Subliminal Conditioning of Attitudes

Jon A. Krosnick
Andrew L. Betz
Ohio State University

Lee J. Jussim
Rutgers University

Ann R. Lynn
Ohio State University

Most of the literature on attitude formation assumes that attitudes are the products of deductive integration of an individual's beliefs about an object's attributes. Two studies demonstrate that attitudes can develop without deduction from such beliefs and, indeed, without individuals' being aware of the antecedents of those attitudes. Subjects viewed nine slides of a target person going about normal daily activities; immediately preceding the presentation of each photograph was a subliminal exposure of an affect-arousing photograph. Half the subjects in each study were subliminally exposed to positive-affect-arousing photos and half to negative-affect-arousing photos. The subliminal photographs affected attitudes toward the target person and shaped beliefs about the target person's personality traits. Presumably because relevant objective data were available, the subliminal photographs apparently had less impact on judgments of the target person's physical attractiveness. These findings demonstrate conditioning of attitudes without awareness of their antecedents.

Two contrasting viewpoints have been advocated with regard to the relation between cognition and affect. Many theorists argue that affective responses to stimuli are derived from beliefs about the attributes of those stimuli (e.g., Fiske, 1982; Linville, 1982; Weiner, 1982). In fact, some theorists go so far as to argue that affective responses can be created *only* through cognitive deductive processes. For example, Schachter (1964, 1971; Schachter & Singer, 1962) has asserted that emotion is not created until a person makes an inference concerning the cause of an arousal response and then labels that response as an emotion. Similarly, Lazarus (1982) argued that cognitive appraisal of meaning or significance for well-being is the root of all affect. Taking the opposing view, however, Zajonc (1980) has argued that "affective judgments may be fairly independent of, and precede in time, the sorts of perceptual and cognitive operations commonly assumed to be the basis of these affective judgments" (p. 151).

This contrast of views is vividly apparent in the literature on the origins of attitudes. Most research on attitudes has assumed that formation of beliefs about an object's attributes precedes and directs formation of an overall positive or negative evaluation of the object (e.g., Anderson, 1981; Fishbein & Ajzen, 1975). That is, people presumably acquire information about an object and deduce their attitudes from that information, even if they do so with only minimal conscious attention.

In contrast, some theorists have argued that attitudes can develop through means other than cognitive deduction from beliefs about the object's attributes. One set of evidence supporting this viewpoint is that on the mere exposure effect (Zajonc, 1968). A number of studies now document that a person's attitude toward an object can be made more positive by repeatedly exposing the person to the object. This effect occurs even when the

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exposures are subliminal, suggesting that it can occur in the absence of information integration regarding object attributes (e.g., Bornstein, Leone, & Galley, 1987; Kunst-Wilson & Zajonc, 1980; Seamon, Brody, & Kauff, 1983a, 1983b; Wilson, 1979).

The focus of this article is on a second process by which attitudes may develop without deduction from beliefs about object attributes: classical conditioning. A number of studies have created attitudes toward neutral stimuli simply by pairing presentations of the stimuli with presentations of objects that elicit affective responses. For example, Staats and Staats conducted a series of investigations in which presentations of neutral target words were paired with shocks, harsh sounds, or presentation of other words that elicited favorable or unfavorable reactions (A. W. Staats & C. K. Staats, 1958; A. W. Staats, C. K. Staats, & Biggs, 1958; A. W. Staats, C. K. Staats, & Crawford, 1962; C. K. Staats & A. W. Staats, 1957). These studies showed that the appropriate attitude was subsequently elicited by the target words alone, and the effects were manifest in verbal attitude self-reports as well as in indirect measures of physiological arousal indicative of attitudes (Maltzman, 1968; Staats et al., 1962). Many others have reported similar findings demonstrating the formation of attitudes toward originally neutral stimuli (Allen & Madden, 1985; Berkowitz & Knurek, 1969; Bierley, McSweeney, & Vannieuwkerk, 1985; Biggers & Pryor, 1982; Byrne & Clore, 1970; Geer, 1968; Gorn, 1982; Griffitt, 1970; Janis, Kaye, & Kirschner, 1965; Murray, 1932; Perdue, Dovidio, Gurtman, & Tyler, 1990; Razran, 1940; Riordan & Tedeschi, 1983; Rosnow, 1966; Zanna, Kiesler, & Pilkonis, 1970; see also Kenrick & Johnson, 1979; Rotton, Barry, Frey, & Soler, 1978). Thus, this body of research suggests that attitudes can be formed on the basis of a temporal association between an affective response and an object (where the affective response could not have been caused by the object) rather than on the basis of beliefs about the attributes of that object.

However, there are alternative explanations for these findings that complicate their interpretation. First, in some studies the affect-eliciting manipulations may have produced attitude changes either by inducing a mood or by priming supportive or nonsupportive thoughts (Bower & Cohen, 1982; Clark, 1982; Isen, Shalker, Clark, & Karp, 1978) or by inducing compliance (Dabbs & Janis, 1965). Second, it is possible that demand characteristics in the experimental settings led subjects to infer and comply with the experimenter's hypothesis (see Kiesler, Collins, & Miller, 1969; Petty & Cacioppo, 1981). In support of this latter criticism, Page (1969, 1970; Kahle & Page, 1976; Page & Kahle, 1976) demonstrated that only subjects aware of the conditioning contingency show the expected effect. Staats, Minke, Martin, and Higa (1972) criticized Page's method for assessing awareness, but Cohen (1964) and Insko and Oakes (1966) used different procedures and reached Page's conclusions as well (see also Allen & Janiszewski, 1989).

Kiesler et al. (1969) summarized the implications of this evidence as follows:

> Accepting a simple behavioristic model [of attitude formation] implies that the learning of the attitudinal response is not mediated by other verbal or cognitive processes. Yet in discussing their data, most researchers who attempt to condition attitudes seem to deny or minimize the importance of whether their subjects were indeed aware of the true purpose of the experiment. From our own standpoint, however, the question of awareness could be a critical one. To the extent that subjects must be aware of the experimenter's intent in order to "become conditioned," a simplistic behavioristic model may not suffice. "Awareness" implies the presence of cognitive activities which conceivably may mediate the observed conditioning effect. (p. 144)

> Until the awareness problem is adequately handled, . . . the results of those researchers who study the classical conditioning of paired associates cannot be taken as providing definitive support for the contention that attitudes can be classically conditioned. (p. 148)

Indeed, the methodological problems in this research led Fishbein and Ajzen (1975) to reinterpret all the conditioning evidence as evidence consistent with their conscious, deliberate-deductive model of attitude formation:

> There is little support for the notion that classical conditioning provides a non-informational basis for attitude formation. Instead, the findings of classical conditioning studies can readily be interpreted within an information processing framework. Although attitudes may be formed in a classical conditioning situation, they do not seem to be the result of automatic conditioning processes; rather, they appear to be determined by *beliefs that are formed about the attitude object.* (p. 180, emphasis added)

The studies reported in this article were designed to overcome the methodological problems of previous conditioning studies. To this end, we developed a laboratory-based paradigm in which presentations of affect-eliciting stimuli were paired with presentations of photographs of a target person. However, the affect-eliciting stimuli were presented *subliminally* in order to avoid the problem of demand characteristics that has plagued past research. Temporal contiguity of presentation is sufficient for establishing an association between two stimuli, and associations between affective responses and stimuli can be stored in memory (Bower, 1981; Fiske, 1981; Isen et al., 1978). We therefore expected that this procedure would form an association in memory between the target per-

son and affective responses, thus creating attitudes toward the target person (Fazio, 1986). In this way, our manipulations may cause subjects to feel differently about the target person than they would otherwise, and the origins of those feelings would not be beliefs about the target person's attributes.

In addition to testing whether attitudes can be established in this fashion, we tested a second hypothesis. It is possible that attitudes toward an object shape beliefs about the object's characteristics. In the present studies, if we succeeded in establishing a positive or negative attitude toward the target person, beliefs about that person's personality traits might be shaped by that attitude. This notion was the basis of the well-known halo effect (Thorndike, 1920) and was the subject of a number of studies by Rosenberg (1960a, 1960b). Rosenberg demonstrated that altering a person's attitude toward an object through posthypnotic suggestion produced corresponding shifts in beliefs about the object's attributes. However, the mechanism by which posthypnotic suggestion operates is not well understood, and so these results are subject to the same demand characteristics interpretation that plagues past studies of attitude conditioning.

This hypothesis was also the subject of a study by Eagle (1959), who briefly presented drawings of a cartoon character either stabbing another person or giving that person a gift. These exposures were immediately masked by long exposures of drawings of the cartoon character alone. Subjects who saw the stabbing drawings ascribed significantly fewer positive personality traits to the cartoon character than subjects who saw the gift-giving drawings. However, Eagle's procedures to assure subliminality of the stabbing and gift-giving drawings, which involved stimuli other than those drawings, seem unlikely to have been effective (see Guthrie & Wiener, 1966, for a critique). Consequently, it is impossible to be certain that the exposures of the stabbing and gift-giving drawings were indeed subliminal.

Eagle's basic finding was replicated in a recent study by Niedenthal (1990, Experiment 2) that used better procedures for assuring subliminality. Niedenthal briefly presented photographs of human faces with either joyous or disgusted expressions, followed immediately by drawings of cartoon characters. Subjects who saw joyous faces ascribed significantly more positive personality traits than negative ones to the cartoon character, and subjects who saw disgusted faces ascribed equal numbers of positive and negative traits to the cartoon character. However, subjects who saw joyous faces rated the cartoon character as equally similar to members of favorable and unfavorable social groups, whereas subjects who saw disgusted faces rated the cartoon character as more similar to members of unfavorable groups than to members of favorable groups. Thus, the two dependent measures examined produced somewhat different results. And, more important, Niedenthal did not report statistical tests of the differences between subjects who saw joyous and disgusted faces. It is therefore not clear whether those differences were reliable.

Furthermore, as was the case for the attitude conditioning studies described above, there are a number of plausible alternative explanations for Niedenthal's and Eagle's findings other than the claim that the faces induced attitudes toward the cartoon characters. First, there is no indication in their articles that the experimenters who collected the data were blind to subjects' experimental conditions or were unaware of the experimental hypotheses being tested. It is therefore possible that subtle pleasant or unpleasant nonverbal or verbal behavior by them during the experiment produced the observed effects. Second, no evidence was offered showing that attitudes toward the cartoon character mediated the effects on the dependent measures. Hence, the manipulations could have activated cognitive categories (e.g., Gabrielcik & Fazio, 1984), and spreading activation could then have produced the observed effects without any involvement of attitudes whatsoever. Third, rather than creating attitudes toward the cartoon characters, the manipulations could have simply induced a general positive or negative mood in subjects (e.g., Robles, Smith, Carver, & Wellens, 1987), which then affected their subsequent reasoning about the cartoon character and would have influenced reasoning about other targets not involved in the conditioning procedure as well.[1] Thus, though consistent with our suspicion that noncognitively induced attitudes toward a person can then shape beliefs about his or her personality, Eagle's (1959) and Niedenthal's (1990) findings are neither strong and consistent nor unambiguous in terms of interpretation.[2]

We set out to establish more definitive evidence for subliminal conditioning of attitudes and to assess the cognitive consequences of such a procedure. In this article, we report the results of two experiments. In each, subjects were shown a series of pictures of a target person. For half the subjects, each presentation was preceded by a subliminal exposure of a positive-affect-arousing color photograph. For the other half, each presentation of the target person was preceded by a subliminal exposure of a negative-affect-arousing color photograph. Photographs were used as affect-arousing stimuli in order to avoid explicit verbal processing.

After viewing the slides, subjects filled out a questionnaire in which they reported their attitudes toward the target person, their beliefs about her personality, and

their beliefs about her physical attractiveness. We expected to find that when the target person was paired with positive affect, she would be liked more and would be viewed as having more desirable personality characteristics than when she was paired with negative affect. But because salient objective data on the target person's physical characteristics were available to the subjects, we expected the conditioning to have less impact on physical attractiveness beliefs. In Study 2, we also measured attitudes toward other objects and measured subjects' moods in order to determine whether the subliminal stimuli affected evaluations of the target person by arousing a general mood.

STUDY 1

Method

SUBJECTS

Subjects were 34 Ohio State University undergraduates who participated in the experiment in partial fulfillment of an introductory psychology course requirement.

PROCEDURE

Subjects arrived at the laboratory alone or in groups of two to five. The subjects were seated next to one another at tables with partitions between the desk surfaces in front of the subjects. All subjects faced a slide projection screen across the room.

The experimenter first handed each subject a questionnaire. On the front page appeared the following instructions, which the experimenter read aloud:

> This is an experiment about how people perceive and remember information about others. We will be showing you a series of pictures taken of a person going about her daily activities. Please watch these pictures in a relaxed but attentive manner. Each slide will be exposed for a very short interval. It is important that you *keep your eyes on the center of the screen* between slides so you can see as many details as possible when the next slide appears.

Subjects then viewed a series of nine photographs of the target person. These photos showed her involved in the following activities: getting into a car, walking through the front door of her apartment, walking on a suburban sidewalk, grocery shopping, sweeping a floor, washing dishes, studying, sitting in a restaurant, and sitting on a porch. Each slide was exposed for 2 s, and there was a 5-s interval between the disappearance of each slide and the appearance of the next one. A Commodore computer was used to control Kodak slide projectors and Uniblitz shutters, which controlled the exposure of the slides.

Immediately preceding these slide exposures were 13-ms exposures of either positive-affect-arousing photos or negative-affect-arousing photos. The positive-affect-arousing photos were exposed in a random order that was the same for all subjects who saw them, and the negative-affect-arousing photos were exposed in a random order that was the same for all subjects who saw them. The positive-affect-arousing photos were of a bridal couple, a young ring bearer, smiling men wearing tuxedos, a group of people playing cards and laughing, a child with a large Mickey Mouse doll, a family talking on the telephone, a pair of kittens, a group of smiling friends playing rugby, and a couple in a romantic setting. The negative-affect-arousing photos were of a skull, a werewolf, a face on fire, a bloody shark, an opened chest during open-heart surgery, a flying bat, internal abdominal organs (from an anatomy textbook), a dead body on a bed, and a bucket of snakes. These photographs were selected on the basis of ratings of pleasantness obtained in a pretest involving a set of 67 photographs.

After exposure of the final slide, the experimenter asked the subjects to turn to the second page of the questionnaire. The directions on this page, which the experimenter read aloud to the subjects, said:

> Now we'd like to get your impression of this person based on what you've seen. Even though you don't have a lot of information about her, answer these questions as best you can.

After subjects completed their ratings of the target person, they were queried extensively about their reactions and perceptions during the lab session. Not one person indicated that he or she even suspected that more was going on than he or she had been told or that any pictures other than those of the target person had been exposed. After subjects were told of the actual purpose of the study, most expressed strong surprise and some even expressed disbelief.

DEPENDENT MEASURES

The questionnaire asked subjects to rate the target person on a series of 7-point scales. Given our hypotheses and the long-standing conceptual distinction between attitudes (i.e., summary like/dislike evaluations) and beliefs (i.e., perceptions of object attributes; see, e.g., Allport, 1935; Fishbein & Ajzen, 1975), we used the questionnaire items to compute indexes assessing attitudes, personality beliefs, and attractiveness beliefs.

Attitudes. We computed an attitude index by averaging subjects' responses to two questions measuring overall positive/negative evaluations of the target person. These items asked subjects to rate how much they thought they would like the target person and to rate her on a bipolar *bad-good* scale. Higher scores on this index, whose reliability was .48, indicated more positive attitudes.[3]

TABLE 1: Attitude, Personality Beliefs, and Attractiveness Beliefs for Positive and Negative Conditions, Study 1

Dependent Measure	Condition		Difference	p
	Positive	Negative		
Attitudes	5.71	5.06	0.65	.005
Personality beliefs	5.50	4.74	0.76	.009
Attractiveness beliefs	4.21	3.68	0.53	.060
n	17	17		

NOTE: Ratings could range from 1 to 7; higher numbers indicate more favorable attitudes and beliefs.

Personality beliefs. The questionnaire included 21 items measuring subjects' beliefs about the target person's personality characteristics. Some of these items were taken from the semantic differential (Osgood, Suci, & Tannenbaum, 1957), and others were created by pairing adjectives rated either highly negatively or highly positively in a previous study (Anderson, 1968) with antonyms to form bipolar rating scales. An exploratory factor analysis of these items revealed that a single underlying factor explained 42.4% of their variance, with the next and subsequent factors each explaining less than 12%. Fourteen of the items had factor loadings greater than .5 on the first factor: *not at all friendly—extremely friendly, slow-fast, cruel-kind, fair-unfair, unsuccessful-successful, strong-weak, honest-dishonest, friendly-unfriendly, unselfish-selfish, polite-rude, humorless-humorous, forgiving-unforgiving, considerate-thoughtless,* and *disreputable-reputable.* The loadings of these items on the first factor were all in directions such that more positive scores on the factor were associated with more complimentary personality beliefs. Therefore, after recoding some items so that larger numbers always indicated more complimentary trait ascriptions, these items were averaged to form a personality beliefs index, with a reliability of .94.

Attractiveness beliefs. Subjects also rated how physically attractive they thought the target person was, and they rated her on a bipolar *ugly-beautiful* scale. These two items were averaged to form an attractiveness beliefs index, whose reliability was .67. Higher scores again indicated more complimentary beliefs.[4]

Results

Table 1 presents the means for the attitude, personality beliefs, and attractiveness beliefs indexes. As expected, subjects in the positive affect condition rated the target person significantly more favorably than subjects in the negative affect condition on the attitude index (between-group difference = 0.65 scale units, $t[32] = 2.71$, $p = .005$, one-tailed) and the personality beliefs index (between-group difference = 0.76 scale units, $t[31] = 2.50$, $p = .009$, one-tailed). The positive affect subjects also rated the target person as more attractive than the negative affect subjects did, but the effect here was a bit smaller than for the other dependent variables and not quite statistically significant (between-group difference = 0.53 scale units, $t[32] = 1.85$, $p = .06$, one-tailed). However, a MANOVA indicated that the effect of the subliminal slides on ratings was not significantly different across the three dependent measures, $F(2, 62) = 0.47$, $p = .50$.

Discussion

These results provide support for our expectations that pairing presentations of affect-arousing stimuli with presentations of an object can condition attitudes toward that object and beliefs about its attributes. Though not statistically significant, these data are also consistent with our prediction that relatively unambiguous objective data about the target person's physical attractiveness would reduce the effect of the conditioning procedure on attractiveness beliefs.

Encouraging as these findings are, there are a number of reasons to be suspicious of their validity. First, the experimenter was not blind to the experimental conditions to which subjects were assigned, and so the experimenter could have behaved in ways that produced the observed rating differences. Second, there is no evidence here that the subliminal slides produced attitudes through a conditioning process. Instead, the affect-arousing slides may have aroused a mood that shaped ratings of the target person. Finally, although the 13-ms exposure time was extremely short and no subjects indicated seeing the affect-arousing slides, these slides might have been detectable and therefore might not have been subliminal.

To examine this latter possibility, we conducted a pilot study to determine whether the 13-ms exposures of the affect-arousing slides were in fact subliminal. To do so, we set up a relatively conservative detection task. Subjects viewed the slides of the target person just as the participants in Study 1 had done. However, the pilot study subjects were told that they would be seeing very short exposures of other slides immediately preceding each photo of the target person. The subjects were told that half of the brief exposures would be color photographs and half would be words in black ink on a white background. They were instructed to circle either the word *photo* or the word *word* on their questionnaires after each slide exposure to indicate which they thought the brief flash had been. As it turned out, most of the subjects in

this pilot study were able to make these judgments at a rate significantly better than chance. This indicated that when told that a briefly presented stimulus would be exposed, these subjects were able to make a very gross determination of its content.

However, our greater concern was with whether subjects were able to detect the affective content of the affect-arousing slides. We therefore conducted another pretest in which subjects were again shown the series of affect-arousing photographs followed by masking slides. But in this case, we asked subjects to indicate for each briefly presented image whether it was "good or pleasant" or "bad or unpleasant." The results revealed that subjects were not able to detect the affective content of the affect-arousing slides at any better than chance levels. Thus, this evidence was reassuring that the effects of the affect-arousing slides in Study 1 probably occurred without awareness.

Nonetheless, it is difficult to be absolutely certain that the affect-arousing photos were actually subliminal in Study 1. We therefore decided to attempt to replicate the results of Study 1 in a second study. In this, we shortened the length of time the affect-arousing slides were exposed, and we used new photos of a different target person that we thought would be more effective at masking the affect-arousing slides.

STUDY 2

Method

Subjects. Subjects were 128 Ohio State University undergraduates who participated in the experiment in partial fulfillment of an introductory psychology course requirement.

Procedure. The procedure for this study was the same as for Study 1, with three exceptions. First, the affect-arousing slides were exposed for 9 ms instead of 13 ms. Second, three experimenters were used instead of only one, and all were blind to experimental condition. Third, a number of additional measures were collected to determine whether the observed effect was due to mood rather than attitude conditioning.

The basic dependent measures used in Study 2 were identical to those used in Study 1, and so we computed the same attitude, personality beliefs, and attractiveness beliefs indexes.[5] After completing these measures, subjects answered four sets of additional questions intended to assess whether the affect-arousing photographs had altered subjects' moods. First, subjects were shown a single photo of a second target person standing in front of a brick wall and then rated her on the same scales they had used to evaluate the first target person. Second, subjects completed a mood adjective checklist by indicating which of 81 emotions they had felt during the day. Third, subjects indicated how they felt about 10 neutral words by rating them on a 6-point scale with endpoints labeled *good* and *bad*. And fourth, subjects answered three questions asking them how happy they were with their lives. The order in which these four tasks were performed was counterbalanced across subjects. We viewed them all as potentially indicative of subjects' moods.

TABLE 2: Attitude, Personality Beliefs, and Attractiveness Beliefs for Positive and Negative Conditions, Study 2

Dependent Measure	*Condition*		*Difference*	p
	Positive	*Negative*		
Attitudes	5.34	5.06	0.28	.049
Personality beliefs	5.26	5.06	0.20	.062
Attractiveness beliefs	4.14	4.15	-0.01	.490
n	64	64		

NOTE: Ratings could range from 1 to 7; higher numbers indicate more favorable attitudes and beliefs.

To assess whether the affect-arousing slides had been subliminal, two steps were taken at the end of the experimental procedure. First, subjects were told:

> The main purpose of this experiment was to discover if ratings of the first woman you saw can be influenced by slides being flashed just before each slide of the woman. For some subjects in this experiment, each slide of the woman was preceded by a flash of another picture. These slides were flashed very quickly, so quickly that many people do not notice them. We'd like to know whether you noticed any flashes of other slides while you were seeing the photos of the woman. If you did, circle *yes*; if you didn't, circle *no*.

After answering this question, subjects performed a relatively conservative perception check procedure similar to the one used in the first pilot study described above. In it, subjects saw 18 photos of the target person, each one preceded by a 9-ms flash either of one of the affect-arousing color photos or of a word typed in black ink on a white background. For each of the 18 trials, subjects indicated whether they thought the flashed slide was a photo or a word.

Results

Table 2 presents the means for all subjects on the attitude, personality beliefs, and attractiveness beliefs indexes. As in Study 1, the positive affect group rated the target person more positively than the negative affect

group on the attitude index (difference = 0.28 units, $t[126] = 1.67$, $p = .049$, one-tailed) and the personality beliefs index (difference = 0.20 units, $t[122] = 1.55$, $p = .062$, one-tailed). Also as expected, the difference between the conditions on the attractiveness beliefs index was essentially zero (difference = –0.01 units, $t[126] = 0.04$, n.s.). Thus, the expected pattern of means was obtained. However, a MANOVA again indicated that the impact of the subliminal slides did not vary significantly across the three dependent variables, $F(2, 244) = 1.45$, $p = .24$.

The ratings of the second target person, of the 10 neutral words, of emotions felt that day, and of life satisfaction showed no consistent differences between the positive and negative conditions, and none of these differences was statistically significant. This suggests that the affect-arousing slides did not create a general mood that influenced all ratings the subjects made.

When subjects were asked whether they had seen any flashes of photographs preceding the exposures of the target person's pictures, 93% said no and only 7% said yes. Furthermore, the perception check procedure revealed that the exposures of the affect-arousing slides had been subliminal. Because there were 18 trials, on each of which subjects chose either *photo* or *word*, the number of correct answers to be expected if subjects were unable to perceive the stimuli and were simply guessing is 9 (i.e., 50%). In fact, the distribution of the numbers of slides that subjects correctly identified closely resembled a normal curve, with a mean of 8.9 and a standard deviation of 2.1. Sixty-four percent of the subjects correctly identified 9 or fewer of the slides, and 90% correctly identified 11 or fewer. If all subjects were simply guessing, the binomial distribution predicts that 7.61 subjects should have provided 12 or more correct answers, and the observed number of subjects doing so was 8; $\chi^2(1) = 0.02$, n.s. Thus, it seems clear that the affect-arousing slides in this study were indeed subliminal.

GENERAL DISCUSSION

Taken together, these two studies show that attitudes toward an object can be generated through processes other than deduction from beliefs about the attributes of the object. Specifically, pairing a subliminally presented affect-arousing slide with presentation of photos of a target person influenced subjects' attitudes toward the target person. When the target person was paired with positive affect, she was liked more and was seen as having more complimentary personality traits than when she was paired with negative affect. However, the subliminal slides may not have shaped all evaluative judgments about the target person equally; beliefs about her physical attractiveness, which could be based on salient objective data, appeared to be less affected, although the results on this point were relatively weak. Nonetheless, these studies demonstrate that it is possible to like or dislike a person without knowing the correct reason for the attitude.

These demonstrations represent important contributions to the literature on classical conditioning of attitudes because demand characteristics cannot account for our results. Subjects in Study 1 were almost certainly not aware that affect-arousing stimuli were being presented, and those in Study 2 definitely were not. Therefore, subjects could not have intentionally complied with our hypothesis that the affect would influence their ratings of the target person. In Study 2, the experimenters could not have communicated to the subjects which target persons to like and dislike, because they were blind to experimental condition. It is clear as well that our results do not simply reflect priming effects of a mood state. Measures of mood in Study 2 indicated no difference between the subjects in the positive and negative conditions.

The evidence reported here speaks to the more general question raised in the conditioning literature whether conditioning is possible without awareness. McSweeney and Bierley wrote in 1984 that it was then too early to answer this question. However, the present studies indicate that conditioning of attitudes is indeed possible in the absence of awareness. The present data also suggest that attitudes created nondeductively may influence beliefs, just as Thorndike (1920), Rosenberg (1960a, 1960b), and others suspected. Thus, strong attitudes may guide belief formation, perhaps over an extended period, producing an entire system of synthesized "knowledge" about an object.

Some speculation is in order concerning the mechanism by which our method influenced attitudes toward the target person and beliefs about her personality. As described near the beginning of this article, previous research suggested that by repeatedly pairing an affective response with presentation of a stimulus, we could develop an association in memory between the two. Our assumption was that this association would lead subjects to tag the stimulus as arousing good or bad feelings and to respond to the stimulus with that affect.

The attitudes established by the present procedure might have influenced beliefs about a target person's personality by a number of processes. For example, the influence on beliefs could have resulted from priming of consonant personality traits through spreading activation from an affect node. Thus, if the target person was associated with negative affect, thinking about her might

result in activation of a negative affect node, which, in turn, might activate related concepts such as *dishonest* or *unfriendly*, leading to description of her in those terms. Alternatively, cognitive consistency pressures could have led subjects to describe target persons in a manner consistent with the associated affect. Or this effect might have been achieved on-line if the affect guided attention to features of the photographs during the exposure phase of the procedure and subsequent inferences.

This attitude-driven process of trait inference may occur quite often in everyday life. Prejudice, for example, may not be wholly explained by schema-based stereotyping and/or motivational mechanisms. A mechanism such as the one demonstrated in these studies may also be an important factor. An entire childhood spent hearing a certain group of people referred to with negative affect or seeing them, either in the media or in reality, associated with situations that arouse negative affect may generate a fairly strong negative attitude. This attitude may lead an individual to generate consonant beliefs about the group's characteristics.

This kind of process may account in part for the unresponsiveness of some attitudes to argument-based persuasion. If the origin of an attitude is an affective orientation that developed through many years of association between the expression or experience of a particular affect and the attitude object, the attitude may be strong and stable. Logical arguments might then be ineffective at changing such an attitude, for two reasons. First, it is unlikely that these arguments can undermine the basis of the affect. Second, the affect may make a person unresponsive to factual information or a logical argument that has evaluative implications conflicting with the preexisting attitude. Research testing such hypotheses regarding attitudes created through nondeductive processes clearly seems merited (for a recent example of such work, see Edwards, 1990).

Finally, it is useful to note that the present results contribute to the growing literature on the influence of subliminal stimuli. Studies as early as the 1950s suggested that subliminal stimuli can affect a number of other variables (see, e.g., Silverman & Weinberger, 1985). Critics have questioned whether the effects demonstrated in these early studies were in fact the result of subliminal perception (see, e.g., Dixon, 1971, 1981; Erdelyi, 1974; Holender, 1986; Moore, 1982; Volkey & Read, 1985). But the accumulating body of evidence is becoming increasingly convincing.

Five types of effects of subliminal stimuli have been repeatedly demonstrated in recent years. The first set of studies demonstrated that subliminal exposures of a stimulus can activate concepts in memory that then enjoy enhanced impact on subsequent judgments (e.g., Bargh, Bond, Lombardi, & Tota, 1986; Bargh & Pietromonaco, 1982; Devine, 1989, Experiment 2; Erdley & D'Agostino, 1988; Gabrielcik & Fazio, 1984; Lewicki, 1985, 1986, Experiment 8.2, pp. 215-219). Subliminal concept activation has also been shown to alter response latencies of subsequent judgments (Fowler, Wolford, Slade, & Tassinary, 1981; Greenwald, Klinger, & Liu, 1989; Marcel, 1983; McCauley, Parmelee, Sperber, & Carr, 1980; Niedenthal, 1990, Experiment 1; Perdue et al., 1990; Perdue & Gurtman, 1990). Third, subliminal stimulation of psychodynamic symbiotic fantasies has been shown to improve psychological functioning and to reveal the nature of psychological disorders (see, e.g., Balay & Shevrin, 1988; Bryant-Tuckett & Silverman, 1984; Hardaway, 1990; Shevrin, 1973, 1986; Silverman & Weinberger, 1985). Fourth, subliminal stimuli have been shown to induce mood states (Byrne, 1959; Hawkins, 1970; Robles et al., 1987; Tyrer, Lewis, & Lee, 1978). And finally, subliminal mere exposure to an object has been shown to increase liking of that object (Bornstein et al., 1987; Kunst-Wilson & Zajonc, 1980.[6]

Our work contributes to this growing literature in two principal ways. Our studies are the first to demonstrate subliminal conditioning of attitudes while ruling out alternative explanations such as demand characteristics and mood induction. And we have provided the first evidence suggesting that subliminally created attitudes may shape the formation of beliefs about the attributes of an object, although further tests of this would be desirable.[7] This helps to bolster the case for affect-driven subliminal effects and to clarify their nature.

NOTES

1. It is also conceivable that these latter two possibilities worked simultaneously. That is, activating a general mood may have made certain categories of information more available in memory, which may then have produced the observed effects (e.g., Ehrlichman & Halpern, 1988).

2. Baldwin, Carrell, and Lopez (1990) reported a relevant study, although it did not involve classical conditioning of attitudes (i.e., repeated paired presentations of a conditioned and an unconditioned stimulus). They briefly presented photographs of smiling or frowning faces of people who either were significant others for subjects or were unfamiliar to them. A smiling face of a significant other led subjects to make more positive ratings of their own research ideas shortly after exposure, and a frowning face of a significant other led subjects to make more negative ratings of their own personalities shortly after exposure. In these studies, the experimenter was effectively blinded to subjects' conditions, but the researchers' criterion for ensuring that their briefly presented stimuli were indeed subliminal was quite lenient (i.e., asking subjects whether they had seen anything). Furthermore, as in the Niedenthal and Eagle studies, the results Baldwin et al. obtained did not replicate in every test (see, e.g., the "second face" results in Study 1); their faces may have induced moods that influenced the ratings; and their effects may have been produced by spreading activation rather than affective processes. It is also possible that their dependent

measures, self-referent ratings, were uniquely responsive to a person's internal affective state, whereas attitudes toward objects other than the self may not be. Nonetheless, their findings are encouraging regarding our hypothesis.

Edwards (1990, Experiment 1) also reported a relevant study, although its implications are not clear. In it, brief exposures of smiling or frowning faces were expected to influence attitudes toward subsequently presented Chinese ideographs. However, in Edwards's design, the valence of the exposed face was always perfectly confounded with the valence of paragraphs of verbal information presented to subjects about each ideograph. Only the order of presentation was varied. Therefore, it is impossible to use her data to assess the impact of the faces on attitudes per se. Moreover, Edwards reported no evidence to support the assertion that the exposures of the faces were indeed subliminal.

3. Two additional items included in the questionnaire were intended to measure attitudes: ratings on bipolar scales anchored *annoying-pleasing* and *valuable-worthless*. However, various factor analyses indicated that these items did not reflect the underlying attitude construct measured by the liking and *good-bad* items, and so the *annoying-pleasing* and *valuable-worthless* items were not included in the attitude index.

4. The correlations among the three indexes were $r_{att,pers} = .79$; $r_{att,attr} = .42$; $r_{pers,attr} = .31$. Strong correlations between attitudes and beliefs, such as the first of these, are not uncommon in attitude research (see, e.g., Ajzen & Fishbein, 1980).

5. The correlations among the three indexes in this study were $r_{att,pers} = .70$; $r_{att,attr} = .47$; $r_{pers,attr} = .32$.

6. Subliminal studies involve stimuli that subjects cannot detect even if they try to, thus distinguishing these studies from research exploring nonconscious processing of detectable stimuli (e.g., Hill, Lewicki, Czyzewska, & Boss, 1989; Lewicki, 1986). For example, in the Hill et al. (1989) study, subjects viewed target persons of different heights engaging in various tasks; before each presentation, subjects were told the target's "likableness." For some subjects, the short target was likable; for others, the tall target was likable. Hill et al. demonstrated that subjects used their implicit knowledge about this covariation when judging targets' likableness later.

Though informative regarding nonconscious processing, this work does not reveal the effects of subliminal stimuli. Subjects consciously attended to the information from which covariation assessments were implicitly derived; only the derivation process was nonconscious. Therefore, this and other such studies of unattended but detectable stimuli (e.g., Janiszewski, 1988; Niedenthal & Cantor, 1986; Nielsen & Sarason, 1981) are suggestive but not conclusive regarding the influence of truly subliminal stimuli on attitudes and judgments.

7. See Betz (1990) for information on other studies using different methods that failed to replicate these results.

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