions

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We examine two explanations of the subliminal affective priming effect. The feelings-as-information model (Schwarz & Clore, 1988) holds that judgements are based on perceptible feelings. Hence, affective influences depend on the source to which feelings are (mis)attributed. In contrast, the affective primary hypothesis (Zajonc, 1980) suggests that affective influences should resist attributional interventions. This is because the affective system responsible for preferences is separate from the cognitive system responsible for inferences; because early affective processes are automatic and therefore inaccessible to higher-order interventions; and because early affective responses are not represented as conscious feelings. We tested these explanations in two experiments that crossed subliminal affective priming with (mis)attribution manipulations. Both studies found reliable shifts in judgements of neutral stimuli as a result of primes even when subjects were aware that their feelings might not be diagnostic for the judgement at hand. Subjects did not report experiencing any feelings in response to the primes. The obtained affective priming effect was independent of response times and subjective reports of engaging in judgemental corrections. However, the priming effect did prove sensitive to the experimental instructions. We discuss the implications of these findings for the affective primacy hypothesis and the feelings-as-information model.

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INTRODUCTION

Numerous studies have demonstrated a pronounced impact of affective states on evaluative judgements (for reviews see Clore, Schwarz, & Conway, 1994; Forgas, 1995; Schwarz & Clore, 1996). In the present paper, we address a specific aspect of the interplay between affect and cognition, namely, how exposure to affective stimuli presented below the threshold of awareness influences evaluations of unrelated target stimuli. In a recent study, Murphy and Zajonc (1993) exposed subjects to supraliminally presented neutral stimuli in the form of Chinese ideographs and asked them to make a liking judgement (study 1) or to judge whether the ideographs represented "good" or "bad" objects (study 2). The subjects did not know that the ideographs were preceded by affective and nonaffective subliminal primes. Affective primes were pictures of smiling or angry faces, whereas nonaffective primes were pictures of random polygons. Subliminal affective primes produced systematic shifts in subjects' judgements of the ideographs—ideographs preceded by smiling faces were liked the most and ideographs preceded by frowning faces were liked the least, with ideographs preceded by polygons falling in between. Murphy, Monahan, and Zajonc (1995) replicated these effects in a more extensive study.

Despite numerous studies that have found affective priming, the mediating process has received little attention. Previous research focused primarily on demonstrating that affective priming can be achieved with minimal stimulus exposures (e.g. Bargh & Pietromonaco, 1982; Murphy & Zajonc, 1993; Niedenthal, 1990), and on exploring the interactions between cognitive and affective processes (e.g. Edwards, 1990; Kitayama, 1991). The present paper addresses the affect-judgement link more directly. We seek to determine whether subliminal affective priming effects are mediated by controllable processes involving inferences from consciously experienced affect, or by automatic processes impervious to higher-order interventions. We begin by comparing two explanations of subliminal affective priming effects and subsequently report two studies designed to test these contrasting explanations.

A Feelings-as-information Account of Affective Priming

According to the feelings-as-information model, affective influences occur because judgements are based on perceptible affective states. Schwarz and Clore (1983, 1988, 1996; Clore, 1992) proposed that people may simplify complex judgemental tasks by turning to their apparent affective reaction to the target, essentially asking themselves, "How do I feel about it?" In so doing, they may misread pre-existing feelings as a reaction to the target,

resulting in more positive evaluations when in a positive rather than negative affective state. Referring to an early version of the Murphy and Zajonc paper (1993), Schwarz (1990, p. 538) speculated on how the feelings-as-information model may explain subliminal affective priming effects: "Given the absence of any useful knowledge about the ideograph, subjects may be likely to turn to their affective response, asking themselves, 'How do I feel about it?' If they encounter positive feelings, they may conclude that the ideograph may mean something positive—unless they have reason to doubt the informational value of their feelings."

According to the feelings-as-information model, judgements are only based on affective experiences if the experiences are perceived as diagnostic for the judgement at hand. If the informational value of the experience is called into question, for example, if subjects (mis)attribute their feelings to a source unrelated to the target, the impact of affective states on judgement is eliminated (e.g. Schwarz & Clore, 1983). This model assumes reliance on one's feelings as a *default* that does not require conscious attribution of the feeling to the object of judgement, but holds that conscious attribution of the feeling to an irrelevant source eliminates the otherwise observed affective influence.

Although many studies support the predictions of the feeling-as-information model for the impact of moods and other phenomenal experiences (see Clore et al. 1994; Schwarz & Clore, 1996 for reviews), it is an open issue whether the model applies to subliminal priming effects. There are good reasons to think it might. Clearly, the procedures used in subliminal priming experiments guarantee that subjects are not aware of the source of their affective reaction. Hence, they are likely to perceive their own affect as a response to the supraliminally presented target, thus rendering it relevant to the judgement. If so, making subjects aware of the potential impact of subliminal primes should eliminate the impact of affective priming, because it renders salient an irrelevant source of their affective experience. Consistent with this prediction, Murphy and Zajonc (1993) obtained no priming effect when they presented smiling or frowning faces supraliminally, suggesting that awareness of the source of one's feelings eliminated their impact. Hence, the available findings are compatible with a feelings-as-information account of affective priming effects, although a specific empirical test is missing.

An Affective Primacy Account of Affective Priming

In 1980, Zajonc proposed the affective primacy hypothesis (Zajonc, 1980, 1984, 1994). The hypothesis holds that affective reactions require minimal stimulus elaboration and can occur very quickly. The hypothesis also suggests that the affective system, concerned with stimulus evaluation, is

separate and partially independent from the cognitive system concerned with stimulus meaning. Translating Zajonc's hypothesis into the language proposed by Fodor (1983), the affective system represents a mental module. Such a module is domain-specific (concerned with the evaluation of emotional significance), operates on pre-semantic input (before the level of meaning), encapsulated (independent from modules that process other attributes), and cognitively impenetrable (impervious to higher-order influences). The assumptions of the affective primacy hypothesis are consistent with psychological and neurophysiological evidence (Aggleton & Mishkin, 1986; Damasio, 1994; Kunst-Wilson & Zajonc, 1980; LeDoux, 1989, 1993).

The affective primacy hypothesis predicts independence of subliminal affective priming from attributional manipulations for several reasons. Attributional interventions attempt to change preferences by targeting conscious inferences. Inferences, however, are a part of the high-order, semantic system that has no direct access to the low-order, nonsemantic preference system. Consistent with this assumption, studies on automatic vigilance (Pratto, 1994; Pratto & John, 1991) and automatic evaluation (Bargh, Chaiken, Govender, & Pratto, 1992) found that the operation of affective processes is highly independent of inferential goals (Bargh, 1989).

Note, however, that subliminal affective priming should *not* be expected to be independent of all aspects of attributional manipulations. These manipulations should have no *inferential* effects, yet they may influence such variables as attention or affective states that, in turn, may modify affective priming via affect-affect interactions (Murphy, Monahan, & Zajonc, 1995) or attention-affect interactions (Lang, 1995).

Another reason why, according to the affective primacy hypothesis, attributional interventions should be ineffective is related to the assumptions about the form of early affective experiences. Any successful manipulation of the inferences that subjects may draw from their feelings requires some awareness of these feelings in the first place. However, affective priming may *not* involve a change in consciously experienced feelings. First, some affective influences on perception, interpretation, and decision may be mediated by low-level systems that do not produce any accompanying conscious affect at all (Damasio, 1994). Second, even if affective priming leads to a noticeable affective reaction, this reaction may not be represented as a feeling, but only as a change in a preference. Recent theorising suggests that the system that evaluates the emotional significance of stimuli is faster than the system that elicits feelings (LeDoux, 1993). Ladavas, Cimatti, DelPesce, and Tuozzi (1993) found that evaluative discrimination responses (presumably underlying preferences) were obtained when subliminal affective slides were presented to the right and to

the left hemisphere of a split-brain patient. However, autonomic responses (presumably underlying feelings) were only obtained when subliminal slides were presented to the right hemisphere. The left hemisphere, which is less able to respond to emotional stimuli, produced autonomic responses only for slides presented supraliminally.

In sum, the minimal exposure conditions of subliminal priming may elicit weak, undifferentiated preference responses, but may not support the amount of processing necessary to elicit identifiable feelings. More generally, preferences seem to represent what Fodor (1983) calls "shallow output" (i.e. they are primitive, pre-semantic, and unappraised—uninterpreted). As Zajonc (1994) suggested, an early, unappraised affect must be elaborated and integrated with the output of other modules to result in an identifiable feeling. In that respect, subliminal affective priming may be similar to the mere exposure paradigm, where subjects do not perceive themselves as changing preferences by virtue of exposure.

The preceding discussion indicates that subliminal priming may not elicit feelings that can be used as input into an inferential strategy. Several approaches to the affect-judgement link share this assumption but differ regarding the nature and locus of the processes that mediate between affect and judgement. Some accounts are consistent with the affective primacy hypothesis and postulate low-order, sensory, nonsemantic processes. Other accounts assume high-order semantic mediation. Moreover, the accounts locate the critical process at different stages—attention, perception, interpretation, or generation of motor response. First, research into the affect-attention link proposes that affective primes lead to heightened attention to affect-congruent information (see Derryberry & Tucker, 1994 for a review). Second, research into the affect-perception link suggests that affective primes trigger activation in perceptual memory, which results in a more efficient perception of affect-congruent targets (see Niedenthal, Setterlund, & Jones, 1994 for a review). Third, semantic network models suggest that affective primes bias interpretation of targets by activating valence-congruent concepts (see Bower, 1991 for a review). Finally, affect elicited by primes may modify judgement behaviour via connections between the affective system and the motor response system (see Zajonc & Markus, 1984 for a review). We return to these issues in the Discussion section.

Overview of Studies

As the earlier discussion illustrates, several lines of evidence are compatible with the notion that affective influences on judgement and behaviour may be mediated by mechanisms other than the misattribution of experienced feelings. However, until the role of these mechanisms in subliminal

priming is more precisely specified, systematic empirical tests of these mechanisms remain difficult. In contrast, the feelings-as-information model generates predictions that are amenable to empirical testing. Hence, the present studies focus on a test of the predictions generated by the feelings-as-information account. Specifically, we informed subjects in some conditions of our experiments that they would be exposed to subliminal primes that might elicit a feeling. Depending on conditions, subjects were either informed that this reaction would be positive, informed that it would be negative, or were not informed about its valence. These attribution manipulations were introduced as a between-subjects factor and were crossed with the valence of the subliminal primes, which was manipulated within subjects.

Based on these manipulations, the feelings-as-information model predicts the emergence of augmentation and discounting effects (Kelley, 1972). When subjects expect subliminally presented primes to elicit a positive feeling, they should (correctly) attribute any positive feeling they experience to the impact of the priming manipulation (i.e. to a subliminally presented smiling face). Similarly, when subjects expect subliminally presented primes to elicit a negative feeling, they should (correctly) attribute any negative feeling they experience to the impact of the priming manipulation (i.e. to a subliminally presented frowning face). Given that subjects are told that the priming manipulation is unrelated to the judgement task, they should discount the informational value of their on-line affective experience and thus not exhibit the subliminal priming effect. In contrast, if an affective experience elicited by the subliminal primes is inconsistent with subjects' expectations, the experience cannot be attributed to the experimental manipulation and should seem particularly diagnostic, resulting in increased subliminal priming effects. Accordingly, a discounting effect is predicted when subjects' experiences match their expectations and an augmentation effect is predicted when their experiences contradict their expectations. Finally, when subjects are informed that subliminally presented materials may elicit an unspecified reaction, they may doubt the informational value of any reaction they may experience, thus reducing subliminal priming effects independent of the valence of their experience.

Note that the aforementioned predictions of discounting *and* augmentation effects are incompatible with an alternative set of predictions that may be derived from the implications of the experimental instructions, independent of subjects' affective experiences. As Strack and colleagues (Strack, 1992; Strack, Schwarz, Bless, Kübler, & Wänke, 1993; see also Wegener & Petty, 1995) demonstrated, subjects may correct judgements to compensate for influences suggested by the experimenter. If so, subjects who are informed about positive influences should correct all judgements down-

ward, whereas subjects who are informed about negative influences should correct all judgements upward, independent of their actual affective experience. In contrast to such a main effect of expectations, the feelings-as-information model predicts an interaction of expectations with actual affective experiences, as described earlier.

The affective primacy hypothesis predicts that the attributional manipulations should not produce the aforementioned pattern of judgements. This prediction rests on three assumptions. First, the system involved in affective priming is resistant to inferences, because inferences are semantic whereas preferences are nonsemantic. Second, affective priming is automatic and should be encapsulated from any higher-order intervention. Third, affective changes mediating affective priming are either not represented consciously at all, or at least they are not represented as feelings. Hence, subjects are not aware of a feeling experience that may be discounted or augmented as a source of information in forming a judgement about the target.

Given that the affective primacy hypothesis predicts a null effect of attributional interventions, we did not want to reject the feelings-as-information model because of potentially weak manipulations, resulting in the acceptance of the affective primacy hypothesis as a default. Therefore, we took the following steps: Our attributional manipulations were clear and explicit; the attributional manipulation was changed from study 1 to study 2; and both studies independently tested for the presence of affective experiences. The robustness of affective priming will be demonstrated if it is obtained even when the experiment offers subjects a clear opportunity to discount the influence of affective primes.

EXPERIMENT 1

Method

Subjects

Sixty-three male and female undergraduate subjects at the University of Michigan participated in partial fulfilment of a course requirement. Subjects who knew Chinese, Korean, or Japanese were excluded from participation.

Materials and Apparatus

Order and type of stimuli. The liking judgement task consisted of the presentation of target ideographs preceded by various primes. There were two blocks of 20 trials. Each block employed a different arrangement of stimuli. In the first block of 20 trials the order of primes within a block was

randomised and consisted of: (a) five distinct ideographs preceded by no primes at all; (b) five distinct ideographs preceded by pictures of five distinct polygons; (c) five distinct ideographs preceded by primes showing angry faces of five distinct individuals; and (d) five distinct ideographs preceded by pictures of happy faces of five distinct individuals.

In the second block, the primes consisted of: (a) five distinct ideographs preceded by no primes at all; (b) five distinct ideographs preceded by pictures of five distinct polygons; (c) five ideographs repeated from the first block were preceded by angry faces of the same individuals that provided happy expressions used in block 1; and (d) five ideographs repeated from the first block were preceded by happy faces of the same individuals that provided angry expressions used in block 1.

Primes. Photographs of 10 individuals served as facial primes. Each individual provided two expressions—happiness and anger. These 10 individuals were selected from a set of 65 slides pre-tested to provide good examples of anger and happiness.

Stimulus presentation. The exposure conditions and the equipment were identical to the one used by Murphy and Zajonc (1993). Four slide projectors with a Uniblitz shutter and a red filter were used to project 45cm × 60cm images on a screen at subjects' eye level at a distance of approximately 1.5m. This presentation resulted in a 17-degree visual horizontal angle and 20-degree vertical angle. Luminance of the screen field was approximately 60cd/m^2. The shutters were controlled by two Uniblitz relay control boxes connected to an XT-computer. The shutter speed for the subliminal prime was set at 4msec which, after adding open and shut delay, results in a 10msec flash.

Procedure and Design

Sequence of events during affective priming. On arrival at the laboratory, subjects were told that the study consisted of two tasks. In the first task they would make liking judgements of several Chinese ideographs on a 6-button response box. Number 1 on the box indicated that the subject did not like the ideograph at all, whereas number 6 indicated that it was liked quite a bit. Each trial lasted for about 11 seconds (see Fig. 1). The subliminal stimulus (the face or the polygon) was presented for 10msec and was immediately followed by an ideograph that also served as a backward mask. The SOA between the prime and the ideograph was approximately 5msec. Each ideograph stayed on the screen for 2000msec. After an 8-second pause for the subject's response, the next pair consisting of subliminal prime and ideograph was shown. After the first task, there was a short break. The second task of the study tested whether the primes were presented subliminally (see later).

Manipulation of inferences. For the first task of the study, subjects were given one of the five written instructions, designed to manipulate beliefs about their affective reactions during the experiment. In the first condition, subjects were not informed about subliminal stimuli, but were simply asked to make liking judgements of ideographs. This condition was designed as a simple replication of the Murphy and Zajonc (1993) study 1, and we refer to this condition as a "*no expectations*" condition.

In the "*nonspecific expectation condition*", instructions stated that shortly before the presentation of ideographs other pictures would appear very briefly on the screen. The instruction mentioned that these pictures would appear so briefly that no one would be able to see them consciously. Possible affective reactions and the nature of subliminal pictures were not mentioned. To justify to subjects the presence of subliminal primes, the instructions referred to "the second part of the study" where these slides would be relevant. The purpose of the "nonspecific expectation condition" was to test whether the sheer fact of being informed about possible primes would eliminate the basic affective priming effect. For this condition, and for all the remaining conditions, the affective primacy account predicts a replication of the priming effect. The feelings-as-information account predicts that in the nonspecific expectation condition subjects may become distrustful of their affective reactions, which

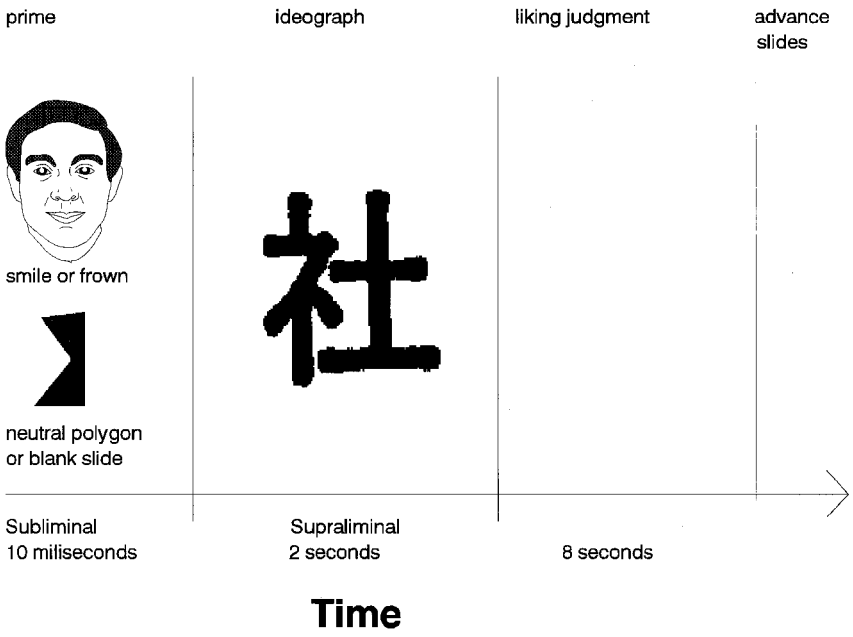

FIG. 1. Sequence of events on one trial during liking judgement task.

should undermine the priming effect. Priming effects should be weakened to the extent that subjects thought these "other pictures" might influence their affective state.

In the "*positive expectation condition*" subjects were informed that subliminal smiling faces would briefly appear before some ideographs and may bring on "some pleasant feelings" and cause some "positive gut reactions". For this condition the feeling-as-information account predicts that subjects should discount their positive reactions to the ideographs preceded by positive primes, whereas their judgements of ideographs preceded by negative primes should continue to be influenced. Moreover, the judgements of ideographs preceded by negative primes should be especially unfavourable because, by the logic of the augmenting effect, subjects should treat their negative reactions as especially diagnostic of their true liking response to the target ideographs.

In the "*negative expectation condition*" subjects were informed that subliminal angry faces would appear before ideographs and may bring on "some unpleasant feelings" and cause some "negative gut reactions". Predictions for this condition are the exact reversal of predictions for the positive expectation condition.

In the "*positive and negative expectation condition*" subjects were informed that angry and happy faces would be shown and might cause corresponding feelings and "gut reactions". Here, assuming sufficient discounting, the feeling-as-information account predicts a disappearance of the priming effect, whereas the affective primary account predicts no such effect.

Forced choice. Following 45 trials, subjects in all conditions were given a forced-choice test of awareness (see Fig. 2 for details). Subjects were told that this part of the experiment dealt with recognition of stimuli presented very briefly. As in the first part of the study, a prime (happy face, angry face, or polygon) was presented for 10msec and was immediately masked by a 2-second presentation of an ideograph. One second after the ideograph disappeared, two pictures were flashed on the screen for 7 seconds: An image of the actual prime on one side of the screen and an alternate image (a distractor) on the other side of the screen. Subjects indicated which of the two images they thought was the prime by pressing one of the six buttons on a response box. Three buttons to the left indicated, with degrees of certainty varying from "sure" to "just guessing", that a correct picture of the prime was on the left part of the screen. Three buttons to the right indicated, with various degrees of certainty, that the correct prime was on the right. Using this response scale, the number of response options on the forced-choice test was identical with the number of response options in the liking part. The screen position of the correct image was randomised. The distractor for the facial prime was a face with the same expression and the

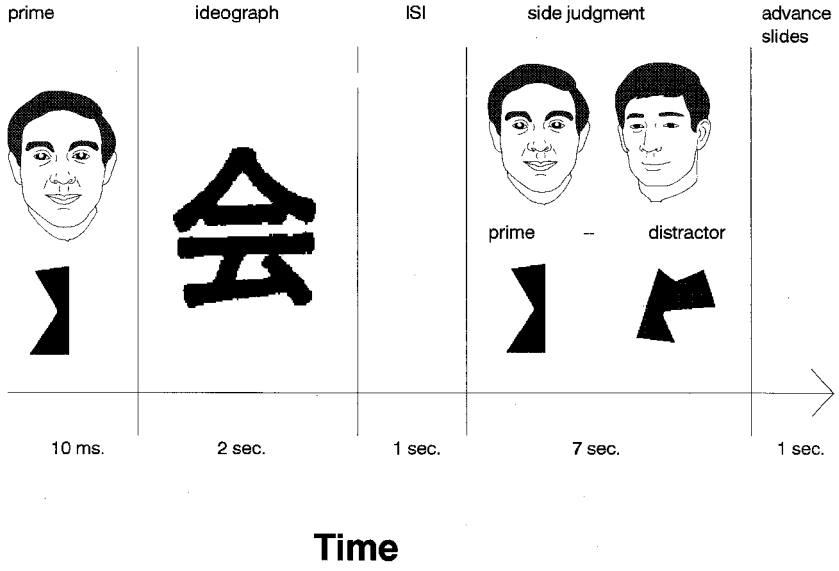

FIG. 2. Sequence of events on one trial during forced-choice task.

same gender, but of a different person. The distractor for the polygon was a different polygon.

This design of the forced-choice test, using two different people with the same facial expression, controls for the ability to recognise a particular face. However, it does not control for whether subjects were aware of the smiling versus the angry expressions used as primes. That is, the results of the forced-choice test leave open whether subjects have access to the valence of the prime. Although a different design could help answer this question, the primary purpose of the forced-choice test was to establish whether subjects could perceive the descriptive features of the primes consciously.

Interviews. After the experiment, subjects were interviewed and probed for their awareness of the "other pictures" (primes), the presence of affective reactions to primes and ideographs, and their strategies for making the liking judgement. Subjects were also asked about their awareness of the primes during the forced-choice task, and their strategies for making the forced-choice judgement. After the interview each subject was thoroughly debriefed.

Design

The judgement part of the study reflects a $5 \times 4 \times 2$ mixed design. The Type of Expectation factor was manipulated between subjects (no expectations, nonspecific prime expectation, positive prime expectation, negative

prime expectation, positive and negative prime expectation). The Type of Prime factor was manipulated within subjects (happy face, angry face, polygon, or nonprime). Finally, the presentation order was represented by the within-subjects factor Block Order (first 20 trials, last 20 trials).

Results

The key questions addressed by our analyses are: (1) whether subliminal primes influence subjects' judgements of the ideographs; and (2) whether this influence is modified by subjects' expectations about the alleged impact of subliminal primes. The analyses given later are based on data from the first block (20 trials). The data from the second block (last 20 trials) were also analysed and will be discussed in a later section. Means from both blocks are presented in Table 1.

Priming effect. A 4 (type of prime) × 5 (type of expectation) MANOVA was performed on the liking judgements. This analysis revealed a significant main effect for type of prime [$F(3,174) = 4.72$, $P < .005$]. The upper panel of Table 1 shows that in each condition subjects rated the ideographs preceded by happy primes higher than ideographs preceded by angry primes. More specifically, paired *t*-tests revealed that across all conditions

TABLE 1
Experiment 1: Mean Liking of Ideographs as a Function of Prime, Expectation Condition, and Trial Block

	Experimental Condition					
Prime	*No Expect.*	*Nonspec. Expect.*	*Pos. Expect.*	*Neg. Expect.*	*Pos. & Neg. Expect.*	*All*
First block						
Happy	3.63	3.98	4.03	3.58	3.85	3.81
Angry	3.47	3.25	3.43	3.4	3.6	3.43
Polygon	3.46	3.45	3.78	3.6	3.65	3.58
No prime	3.27	3.72	3.77	3.82	3.57	3.62
Total	3.46	3.6	3.75	3.6	3.67	3.61
Second block						
Happy	3.69	3.31	3.4	3.68	3.72	3.56
Angry	3.74	4.2	3.93	3.68	3.9	3.89
Polygon	3.46	3.34	3.77	3.35	3.58	3.5
No prime	3.4	3.71	3.58	3.2	3.63	3.5
Total	3.57	3.64	3.67	3.48	3.71	3.61
n:	14	13	12	12	12	63

Note: Scale range is 1–6: 1, don't like the ideograph; 6, like the ideograph a lot.

ideographs preceded by happy primes were rated higher than ideographs preceded by angry primes [$t(62) = 3.62$, $P < .01$; polygons $t(62) = 2.63$, $P < .02$; or no primes $t(62) = 2.02$, $P < .05$]. These findings represent an overall affective priming effect.

Effects of expectations. The MANOVA revealed no significant prime × type of expectation interaction, $F < 1$, indicating that the overall strength of the affective priming effect did not depend on subjects' expectations about the alleged impact of subliminal primes. More detailed analyses confirmed this conclusion. Specifically, we created two indices of the effectiveness of affective primes. One index measured the effectiveness of positive primes, the other measured the effectiveness of negative primes. These indexes were calculated by taking the difference between each subject's liking of ideographs preceded by affective primes and this subject's liking of ideographs preceded by nonaffective primes (polygons and blank primes).

As shown in Table 2, the pattern of means did not conform to the predictions derived from the feelings-as-information account. The obtained differences in judgements of ideographs preceded by happy versus angry primes were most pronounced in the nonspecific expectation condition [$t(12) = 4.2$, $P < .002$]. Hence, a manipulation expected to undermine the effect of subliminal priming appears to have strengthened it. Similarly, the effect of positive primes in the positive expectation condition, where the feeling-as-information account predicts a discounting of positive affect, was nonsignificantly stronger than in the negative

TABLE 2
Experiment 1: Effectiveness of Affective Primes as a Function of Prime, Expectation Condition, and Trial Block

	Experimental Condition					
Prime	*No Expect.*	*Nonspec. Expect.*	*Pos. Expect.*	*Neg. Expect.*	*Pos. & Neg. Expect.*	*All*
First block						
Happy	.26	.4	.26	− .12	.24	.21
Angry	.11	− .34	− .34	− .31	− .01	− .17
Second block						
Happy	.26	− .22	− .27	.41	.11	.06
Angry	.31	.68	.26	.41	.29	.39
n:	14	13	12	12	12	63

Note: The effectiveness rating of happy and angry primes represents the difference between ratings of ideographs on trials with affective primes and trials with neutral primes or no primes at all—e.g. effectiveness of happy prime = happy − (neutral + none)/2.

expectation condition, where an augmentation effect was predicted [$t(22) = 1.40$, $P < .18$]. Moreover, the effect of negative primes in the positive expectation condition was not different from their impact in the negative expectation condition [$t(22) = 0.1$]. Similarly, the effects of both types of primes in the condition where subjects expected positive as well as negative influences did not differ from the no-expectation conditions, in contrast to predictions from the feeling-as-information model. Surprisingly, in contrast to Murphy and Zajonc's (1993) previous findings, in the no-expectations condition, no significant priming effect was obtained [$t(13) = 0.98$], although the means were in the predicted direction.

In combination, these findings indicate that informing subjects about a possible influence of subliminally presented materials did not result in the predicted augmentation and discounting effects. If anything, inducing these expectations enhanced the impact of the priming procedure, in particular when the expectations were nonspecific. In fact, affective priming effects were only obtained under expectation conditions and not under the no-expectation condition that replicated the procedures used by Murphy and Zajonc (1993). The latter observation is inconsistent with the prediction derived from the affective primacy account that the affective priming is fully independent of higher-order interventions.

Corrective processes. Based on the feelings-as-information approach, one might expect a negative relation between the speed with which subjects form a judgement and the effectiveness of the primes. This would reflect the possibility that the discounting and augmenting processes take time, a possibility that has not been addressed in previous misattribution studies. To test this conjecture, we computed the correlation between the effectiveness of primes (as defined earlier) and response times (in block 1). In the no-expectation condition this correlation was [$r(14) = .43$, n.s.]. The mean correlation in the four-expectation conditions was [$r(49) = .14$, n.s.]. This finding suggests the effect of the primes was independent of subjects' attempts to consider the informational value of their feelings in the context of the expectations conveyed to them.

Affective experiences. Subjects were asked if they experienced any affective reactions to the primes or the target ideographs. They were also asked to describe how they made their judgements of ideographs. No subject reported experiencing any feelings as a result of the priming. Seven subjects (11%) reported basing their judgements on their "gut-reactions" to the ideographs. These subjects were evenly distributed across expectation conditions and did not significantly differ from other subjects in their response to the priming manipulation, $F < 1$. Other subjects responded that they based their judgements on aesthetic features of the ideographs, what they reminded them of, or simply on how much they liked them. This finding is consistent with the prediction of the

affective primacy hypothesis that affective reactions elicited by the subliminal primes are not represented as conscious feelings.

Results of block 2. Following the procedures used by Murphy and Zajonc (1993), the present experiment had two blocks of trials. In the second block, the same ideographs that were presented in the first block were judged again by the same subjects. However, the repeated ideographs were preceded by facial expressions of the opposite valence (i.e. an ideograph primed with a happy face in block 1 was primed with an angry face in block 2). In the Murphy and Zajonc (1993) experiment, the priming effect in the second block of trials was weaker compared with the effect in the first block. This suggests that affective priming effects established during the first exposure may be quite robust and difficult to obliterate by affective priming during the second exposure. Therefore, data from block 2 were analysed separately. A 4 (type of prime) × 5 (type of expectation) MANOVA was performed on the liking judgements from the second block. This analysis revealed only a significant main effect for type of prime [$F(3,174) = 6.67$, $P < .001$], and no interactions. The pattern reflected in this main effect, however, was *opposite* to the pattern observed for the first block. Specifically, paired t-tests revealed that across all conditions ideographs associated with happy primes in block 2 were liked *less* than ideographs associated with angry primes in block 2 [$t(62) = 2.87$, $P < .01$]. All differences between types of primes mirrored the effects obtained in block 1. Ideographs preceded by happy primes were not liked *less* than ideographs preceded either by polygons or no-primes ($t < 1$), whereas ideographs preceded by angry primes were liked *more* than ideographs preceded by polygons, or no-primes [$t(62) = 4.86$, $P < .001$]. This pattern presumably reflects that the ideographs became associated with an affective evaluation during the first exposure. In other words, in block 1 subjects may have formed and retained an attitude toward the ideograph. This evaluation may have determined judgements during the second encounter with the ideograph, whatever the prime that preceded the exposure in the second block. If this explanation is correct, one should expect a positive correlation between the first judgement and second judgement of the same ideograph, despite pairing with opposite primes. In fact, judgements of repeated ideographs were positively and significantly correlated [$r(63) = .44$, $P < .001$]. As a control we also computed the correlation between comparable judgements of nonrepeated ideographs. These judgements were uncorrelated [$r(63) = .004$, n.s.]. The difference between the aforementioned correlation coefficients was significant, $z = 2.56$, $P < .05$.

Treating block as a within-subjects factor, we obtain a two-way interaction of type of prime and block order [$F(3,174) = 8.37$, $P < .001$]. This reflects that the evaluations are consistent with the valence of the prime in

block 1 [$F(3,174) = 4.72$, $P < .005$] for the simple main effect, but inconsistent with the valence of the prime in block 2 [$F(3,174) = 6.67$, $P < .001$] for the simple main effect.

Forced-choice test. Data from the forced-choice test of prime recognition indicate that the subliminal presentation procedures were successful. The recognition ratio (i.e. the number of correct recognitions of the prime divided by the total number of recognition judgements made) was .48, SD = .10, which is not significantly different from the chance expectation of .50. The recognition ratio did not differ as a function of type of prime (happy face, angry face, polygon), experimental condition, and practice (first 15 vs. last 15 judgements). There was no relationship between subjects' performance on the forced-choice task and the effectiveness of primes in the judgement task.

Discussion

In summary, an affective priming effect across various instructional conditions was obtained in the first block of trials. This finding provides a general replication of the phenomenon found by Murphy and Zajonc (1993) in study 1, although the results obtained in the no-expectations condition, which provided a direct replication of Murphy and Zajonc's procedures, were not significant.

In addition, the results of the second block of trials suggest that affective priming has a lasting effect on preferences. Judgements of the ideographs in the second block were positively correlated with judgements of the same ideographs in the first block (despite being paired with opposite primes.) We suggest that this pattern represents an effect observed in studies that found that a single pairing of an affective prime with a neutral target was sufficient to bias the subsequent impression formed of that target (Niedenthal, 1990; Krosnick, Betz, Jussim, & Lynn, 1992). This finding also suggests that affective priming may be especially effective at the initial attitude-formation stage and may be less effective at the attitude-change stage. On a theoretical level, literature on automatic evaluation proposes that a neutral object can acquire an evaluation as a result of pairing with an evaluative object (Bargh et al., 1992; Fazio, Sanbonmatsu, Powell, & Kardes, 1986). Once the object has its own evaluation associated with it, it will be less susceptible to subsequent priming. This interpretation assumes, of course, that the priming manipulation continued to be as effective in the second block.[1]

[1] We thank an anonymous reviewer for suggesting this interpretation.

Most important, however, the absence of attribution effects suggests that the priming effect was mediated by a process other than that suggested by the feelings-as-information approach. Subjects who were told that the unconscious primes might affect their judgements were as susceptible to their influence as uninformed subjects and neither a discounting effect nor an augmentation effect was observed. On the contrary, the judgements provided by subjects who were informed that they would be exposed to subliminal primes, but were not informed about the specific nature of their impact, showed the strongest priming effect. Note, however, that this latter finding is also inconsistent with the null effect predictions generated by the affective primacy hypothesis. As a *post-hoc* explanation, we suggest that the nonspecific expectation manipulations increased subjects' attention to the display, thus increasing the impact of subliminal primes. The fact that the speed with which subjects provided a judgement was unrelated to the effectiveness of the primes further suggests that the impact of the primes was independent of subjects' attempts to relate their affective response to the situational influences described to them. Finally, subjects' self-reports indicated that they were not consciously aware of any feeling reactions to the primes or the targets.

In general, two explanations may be offered for the findings of Experiment 1. On one hand, the data are consistent with the prediction of the affective primacy account, which holds that the affective system is impenetrable to manipulations of inference and that it involves automatic processes for which subjects are not able to correct. Moreover, as predicted, subliminal priming produced affect that was not represented as a feeling. From this perspective, the misattribution manipulation was unsuccessful because subjects could not correct their judgements for an influence they did not perceive. On the other hand, it is conceivable that our misattribution manipulation was not successful for methodological reasons. Ross and Olson (1981) discussed various reasons why misattribution manipulations may fail. Two reasons that apply to our paradigm are: (1) the plausibility of the misattributional source as a cause of the experience; and (2) the salience of the misattribution source at the time of the experience. Regarding plausibility, our subjects were told that affective changes would be induced by subliminal primes. Although the cause of affect given to our subjects was clearly the true cause, subjects may not have believed that subliminal primes were presented, or were effective, and may simply have discarded this information as bogus. Alternatively, our subjects may have believed what they were told, but because the primes were invisible, they may have quickly forgotten about their existence, reflecting a low salience of the misattribution manipulation. Moreover, subjects may have disregarded the attributional information as irrelevant because they were not conscious of experiencing affective reactions. Finally, even if subjects

discerned their affective reactions, they may have felt confused or overwhelmed by the attributional arithmetic required from them. For example, in the positive expectations condition, the task required subjects to trust negative reactions, but to distrust positive reactions. Given that the valence of the affective prime changed from trial to trial, as the order of happy and angry primes was random, keeping track of all of the reactions may have been too difficult.

EXPERIMENT 2

Given these concerns, we conducted a second study, based on a modified priming manipulation and a different, more salient, and more plausible misattribution manipulation. In redesigning both the priming manipulation and the attribution manipulation we tried to achieve maximum simplicity and phenomenal clarity for subjects. First, if a distinguishable feeling is produced by subliminal manipulations, in contrast to what the affective primacy hypothesis would suggest, we wanted to make it very easy for subjects to recognise it. Accordingly, each set of trials with affective primes was preceded by a set with neutral primes to facilitate recognition of any affective reactions. Moreover, sequences of five affective primes of the same valence were presented to prolong and intensify affective reactions. Second, we used a misattribution manipulation that has been successfully employed in previous studies (Schwarz et al., 1991). Specifically, we played processed New Age music throughout the experiment and informed subjects that this music would elicit positive (or negative) feelings. To accommodate the initial neutral trials, subjects were further informed that these feelings may only set in after some time, thus allowing them to attribute any affective experiences elicited by the subsequent affect trials to the impact of the music. In combination, these changes should facilitate the detection of affective changes, increase the salience of their alleged alternative source, and motivate subjects to engage in appropriate attributional processes. As in Experiment 1, the feelings-as-information model predicts discounting effects on trials where the affective experience matches the alleged impact of the music, and augmentation effects on trials where the affective experience contradicts the alleged impact of the music. In contrast, the affective primacy model predicts no impact of the attributional manipulations.

Method

Subjects

Eighty-seven male and female undergraduate subjects at the University of Michigan participated in partial fulfilment of a course requirement. Subjects who knew Chinese, Korean, or Japanese were excluded from participation.

Materials, Apparatus, and Procedure

Priming manipulation. Subjects were again asked to give liking judgements of ideographs, using the same method as in Experiment 1. Half of the ideographs were preceded by facial affect primes (happy and angry), and half were preceded by neutral primes. In contrast to Experiment 1, the neutral primes were not polygons, but faces of individuals who were asked to pose not showing any specific emotion. This change eliminates the comparability problem between affectively charged primes and neutral primes. In Experiment 2, all primes were facial photographs that differed only on their affective dimension. The exposure, lighting, distance, and response conditions were identical to Experiment 1.

Order of stimuli. The procedure started with five warm-up ideographs preceded by neutral primes. The test ideographs were preceded by four groups of five primes that alternated between neutral and affective faces. The first group of primes consisted of neutral faces, the second of affective faces, the third of neutral faces, and the last of affective faces again. The type of affective prime (happy or angry) following the first group of neutral primes was counterbalanced, creating two orders of stimuli. This counterbalancing allows the examination of the impact of affective responses that are consistent or inconsistent with expectations induced by the attributional manipulations. After the block of 20 trials was completed, it was repeated with a new set of stimuli to explore changes in affective priming manipulation over time. Unlike Experiment 1, however, stimuli used in block 2 were not repetitions of stimuli used in block 1.

Manipulation of inferences. While subjects rated the ideographs, emotionally ambiguous New Age music recorded at half-speed was played in the background. This music was clearly audible from the beginning of the rating task, increased in loudness for the first 30 seconds, and continued for

Warm-up trials	Test Trials
-- NNNNN --	-- NNNNN--HHHHH--NNNNN--AAAAA --
-- NNNNN --	-- NNNNN--AAAAA--NNNNN--HHHHH --

Note:
N – neutral facial expression prime
H – happy facial expression prime
A – angry facial expression prime

FIG. 3. Experiment 2: Arrangement of subliminal facial primes presented before the ideographs.

the rest of the experiment. Subjects were told that although this music was not relevant for the ideograph-rating task, it was played because we were interested in its delayed effects on some tasks following the ideograph ratings. All subjects were told that the music had been shown to have an emotional impact on most people, but that it was unknown how long it would take for the music to have an impact, only that this impact would not be immediate. To keep the subjects vigilant about the music-related changes in their affective states, all subjects were asked four times throughout the experiment: "Do you feel affected by the music?" The onset of this question was timed to precede shortly before the onset of affective primes, thus rendering the music highly accessible as a possible source for any reactions that may be elicited by the primes. As a manipulation of expectations, half of the subjects were informed that after a while this music would make them feel pleasant, whereas the other half were informed that the music would make them feel unpleasant.

Forced choice. After the judgement task, we tested whether the primes were presented at a suboptimal level. The procedure was a simplified version of the forced-choice task from Experiment 1. Subjects were presented with 20 trials on which ideographs were preceded by affective primes. Stimuli and exposure conditions were identical to the first part of the study. Ten ideographs were preceded, in random order, by happy faces and ten were preceded by angry faces. Immediately after the primed ideograph was shown, two faces appeared on the right and left sides of the screen. One face was an exact copy of the prime, the other was a photograph of a different individual of the same gender showing the same facial expression as a prime. Subjects were asked to indicate (by pressing a button) which part of the screen showed the face flashed just before the ideograph.

Interviews. After the main part of the experiment, we asked subjects several questions about the nature of their affective and nonaffective reactions to the music, ideographs, and primes as well as to the timing of these reactions. Subjects were also asked whether they attempted to correct their judgements or were aware of the primes, and were probed for suspiciousness. Finally, all subjects were thoroughly debriefed and thanked.

Design

In combination, these manipulations resulted in a 3 (happy vs. neutral vs. angry primes) × 2 (positive vs. negative expectation about the impact of music) factorial design, with the first factor manipulated within and the second factor manipulated between subjects.

Results

The key questions addressed by our analyses are: (1) whether subliminal primes influence subjects' judgements of the ideographs; and (2) whether this influence is modified by the attributional manipulations.[2]

Priming effect. A 3 (type of prime) × 2 (type of expectation) MANOVA was performed on the liking judgements. This analysis revealed a significant main effect for type of prime [$F(2,170) = 3.88$, $P < .03$]. As in Experiment 1, ideographs preceded by happy primes were liked significantly more than ideographs preceded by angry primes, across both expectation conditions (see Table 3).

Effects of expectations. The MANOVA also revealed a nonsignificant main effect of expectations on judgements [$F(1,85) = 2.97$, $P < .09$]. When subjects expected the music to make them feel good, they liked the ideographs more than when they expected the music to make them feel bad. These expectancy-congruent evaluations resemble a placebo effect (see Ross & Olson, 1981) and are incompatible with the inferential predictions derived from the feelings-as-information model, as well as with the null effect prediction derived from the affective primacy hypothesis.

This main effect was qualified by a nonsignificant prime × type of expectation interaction [$F(2,170) = 2.46$, $P < .09$]. This interaction suggests that the strength of the priming effect depended on subjects' expectations about the alleged impact of the music. More detailed analyses of this interaction revealed that the pattern is inconsistent with predictions of the feeling-as-information model. As in Experiment 1, we created separate indices of the effectiveness of positive and negative primes. These indices represent the difference between the liking of ideographs preceded by the respective affective primes and ideographs preceded by neutral primes.

As shown in Table 4, the effect of the positive primes was somewhat stronger when subjects expected a positive influence of the music than when they expected a negative influence ($t < 1$). Moreover, the effect of the

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[2] All data in the results section of Experiment 2 come from the first block of trials. The second block did not show any main effects or interaction effects of priming and expectation on judgements of ideographs. Unlike Experiment 1, no stimuli were repeated in the second block of Experiment 2. The second block represented a simple continuation of events from the first block with new primes and targets. The absence of the priming effect presumably reflects habituation to the affective priming procedure.

Because there was no effect of order (i.e. whether the tone of the first group of affective primes was consistent or inconsistent with the affective tone of the expectations), data across both order conditions were collapsed.

TABLE 3
Experiment 2: Mean Liking of Ideographs as a Function of Prime and Expectation Condition

	Experimental Condition		
Prime	*Pos. Expect.*	*Neg. Expect.*	*Both*
Happy	3.82	3.70	3.76
Neutral	3.69	3.61	3.65
Angry	3.75	3.36	3.55
Total	3.75	3.55	3.65
n:	44	43	87

Note: Scale range is 1–6: 1, don't like the ideograph; 6, like the ideograph a lot.

TABLE 4
Experiment 2: Effectiveness of Affective Primes as a Function of Prime and Expectation Condition

	Experimental Condition		
Prime	*Pos. Expect.*	*Neg. Expect.*	*Both*
Happy	.12	.09	.11
Angry	.05	−.25	−.09
n:	44	43	87

Note: The effectiveness rating of happy and angry primes represents the difference between ratings of ideographs on trials with affective primes and trials with neutral primes (e.g. effectiveness of happy prime = happy − neutral).

negative primes was significantly *weaker* when subjects expected a positive influence of the music than when they expected a negative influence [$t(85) = 2.13$, $P < .05$]. These patterns are opposite to the discounting and augmentation effects predicted under these conditions. Hence, for both sets of primes, manipulations designed to elicit a discounting of any affective reaction to the prime amplified the primes' impact, whereas manipulations designed to augment any affective reaction to the primes weakened the primes' impact, in contrast to predictions of the feelings-as-information model.

Additional analyses tested whether the effects of priming depended on subjects' actual emotional responses to the music, as revealed by their self-reports at the end of the experiment. The mean liking judgements broken down by the type of response are shown in Table 5. A 3 × 3 mixed MANOVA with prime (happy, neutral, angry) and self-reported response to the music (positive, none, negative) failed to reveal a significant prime by music response interaction [$F(158,4) < 1.1$]. However, further analyses revealed that a significant affective priming effect was obtained only when subjects reported a negative emotional impact of the music [$t(49) = 3.07$, $P < .01$]. The feelings-as-information model cannot account for the overall pattern of findings—the absence of priming in the positive and no-response to music groups, given a strong priming effect in the negative response group. This finding was also not predicted by the affective primacy account. One interpretation of this result suggests that it again may reflect

TABLE 5
Experiment 2: Mean Liking of Ideographs as a Function of Prime, and Reported Emotional Reaction to The Music

	Reported Emotional Reaction				
Prime	*Pos.*	*Mixed*	*None*	*Neg.*	*All*
Happy	3.67	3.56	3.85	3.78	3.76
Neutral	3.71	3.24	3.81	3.62	3.65
Angry	3.65	3.44	3.82	3.44	3.55
Total	3.68	3.41	3.83	3.61	3.65
n:	15	5	17	50	87

Note: Scale range is 1–6: 1, don't like the ideograph; 6, like the ideograph a lot.

an attentional phenomenon. As observed in other domains (see Schwarz, 1990; Schwarz & Clore, 1996 for reviews), negative affect may signal a problematic situation, resulting in increased attention and motivation. If so, increased attention may again have increased the effectiveness of subliminal primes, as suggested by the findings of Experiment 1.

Corrective processes. The feelings-as-information model suggests a negative relation between the response times and the effectiveness of priming, because discounting and augmenting processes take time. Analyses of correlations revealed that no such relation was present in the data [$r(87) = -.04$, n.s.]. This result suggests that the effect of the primes was independent of whether subjects engaged in attributional inference processes.

In addition, subjects were asked the following question: "Did you try to correct for the possibility that your reactions to the ideographs might be influenced by your reaction produced by the music?" Forty-one (47%) of the subjects answered "yes". A MANOVA including all relevant experimental factors and the correct factors (yes/no) revealed neither a main effect nor any interactions, all Fs < 1, involving the correction factor.

Affective experiences. In post-experimental interviews, 70 (80%) subjects reported having experienced an emotional reaction to the music during the judgement task. No subject mentioned any emotional experiences that could be related to subliminal affective primes.

Forced-choice test. To establish whether subjects could distinguish facial primes presented subliminally from distractors, we calculated the ratio of correct recognitions of the facial prime to the total number of recognition judgements. The resulting ratio of .50 (SD = .12) was right at

chance expectation. Subjects' performance did not improve with practice, did not depend on what the type of prime was being recognised, and did not predict effectiveness of primes in the judgement task.

Discussion

The results of Experiment 2 replicated the key findings of Experiment 1. First, they replicated a general subliminal affective priming effect, using a different arrangement of stimuli. Second, manipulations of the perceived diagnosticity of one's affective reaction to the primes did not result in the discounting and augmentation effects predicted by the feelings-as-information model. Instead, the obtained patterns reflected expectation-congruent evaluations. The resistance of subliminal priming to the attributional manipulations used in Experiment 2 is especially meaningful because the discounting manipulation was accessible to subjects' awareness (i.e. the music was audible at all times), and was regarded by most subjects as having an emotional effect. Third, there was no evidence for a mediating role of attributional processes with regard to the strength of the obtained priming effects. Finally, subjects did not report consciously experiencing affective reactions related to the primes, but they did notice affective changes in response to the music.

GENERAL DISCUSSION

Overall, the results of both experiments show a form of affective influence different from that explained by the feelings-as-information model. Subjects' judgements did not show the expected pattern of discounting and augmentation, and the priming manipulation did not elicit conscious feelings that subjects could report. Before we consider the implication of these results, however, we need to address some methodological issues and caveats.

Power

The absence of the attributional effects predicted by the feelings-as-information model is a null finding. Accepting a null finding requires that the studies gave the effect a reasonable chance to manifest itself. Concerns about power are further amplified by the fact that the (mis)attribution effects were tested between subjects, whereas the priming effects were tested within subjects. Although these design features provided more power for detecting affective priming effects than for detecting attribu-

tional effects, several reasons make us doubt that the crucial null finding is due to a lack of power.

First, in both experiments the obtained pattern of means was *opposite* to the predictions of the feelings-as-information model. Hence, an increase in power would likely provide stronger evidence against rather than for the predictions of the model, if we assume that additional subjects would not reverse the direction of the observed effects. Second, several studies using comparable cell sizes have shown that attributional manipulations, similar to those we employed, can undermine the impact of subjective experiences like moods, arousal, or experienced ease of recall (e.g. Bornstein & D'Agostino, 1994; Schwarz & Clore, 1983; Schwarz et al., 1991; Schwarz, Servay, & Kumpf, 1985; Sinclair, Mark, & Clore, 1994; Zanna & Cooper, 1974). Third, the attributional manipulation used in Experiment 2 was modelled closely after a successful manipulation used by Schwarz et al. (1991), although it was targeted to address ease of retrieval experiences in their study. Finally, it is worth keeping in mind that both studies attempted to counter a subliminal effect with explicit supraliminal attribution manipulations.

Implications for the Affective Primacy Hypothesis

Two of the key findings of the current studies are consistent with the affective primacy hypothesis. First, the priming effect was impervious to attributional manipulations. This finding supports the notion of affect-cognition independence (Zajonc, 1980). This notion is also strengthened by the recent evidence that facial expressions are processed independently of facial identity by the emotional circuits of the amygdala (Adolphs, Tranel, Damasio, & Damasio, 1994). Second, the priming manipulation did not produce conscious feelings. One possible implication is that affect produced by subliminal facial primes is rudimentary and possibly unconscious (Zajonc, 1994). Such unconscious affect may guide participants' judgements and decisions (see Bechara, Damasio, Tranel, & Damasio, 1997 for a recent demonstration). Another possibility is that the pictures of emotional facial expressions were insufficient to trigger emotional feelings even if they had been exposed supraliminally.[3]

[3] The exact nature of affective responses elicited by subliminal and supraliminal presentation of facial expressions needs to be investigated further. However, a recent study found that subliminally presented expressions elicit facial EMG responses—a sensitive indicator of an underlying affective state (De Groot, 1996; Cacioppo, Petty, Losh, & Kim, 1986). Furthermore, the preferences elicited by subliminal facial priming combine additively with preferences elicited by mere exposure (Murphy, Monahan, & Zajonc, 1995). The additive pattern suggests that preferences formed by both procedures are rather undifferentiated and independent of associated content.

There were also two sets of findings that were not predicted by the affective primacy. First, in Experiment 1 judgements of stimuli in block 2 were significantly and positively correlated with judgements of the same stimuli in block 1. This occurred despite the fact that in block 2 the stimuli were paired with opposite affective primes. The fact that subjects retained a previously formed evaluation suggests that evaluative conditioning occurred. Evaluative conditioning requires a link between affect and memory for the stimulus, and suggests that affect interacts with cognition on a level of primitive operations (Krosnick et al., 1992; Levey & Martin, 1990). Second, affective priming was sensitive to various influences. In both experiments, the priming effect was influenced by experimental instructions. In both experiments, the priming was not obtained in the second block of trials. In Experiment 2 the strength of priming varied with the responses to the music. These results suggest that, contrary to the strong thesis of independence, the affective system *is* sensitive to various modifying influences (see also Parrott & Schulkin, 1993). However, as will be discussed later, the available findings suggest that the obtained effects may reflect an affect-affect interaction, or an interaction between affect and low-level cognition.

The present experiments were not designed to test a specific alternative to the feelings-as-information model, reflecting the lack of sufficiently specified process accounts. However, it is useful to evaluate how other assumptions about the processes underlying affective priming may account for the present findings. There are four different types of explanatory models that may be used to account for the present findings: (1) semantic accounts; (2) attention/perceptual memory accounts; (3) response stage priming accounts; and (4) preference misattribution accounts.

Semantic accounts. These accounts, incompatible with the affective primacy, explain affective priming effects by mediation of processes concerned with meaning. A purely semantic model assumes that there is no difference between priming with affective and nonaffective stimuli. In both cases, priming involves processing of the meaning of the prime and interpretation of the target in terms of activated concepts (e.g. Higgins, Rholes, & Jones, 1977). Recent evidence argues against a purely semantic model. In experiments by Murphy and Zajonc (1993) priming at very low exposure conditions was obtained only with affective primes. Nonaffective primes produced priming only when exposure times were increased, resulting in supraliminal exposure. This suggests that affective priming, at least under subliminal conditions, involves some unique processes.

The logic of an intermediate affective-cognitive model (e.g. Bower, 1991; Forgas, 1992) allows for a primary affective response to be elicited

by a prime. This affective response, however, leads to affect-congruent judgements *only* if it renders affect-congruent concepts accessible. Unfortunately, the semantic network model has trouble explaining several affective influence phenomena (see discussions by Niedenthal et al., 1994; Forgas, 1995; Bargh, Chaiken, Raymond, & Hymes, 1996).

Hence, satisfactory explanations of the affective priming effects are likely to be offered by models that assign an important role to the early affect and do not assume high-level semantic mediation. Three different accounts satisfy this criterion. They postulate early affective states and assume that the mediating process is low-level and automatic. These accounts differ in locating the process responsible for priming at different stages—attention, perception, or response generation.

Attention and perceptual memory accounts. One way in which affect can influence judgements is by changing the perception of targets via a front-end priming mechanism. This mechanism may involve changes in attention to affect-congruent stimuli (Broadbent & Broadbent, 1988; Derryberry & Tucker, 1994). Alternatively, the mechanism could involve priming of affect-congruent perceptual representations (Niedenthal et al., 1994). From both the attentional and perceptual memory perspective, the affective priming effects may be explained by assuming that exposure to happy primes increases either attention to, or activation of, positive aspects of the target ideograph, whereas exposure to angry primes increases either attention to, or activation of, its negative aspects. Consistent with this assumption, we found in Experiment 2 that subliminal primes were most effective when the affective valence of the primes was congruent with the affect mentioned in the expectation instructions. That is, happy primes tended to be most effective when the expectation manipulation led subjects to expect positive affect, and negative primes were most effective when the expectation manipulation led subjects to expect negative effect. This may either indicate that the expectation manipulation itself influenced subjects' affect, resulting in differential attention to, or activation of, affect-congruent material, or that subjects' expectations influenced perception independent of an influence on their affect.[4]

Complicating this issue, however, we did not observe a parallel effect in Experiment 1, where the impact of the primes was only enhanced by the

[4] In general, the plausibility of the perceptual/attentional explanation for the current studies rests on the two assumptions. First ideographs as targets have features that can be differentially attended to, activated, or interpreted depending on the prime. Second, such differentially activated or interpreted features can vary in an affective value. Both assumptions are consistent with findings from experimental aesthetics that show contextual dependence of perceptions, interpretations, and preferences for simple visual elements (Berlyne, 1974; McManus, 1980).

expectation manipulation when subjects were informed that they would be exposed to subliminal primes, but were not informed about how these primes might affect them. Although this latter finding may also be traced to differences in attention to the task, these differences were independent of valence, in contrast to the findings in Experiment 2. Another finding that may be related to nonspecific differences in attention is the disappearance of priming in the second block of both experiments.

Response stage priming accounts. In 1984, Zajonc and Markus proposed that affect can interact with cognition because both systems have direct links to the motor response system. According to this idea, low-level affective information influences judgement by biasing the selection of a motor response, which is normally under the control of the cognitive system. Interestingly, recent research suggests that sensory information may indeed specify response parameters while bypassing higher level representation. For example, Neumann and Klotz (1994) found that a subliminal, nonaffective visual prime may directly trigger a motor response. Other findings suggest that affective stimuli may have especially powerful unmediated effects on the response system (Bargh et al., 1996; Cacioppo, Crites, Gardner, & Berntson, 1994; Cacioppo, Priester, & Berntson, 1993; Lang, 1995; Ohman & Soares, 1994). Although provocative, the response stage priming account cannot explain the instruction effects and the disappearance of priming effects in the second block of both experiments.

Preference attribution accounts. Finally, a modified attributional model can be proposed. According to this model, subliminal affective primes automatically activate an associated evaluation (Fazio et al., 1986; Bargh et al., 1992), which is misinterpreted as an evaluative response to the supraliminally presented target. Although this interpretation shares the attributional assumption of the feelings-as-information model, it does not postulate a role for experienced "feelings" that are accessible for conscious inferences. Hence, (mis)attribution manipulations would not be expected to influence subjects' automatic preference judgements. Moreover, this account does not need to trace the elimination of affective priming effects to any awareness of an irrelevant source that undermines the informational value of subjective experiences. This way, the model can account for the block effects observed in Experiment 1. From this perspective, subjects may have "misread" their preference response to the subliminal primes as a response to the ideographs presented in the first block, presumably because the neutral ideographs did not elicit any systematic preferences on their own. However, when the same ideographs were shown in the second block, they had already acquired an evaluation during the previous encounter. Consequently, the ideographs could elicit their "own" preference response, resulting in a lack of impact of the preference elicited by the prime.

In sum, the emergence of affective priming effects, the lack of discounting and augmentation effects, the absence of feelings, and the block effects observed in Experiment 1 are compatible with the preference misattribution account. However, this account provides no compelling explanation for the instructional effects observed in both experiments and disappearance of priming in the second block of Experiment 2.

Implications for the Feeling-as-information Model

Research on affective influences on judgement has predominantly addressed the impact of consciously experienced affect in the form of moods and emotions. Most of this research is consistent with the assumption that affective influences are mediated by the use of one's affective states as a source of information, as conceptualised in the feelings-as-information model (see Clore et al., 1994; Schwarz & Clore, 1996 for recent reviews). The alternative accounts discussed earlier, the semantic network account, the response priming account, and the attention and perceptual memory account, do not explain the repeatedly observed dependence of affective influences on the perceived informational value of individuals' feelings (Schwarz & Clore, 1996).

The present findings, however, raise the possibility that some affective influences are unlikely to follow the inferential patterns observed for moods and emotions (see Forgas, 1995, p. 43 for a discussion of this issue). This may be the case when affective reactions feed into currently underspecified automatic processes, which result in a change in judgements. This may also be the case when affective reactions are not represented in a form of conscious feeling. Hence, the present findings do not falsify the feelings-as-information model as an account for the impact of subjective experiences. Rather, they suggest that the logic underlying the model may be inapplicable to conditions where the affect induction does not result in consciously experienced feelings.

Moreover, as indicated earlier, the present findings may be interpreted as suggesting that affective priming involves a (mis)attribution of preference responses instead of a misattribution of feelings. A test of this possibility would require that the experimental instructions target (mis)attribution of preference responses rather than of feelings and "gut reactions". Note, however, that such discounting predictions again assume that the evaluative response and a target stimulus are linked by an inferential "attributional" process, and not by a more primitive process. Furthermore, the discounting prediction assumes that subjects are able to detect and separate two liking responses—the first to the prime, and the second to the ideograph. If the liking responses were not separable for some reason (e.g. because subjects experience only one single, or one combined, preference

response that is simultaneous to the perception of the ideograph), attributional manipulations would be inefficient. Nevertheless, the obtained affective priming effects could still reflect a misreading of the preference response to the prime as a preference response to the ideograph.[5]

In conclusion, the present findings suggest that there are good theoretical and empirical reasons to consider models of affective influences on evaluative judgements that do not require a mediating role of consciously experienced feelings. The findings also suggest that some types of affective influences may not be responsive to attributional manipulations designed to vary their informational value. Although our present understanding of the precise mechanisms underlying subliminal affective priming remains tentative, current research suggests that the affective primacy hypothesis provides a framework that may guide the search for a theoretical account of this basic phenomenon.

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[5] The issue of separability and discriminability of affective responses is of key importance here. This is further highlighted by recent findings by Gasper and Clore (1996). These authors informed subjects about plausible situational causes of their moods, but obtained the usual discounting effect only for subjects high on attention to emotion. In contrast, subjects low on attention to emotion showed an increase in mood-congruent judgement under discounting conditions, presumably reflecting enhanced attention to their feelings. This type of evidence suggests that when detectability of affective changes is situationally or dispositionally low, a discounting manipulation may actually enhance affect-congruent effects. The findings of Gasper and Clore (1996) are consistent with the pattern observed in Experiment 1, where forewarning led to an increase in the affective priming effect. However, in Experiment 1 forewarned subjects did not report experiencing feelings, nor did they report relying more on ''gut reactions'' while making judgements of ideographs, thus suggesting that forewarning increased attention to the task rather than attention to emotion.

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