Research Article

SUBLIMINAL MERE EXPOSURE: Specific, General, and Diffuse Effects

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Abstract—*The present research examined the possibility that repeated exposure may simultaneously produce specific and diffuse effects. In Study 1, participants were presented with 5-ms exposures of 25 stimuli each shown once (single-exposure condition) or with five repetitions of 5 stimuli (repeated-exposure condition). Participants in the repeated-exposure condition subsequently rated their own mood more positively than those in the single-exposure condition. Study 2 examined whether affect generated by subliminal repeated exposures transfers to unrelated stimuli. After a subliminal exposure phase, affective reactions to previously exposed stimuli, to new but similar stimuli, and to stimuli from a different category were obtained. Previously exposed stimuli were rated most positively and novel different stimuli least positively. All stimuli were rated more positively in the repeated-exposure condition than in the single-exposure condition. These findings suggest that affect generated by subliminal repeated exposure is sufficiently diffuse to influence ratings of unrelated stimuli and mood.*

Things do not seem the same to those who love and those who hate, nor to those who are angry and those who are calm. For to the friend the man about whom he is giving judgment seems either to have committed no offense or a minor one, while for the enemy it is the opposite. And to the man who is enthusiastic and optimistic, if what is to come should be pleasant, it seems to be both likely to come about and likely to be good, while to the indifferent or depressed man it seems the opposite. . . .

—Aristotle (trans. 1991, p. 141)

The mere-exposure effect, whereby preference for a stimulus increases with repeated stimulus exposures, is a robust and important social psychological phenomenon (Harrison, 1977). It has been consistently replicated not only across cultures (P.B. Smith & Bond, 1993), but also across species (Zajonc, 1971; Zajonc, Wilson, & Rajecki, 1975). Reliable and replicable exposure effects have been found even for stimuli presented below conscious awareness (Barchas & Perlaki, 1986; Bonnano & Stilling, 1986; Bornstein, 1989; Bornstein, Leone, & Galley, 1987; Kunst-Wilson & Zajonc, 1980; Mandler, Nakamura, & Van Zandt, 1987; Murphy, Monahan, & Zajonc, 1995; Seamon, Brody, & Kauff, 1983a, 1983b; Seamon, Marsh, & Brody, 1989).

Yet, despite the fact that more than 200 research articles have been published on this topic, neither the process whereby preference for a stimulus increases as a function of repeated exposures nor the nature of the affect generated is fully understood. For example, it is well established that when a particular stimulus is repeatedly exposed, preference for that specific stimulus increases logarithmically as a function of the number of exposures (Bornstein, 1989; Harrison, 1977; Zajonc, 1968). This holds true for an enormous variety of stimulus domains, populations, and exposure conditions.

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However, there is also evidence that the positive affect generated through repeated exposures may influence perceptions of stimuli that have not been exposed but are similar to those that have been exposed. Gordon and Holyoak (1983) found liking to increase not only for stimuli previously presented (prototypes), but for similar stimuli as well (analogues). This finding suggests that the positive affect induced by virtue of repeated exposure may generalize onto novel stimuli that are physically or structurally similar to those presented previously.

If the positive affect generated through repeated exposure can generalize to similar but novel stimuli, might it also be sufficiently diffuse to transfer even to unrelated stimuli? In a previous study, we (Murphy et al., 1995) found that affect produced by repeated exposures merges additively with affect generated through an entirely unrelated source, namely, subliminal priming of happy and angry faces. One possible explanation of these findings is that repeated exposures may elevate the tonic mood state of the individual. This elevated mood may, in turn, become associated with any stimulus in the individual's immediate surroundings. If a given experience, for any reason, generates a positive affective disposition to a particular stimulus, the individual's overall general mood also is likely to become elevated. For instance, a person who sees an enjoyable movie is quite likely to leave the theater not only with a positive disposition toward that particular movie, but also with an elevated overall mood.

In sum, although the impact of repeated exposure on preference for the specific stimuli shown has been well documented, the possibility that repeated exposures of any stimuli may, of themselves, produce more diffuse effects has not been demonstrated. Study 1 examined whether repeated exposures are capable, in and of themselves, of elevating the nonspecific overall mood of the individual.

STUDY 1

Participants were subliminally exposed either to a series of 25 distinct stimuli or to 5 stimuli that were each repeated five times in a random sequence. Following this initial exposure phase, the overall tonic mood state of the participants, without any reference to the previously flashed stimuli, was assessed. The purpose of Study 1 was to determine if repeated subliminal exposures of novel stimuli are capable of enhancing participants' tonic mood state.

Method

Participants

Seventy-four undergraduates at the University of Georgia served as participants in fulfillment of a course requirement. Approximately half were females. No participants who knew Chinese, Japanese, or Korean were included. Participants were randomly assigned to a repeated-exposure treatment ($n = 36$) or to a single-exposure treatment ($n = 38$).

Materials and apparatus

Two slide projectors, each outfitted with a Uniblitz shutter and a red filter, were used to project images onto a screen at participants' eye level. The images measured 45 cm × 60 cm at a distance of approximately 1.5 m, or a 17° visual horizontal angle and 20° vertical angle. Luminance of the screen field was approximately 60 cd/m^2. The shutters, calibrated to be accurate within 10% of the selected 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, the sequencing of the shutters, and response collection. Participants received all instructions via the computer.

Chinese ideographs, selected as being affectively bland, novel, and ambiguous (Murphy & Zajonc, 1993; Niedenthal, 1988) were employed. In one condition (repeated exposures), each of 5 Chinese ideographs was presented five times, in random order. In the single-exposure condition, 25 different Chinese ideographs were presented, each just once. Each stimulus was exposed for 5 ms and then masked for 1 s by a random array of white and gray dots.

Procedure

Participants were told that the study consisted of two parts and that in the first part some stimuli would be flashed on the screen very rapidly. The participants were instructed to attend to the screen even though they would not be able to tell what was being flashed. Immediately following the exposure phase, the second part of the study was announced, and the participants were asked to report their current mood. The first mood measure required participants to indicate their mood "right now" by selecting among five pictures of a face that varied from neutral to smiling. The five faces were created by using Faigin's (1990) *The Artist's Complete Guide to Facial Expression*. A prototypical smiling and a prototypical neutral face (p. 190) were used as anchors. From these anchor points, we morphed three intermediate faces, thus generating an equidistant scale from 1 (*neutral*) to 5 (*smiling*).[1] Participants were then asked to report their current mood on two 5-point bipolar scales, one ranging from *happy* (5) to *sad* (1) and the other ranging from *upbeat* (5) to *depressed* (1). Participants were subsequently debriefed and thanked.

Results

Participants who had been presented with five repetitions of 5 ideographs in the initial exposure phase tended to select significantly more positive facial expressions as representing their current mood ($M = 2.75$) compared with participants in the single-exposure condition ($M = 2.26$), $t(72) = 2.05$, $p < .05$. Ratings of subjective state on the 5-point bipolar scales produced similar patterns of results: On the happy-sad scale, mean ratings were 3.67 for the repeated-exposure group and 3.21 for the single-exposure group, $t(72) = 2.41$, $p = .02$; on the upbeat-depressed scale, mean ratings were 3.61 and 3.24, respectively, $t(72) = 1.71$, $p = .09$.[2]

1. We are grateful to John Boyd of Stanford University, who ran the morphing program, and Faigin (1990), who provided the initial neutral and smiling faces.

2. Note that in both the repeated- and the single-exposure conditions, participants' mood ratings were above the scale midpoint. Because the pictorial mood scale ranged from neutral to positive, these ratings, by definition, were also above the midpoint.

Discussion

Previous research has clearly documented that preference for specific stimuli can be enhanced through repeated exposures. There has also been a suggestion that new stimuli not exposed but similar to stimuli previously exposed might likewise gain in attractiveness (Gordon & Holyoak, 1983). The present research indicates that repeated exposures, even subliminal exposures, may induce additional, more diffuse effects. In Study 1, participants presented with multiple subliminal repetitions of ideographs reported themselves to be in a significantly more positive mood than their counterparts who were presented with single exposures. This finding suggests that the subliminal repeated exposure of innocuous stimuli is in itself sufficient to enhance an individual's affective state.

STUDY 2

If repeated exposures are capable of enhancing the overall mood state of the individual, they may also produce undedicated affect capable of making any stimulus more attractive. Study 2 was designed to assess whether the positive affect generated through repeated subliminal exposures has specific effects alone (which, in turn, could influence mood), or whether, because of its diffuse character, it can also attach itself to even unrelated stimuli.

Method

Specific, general, and diffuse effects of repeated subliminal exposure were tested in a mixed repeated measures design. The major comparisons involved a 2 × 2 × 3 design with the factors of exposure (single vs. repeated), stimulus exposed (ideographs vs. polygons), and test stimulus (old vs. novel similar vs. novel different). The test stimulus was a within-subjects factor, whereas exposure and stimulus exposed were between-subjects factors. In addition, a control (no-exposure) condition was introduced; the participants in this condition judged the same stimuli as the experimental groups but were not exposed to any stimuli at all prior to the tests. The data of these participants were analyzed separately.

Participants

Two hundred and five undergraduates at the University of Georgia served as participants in fulfillment of a course requirement. Approximately half were females. No participants who knew Chinese, Japanese, or Korean were included. Seventy-five participants were assigned to the repeated-exposure treatment, 75 were assigned to the single-exposure treatment, and 55 were assigned to the control treatment.

Materials and apparatus

The same equipment and exposure parameters as in the first phase of Study 1 were employed.

Procedure

Participants were given the following instructions:

The study you will be participating in examines how quickly people can make judgments of new or novel stimuli. The novel stimuli you will view are a series of drawings. The drawings will be presented at very rapid speeds, so rapid that you may be unable to consciously perceive them. After a drawing is

"flashed" briefly on the screen, it will be followed by a 1-s exposure of a background picture. The background picture is a print of black, white, and gray dots. The background picture will give you a place to focus your eyes before the next picture is flashed. Each drawing will be flashed for only 5 ms and will be *very difficult* to see. Even if you feel that you can only see the background picture and cannot see the drawings, we would still like you to pay attention to the background picture. One second before each drawing is flashed on the screen, the computer will "beep" to alert you.

After the initial exposure phase, participants were presented with test stimuli, each for a 1-s duration. They were asked to rate how much they liked each of 15 stimuli on a scale from 1 (*not at all*) to 5 (*quite a bit*). For the repeated- and single-exposure groups, 5 of the 15 stimuli had been previously shown in the initial exposure phase (old), 5 were similar to those in the initial exposure phase but were new (novel similar), and 5 were from a completely distinct category (novel different).

Approximately half of the participants viewed Chinese ideographs during the exposure phase, and the other half viewed random polygons. The Chinese ideographs were divided into two equivalent sets (A and B). Half of the participants exposed to the Chinese ideographs viewed set A, whereas the other half viewed set B. Participants who were initially exposed to ideographs from set A were tested for their reactions to novel similar stimuli taken from set B, and those initially exposed to set B were tested for their reactions to novel similar stimuli from set A. Similarly, the polygons were also divided into two equivalent sets (A and B). Half of the participants exposed to the polygons viewed set A, whereas the other half viewed set B. Participants who were initially exposed to set A were tested for their reactions to novel similar stimuli taken from set B, and those initially exposed to set B were tested for their reactions to novel similar stimuli from set A. For participants first exposed to Chinese ideographs, polygons served as the novel different test stimuli. For participants first exposed to polygons, Chinese ideographs served as the novel different test stimuli.

In the test phase, the order of presentation of the 15 stimuli was random. Participants in the control condition rated the same stimuli in the test phase as did the participants in the experimental conditions. Specifically, half of the control participants rated 10 polygons and 5 ideographs, whereas the other half rated 10 ideographs and 5 polygons.

Results

The results of Study 2 are depicted in Figure 1. There was no effect due to set (A or B) for participants exposed to polygons or participants exposed to ideographs. Nor was there a significant difference between participants initially shown ideographs and those shown polygons. Thus, these two counterbalancing factors were ignored in subsequent analyses.

As Figure 1 shows, there were significant main effects for both exposure and test stimulus. Participants subliminally presented with five repetitions of each of 5 stimuli in the exposure phase tended to rate all stimuli more positively than those who were initially presented with 25 single exposures, or those in the control group, $F(2, 202) = 11.07$, $p < .001$, $\eta^2 = .10$. This was true for all three stimulus types judged: old stimuli, $F(2, 204) = 12.81$, $p < .001$; novel similar stimuli, $F(2, 203) = 4.47$, $p < .01$; and novel different stimuli, $F(2, 203) = 3.50$, $p < .025$.

The effects of test stimulus were evaluated by a separate analysis because the control group did not figure as an orthogonal factor with respect to the other two; that is, the stimuli cannot be categorized as old, novel similar, and novel different for the control participants. With participants from the control group excluded, the main effect for test stimulus in a 2 (exposure: repeated vs. single) × 3 (test stimulus: old vs. novel similar vs. novel different) analysis of variance was significant, $F(2, 292) = 15.29$, $p < .001$, $\eta^2 = .10$. For participants in both the single- and repeated-exposure conditions, novel different stimuli ($M = 2.56$) were liked significantly less than novel similar stimuli ($M = 2.94$), $t(151) = 3.24$, $p < .01$, and were liked significantly less than old stimuli ($M = 3.03$), $t(151) = 4.84$, $p < .001$. However, the difference between the ratings of old stimuli and novel similar stimuli was not significant in either the single- or the repeated-exposure treatment, indicating substantial generalization effects. The ratings were lower in the control (no-exposure) condition than in any other condition, with the exception of the novel different stimuli in the single-exposure condition.

GENERAL DISCUSSION

In Study 1, individuals exposed to five subliminal repetitions of 5 stimuli reported themselves to be in a significantly better mood than individuals exposed to single exposures of 25 stimuli. The results of Study 2 further reveal that the positive affect generated through repeated exposures is sufficiently diffuse to become attached (a) to the original source stimuli, (b) to similar stimuli previously not seen, and (c) even to unrelated, unfamiliar, and quite distinct stimuli. These findings suggest that the process whereby stimuli repeatedly encountered gain in positive affect relies on a general state of reduced alertness and tension perhaps deriving from an attenuation of the orienting reflex (Sokolov, 1963; see also Zajonc, 1997, for a more complete discussion).

The idea that tonic mood state may play a role in the mere-exposure paradigm sheds new light on an old paradox, namely, the fact that repeated exposures increase liking even under degraded viewing conditions in which recognition accuracy is no better than chance (Kunst-Wilson & Zajonc, 1980; Wilson, 1979). Indeed, Bornstein's (1989) meta-analysis of mere-exposure research revealed an inverse relationship between stimulus recognition accuracy and the magnitude of the effect, a result that could be explained by assuming that subliminal exposures recruit a minimum of cognitive correlates and thus generate less variance than supraliminal stimuli available to conscious awareness. This raises the possibility that the mere-exposure effect depends, at least in part, on the source of the affect remaining undedicated. In our previous work (Murphy et al., 1995), we found that affect derived from two independent sources—priming of smiling or angry faces and mere exposure—was additive only when both sources of the affect were presented under subliminal viewing conditions. Whereas affective primes in the form of a smiling or angry face became less potent when presented at an optimal exposure duration, increases in liking generated through repeated exposures did not differ as a function of exposure duration. These results were interpreted as supporting a crucial distinction between sources of affect available to conscious awareness as opposed to sources of affect of which one is not consciously aware. We argued that although participants were wary of smiling and angry faces shown at optimal

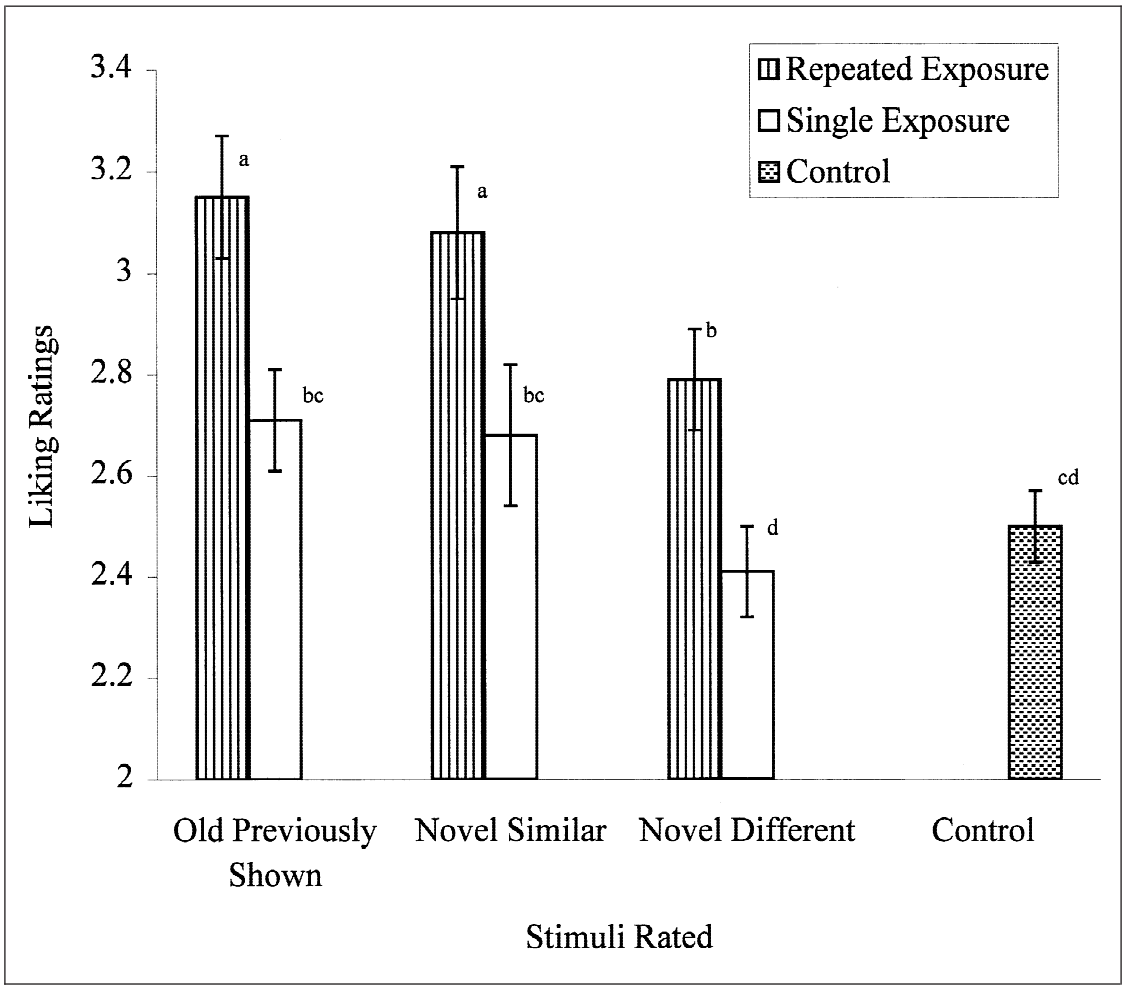

Fig. 1. Liking ratings as a function of exposure condition and stimulus type. Bars marked with the same letter are not significantly different (Student *t* tests, $p < .05$).

exposure durations immediately prior to the ideographs they were judging, they were not similarly suspicious of repeated exposures (see also Snell, Gibbs, & Varey, 1995). Because individuals are typically unaware of the relationship between repeated exposures and liking, the positive affect generated remains diffuse and capable of attaching itself to even unrelated targets.[3]

The current results are somewhat at odds with the perceptual-fluency explanation of the mere-exposure effect. According to a perceptual-fluency account, previously presented stimuli are easier to encode and process than are novel or unfamiliar stimuli, and this ease of processing is interpreted by the individual as liking (Bornstein & D'Agostino, 1994). A perceptual-fluency explanation might well account for the positive affect engendered toward previously presented stimuli. One could also argue that perceptual fluency might likewise lead to an increased preference for structurally similar, but novel, stimuli. But it is unclear how perceptual fluency could explain an increase in liking for novel stimuli from a completely distinct category, as found in Study 2. Rather, the present findings suggest that the positive affect generated through repeated exposures is not exclusively dedicated to its source stimuli, but can be transferred to even unrelated and dissimilar stimuli. Thus, we must conclude that although perceptual fluency might well be a sufficient condition for the enhancement of affect with repeated exposures, it is not a necessary one.

Nor do our findings support explanations of the mere-exposure phenomenon that rely on growth in familiarity of a particular stimulus or category of stimuli. Recently, E.R. Smith (1998) suggested that mere exposure is "best viewed as a type of misattribution" in which "previous exposure changes the way the perceiver subjectively experiences the stimulus, producing a relatively vague feeling of familiarity" that, in turn, "will be interpreted as liking" (p. 416). As suggested by the results of Study 1, it appears that enhancement of one's mood state can occur by virtue of repetition of exposure, and, as repeatedly demonstrated in previous research (e.g., Murphy & Zajonc, 1993;

3. Because the pattern of variation associated with subliminal prior exposures in Study 2 is consistent with previous research (e.g., Kunst-Wilson & Zajonc, 1980; Murphy et al., 1995; Seamon et al., 1983a, 1983b), the validity of these subliminal, 5-ms effects is strengthened. Moreover, these results were obtained using a between-subjects design that is needed to overcome individual difference variance. The effects of repeated exposure have been obtained before in between-subjects designs (Gordon & Holyoak, 1983; Moreland & Zajonc, 1976), but the exposures were supraliminal.

Murphy et al., 1995), this exposure effect does not require any feelings of subjective familiarity.[4]

Recent research by Whalen et al. (1998) clearly shows that affective reactions can be produced in the absence of stimulus knowledge. Subliminal smiling and fearful faces were presented to participants while their brain activity was recorded by functional magnetic resonance imaging. Significant increases in amygdala activity were obtained in response to fearful faces, and decreases were obtained in response to smiling faces. Also, Elliott and Dolan (1998) replicated Kunst-Wilson and Zajonc's (1980) experiment, using positron emission tomography scans to record brain activity associated with preferences and recognition judgments. Left frontopolar and parietal activation was found for recognition judgments, whereas preference judgments were associated with right lateral frontal activation. Yet participants could not distinguish between new and old stimuli, nor was there any indication of subjective familiarity for previously exposed stimuli. These results, paired with the results of the present study, suggest that neither perceptual fluency nor misattribution is a sufficient theoretical explanation of the mere-exposure effect.

An enhancement of mood state by virtue of repeated exposures could have merit from an evolutionary perspective. For instance, it would explain how infants across species bond not only with their caregivers but also with their surroundings and are extremely hesitant to separate from either—a phenomenon well documented in research on imprinting. This effectively keeps the young from straying unattended into danger. Indeed, a preference for recurring nonharmful stimulation is biologically adaptive throughout the life span, allowing the organism, by contrast, to exercise greater vigilance toward novel and potentially harmful stimuli. Moreover, the seemingly simple process of repeated exposures may play a significant role in the internalization of cultural practices and the affective investment in one's cultural artifacts. Consequently, the growth in positive affect stemming from repeated exposures might explain some of the more fundamental elements of the adaptation of organisms to their physical and social environments.

The broader implications of the present research obviously require further study. What is evident, however, is that the positive affect generated via repeated exposures is not dedicated solely to its specific source stimulus. Rather, it appears to be, at least in part, diffuse and capable of permeating the field of the individual's attention and "spilling over" onto and attaching itself to even unrelated objects.

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4. See Winkielman, Zajonc, and Schwarz (1997) and Winkielman, Berridge, and Wilbarger (2000) for further discussion of how misattribution can be ruled out as an explanatory factor in mere exposure.

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