Additivity of Nonconscious Affect: Combined Effects of Priming and Exposure

Sheila T. Murphy
University of Southern California

Jennifer L. Monahan
University of Georgia

R. B. Zajonc
Stanford University

Affect deriving from 2 independent sources—repeated exposure and affective priming—was induced, and the combined effects were examined. In each of 4 studies, participants were first shown 72 Chinese ideographs in which the frequency of exposure was varied (0, 1, or 3). In the second phase participants rated ideographs that were primed either positively, negatively, or not at all. The 4 studies were identical except that the exposure duration—suboptimal (4 ms) or optimal (1 s)—of both the initial exposure phase and the subsequent priming phase was orthogonally varied. Additivity of affect was obtained only when affective priming was suboptimal, suggesting that nonconscious affect is diffuse. Affect whose source was apparent was more constrained. Interestingly, increases in liking generated through repeated exposures did not differ as a function of exposure duration.

Systematic data on nonconscious[1] affective processes are scarce and scattered. Although the concept figures prominently in the psychoanalytic literature (e.g., Fenichel, 1945, pp. 161–167, 238–240), its role as an explanatory construct in general experimental psychology has suffered critique, rejection, and disdain. Yet there are a number of experimental results that are difficult to interpret without postulating some form of nonconscious affect. These include the phenomena of perceptual defense (Bootzin & Natsoulas, 1965; Bruner & Postman, 1948), perceptual vigilance (Blum, 1954; Pratto & John, 1991), subliminal perception (Shevrin, 1990), mood effects on memory (Bower, 1981), autonomic discrimination without awareness (Corteen & Wood, 1972; Lazarus & McCleary, 1951; McGinnies, 1949), growth of positive affect produced by subliminal repeated exposure (Bornstein & D'Agostino, 1992; Kunst-Wilson & Zajonc, 1980), unconscious affective priming (Kitayama, 1991; Murphy & Zajonc, 1987, 1988, 1993; Niedenthal, 1987, 1990), and others. Although many of these phenomena were dismissed as artifacts (Dixon, 1981; Erdelyi, 1974; Eriksen, 1963; Goldiamond, 1958; Zajonc, 1962), for most, an explanation more parsimonious than the activation of nonconscious affect has not been successfully defended.

Intuition concurs. We have daily experiences in which we find ourselves cheerful or depressed without having the slightest clue as to the origins of these states. "Free-floating anxiety," surely a form of nonconscious affect, afflicts millions (Beck, 1976), yet its workings are far from explicated. There are also reports of "free-floating joy," a much less worrisome and therefore even less researched phenomenon (Isen, 1990).

Affect is nonconscious when the person is not aware of its source, of its target, or both. In phobias, for example, the patient is aware of the target (e.g., spiders) and of the feeling evoked, although the fear's origins, embedded in the patient's reinforcement history, may not be accessible to awareness. In cases of free-floating anxiety, the origin and target of the anxiety are both unrecognized by the patient (Beck, 1976), but the feeling state itself figures prominently in consciousness. It is possible for affect to gain influence over behavior or mental processes with even less access to awareness. Without conscious access to source, to target, or to the feeling state itself, affective influences may be revealed only indirectly (Reingold & Merikle, 1988,

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Correspondence concerning this article should be addressed to Sheila T. Murphy, Annenberg School of Communication, University of Southern California, 3502 South Hoover St., Los Angeles, California 90089-0281.

[1] Some authors use the term *unconscious* interchangeably with *nonconscious.* Because the former term may imply repression, we prefer the latter. Moreover, Freud (1915) often contradicted himself when speaking of the role of consciousness in emotional and affective reactions. At one point, he stated the following:

> It is surely the essence of emotion that we should be aware of it, i.e., that it should become known to consciousness. Thus the possibility of the attribute of unconsciousness would be completely excluded as far as emotions, feelings, and affects are concerned. (p. 177)

Yet in the same context he remarks, "But in psycho-analytic practice we are accustomed to speak of unconscious love, hate, anger, etc., and find it impossible to avoid the strange conjunction, 'unconscious consciousness of guilt,' or a paradoxical 'unconscious anxiety" ' (pp. 177–178).

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1991; Schacter, 1987), such as in word associations or slips of the tongue. Qualitative differences among these types of nonconscious affect are of interest in and of themselves. However, as a point of departure into the investigation of nonconscious affect, the current work focuses on affect of which the individual is not aware of the source, that is, its eliciting stimulus condition.

Part of the confusion surrounding the study of nonconscious affect is that, with few exceptions (e.g., Kihlstrom, 1987), theoretical reviews of the literature have sought to absorb affect into cognitive theories and thus treat nonconscious affect and nonconscious cognition as representing the same process. How might affective and cognitive processes differ? The roots of the distinction between cognition and emotion reach to Greek epistemology of the 5th century BC. Protarchus observed that we can readily say of cognitions (i.e., knowledge) that they are either true or false. But the same cannot be said of emotions. One can certainly conceal or distort the expression of an emotion, such as anger, and thus falsify its outward manifestation. But we cannot say of the *experience* of our anger that it is either true or false.

Moreover, cognitions are dedicated. They have a specific address, target, or referent. They are always *about* something. This content specificity may apply to both conscious and nonconscious cognitions.[2] In lexical priming, for example (Marcel, 1983a, 1983b; Meyer & Schwaneveldt, 1971), suboptimal primes influence only judgments of words that are semantically related. The prime NURSE reduces the response time of the lexical decision for the word DOCTOR, but it has no influence over the response time to the word MUFFLER. Such semantic priming effects are explained by appealing to semantic or cognitive network models that focus on spreading activation from the node representing the prime to the node representing the target (den Heyer, Briand, & Smith, 1985; Neely, 1977). If the target is semantically related to the prime, search is facilitated because the target node has been activated with the prime as part of the entire network. In short, cognition, even when nonconscious, appears to be dedicated and content specific, influencing only related concepts.

In contrast, nonconscious affect need not be dedicated; it need not be *about* a particular target. In the extreme case, nonconscious affect is more like liquid. It can disperse, scatter, permeate, combine, fuse, blend, spill over, and become attached to totally unrelated stimuli.[3] In a recent series of studies, Murphy and Zajonc (1987, 1988, 1993) presented Chinese ideographs that were preceded by 4-msec suboptimal[4] exposures to a variety of primes. In certain conditions the suboptimal primes consisted of faces expressing positive or negative emotions. These nonconscious affective primes were capable of inducing affect that became displaced onto the Chinese ideographs. When preceded by a positive facial expression, the ideographs were judged more positively than when preceded by a negative facial expression, even though neither expression nor even the presence of an image of a face was accessible to participants' awareness.[5] In contrast to the affective facial primes, suboptimal priming using nonaffective primes, such as geometric shapes, failed to produce related shifts in participants' judgments of the ideographs. For example, symmetric primes presented suboptimally did not induce participants to view subsequent target ideographs as more symmetric. Thus, the content of cognitive priming at suboptimal viewing conditions did not diffuse freely onto unrelated stimuli. Affect and cognition, therefore, appear to have different time trajectories and distinct content constraints (Murphy & Zajonc, 1987, 1988, 1993 Figures 2 and 3; Zajonc, 1980), suggesting that they are separable processes.

The explanation of these effects appealed to the affective primacy hypothesis, which holds that affective reactions can be evoked with minimal sensory input and virtually no cognitive processing and that they can be evoked earlier than cognitive responses. It was presumed that because affect is primary and because of its diffuse quality, nonconscious affect deriving from the facial primes could "spill over" onto the target Chinese ideographs.

It is interesting to note that the identical affective primes presented for 1,000 msec, and therefore available to conscious awareness, did not significantly alter ratings of the ideographs. These findings suggest that while nonconscious affect may be diffuse in nature and capable of attaching itself even to unrelated targets, conscious affect, because it contains significant cognitive components, may be more constrained.

In addition to the tendency to subsume affect into cognitive processes, previous research has also failed to observe the distinction between reactions that are based on nonconscious affect and those based on more conscious affective evaluations. Nonconscious affect is diffuse, and its target is at best ambiguous. As cognitive processes enter into the affective reaction, elaboration or appraisal of these reactions accumulates (Ellsworth & Smith, 1988), and affect gains in specificity. Affect deriving from cognitive appraisal (Ellsworth & Smith, 1988; Lazarus, 1982) has a specific source and target. It is for this reason that when the faces expressing affect in the experiments by Murphy and Zajonc (1993) were presented for a full second, cognitive factors contributed to and diluted the overall affective reaction. Because of increased cognitive elaboration and the re-

[2] In the case of nonconscious cognitive or perceptual influences (e.g., Bargh, Bond, Lombardi, & Tota, 1986; Bargh & Pietromonaco, 1982; Greenwald, Klinger, & Lui, 1989; Higgins, Rholes, & Jones, 1977; Lewicki, 1986; Marcel, 1983a, 1983b; Merikle, 1982; Meyer & Schwaneveldt, 1971; Srull & Wyer, 1980; Uleman & Bargh, 1989), the effects appear to be content specific.

[3] These metaphors may prove particularly apt in light of recent studies linking mood and other massive states such as sleep to nonsynaptic neurotransmission (Bach-y-Rita, 1993). In the course of this process, neurotransmitters and other neuroactive substances such as dopamine, norepinephrine, serotonin, and acetylcholine are diffused through the extracellular fluid and reach extrasynaptic receptors (DiChiara, 1990; Ungerstadt, 1984). Extrasynaptic transmission has been demonstrated not only for massive states but for acute events such as responses to sensory stimuli. For example, nitric oxide, commonly referred to as laughing gas, is diffused in this manner and has a remarkably fast onset (a matter of a few seconds) and decay (Garthwaite, 1991). Such extrasynaptic transmission also takes place in the autonomic nervous system and, consequently, has direct implications for affective excitation (Stjärne, 1986, 1989).

[4] The term *suboptimal* was used by Murphy and Zajonc (1993) to indicate that stimulus presentation did not afford access to the stimulus sufficient for recognition. The term *subliminal* was not used in the earlier and the present research because individual limens were not assessed for each participant.

[5] It is important to note in this context that the prime and the target were semantically and categorically unrelated.

sultant specificity or dedication, appraised affect may be more resistant to being displaced or combined. For instance, the fact that one is disappointed over a rejected article does not readily merge with one's pleasure over an election outcome. If one of these sources of affect is not accessible to awareness, however, fusion of the two affective reactions is more likely. Schwartz and Clore (1983), for example, found that when survey respondents were asked about their well-being, they gave more positive answers on sunny days. When participants were made aware of the weather, the effect disappeared. Thus, conscious affect, to the extent it involves cognitive appraisal, may be content specific.

As Merikle (1992) noted, the distinction between conscious and nonconscious perceptual processes is much more interesting and significant if access to awareness leads to qualitatively different consequences than if nonconscious processes are merely weaker versions of conscious processes. To test the hypothesis that nonconscious affect is diffuse whereas affect whose source we are consciously aware of is more constrained, affect from two independent and unrelated sources could be induced, and the manner in which the two effects combine could be examined. To do so, the present research relied on two paradigms: the affective priming paradigm discussed earlier and the growth of positive affect produced by repeated exposure (Kunst-Wilson & Zajonc, 1980).

Research has consistently shown that when frequency of exposure to a particular stimulus is increased, the stimulus is better liked. This "mere exposure" effect was initially found for stimuli fully accessible to awareness and has been demonstrated in a variety of contexts using a wide assortment of stimuli, populations, and procedures (Bornstein, 1989; Harrison, 1977).[6] Early theorists explained this growth in affect with repeated exposures as being based on feelings of subjective familiarity or recognition. In this theoretical framework, an individual confronted with a familiar object experiences a "glow of warmth, a sense of ownership, a feeling of intimacy" (Tichener, 1906, p. 411). More recent theorizing, however, challenges this notion that subjective familiarity underlies the mere exposure phenomenon. Evidence has accumulated showing that affect which the valence derives from repeated exposures can be obtained with stimulus exposures that are not accessible to the participants' awareness (Barchas & Perlaki, 1986; Bonnano & Stilling, 1986; Bornstein, Leone, & Galley, 1987; Kunst-Wilson & Zajonc, 1980; Mandler, Nakamura, & Van Zandt, 1987; Seamon, Brody, & Kauff, 1983a, 1983b). In these studies the initial stimulus exposures were so degraded that subsequent tests revealed no more than chance discrimination between old and new stimuli. Yet despite this lack of conscious recognition, the stimuli increased in attractiveness as a function of the actual number of degraded exposures. In fact, the growth in preference with repeated exposures is as true for degraded stimuli (Kunst-Wilson & Zajonc, 1980; Seamon, Brody, & Kauff, 1983a, 1983b) as it is for optimally presented stimuli (Matlin, 1971; Moreland & Zajonc, 1977, 1979), and in one comparison, the exposure effect was found to be stronger for the degraded condition (Bornstein, 1987). Thus, several studies have found that subjective familiarity is not a necessary precondition for the growth of affect associated with exposure (Kunst-Wilson & Zajonc, 1980; Matlin, 1971; Wilson, 1979). Instead, it is the person's objective history of encounters that influences the gain in positive affect toward the object exposed.

Why is it the case that the mere exposure effect has been demonstrated at both suboptimal and optimal durations, whereas affective priming is effective suboptimally and relatively ineffective at optimal durations? Recall that in the aforementioned priming study (Murphy & Zajonc, 1993), affect did not influence evaluations when participants became aware of a source of affect other than the target ideographs, namely the optimal facial primes. In the mere exposure paradigm, however, the source of the positive affect generated seems to be equally obscure at both suboptimal and optimal exposure durations. In studies involving mere exposure, individuals are unaware of the relationship between frequency of exposure and affect and virtually never refer to their repeated experience with the stimuli in explaining their preferences. In much the same way that increasing the length of time of exposure to a word in a foreign language does not clarify its meaning, increasing the length of time people are exposed to a novel stimuli does not lead them to infer the relationship between repeated exposures and positive affect. Hence, in the mere exposure paradigm, the source of the affect typically remains unavailable regardless of exposure duration.

Combining priming and exposure within the same experimental paradigm and comparing their effects under optimal and suboptimal stimulus durations may shed some light on the interplay of affect, cognition, and awareness. The present research attempted to do just that by crossing stimulus accessibility—optimal and suboptimal—with these two paradigms of affective influence—repeated exposure and affective priming—in a series of four studies. Each study included an initial exposure phase in which mere exposure was induced by varying the frequency of exposure to novel stimuli, Chinese ideographs. In a second phase, participants rated ideographs that were preceded by positive, negative, or no affective primes. Extrapolating from the previous experimental literature, a number of predictions can be made. Because exposure effects work under both optimal and suboptimal conditions, there should be a main effect for exposure in all four studies. According to the study by Murphy and Zajonc (1993), however, affective priming should be effective only under suboptimal conditions.

Our primary hypothesis, however, concerns the additivity of nonconscious affect. If nonconscious affect were diffuse, we would expect suboptimal affective priming to combine with the positive affect generated from repeated exposures. Moreover, there is no reason to believe that the contribution from an initial

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[6] Exposure effects have been found for ideographs (Moreland & Zajonc, 1977; Zajonc, 1968), letters (Nuttin, 1987), nonsense words (Matlin, 1971), odors (Balogh & Porter, 1986; Davis & Porter, 1991), flavor (Newlin & Pretorius, 1991), colors (Franchina, 1991), food (Rogers & Hill, 1989), geometric figures (Fink, Monahan, & Kaplowitz, 1989; Seamon, Marsh, & Brody, 1984), photographs of faces (Morinaga & Matsumura, 1987), actual persons (Moreland & Beach, 1992) and many other stimuli. Populations found to be responsive to exposure effects include undergraduates (Bornstein, 1989), nationals of 12 different countries (Nuttin, 1987), sons of alcoholics (Newlin & Pretorius, 1991), amnesiacs (Williams, 1990), dieters (Rogers & Hill, 1989), human neonates (Davis & Porter, 1991), chick embryos (Grier, Counter, & Shearer, 1967; Rajecki, 1972, 1973), chicks (Franchina, 1991), ducklings (Lickliter & Gottlieb, 1986), as well as several other species. Readers might refer to Bornstein (1989) or Harrison (1977) for more extensive reviews of the mere exposure literature.

source of affect (repeated exposures) should change as a result of affect deriving from a second source (priming). Thus, because the two influences are mutually independent, we predicted that the affect derived from suboptimal priming, positive or negative, would combine in a roughly additive fashion with exposure effects. When both sources of affect—repeated exposure and priming—are suboptimal (Study 1), exposure effects should have parallel curves for the various affective prime conditions (negative, neutral, and positive). Because, as discussed previously, individuals are not aware of the influence of repeated exposures on liking, the same pattern of results should hold true when repeated exposures become optimal (Study 2). In contrast, as the affective primes become available to conscious awareness, we expected their influence to become constrained. Consequently, when affective primes were presented under optimal viewing conditions (Studies 3 and 4), we expected their effect to be substantially reduced, perhaps even eliminated, but when present, no longer additive.

Method

Overview

The primary objective of the present studies was to determine whether, and under what conditions, affect derived from two independent sources will merge. To this end, participants were first exposed to a series of Chinese ideographs at 4-msec suboptimal (Studies 1 and 3) or 1,000-msec optimal (Studies 2 and 4) viewing conditions. The purpose of this initial exposure phase was to induce the mere exposure effect by varying stimulus duration (a between-subjects factor) and frequency of exposure (a within-subject factor) to novel stimuli. The second phase of the experiment involved a priming paradigm in which the presentation of one stimulus, or prime, alters participants' perceptions of a second target stimulus. In this second phase, participants rated ideographs that were primed either positively, negatively, or not at all. In Studies 1 and 2, these primes were suboptimal, whereas in Studies 3 and 4, these primes were presented at optimal viewing conditions.[7]

Participants

One hundred forty undergraduates served as participants in partial fulfillment of a course requirement. Approximately one half of the participants were female. No students who were familiar with the Chinese, Japanese, or Korean language participated. Studies 1 and 2 had 40 participants each, whereas Studies 3 and 4 had 30 each.

Design

Combining all four studies, the design is a 2 (Stimulus Duration: optimal vs. suboptimal) × 2 (Priming Duration: optimal vs. suboptimal) × 3 (Frequency of Exposure: zero, one, three) × 3 (Valence of Prime: negative, no prime, positive) mixed factorial with the first two factors between-subjects factors and the last two factors, within-subject. Mere exposure was induced suboptimally in Studies 1 and 3, whereas an optimal stimulus duration was used in Studies 2 and 4. Affective priming was induced suboptimally in Studies 1 and 2 and optimally in Studies 3 and 4.

Within each study, the two unrelated sources of affect—frequency of exposure and affective priming—were crossed in a 3 × 3 within-subject factorial design. The exposure factor was the number of times each ideograph was exposed in the initial exposure phase (zero, one, or three exposures). The priming factor was the valence of the affective prime (negative, no prime, positive) that was presented in the subsequent rating phase.

Materials and Apparatus

Equipment. Two slide projectors, each outfitted with a Uniblitz shutter and a red filter, were used to project 45- × 60-cm images onto a screen at participants' eye level at a distance of approximately 1.5 m. This presentation resulted in a 17° visual horizontal angle and a 20° vertical angle. Luminance of the screen field was approximately 60 cd/m^2. The shutters, calibrated to be accurate to within 10% of the selected shutter speed, were controlled by two Uniblitz Relay Control Boxes (Model T-132).

MicroExperimental Lab Software (MEL) on an IBM XT microcomputer was used to control the slide carousels and the sequencing of the Uniblitz shutters, and to collect participants' responses. Participants received all instructions on the computer.

Target stimuli. The stimuli used in the repeated exposure phase and then as targets of affective priming were Chinese ideographs, selected as being affectively bland, novel, and ambiguous (Murphy & Zajonc, 1987, 1988; 1993; Niedenthal, 1987, 1990).

Affective primes. Slides of eight male and eight female faces expressing happiness or anger, previously judged to be clear examples of the emotions of happiness and anger (Ekman, 1972), were selected as affective primes. Among possible affective images, faces were selected as affective primes because the facial configurations associated with happiness and anger have been found to be universally recognized as indicators of positive and negative affect (Ekman, 1972), thus reducing the possibility of idiosyncratic responses to the primes. Previously, these faces were found to produce reliable priming effects (Murphy & Zajonc, 1987, 1988, 1993). Once again, these priming stimuli were employed only in the rating phase of the present experiment.

Procedure

For the suboptimal presentations of the Chinese ideographs, the following instructions were given:

> The experiment you will be participating in deals with how quickly people can make judgments of new or novel stimuli. The novel stimuli you will view are drawings of Chinese ideographs. The Chinese ideographs will be presented at very rapid speeds, so rapid that you may be unable to CONSCIOUSLY see them. After a Chinese ideograph is "flashed" briefly on the screen it will be followed by a one-second exposure of a background picture. The background picture is a print of black, white and grey dots. The background picture will give you a place to focus your eyes before the next ideograph is flashed.
>
> Each ideograph will be flashed for only 4 milliseconds and will be VERY DIFFICULT to consciously detect. Even if you feel that you cannot see the Chinese ideographs, we would still like you to pay attention to the screen. One second before each picture is flashed on the screen, the computer will "beep" to alert you.
>
> After you view this first series of ideographs, you will make some snap judgments about a second series of ideographs. We will explain more about these snap judgments after you view the first series.

In Studies 2 and 4, the ideographs in the initial exposure phase of the experiment were presented at optimal durations of 1,000 msec. To provide a rationale for viewing the ideographs during the exposure phase, participants were told that the study dealt with snap judgments of novel stimuli and that in the second phase of the study they would be

[7] Because of space concerns, the four studies are first presented in a single overall analysis. These between-subjects analyses should be interpreted with caution, however, because participants were not randomly assigned to the four experiments.

making some snap judgments of a series of Chinese ideographs. First, however, to provide a basis for comparison, they would be shown a cross-section of ideographs similar to those they would later be asked to judge.

Phase 1: Repeated exposures. During the initial exposure phase, participants viewed 72 ideographs. In Studies 1 and 3, each ideograph was shown for 4 msec, immediately followed by a backward mask consisting of a slide with white, grey, and black dots. In Studies 2 and 4, the same ideographs were shown for 1,000 msec each. In all studies there was a 1,500-msec interval between successive exposures.

Of the 72 exposures, 24 were filler ideographs, each of which was shown only once and was not included in the second, affective priming phase of the experiment. The sole purpose of the filler ideographs in the initial exposure phase was to increase the overall pool of ideographs so that participants would be less likely to notice repetitions. The remaining 48 exposures served to induce the mere exposure effect by varying frequency of presentation. These 48 trials consisted of 24 different ideographs divided into two groups (A and B) of 12 ideographs each.

As frequency of exposure was manipulated in Phase 1, it was counterbalanced. Specifically, to ensure that there was no systematic difference between ideographs selected to be shown only once as opposed to those shown three times, in the initial exposure phase frequency of exposure to sets A and B was counterbalanced. Thus, half of the participants within each study were presented with set A ideographs three times in the initial exposure phase (36 presentations) and set B ideographs only once (12 presentations). The other half of the participants were presented with each of the set B ideographs three times and each of the set A ideographs only once.

Phase 2: Affective priming. Following the exposure phase, participants rated a series of 48 ideographs. Of the 48 ideographs rated, 12 had been shown three times during the initial exposure period, 12 had been shown once, and 24 had not been presented previously. Thus, participants rated 24 ideographs they had seen previously (the ideographs included in sets A and B) as well as 24 ideographs they had not encountered previously (12 ideographs of the zero-exposure set C and 12 filler ideographs). "New" ideographs shown only in the rating phase remained the same for all participants. Precautions were taken to ensure that new ideographs did not differ in terms of likability or complexity from those in sets A or B. Indeed, care was taken to exclude ideographs with extreme liking ratings and to include 6 relatively simple and 6 relatively complex ideographs at each level of exposure (zero, one, and three).[8]

Within each exposure condition (zero, one, or three exposures), four ideographs were primed with positive affective primes, four were primed with negative primes, and four had no primes. As affective priming was manipulated in Phase 2, valence of affective prime was counterbalanced. Specifically, to ensure that there was no systematic association between particular ideographs and particular primes, the valence of the prime associated with any given ideograph was counterbalanced during this second rating phase. In other words, any given ideograph in sets A, B, and C was preceded by a negative prime for one third of the participants, a positive prime for another third, and no prime for the final third. All participants rated the ideographs in the same order. The first and last three ideographs in the sequence were filler ideographs shown without primes.

In Studies 1 and 2, the affective primes were presented suboptimally using a backward pattern-masking technique, in which the prime (a face) was presented for 4 msec, followed immediately by the presentation of a target stimulus (an ideograph) for 1,000 msec. Participants were not informed that the ideographs were preceded by suboptimal primes. The rating series began with three practice trials. By contrast, in Studies 3 and 4 the same apparatus and procedure were used except the facial primes were presented optimally for 1,000 msec each. To provide a rationale for viewing the facial primes during the rating phase, participants were given additional instructions prior to rating the ideographs:

> While you are rating the set of Chinese Ideographs, you may notice a series of pictures of people expressing different forms of emotion on the screen. You do not need to rate these pictures as subjects in other conditions will do so. Remember, your job is to rate *only* the Chinese Ideographs.

Dependent Measures

In Phase 2 of the study, the target ideographs were each presented only once. Participants made two judgments about each ideograph: liking and recognition. Participants were first asked to rate how much they liked a particular ideograph on a scale from 1 to 5 where 1 meant that they did not like the ideograph at all and 5 meant they liked the ideograph quite a bit. Next, as an indicator of recognition, participants were asked whether they thought the particular ideograph had been shown during the first series. They were instructed to press a key marked OLD if they thought they had seen the ideograph in the first phase and to press a key marked NEW if they felt the ideograph had not been shown previously.[9]

Manipulation Check: Forced-Choice Test of Awareness

A number of criticisms have been leveled at experiments reporting priming effects obtained with stimuli presented under degraded conditions. For the most part, these critics justifiably question whether there is a total absence of conscious detection or identification (Holender, 1986). To ensure that the degraded 4-msec presentation of the affective primes was, in fact, below conscious awareness, participants were given a forced-choice test of awareness following the 48 trials, as suggested by Eriksen (1980). At this point, participants were informed that they would be given a series of trials in which faces were presented briefly, immediately followed by an ideograph. As in the experiment itself, the computer emitted a "beep," signaling a 4-msec presentation of a prime (a face) that was immediately followed by a 1,000-msec presentation of a backward mask (an ideograph). Participants were then presented with two test faces: an image of the actual prime on one side of the screen and of an alternate face, or foil, on the other side of the screen. The faces were of the same gender and expressed the same emotion.[10] Participants were then asked which of the two faces they thought was the prime. The rationale underlying this forced-choice test is that if participants truly cannot detect the prime, they should do no better than chance at recognizing it. Each participant took part in 12 such forced-

[8] A pretest was conducted in which an additional 30 participants rated a preliminary pool of ideographs with respect to liking and complexity.

[9] The decision to use a dichotomous recognition judgment (OLD–NEW) was guided by an interest in replicating the paradigm used in previous studies (i.e., Moreland & Zajonc, 1979). It should be noted, however, that a 5-point scale similar to that used in the liking judgment would have permitted a greater degree of sensitivity and comparability (Reingold & Merikle, 1988).

[10] It is important to note that the emotional expression of the prime and foil was kept constant. In a study by Murphy (1990), participants in a similar forced-choice test of awareness were unable to discriminate between two faces (the actual suboptimal prime and a foil) when the faces expressed the same emotion (i.e., both smiling) but were able to identify the prime accurately when the two faces expressed hedonically opposing emotions (one smiling and one angry). In short, it appears that participants are able to process nonconscious affective cues that allow them to perform at a level greater than chance on this task. Because the purpose of this manipulation check was to test for subjective awareness of the suboptimal primes, however, the hedonic valence of the prime and foil was held constant.

choice trials. Participants were subsequently debriefed and thanked for their participation.

Results

Manipulation Check: Forced-Choice Test of Awareness

On the forced-choice test of awareness, participants scored an average of 5.80 correct out of a possible 12, which is not significantly different from a chance score of 6. This result demonstrates that a 4-msec exposures, participants were unable to distinguish between a facial prime presented 1 s earlier and a novel face.

Analyses

These analyses examine the effects of repeated stimulus exposure and affective priming on the liking rating of the target Chinese ideographs. The 36 liking means from all four data sets ($N = 140$) were entered into a 2 (Exposure Duration: optimal vs. suboptimal) × 2 (Priming Duration: optimal vs. suboptimal) × 3 (Number of Exposures: zero, one, three) × 3 (Valence of Prime: negative, no prime, positive) mixed analysis of variance (ANOVA) with the first two factors between-subjects and the last two factors within-subjects.[11] Duration of the repeated exposures and primes are between-subjects factors, whereas the frequency of exposures and type of prime are within-subject factors. There was no significant effect caused by which ideograph set (A or B) was shown three times as opposed to only once in the initial exposure phase; therefore, this counterbalancing was ignored in the subsequent analysis. Similarly, there appeared to be no relationship between the pairing of any particular ideograph with a particular valence of prime; thus, the counterbalancing of valence of prime in Phase 2 was likewise excluded from the following analysis.

Duration of repeated exposure.[12] Across the four studies, the main effect for stimulus duration during the initial exposures phase was significant, ($M = 3.11$ optimal, $M = 2.95$ suboptimal), $F(1, 136) = 4.45, p = .037$. A closer examination of the means, however, indicates that the effect for duration occurred only in the one-exposure condition. In the one-exposure condition, ideographs shown optimally were liked marginally better than ideographs shown suboptimally (*M*s of 3.06 and 2.89, respectively), $t(138) = 1.90, p < .06$. There were no other significant differences within stimulus duration.

Duration of prime. There was no between-subjects effect for duration of prime, $F(1, 136) = .34$, $p = .56$. As subsequent analyses demonstrated, however, the duration of prime interacted with valence of prime. No other effects were reliable.

Number of exposures. Across all four studies, the within-subject factor of frequency of exposure (zero, one, three) on liking was significant (zero exposure $M = 2.78$, one exposure $M = 2.97$, three exposures $M = 3.34$), $F(2, 272) = 77.83, p < .001$. As frequency of exposure increased, the liking evaluations became more positive. There were no interactions between frequency of exposure and stimulus duration or duration of prime. Thus, as predicted, the mere exposure effect was operant under both suboptimal and optimal conditions.

Valence of prime. The main effect for the within-subject factor of valence of prime—negative prime ($M = 2.83$), no prime ($M = 3.06$), positive prime ($M = 3.20$)—was also significant, $F(2, 272) = 35.45, p < .001$. As the valence changed from negative to neutral to positive, evaluations became more positive. Valence of prime did not interact with stimulus duration in the initial exposure phase, yet it did interact significantly with duration of prime, $F(2, 272) = 47.91, p < .001$. An examination of the means indicates that priming was more effective at the suboptimal level. The mean liking ratings for target ideographs preceded by smiling facial primes were significantly more positive when the prime was presented suboptimally as opposed to optimally (means of 3.35 and 3.01, respectively), $t(138) = 3.61$, $p < .001$. For ideographs shown with an angry face, the mean liking for the suboptimal prime was significantly more negative than that for the optimal prime (*M*s of 2.65 and 3.07, respectively), $t(138) = 5.09$, $p < .001$. The means for the no-prime condition did not significantly differ according to priming duration (*M*s of 3.09 and 3.08), $t(138) = .47$, *ns*. No other effects were reliable. These results supported our hypothesis that the suboptimal primes would result in a purer affective response: Only when the primes were suboptimal did the positive primes lead to more positive evaluations and the negative primes lead to more negative evaluations. This pattern did not hold for optimally presented primes.

Combined Effects of Exposure and Affective Priming

We hypothesized that when affective primes were presented suboptimally, they would combine in an additive fashion with the positive affect generated through repeated exposure. Thus, in Studies 1 and 2, it was hypothesized that frequency of exposure and valence of the affective primes would have roughly parallel effects. Such an additive effect was not hypothesized for Studies 3 and 4, in which the affective primes were presented optimally.

Suboptimal exposure–suboptimal primes. Figure 1 presents mean liking ratings of the ideographs as a function of repeated suboptimal exposure and suboptimal affective priming. Liking ratings were analyzed by subtracting the constant 3 to produce scores that ranged from +2 to −2 such that positive numbers indicate an increase from the midpoint on the 5-point Likert scale, whereas negative numbers indicate a decrease.

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[11] In light of our unequal cell sizes, we used a Model III multivariate analysis of variance (MANOVA).

[12] Because previous research has shown exposure effects obtained under optimal conditions to have logarithmic slopes, we assessed quadratic and linear trends for frequency of exposure (three, one, and zero), although the shapes of the exposure slopes do not pertain to the theoretical effects of interest in this study. The *linear and quadratic trends* for number of exposures (three, one, zero) were significant $t(278) = 10.62$, $p < .001$, $t(278) = -3.0$, $p = .003$; this quadratic effect was primarily accounted for by the results for the two suboptimal data sets (Studies 1 and 3). For Study 1, the data revealed a significant linear trend for exposure, $t(78) = 5.43, p < .001$, and a marginal quadratic trend, $t(78) = 1.85, p = .07$, and this finding was replicated in Study 3, $t(58) = 4.57$, $p < .001$, and $t(58) = -2.21$, $p = .05$, for the linear and quadratic effects, respectively. However, care should be taken in interpreting these quadratic results given that the analyses are based on only three data points, one of which was a zero-exposure condition. There were no quadratic interaction effects between number of exposures and valence of prime. Finally, there were no quadratic effects for exposure in the two optimal exposure data sets.

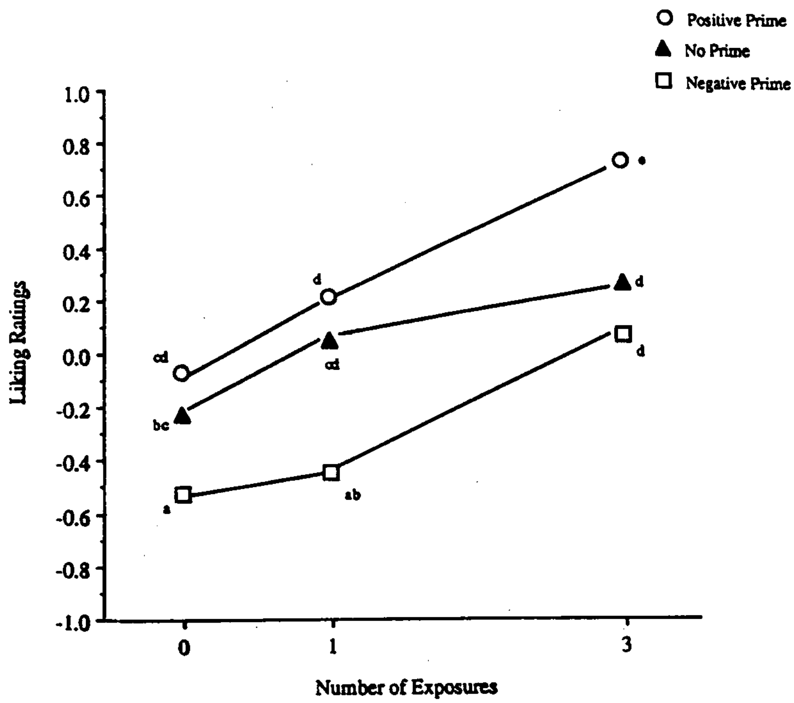

Figure 1. Study 1: Liking ratings as a function of suboptimal exposure and suboptimal affective prime. The liking ratings reported are subtracted from the average liking rating of 3. Items with shared subscripts are not significantly different at $p < .016$.

The data revealed a main effect for frequency of exposure (zero exposure M = 2.72, one exposure M = 2.93, three exposures M = 3.34, $F(2, 78) = 23.37, p < .001$) and for affective priming (negative prime M = 2.69, no prime M = 3.02, positive prime M = 3.27), $F(2, 78) = 30.02, p < .001$. Figure 1 shows mean liking ratings of the ideographs as a function of frequency of exposure and affective priming. In Figure 1, the intercept differences among the three curves reflect the effects of nonconscious priming, whereas the slopes of the curves represent the mere exposure effect. As shown in Figure 1, positive priming adds a constant to the affect generated by all three exposure frequencies, whereas negative priming subtracts a constant from the affective ratings in these three frequencies. Across exposure conditions, ideographs shown with positive primes produced significantly higher liking ratings than those shown with no prime, which, in turn, produced significantly higher liking ratings than ideographs shown with negative primes. The interaction between priming and exposure was not significant, $F(4, 156) = 1.70$, *ns*. These results indicate, therefore, that when two sources of affect are nonconscious, affect combines additively, the three exposure slopes being parallel.

Optimal exposure–suboptimal primes. Figure 2 shows mean liking ratings of the ideographs as a function of repeated optimal exposure and suboptimal affective priming. These data reveal main effects for both repeated exposure (zero exposure M = 2.72, one exposure M = 3.00, three exposures M = 3.38), $F(2, 78) = 35.38, p < .001$, and for affective priming (negative prime M = 2.61, no prime M = 3.07, positive prime M = 3.42), $F(2, 78) = 55.16, p < .001$. In Figure 2, the intercept differences among the three curves reflect the effects of nonconscious priming, whereas the slopes of the curves represent the mere exposure effect.

As is evident in Figure 2, the means increased as a function of frequency of exposure. In addition, across frequencies, ideographs shown with positive suboptimal primes produced significantly higher liking ratings than those shown with no prime, which, in turn, produced significantly higher liking ratings than ideographs shown with negative primes. The Exposure × Priming interaction was significant, $F(4, 156) = 4.83, p < .01$.[13] The source of this interaction is to be found among the priming means in the zero-exposure condition. Among ideographs not included in the initial exposure phase, the mean difference (M = .06) between those shown with no prime and those shown with a happy prime was not significant. However, at one exposure, there was a significant difference among all three priming conditions, as depicted in Figure 2. Thus, for the one- and three-exposure conditions, the three priming curves are parallel. Furthermore, when the analysis of variance was recalculated for the one- and three-exposure conditions, eliminating the zero-exposure condition from the analysis, the main effects for exposure, $F(1, 39) = 23.88, p < .001$, and priming, $F(2, 78) = 29.28, p < .001$, remained significant, whereas the Priming × Exposure interaction, $F(2, 78) = 2.07, p = .13$, was no longer significant.

[13] The means are as follows: three exposures (positive primes M = 3.96, no prime M = 3.34, negative primes M = 2.85); one exposure (positive primes M = 3.36, no prime M = 2.99, negative primes M = 2.63); zero exposure (positive primes M = 2.94, no prime M = 2.88, negative primes M = 2.34).

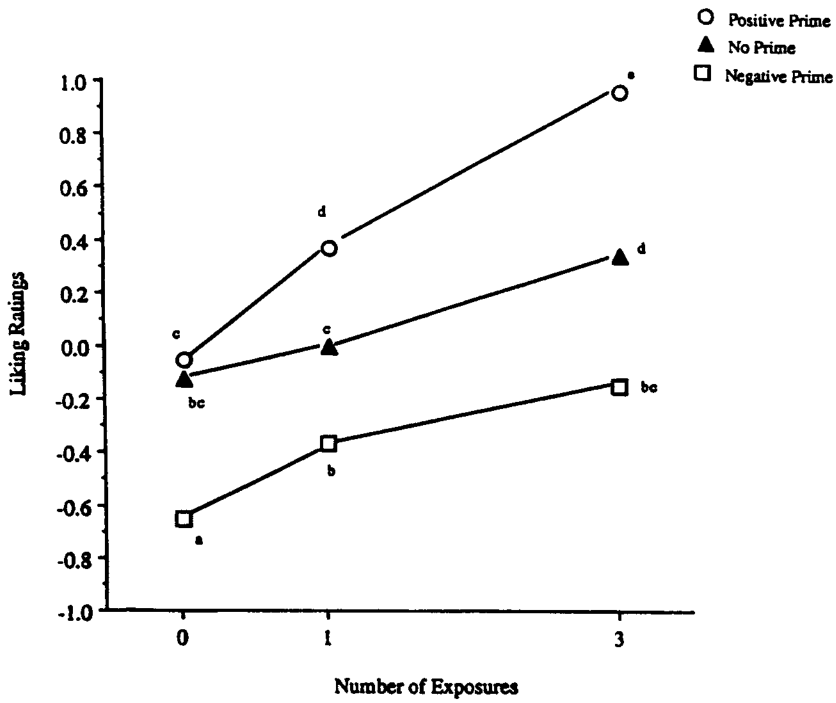

Figure 2. Study 2: Liking ratings as a function of optimal exposure and suboptimal affective prime. The liking ratings reported are subtracted from the average liking rating of 3. Items with shared subscripts are not significantly different at $p < .016$.

The results from Studies 1 and 2 support the hypothesis that nonconscious affective primes combine additively with repeated exposure effects, whether the exposure effect is suboptimal (Study 1) or optimal (Study 2). Studies 3 and 4 examined the effects of optimal affective primes.

Suboptimal exposure–optimal primes. In Study 3, the exposure effect was suboptimal, whereas the affective primes were shown at optimal viewing levels. Although a main effect for exposure was obtained (zero exposure M = 2.71, one exposure M = 2.84, three exposures M = 3.21), $F(2, 58)$ = 16.03, $p < .001$, there was no main effect for affective priming, $F(2, 58)$ = .66, *ns*, nor was there a significant interaction effect, $F(4, 116)$ = 1.64, *ns*. Even though the Chinese ideographs were presented at suboptimal viewing conditions, liking once again increased as a function of frequency, with additional exposures resulting in higher liking ratings, as evident in Figure 3.

Optimal exposure–optimal primes. Study 4 examined mean liking ratings of the ideographs as a function of repeated optimal exposure and suboptimal affective priming. The data revealed a main effect for frequency of exposure (zero exposure M = 3.01, one exposure M = 3.14, three exposures M = 3.42), $F(2, 58)$ = 11.08, $p < .001$, but the effect for affective priming was not significant, $F(2, 58)$ = 1.00, *ns*, nor was the Exposure × Priming interaction significant, $F(4, 116)$ = 1.41, *ns*. In Figure 4, the intercept differences among the three curves reflect the effects of conscious priming, whereas the slopes of the curves represent the exposure effect. Although the means increase as a function of exposure, as shown in Figure 4, the means did not vary as a function of optimal affective prime.

The results from Studies 3 and 4 indicate that when the affective priming stimuli were presented at optimal durations, there was no diffuse affect to combine with the affect generated by mere exposure in either an additive or interactive fashion.

Recognition Memory

Suboptimal stimulus durations.[14] Because the Chinese ideographs were presented at suboptimal viewing levels in Studies 1 and 3, the data for Studies 1 and 3 (suboptimal durations) were collapsed to report one overall analysis for recognition memory under suboptimal viewing conditions. Table 1 presents the liking ratings of ideographs at each exposure frequency (zero, one, three) as a function of participants' perceived and actual recognition. Results of the t tests presented in Table 1 suggest that the exposure effect did not depend on whether the participants themselves judged the stimulus to be old or new.[15] Collapsing across priming conditions, participants tended to

[14] The data for Studies 1 and 3 (suboptimal exposures) were collapsed to allow reporting of one overall analysis for recognition memory under suboptimal viewing conditions because there were no significant differences between the two studies for the exposure analyses. A similar analysis is reported for Studies 2 and 4 (optimal exposure). The original analyses, broken out by all four studies, are available from Sheila T. Murphy.

[15] It should be noted that in an attempt to avoid a Type I error, we used a conservative ($p < .016$) significance level. This level was based on the following logic: Because there are three t tests possible within each level of exposure or within each level of priming, we set the alpha at .05/3 = .016.

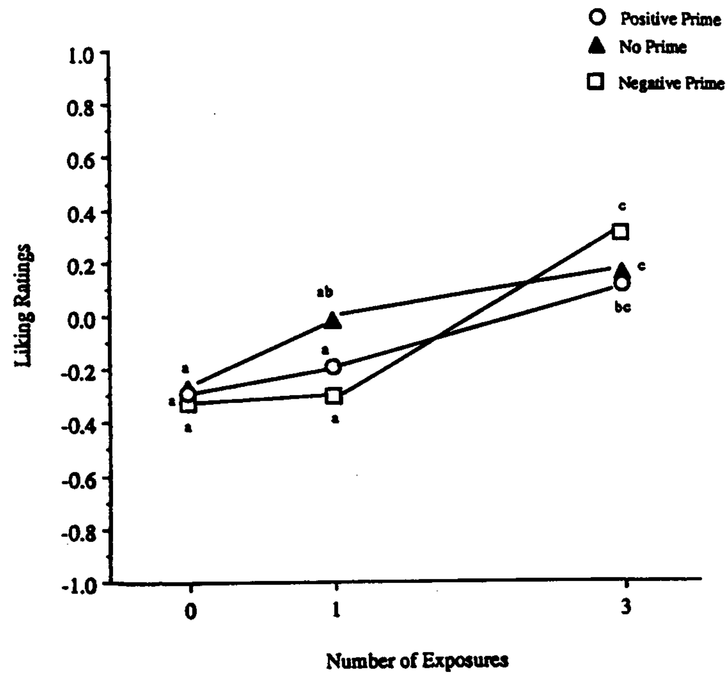

Figure 3. Study 3: Liking ratings as a function of suboptimal exposure and optimal affective prime. The liking ratings reported are subtracted from the average liking rating of 3. Items with shared subscripts are not significantly different at $p < .016$.

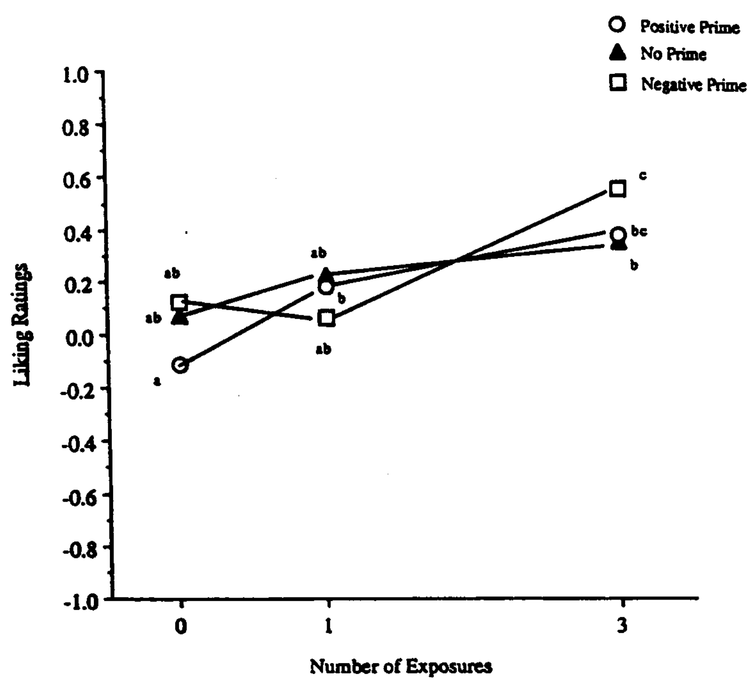

Figure 4. Study 4: Liking ratings as a function of optimal exposure and optimal affective prime. The liking ratings reported are subtracted from the average liking rating of 3. Items with shared subscripts are not significantly different at $p < .016$.

give higher liking ratings to ideographs to which they actually were previously exposed, independently of their perception of familiarity. In addition, when the ideographs were shown suboptimally in the initial exposure phase, participants' liking ratings of the ideographs perceived as old were not significantly more positive than their ratings of the ideographs perceived as new.

Regardless of the number of suboptimal presentations in the initial exposure phase (zero, one, or three) the accuracy rate never exceeded chance (48%, 40%, and 44%, respectively). The overall accuracy rate was 44%. The data show, therefore, that liking ratings are under the influence of the person's objective history of experience with these stimuli and not the person's impression of familiarity. This was so even if the participants were not aware of that history. Subjective judgments of familiarity contributed virtually nothing to liking responses. Stimuli thought to be old were rated −.04 on the liking scale, whereas those thought to be new were also near the neutral point (.02). In contrast, zero, one, and three exposures generated a clear increase in liking scores: −.23, −.06, and +.27, respectively.

Optimal stimulus durations. In Studies 2 and 4, the Chinese ideographs were presented at optimal viewing levels. Collapsing across priming conditions, the t tests presented in Table 2 suggest that participants tended to give higher liking ratings to ideographs to which they had been previously exposed and that these judgments did not depend on whether the participants themselves judged the stimuli to be old or new. In other words, participants were influenced by actual frequency of exposure (zero exposure M = −.15, one exposure M = .09, three exposures M = .39), whereas their subjective impressions of familiarity had little influence on their judgments.

Within each exposure frequency, liking ratings of ideographs perceived as old were not significantly different from ratings of those perceived as new. Collapsing across both priming and exposure conditions, liking ratings of ideographs perceived as old were somewhat higher than ratings of ideographs perceived as new (.17 vs. .02, respectively). Participants who viewed the ideographs in the initial phase under optimal viewing conditions were fairly accurate in discriminating between objectively new and objectively old ideographs. Participants correctly identified as old 72% of the ideographs that were exposed three times in the exposure phase. Likewise, they were able to identify new ideographs with an overall accuracy of 70%. However, accuracy dipped to near chance (55% correct) for ideographs shown only once in the exposure phase. The overall accuracy rate for the old–new judgments was 66%, significantly above chance.

Table 1
Liking Ratings of Ideographs as a Function of Perceived and Actual Suboptimal Exposure

Perceived exposure	Zero	One	Three
	Actual exposure		
Old	$-.24_a$	$-.10_a$	$.24_b$
	(437)	(335)	(373)
New	$-.22_a$	$-.03_a$	$.29_b$
	(403)	(505)	(467)
	Percentage of correct responses		
	48	40	44

Note. The liking ratings reported are subtracted from the average liking rating of 3. The number of judgments within each cell are presented in parentheses. This table represents the data from Studies 1 and 3, in which ideographs in the initial exposure phase were presented suboptimally for 4 ms. Items with shared subscripts are not significantly different at $p < .016$.

Table 2
Liking Ratings of Ideographs as a Function of Perceived and Actual Optimal Exposure

Perceived exposure	Zero	One	Three
	Actual exposure		
Old	$-.19_a$	$.04_b$	$.42_c$
	(248)	(462)	(608)
New	$-.14_a$	$.07_b$	$.34_c$
	(592)	(378)	(232)
	Percentage of correct responses		
	70	55	72

Note. The liking ratings reported are subtracted from the average liking rating of 3. The number of judgments within each cell are presented in parentheses. This table represents the data from Studies 2 and 4, in which ideographs in the initial exposure phase were presented optimally for 1 s. Items with shared subscripts are not significantly different at $p < .016$.

Post Hoc Analyses: Exposure Effects and Stimulus Complexity

Previous research has found that the mere exposure effect may be moderated by stimulus complexity (e.g., Bornstein, 1987; Bornstein et al., 1987; Saegert & Jellison, 1970). To examine the effects of stimulus complexity, the ideographs used in this study were rated as relatively simple or complex by independent raters. Each Exposure (zero, one, three) × Priming Condition (positive, no prime, negative) had two complex and two simple ideographs. Complexity was then entered as a two-level within-subject factor in the 2 × 2 × 3 × 3 mixed ANOVA.[16] The results indicated no significant main effect for stimulus complexity but several theoretically interesting interactions that are reported below.

Stimulus complexity × duration of exposure. Stimulus complexity interacted with stimulus duration (optimal vs. suboptimal), $F(1, 136) = 5.62$, $p = .019$. There were no significant differences caused by stimulus duration for the complex ideographs (Ms of 3.09 optimal and 3.00 suboptimal);

[16] Given that there were 48 different ideographs in the liking phase, each of which could only be shown once and each of which was either simple or complex, one could consider ideographs to be nested within complexity. However, when the design is a 2(Duration of Exposure) × 2(Duration of Prime) × 3(Frequency of Exposure) × 3(Affective Priming) × 2(Complexity) factorial with ideographs nested with complexity, the effect of the nested factor (ideograph) is not significant.

however, there was an effect for the simple ideographs such that the simpler ideographs were liked significantly more when presented at optimal duration levels during the initial exposure phase (*M*s of 3.15 optimal and 2.93 suboptimal, $F[1, 138] = 8.97$, $p = .003$). Stimulus duration of the ideographs in the initial exposure phase did not interact with duration of priming.

Stimulus complexity × number of exposures. Stimulus complexity interacted with frequency of exposure, $F(4, 544) = 4.75$, $p = .001$, such that for ideographs not previously seen in the initial exposure phase (zero exposures), complex ideographs were liked significantly more than simple ideographs (*M*s of 2.93 and 2.70, respectively), $t(139) = 3.80$, $p < .001$. However, for ideographs that appeared three times in the exposure phase, complex ideographs were liked significantly less than simple ideographs (*M*s of 3.26 and 3.42 respectively), $t(139) = 3.29$, $p = .001$. There were no significant differences for ideographs shown only once in the exposure phase (*M*s of 2.96 complex and 2.99 simple).

Discussion

The present studies were carried out under the premise that affect whose source is unavailable to awareness may have properties that distinguish it from affect whose source is known. More specifically, it was proposed that nonconscious affect may be diffuse and that affect generated from one source (repeated exposure) might easily combine with nonconscious affect elicited from a second source (priming). Thus, it was predicted that affect derived from suboptimal priming, positive or negative, would combine in a roughly additive fashion with mere exposure effects. This was indeed the case. Positive suboptimal priming roughly added a constant, whereas negative suboptimal priming subtracted a constant from the positive affect generated by mere exposure. This effect occurred regardless of whether the ideographs in the initial exposure phase were presented suboptimally for 4 msec as in Study 1 or optimally for 1,000 msec as in Study 2. In sum, positive suboptimal primes augmented whereas negative suboptimal primes attenuated the exposure effect.

In contrast to nonconscious affect, we assumed that affect available to conscious awareness would recruit cognitive appraisal and consequently be less diffuse and less likely to combine with an unrelated source of affect in a simple additive fashion. This issue was addressed systematically in Studies 3 and 4. In Study 3, the ideographs in the initial exposure phase were presented suboptimally, whereas the smiling and scowling facial primes were presented optimally. Here, as in the work of Murphy and Zajonc (1993), the optimally presented affective primes did not significantly sway judgments of the target ideographs. It is our contention that as the duration of the primes increased to 1 s, participants could readily identify the source of affect, namely the smiling and angry faces, and the associated affect became dedicated, thereby losing its capacity to merge. Note that this constriction relies on awareness of the source of affect. To the extent that individuals were aware and perhaps suspicious of the facial primes presented for 1 s immediately prior to the ideographs being rated, the primes should have little or no effect. Conversely, to the extent that individuals were *not* aware of the positive affect generated by optimally repeated exposures, the affect should continue undisrupted. These hypotheses were supported in Study 4, in which both the ideographs in the initial exposure phase and the facial primes presented in the subsequent judgment phase were shown optimally for 1,000 ms.

Combined Effects of Affective Priming and Repeated Exposure

When all four studies are entered into a single analysis, a clear pattern emerges. Whereas the growth in preference with repeated exposures proceeded regardless of stimulus duration, affective priming was only effective suboptimally. These divergent results from these two sources of affect—priming and repeated exposure—highlight the inadequacy of relying on exposure duration alone as an index of awareness. In the present research, no participant indicated being aware of any suboptimally presented stimuli. This lack of awareness was further evidenced by a failure on the part of participants to exceed chance on a forced-choice test of awareness. At suboptimal exposures, then, both the repeated exposures and the affective primes were similarly unavailable to conscious awareness. Under optimal exposure conditions, however, differences between the two sources of affect arose. More specifically, in the optimal priming conditions, participants indicated that they were somewhat suspicious of the smiling and angry faces presented immediately prior to the ideographs they were asked to judge. In conditions involving optimal repeated exposures, participants were generally aware of the repetitions as revealed in an elevated, but less than perfect, recognition rate. Yet despite the fact that recognition accuracy was fairly high for ideographs seen for 1 s, participants remained unaware of the positive affect associated with these repeated exposures.

During debriefing, when participants were informed that some ideographs were repeated and they were asked to speculate as to possible effects of multiple repetitions, the vast majority of participants predicted that repeated exposures would lead to boredom and decreased liking. These naive hypotheses clearly indicated that participants were not "aware" of the affective influence generated by the repeated exposures to the same degree that they were aware of the potential affective influence of the smiling and angry primes. This lack of awareness regarding the actual source of the affect, namely that repeated exposures leads to increased liking, allowed the mere exposure effect to continue undisrupted.

The proposition that awareness of the source of affect may constrain its influence is particularly interesting in light of earlier claims that the mere exposure phenomenon can be explained by the "warm glow of familiarity." Bonnano and Stilling (1986), for instance, who showed that a more pointed recognition question yielded the same results as liking, argued that familiarity *is* a factor in the exposure effect. In ascertaining familiarity, however, they asked their participants to "choose the shape that initially seems most familiar, or pops out at you" (p. 407). It is possible that their participants, prompted to choose the figures that "pop out at them," used liking as the basis for making familiarity judgments. Like Bonnano and Stilling, Brooks and Watkins (1989) also have asserted that recognition mediates liking in the mere exposure effect rather than the converse (see also Birnbaum & Mellers, 1979). Their argument hinges on the fact that with optimal exposures, a greater "hit rate" was obtained for recognition than for liking. Indeed, when exposure effects were induced optimally, as in Studies 2 and 4, perceived and objective history with the stimuli were significantly related. However, the fact that at optimal exposure levels, perceived and objective history were related does not in itself invalidate the proposition that liking need not depend on recognition. Only if it is shown that participants' perception of familiarity mediates liking, rather than their objective history with the stimuli, would the familiarity argument hold. We do not find this relationship when the mere exposure effect is induced suboptimally, as in Studies 1 and 3. Rather, when degraded stimuli are exposed repeatedly, participants' liking ratings were more reflective of their objective history with the stimuli than with their recognition memory. This finding is consistent with Reingold and Merikle's (1991) criterion that nonconscious perception is demonstrated whenever an indirect measure (liking) shows greater sensitivity than a direct measure (recognition).

Properties of Nonconscious Affect

Affect from two independent sources—priming and exposure—was found to combine in an additive fashion only when the individual was unaware of the source of the affect. As the source of affect became known (e.g., optimally presented facial primes), cognitive correlates became involved and the affect became referenced. This qualitative difference highlights one property of nonconscious affect, namely that it is relatively diffuse and can become attached even to unrelated stimuli.

Moreover, because it is not subject to cognitive appraisal, nonconscious affect may yield stronger or less adulterated effects. Recall that it was argued that longer stimulus durations may allow access to attributes of the facial primes not previously available. For example, when the stimulus duration is prolonged to 1,000 msec, a smiling face may reveal features that induce negative affect such as thin lips or a bulbous nose. The positive affect produced by the semblance of the smile may consequently be diminished or even reversed. Hence, at longer exposure durations further appraisals become possible, and the initial affective reaction may be diluted.

A post hoc analysis dividing the ideographs on the basis of complexity supports this contention and provides further insight into the properties of nonconscious affect. Relatively simple ideographs were liked significantly more at optimal exposure levels. This may be an indication that in more complex stimuli, a variety of features may trigger affect, some of them contradictory, whereas simple stimuli provide a more pristine canvas. This hypothesis is further supported by the fact that, in the present series of studies, simple ideographs produced significantly higher liking ratings at three exposures than did complex ideographs at both optimal and suboptimal exposure levels. Together, these findings suggest that simple stimuli may hold a relative advantage in the production and transmission of nonconscious affect.

On a related note, Greenwald (1992) argued that, at the nonconscious level, analytic capacity may be severely limited. We concur. Nonconscious affective processing is gross. Murphy (1990), for example, was unable to find evidence of emotional specificity at the nonconscious level. In a forced-choice discrimination paradigm, participants were exposed to 4-msec suboptimal primes of faces expressing Ekman's (1972) six basic emotions. Participants were then shown two faces—an image of the actual prime and an incorrect alternative face, or foil—and asked to "guess" which of the two faces was the suboptimal prime. Participants made forced-choice discriminations between all possible pairs of Ekman's six basic emotions. Only the positive emotion of happiness was differentiated at a level greater than chance from the negative emotions of anger, fear, sadness, and disgust. Participants were unable to differentiate any of these negative emotions from one another. These data were interpreted as indicating that although primitive positive or negative affective reactions may occur relatively early in the information-processing chain, even outside of conscious awareness, some sort of cognitive elaboration may be required to define precisely which specific emotion, such as anger or fear, will ultimately emerge.

The theory offered here and by Murphy (1990) and Murphy and Zajonc (1993) resembles the two-factor model proposed 3 decades ago by Schachter and Singer (1962). Both theories have as their elementary concepts an affective process and a cognitive process. But there is an important distinction. Schachter and Singer regarded emotion as requiring the presence of a nonspecific arousal that drives the person to seek an explanation. This nonspecific arousal was hypothesized to recruit cognitive appraisal that could provide meaning to an experience. The present conceptualization, in agreement with Maslach (1979), casts doubt on the notion of arousal that is devoid of valence. Rather, we assume that arousal must be either positive or negative.

The present results, together with those of Murphy and Zajonc (1987, 1988, 1993) and Murphy (1990), demonstrate that nonconscious affect is not merely a paler version of conscious affective processes, but rather has distinct dynamic properties. Affect derived from nonconscious sources seems to be more readily combined and displaced than affect based on cognitive appraisal. Moreover, nonconscious processing appears to be limited in its ability to process complex or emotionally specific information. Finally, in contrast to earlier theoretical models that assumed undifferentiated affective arousal (e.g., Schachter & Singer, 1962), evidence suggests that even at the nonconscious level, affect is hedonically valenced. Although these qualitative differences are far from exhaustive, they represent a first step toward understanding the workings of nonconscious affect.

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