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Guilty by Mere Association: Evaluative Conditioning and the Spreading Attitude Effect

Eva Walther
University of Heidelberg

Five experiments investigated the phenomenon that attitude formation is not confined to the co-occurrence of an attitudinal object with an evaluated experience. The pairing of a target with a (dis)liked person not only affects the evaluation of the previously neutral person but spreads to other individuals who are (pre)associated with the target (spreading attitude effect). Experiments 1 and 2 provided evidence for the spreading attitude effect in appetitive as well as aversive evaluative conditioning. Experiment 3 showed that the spreading attitude effect is a robust phenomenon resistant to extinction. Experiment 4 demonstrated that attitude spread can be transferred to 2nd-order conditioning. Finally, Experiment 5 supports the notion that the spreading attitude effect is not dependent on cognitive resources. Implications for social as well as applied psychology are discussed.

More than 40 years ago, Staats and Staats (1958) demonstrated that attitudes can be acquired through classical conditioning. The authors showed that the contingent presentation of national names (e.g., Dutch) with words of positive or negative valence (e.g., *happy*, *bitter*) led to a change in the evaluation of the national names in a positive or negative direction, respectively. Although these studies were later criticized for their failure to rule out demand effects and for other methodological shortcomings (Page, 1974; Page & Kahle, 1976), there is substantial agreement in the literature that attitudes can be formed through simple learning mechanisms (Cacioppo, Marshall-Goodell, Tassinary, & Petty, 1992; De Houwer, Baeyens, & Eelen, 1994; De Houwer, Thomas, & Baeyens, 2001; Kim, Lim, & Mukesh, 1998; Petty & Cacioppo, 1984; Rozin, Wrzesniewski, & Byrnes, 1998). Despite this widely accepted, crucial role of classical conditioning in the acquisition of attitudes, surprisingly little theoretical and empirical work in social psychology has been devoted to examining the influence of so-called primitive learning mechanisms on attitude formation and attitude change. As Cacioppo et al. (1992) noted,

> The putative potency of classical and Pavlovian conditioning to influence peoples' visceral reactions (literally and figuratively) to people, objects, and events (e.g., Baeyens, Crombez, Van den Bergh, & Eelen, 1988; Martin & Levey, 1987; Rozin & Zellner, 1985) stands in stark contrast to the coverage it receives in reviews of contemporary attitude theories (see review by McGuire, 1985) and attitude texts (e.g., Okeefe, 1990; Oskamp, 1991; Rajecki, 1990). (p. 208)

This is somewhat surprising given that there are some areas in social psychology that are currently experiencing a renaissance of (neo)behaviorism (see Bargh & Ferguson, 2000), in which attitudes are seen to be automatically and preconsciously activated by attitude objects in the environment (Bargh, Chaiken, Govender, & Pratto, 1992; Bargh, Chaiken, Raymond, & Hymes, 1996; Fazio, Chen, McDonel, & Sherman, 1982; Fazio, Sanbonmatsu, Powell, & Kardes, 1986). Thus, although more and more unconscious aspects of feeling and thinking have been discovered in areas of attitude research, the opposite trend has emerged within the field of classical conditioning: There is now a growing body of evidence that conscious awareness of the contingencies between conditioned stimuli (CSi) and unconditioned stimuli (USi) is a necessary precondition for learning to occur (Brewer, 1974; Dawson, 1973; Dawson & Schell, 1987; see also Levey & Martin, 1983, for an opposing position). In other words, whereas Pavlovian learning theory has abandoned the simplistic view of the autonomous reaction by identifying more and more conscious aspects of higher cognitive functioning within primitive learning (Öhman, 1983), the opposite trend is taking place in certain areas of social psychology. However, several researchers have recently argued that a distinction should be made within the paradigm of classical conditioning between different types of conditioning; namely, signal learning and evaluative conditioning (Baeyens & De Houwer, 1995; Baeyens, De Houwer, Vansteenwegen, & Eelen, 1998; Hammerl & Grabitz, 1996).

Signal Learning Versus Evaluative Conditioning

The contemporary conception of classical conditioning as signal learning takes higher cognitive processes (e.g., rule learning) into account and can be considered as an associative mechanism that allows the organism to make predictions about significant events in the environment (Rescorla & Wagner, 1972). As a logical consequence of this notion, the contingency (i.e., statistical correlation) between the CS and the US is a crucial determinant of

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Correspondence concerning this article should be addressed to Eva Walther, Department of Psychology, University of Heidelberg, Hauptstrasse 47-51, 69117 Heidelberg, Germany. E-mail: eva.walther@psychologie.uni-heidelberg.de

signal learning.[1] A prototypical signal learning procedure involves a tone as a CS followed contingently by a shock as a US. Thus, within the signal learning paradigm, the organism learns an if–then relationship between CS and US; that is, the organism acquires an expectancy that the shock will follow if the tone occurs.

Different from signal or expectancy learning, evaluative conditioning can be described as the learning of likes and dislikes, that is, as the acquisition of preferences. Whereas in a signal learning paradigm no one would think to ask about the likability of the shock, that is precisely the question of interest to evaluative learning, in which simple affective qualities of stimuli are processed (Martin & Levey, 1978). In a prototypical evaluative conditioning study, a subjectively neutral picture of a human face is presented repeatedly with a subjectively liked or disliked human face; the result is a substantial valence shift in the formerly neutral stimulus (e.g., Baeyens, Eelen, Crombez, & Van den Bergh, 1992). This means that the CS in an evaluative conditioning paradigm does not acquire a predictive value but merely attains the affective qualities of the US. Results of evaluative conditioning are commonly measured by means of visual like–dislike rating scales, not by means of psychophysiological measures (e.g., skin conductance) that are used in signal learning studies.

There are three major characteristics of evaluative conditioning that challenge the information processing account of classical conditioning and give rise to the hypothesis that evaluative conditioning is a separate type of learning: First, in contrast to signal learning, evaluative conditioning is not dependent on an awareness of the contingencies. Several studies indicate that evaluative conditioning occurs in the complete absence of awareness of the contingency between the presentation of the CS and the US (Baeyens, Eelen, & Van den Bergh, 1990). Second, evaluative conditioning is not dependent on the statistical CS–US contingency but seems to be sensitive to contiguity; that is, to mere spatio–temporal CS–US co-occurrences (Baeyens, Hermans, & Eelen, 1993). Thus, weakening the contingency in an evaluative learning paradigm (e.g., by single CS or US presentations in the acquisition phase) does not automatically decrease conditioning, as would be the case in signal learning (Baeyens, Hermans, & Eelen, 1993). Baeyens et al. (1992) hypothesized that this insensitivity of evaluative learning to violations of the contingency rule exists because evaluative conditioning may be a kind of referential learning in which the CS acquires the capacity to activate (un)consciously the US representation, without actually generating the expectancy that the US is going to occur in the presence of the CS. Third, after successful evaluative conditioning, unreinforced (i.e., single) CS presentations do not alter the valence of the stimulus; that is, evaluative conditioning is resistant to extinction (Baeyens, Eelen, Van den Bergh, & Crombez, 1989).

Evaluative Conditioning in Social Psychology

One reason why signal learning has been rarely applied to social psychology is that strict contingency between the CS and the US hardly ever occurs in the real world, in which individuals usually encounter other people in different compositions and settings. Because evaluative conditioning is not restricted to strong CS–US contingencies, it increases the range of situations in which evaluative learning can be applied. But the notion that evaluative conditioning is resistant to extinction (Baeyens et al., 1989) might be even more important. It is a well-known phenomenon in psychology as well as in real life settings that an affective meaning (e.g., prejudice), once established, can be surprisingly persistent. In terms of evaluative conditioning, this might be due to the fact that the CS itself acquires affective qualities of the US (Baeyens et al., 1992). Because evaluative conditioning is believed to be due to purely affective mechanisms that are not dependent on contingency awareness, it also highlights the crucial role of noncognitive evaluative processes in attitude formation (Eagly & Chaiken, 1993) and supports Zajonc's (1980, 2000) notion of *affective primacy*.

Compared with several other influential attitude models (e.g., affective priming, evaluative generalization), evaluative conditioning is of critical importance for attitude research because it is one of the experimental models that explains how likes and dislikes are created (Rozin et al., 1998). Whereas research within current automatic attitude models is primarily concerned with the (spontaneous) activation of already existing attitudes, evaluative conditioning refers to the formation or the acquisition of attitudes and preferences. Evaluative learning, as reported to date, is restricted to situations in which there is direct contact between a neutral and a valued event. However, there is empirical evidence that evaluative learning might also occur under the complete absence of any kind of valued (conscious or unconscious) experience (Hammerl & Grabitz, 1996).

The Spreading Attitude Effect—A Special Case of Evaluative Conditioning

The spreading attitude effect refers to the phenomenon that a liked or disliked US may affect not only the evaluation of the CS that is directly paired with the US but also other stimuli that are merely associated with the CS. Consider a situation in which Mary is watching two persons, Peter and Paul, spending time together at a conference. Since she knows neither Paul nor Peter particularly well, she sees them both as affectively quite neutral individuals. A short time later, however, she notices Paul talking with Marc, a person she definitely does not like. If the co-occurrence of Paul with Marc affects not only the evaluation of Paul (i.e., evaluative conditioning) but also the evaluation of Peter, the spreading attitude effect has taken place. Thus, Paul's bad company decreases not only his likability but also the likability of persons merely associated with him (i.e., Peter).

The mechanism that mediates the spreading attitude effect is *sensory preconditioning*. Sensory preconditioning means that the affective value is transferred (or spreads) to objects or events that are preassociated with the CS because of prior experimental learning. Unlike consistency theories (e.g., balance theory; Heider, 1958) or response generalization (Tursky, Lodge, Foley, Reeder, & Foley, 1976), the spreading attitude effect implies neither a conscious representation nor a direct link between the attitudinal

[1] Rescorla (1989), for instance, demonstrated that signal learning only occurs if $[p(\text{US/CS})]$ is $>$ or $<$ $[p(\text{US/no CS})]$ but not if $[p(\text{US/CS})] = [p(\text{US/no CS})]$.

However, in evaluative learning, Baeyens, Herman, and Eelen (1993) presented data indicating that evaluative conditioning did not interact with the level of contingency.

objects. Instead, the only connection between these two variables is given by the third person, Paul. In recent studies, Skowronski, Carlston, Mae, and Crawford (1998) found that communicators become associated with their verbal description of others. What the spreading attitude effect adds to this research is that evaluative statements can also influence other individuals merely associated with the communicator. Although sensory preconditioning is a well-established paradigm within the psychology of learning (Barnet, Grahame, & Miller, 1991; Kimmel, 1977; Pfautz, Donegan, & Wagner, 1978; Razran, 1971; Rizley & Rescorla, 1972), the implications of this phenomenon have not received much attention in social psychology.

The present studies aim to obtain evidence that evaluative conditioning and, above all, the special case of the spreading attitude effect occur with human participants and with socially significant material. More specifically, I want to demonstrate that attitudes toward individuals may be formed through simple mechanisms of evaluative conditioning and, most important, that these alterations of preferences may work without the direct contact of a liked or disliked US. The implications of the spreading attitude effect for attitude formation in social psychology are clear: Attitudes are not always based on a direct positive or aversive experience. Many prejudiced people have never encountered the objects of their antipathy. Instead, attitudes are often based on prior experiences with similar attitudinal objects, on second-hand information, or on mere associations.

However, the fact that these preassociations are experimentally established and that the primary affective insignificance (i.e., neutrality) of the stimuli is controlled sets the spreading attitude effect apart from other attitude accounts (e.g., response generalization; Tursky et al., 1976; balance theory; Heider, 1958). Evaluative learning does not affect each (similar) person but only those highly specific individuals actually associated with the CS through prior experimental learning. In a spreading attitude paradigm, Peter and Paul have nothing in common except simple co-occurrence. Moreover, the spreading attitude effect is not due to verbalizable social knowledge but works presumably without conscious awareness.

Overview of the Experiments

Five studies were designed to demonstrate that the spreading attitude effect is a robust phenomenon that can be fruitfully applied to social psychology. The reported experiments extend earlier studies (Hammerl & Grabitz, 1996) empirically as well as theoretically in several ways: First, I set out to demonstrate spreading attitudes with socially significant material; that is, with pictures of human faces. Among all attitude objects, other individuals are clearly the most significant within social psychology. There is ample evidence that "social stimuli are complex and carry multiple meanings and associations" (Tursky, Lodge, & Reeder, 1979, p. 452) that may support but also inhibit (pre)associative learning. However, until now, social stimuli (i.e., pictures of human faces) have been never used within a sensory preconditioning paradigm. Considering the wide agreement that human faces have a special status (see Hassin & Trope, 2000, for an overview; Stapel, Koomen, & Ruys, 2001), it was hard to predict how the results from previous studies, in which pictures of sculptures and fountains were used as USi and CSi (Hammerl & Grabitz, 1996), would transfer to the social world. Hoffman and Haxby (2000), for instance, recently found specific brain regions that respond only to faces, not to other stimuli. Although the broad issue of defining and measuring contingency awareness is not the major concern of the present work, I also predicted that verbalizable knowledge of the stimulus pairings would not be a crucial mediator of the spreading attitude effect.

Second, previous studies of sensory preconditioning (Hammerl & Grabitz, 1996) have demonstrated attitude spread only on the basis of appetitive conditioning (i.e., conditioning in which a positively evaluated US is applied), not aversive conditioning (i.e., conditioning in which a negatively evaluated US is applied). Given that attitude spread is highly relevant not only to the origins of prejudice toward individuals and groups but also to the genesis of phobias (Baeyens et al., 1992), it seems particularly important to show the spreading attitude effect within an aversive conditioning paradigm as well (Experiment 2).

The most important prerequisite for the applicability of the spreading attitude effect, however, is the robustness and the stability of the phenomenon. Thus, the impact of the phenomenon would increase substantially if it were possible to show that the acquired positive or negative attitude toward Peter through preassociation with Paul does not fade away if Peter shows up alone after the conditioning phase. Experiment 3 intended to show that the spreading attitude effect is not reduced by CS-alone presentations after learning. In other words, I was hoping to provide the first test of the hypothesis that the spreading attitude effect is resistant to extinction. An extinction procedure consisting of a repeated postconditioning presentation of the (pre)conditioned faces was not expected to eliminate the evaluative conditioning effect.

One intriguing property of conditioning is its susceptibility to second-order learning, which indicates that the CS itself can acquire the qualities of a US. The fourth experiment set out to establish second-order conditioning (forward spread) for the first time in an evaluative conditioning experiment.

Of considerable interest from both a theoretical and an applied perspective is the question of whether spreading attitudes can be found when processing capacity is low. Given that watching people is seldom the focus of attention but is something individuals do incidentally, it is important to know whether the spreading attitude effect occurs when people are distracted. Experiment 5 was conducted to support the theoretical notion that the spreading attitude effect is not dependent on mental resources.

Beyond these primary goals, the present research is concerned with several methodological issues inherent in the prototypical evaluative conditioning paradigm. Although Baeyens, Eelen, and Van den Bergh (1990) used pictures of human faces successfully as stimuli in their standard evaluative conditioning design, these studies were discredited later as artifacts because CSi and USi were usually paired by the experimenter with respect to their similarity (cf. Field & Davey, 1998). The present studies avoid this criticism by randomly pairing the CSi and USi. Moreover, I rendered demand effects as implausible as possible by conducting the whole experimental session through a computer program and by telling participants explicitly that all stimuli were selected at random.

The past 10 years have seen an ongoing debate over whether evaluative conditioning is dependent on contingency awareness (Baeyens et al., 1990; Field, 2000; Shanks & St. John, 1994). Although there is disagreement on this question, most researchers in this field favor the view that evaluative learning does not depend on verbal knowledge of the presented contingencies (cf. Hammerl, 2000). However, Shanks and St. John (1994) argued that a distinction should be made between demand awareness (i.e., awareness of the hypothesis being tested) and contingency awareness (i.e., awareness of the statistical relation between CS and US). To deal with this issue, I separately assessed contingency and demand awareness in the present studies. Finally, the present work seeks to show that the spreading attitude effect is a reliable phenomenon that can be established within various standard designs of evaluative conditioning.

Experiment 1: Attitude Spread in an Appetitive Evaluative Conditioning Paradigm

Method

Participants and Design

Forty students (20 men, 20 women)[2] from the University of Heidelberg, Heidelberg, Germany, participated in groups of up to 3 persons. They were either compensated with monetary payments or given partial credit toward a course requirement. Students were randomly assigned to a 2 (preassociation: present vs. absent) × 2 (US: present vs. absent) within-subject design used in previous studies (Hammerl & Grabitz, 1996) to establish sensory preconditioning effects (see Table 1).

Materials and Procedure

The first experiment is described in greater detail than are the subsequent ones, which follow the same general procedure. Participants were greeted by a female or male experimenter and seated in front of a computer screen. The experiment consisted of four sequential phases, which were guided entirely by a computer program: the baseline phase, the preconditioning phase, the conditioning phase, and the test phase. The cover story (adapted from Baeyens et al., 1992) on the first screen informed participants that it was their task to watch and sometimes to judge different types of stimuli randomly selected by the computer program. The instruction that followed asked participants to express their first, immediate, and spontaneous reaction toward the presented photographs on a 20-cm-long graphic rating scale (labeled *disliked* on the left and *liked* on the right) by positioning the cursor on any point of the scale and then pressing the left mouse key. To avoid response sets, the graphic scale consisted of no additional numbers or other numerical labels. The computer program computed the negative judgments on the left side from negative (–1) to extreme (–100) and the positive judgments on the right side from positive (1) to extreme (100). The neutral (0) midpoint of the scale served as a starting position for each judgment.

Baseline. In all conditions, 90 black-and-white pictures of White male faces (7 cm wide × 8 cm long) selected from German magazines and from the Internet were displayed for 3 s each in a full frontal view in the center of the screen. Care was taken to select a large variety of these pictures with respect to age, expression, and attractiveness. After 3 s the picture disappeared, the graphical rating scale appeared, and participants had the opportunity to evaluate the target. The computer program categorized the moderately rated stimuli (higher than −20 but lower than 20) as neutral stimuli and the most liked stimuli (lower than 80) as appetitive USi and randomly selected the stimuli for the preconditioning and the conditioning phases from these two categories. The baseline was followed by a 5-min unrelated paper-and-pencil distractor task in which participants were requested to rate their current mood state on several adjective scales. However, no effect of mood was obtained in this experiment or in any of the other experiments.

Preconditioning and conditioning phase. After the baseline phase, the preconditioning took place. In this phase, pairs of neutral stimuli were shown to establish associations between these stimuli. Participants were shown two pairs of neutral stimuli 5 times in both the experimental and the control condition, resulting in a total of 10 presentations in each group. In the experimental group, the neutral stimulus N1[3] was paired with N2 (i.e., the stimulus that was afterward paired with the US), and N4 was paired with N5 (i.e., the stimulus afterward paired with control stimulus N6). In the control group, however, N1 was paired with N3, and N4 was paired with N5 (see Table 1). Note that only N2 in the experimental group, not N3 in the control group, was paired with a US in the later conditioning phase. In keeping with previous studies (Hammerl & Grabitz, 1996), I assessed effects of preconditioning by comparing N1 with N4 in the experimental group. Participants were instructed that all they had to do now was to watch the presented faces. A trace conditioning procedure was used in the preconditioning and in the conditioning phase: Each picture was displayed for 2 s with a trace interval (i.e., the interval between the end of the first stimulus and the beginning of the second stimulus of a pair) of 2 s and an intertrial interval (ITI; time between the offset of the last stimulus of the previous pair and the onset of the first stimulus of the next pair) of 4 s.

The conditioning phase followed the preconditioning phase without delay. In this phase, five N2–US pairings and an equal number of N5–N6 control pairs were shown. To establish appetitive conditioning, I used only positively evaluated pictures as USi in this study. Note that the stimulus pairings in the experimental and the control group differed only in the preconditioning phase, not in the conditioning phase. It was expected that, because of conditioning, N2 would be evaluated more positively than would N5 in both groups. From the participants' perspective, the two conditioning phases entailed the presentation of human faces quite similar to the baseline, with the difference that no evaluative judgment was required. It was expected that the contingent presentation of N1 and N2 in the preconditioning phase would lead to an association of these two stimuli and that the subsequent conditioning of N2 with an appetitive evaluated event (i.e., US) would lead to a positive attitude toward N2 and N1 as well. (see Table 1). The conditioning phase was followed immediately by the test phase.

Table 1
Pairings of Stimuli Used in the Preconditioning and the Conditioning Phase of Experiment 1 and Experiment 2

Group	Preconditioning phase	Conditioning phase
Experimental	N1–N2; N4–N5	N2–US; N5–N6
Control	N1–N3; N4–N5	N2–US; N5–N6

Note. Each pair of neutral stimuli (N) or neutral and unconditioned stimuli (US) was shown five times in the preconditioning as well as in the conditioning phase. In data analysis, N2 was compared with N5, and N1 was compared with N4.

[2] I addressed the effects of gender in this study, which drew on an equal sample of male and female participants. However, no effect of gender emerged either in this or in any of the other studies.

[3] Care was taken in all studies that the CS (e.g., N1) and the respective control stimulus (e.g., N4) had identical baseline ratings. This means that the matching stimuli that were rated zero or that differed only slightly from zero were used.

Test phase. In the same procedure as in the baseline, participants were required to judge all the visual stimuli that had been presented in the preconditioning and the conditioning phase for a second time. In all studies, I calculated difference scores (test ratings − baseline ratings) to measure evaluative changes in the judgment of the conditioned and preconditioned stimuli. Finally, participants were given an open-ended questionnaire to check their awareness of the contingencies. Some of the questions had been used in previous studies (Hammerl & Grabitz, 1996), but they were supplemented and modified to assess different aspects of contingency awareness and to address demand awareness (the two questions that address demand awareness are italicized). The questions read as follows:

1. Was there anything during the experiment that attracted your attention or irritated you? If yes, what?
2. Did you notice separate phases in this study?
3. Can you say anything about the sequence of the stimuli?
4. Did you notice any regularities or patterns during the presentation of the pictures?
5. Did you notice anything in the presentation of the pictures?
6. Did you notice anything in the sequence of pictures?
7. What was the nature of the picture presented in the study?
8. *What do you think is the hypothesis that is being tested in this study?*
9. There were some groups in which there was a contingency between pictures. Do you think that you belonged to such a group?
10. Do you think that particular pictures were combined with other particular pictures?
11. Do you think that the second evaluation of the pictures differed from the first evaluation? If so, (a) In what direction has your evaluation changed? (b) *What do you think is the reason for this change?*

After filling out the questionnaire, participants were debriefed, thanked, and dismissed.

In all studies, answers to the awareness questions were analyzed by two independent raters who were unaware of the hypothesis underlying the experiment but who had been given special training. The raters categorized individuals into three different stages of awareness: 1 = *no awareness*, 2 = *awareness of different phases and/or change of valence in the experiment*, and 3 = *awareness of the contingencies and/or demand*. The agreement between the raters in Experiment 1 was perfect (100%). Because an appetitive evaluative conditioning paradigm, which includes strongly liked pictures as USi, was applied in this study, it was necessary that at least one picture receive a highly positively rating (i.e., higher than 80) in the baseline. Accordingly, the data of 2 participants were excluded from further analysis because these participants rated all pictures in the baseline more negatively than 80.

Results and Discussion

Conditioning and Preconditioning Effects

I analyzed direct conditioning effects by comparing difference scores for N2, which was paired with the appetitive US, with control stimulus N5, which was paired with another neutral stimulus. Because there were no differences between the experimental and the control group, ratings of N2 and N5 were averaged over both conditions. Results indicate that the repeated pairing of a neutral stimulus with a positively evaluated picture evoked a positive attitude toward the formerly neutral face; that is, N2 was evaluated more positively than was N5 $F(1, 36) = 5.17$, $p < .02$ (see Figure 1). Besides this successful replication of evaluative conditioning, the most intriguing findings, however, were expected for the effects of preconditioning: Is it true that the mere preassociation of an innocent human face with a subsequently positively conditioned picture is sufficient to elicit a positive attitude toward this face? Because the hypothesis underlying this question has a directional character and reflects the only theoretically plausible outcome, the criteria listed in the literature on one-tailed tests (cf. Goldfried, 1959; Jones, 1952; Kimmel, 1957) were met, and all

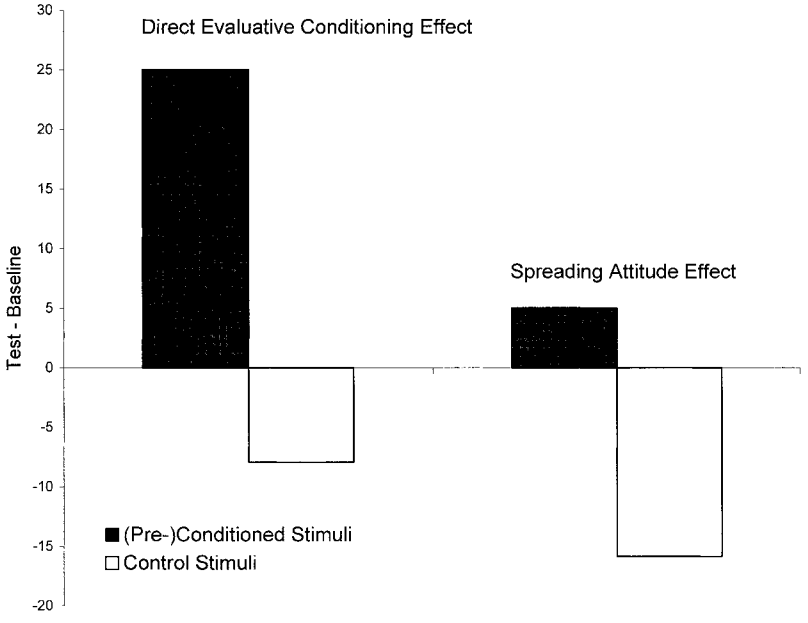

Figure 1. Study 1. Direct evaluative conditioning effect and spreading attitude effect in an appetitive evaluative conditioning paradigm.

simple analyses were tested one sided in these studies.[4] Figure 1 illustrates the results. The evaluation of N1 in the test phase differed from the judgment of control stimulus N4, $t(18) = 1.67$, $p < .06$. It is also evident that the spreading attitude effects were relatively small and only marginally significant. This is not surprising, because the spreading effect is not due to the direct contact with a liked stimulus but is only mediated through an association chain. Nonetheless, there was a spreading attitude effect, indicating that good company may enhance not only Peter's likability but also Paul's. Moreover, there was a strong and positive correlation ($r = .37$, $p < .02$) between the CS (N2) and the preconditioned stimulus (N1), which indicates a positive relationship between the degree of conditioning and the amount of spread. Correlations of all other stimuli, however, were around zero and not significant. Figure 1 also indicates that within appetitive conditioning, there was a strong tendency of the neutral stimuli to elicit more negative evaluations after repeated exposures than in the baseline. This effect, which usually occurs in conditioning paradigms, implies that conditioning first has to overcome contrast before it can become effective. However, the control stimuli (N5, N4), in which the exposure rate was similar to that of the CSi, allowed for an estimate of the amount of conditioning.

Awareness Effects

None of the participants recognized the real purpose of the experiment or reached Level 2 on the awareness measurement. It therefore seems reasonable to conclude that, in this study, conditioning as well as spreading effects worked without participants having verbalizable knowledge of the contingencies.

In sum, I have not only replicated the evaluative conditioning effects obtained in previous studies but also demonstrated that attitude formation is not restricted to the experience of a positively valued event. Instead, it can also be found in stimuli that are merely associated with the stimulus that is contingent to an appetitive US. However, there is no doubt that the spreading attitude effect must be of a small size, because it is influenced only indirectly through the (pre)association with the CS. In keeping with other conditioning effects described in the literature (e.g., Baeyens et al., 1990), these effects of attitude formation occurred without participants' verbalizable knowledge of the contingencies. Almost all of the students who participated in this study failed to even notice that their evaluation changed from the baseline to the test phase.

Demonstrating the spreading attitude phenomenon is of theoretical relevance to the evaluative conditioning literature because preconditioning effects indicate that associative mechanisms are at work in this paradigm. In contrast to Martin and Levey (1987), who explained evaluative conditioning as the result of a holistic representation that represents elements of the CS and US as well as the evaluative nature of the US, the spreading attitude effect provides strong evidence that an association builds the basic structure of the subsequent transfer of valence (see De Houwer, Thomas, & Baeyens, 2001, for an overview). However, the question remains whether preconditioning effects are restricted to appetitive conditioning. After all, there is no single study demonstrating sensory preconditioning in an aversive evaluative conditioning paradigm. Thus, the second experiment is intended to show that bad company may not only decrease the likability of a person (e.g., Peter) but may influence the judgment of other persons who are merely associated with that person (e.g., friends, siblings, coworkers). It was expected that aversive USi would lead not only to a negative evaluation of the CS but also to a stronger dislike of the stimuli (pre)associated with the CS.

Experiment 2: Attitude Spread in an Aversive Evaluative Conditioning Paradigm

Method

Participants and Design

Twenty students (6 men, 14 women) from the University of Heidelberg participated in groups of up to 3 persons. They were either compensated with monetary payments or given partial credit toward a course requirement. Students were randomly assigned to a 2 (preassociation: present vs. absent) × 2 (US: present vs. absent) within-subject design used in previous studies to establish preconditioning effects (see Table 1).

Materials and Procedure

The same procedure and data analysis as in Experiment 1 were used in this study. However, so that I could investigate aversive sensory preconditioning, the computer program selected the most disliked stimuli (rated lower than −80) as USi. The agreement between raters of the awareness questionnaires was perfect (100%).

Results and Discussion

Conditioning and Preconditioning Effects

The results show a more negative evaluation of the conditioned stimuli (N2) compared with the control stimuli (N5) and, thus, a main effect for the stimulus category, $F(1, 19) = 10.19$, $p < .005$. No other effect reached significance, indicating successful aversive conditioning (see Figure 2). To investigate spreading attitude effects, I compared difference scores of N1 in the experimental group with control stimulus N4. Figure 2 clearly shows that reactions toward the preconditioned N1 were more negative than were likability ratings of the control stimulus N4, $t(9) = 1.79$, $p < .06$.

Awareness Effects

None of the participants recognized the real purpose of the experiment or reached Level 2 on the awareness measurement.

Experiment 2 indicates that the scope of the spreading attitude effect is not restricted to appetitive evaluative conditioning but works with negatively evaluated faces as well. In the same way that Peter's good company may lead to a favorable judgment even

[4] Jones (1952), in his seminal article, literally sued for the usage of one-tailed tests in each case "in which theoretical considerations allow the postulation of the direction of experimental effects" (p. 44). Because there is no theoretical account and no single empirical instance of sensory preconditioning effects in the literature that contradicts the direction of the conditioning effect, the present studies not only allow but rather demand the use of one-tailed tests.

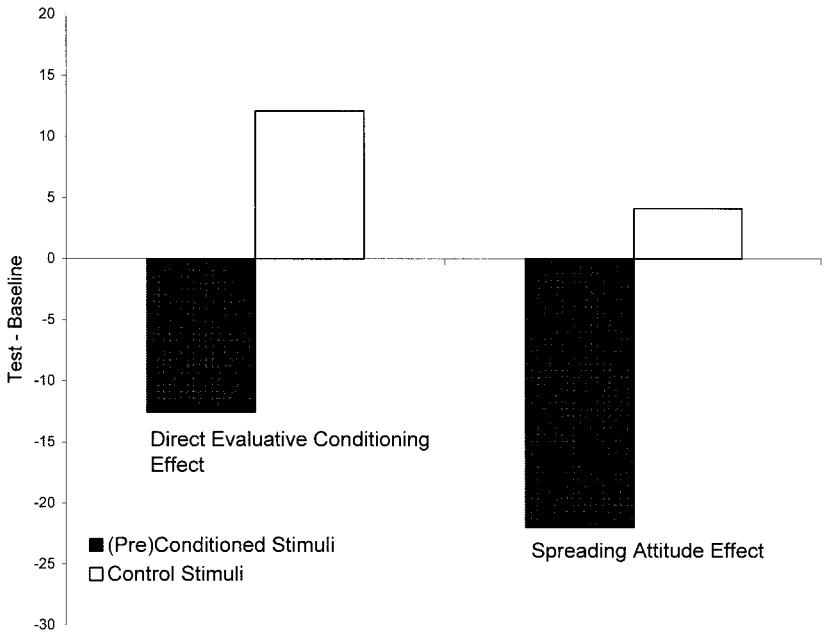

Figure 2. Study 2. Direct evaluative conditioning effect and spreading attitude effect in an aversive evaluative conditioning paradigm.

of those who are merely associated with him, bad company may decrease not only Peter's likability but also Paul's. Similar to Experiment 1, the findings indicate that the spreading attitude effect was demonstrated in relatively small effects that were sometimes only marginally significant. However, there is now increasing evidence that attitude spread is a reliable phenomenon that works with disliked human faces as well. Moreover, Experiment 2 provides additional support for the notion that contingency awareness is not a necessary precondition for conditioning effects to occur. Students in both studies showed no sign of knowledge pertaining to the contingencies or to the cause of changed preferences. This absence of awareness sets evaluative conditioning effects apart from signal learning, in which awareness is often considered a prerequisite for predicting the occurrence of the US from the presentation of the CS.

One of the most cited and most fascinating properties of evaluative learning from a theoretical as well as from an applied perspective is the stability of the conditioned effects (Baeyens et al., 1988). In signal learning only a few single presentations of the CS after acquisition (i.e., extinction procedure) are generally sufficient to eliminate or at least strongly reduce the conditioned response because of changes in the underlying contingency between CS and US. However, Baeyens et al. (1988) demonstrated that several CS-alone presentations do not reduce the acquired valence of the conditioned stimuli in an evaluative conditioning paradigm. This fundamental difference between both types of learning supports the hypothesis that evaluative conditioning is not based on an expectancy that the US is going to occur if the CS is presented. In view of its resistance to extinction, evaluative conditioning is more plausibly explained with a "transfer of value" (Hammerl & Grabitz, 1996, p. 291), so that the CS acquires some affective attributes of the (dis)liked US. That attitudes can be persistent is not new within social psychology. Rozin, Millman, and Nemeroff's (1986) law of contagion, for instance, refers to the fast and stable transfer of affect from one attitudinal object to another. The following experiment is designed to test whether the more subtle spreading attitude effect is also resistant to extinction.

Experiment 3: The Spreading Attitude Effect Is Resistant to Extinction

Method

Participants and Design

Forty-eight students (40 women, 8 men) from the University of Heidelberg participated in groups of up to 3 persons. They were either compensated with monetary payments or given partial credit toward a course requirement. Students were randomly assigned to a 2 (preassociation: present vs. absent) × 2 (US: appetitive vs. control) × 2 (extinction: present vs. absent) design. The first and second factors were varied within subject, and the last factor was varied between subjects.

Materials and Procedure

A procedure similar to Experiment 1 was used in this study. However, in keeping with previous extinction experiments (Baeyens et al., 1989), the following modifications were made: Each stimulus pair in the preconditioning as well as in the conditioning phase was presented 10 times. Every picture was displayed for 1 s, with a trace interval of 1 s and an ITI of 7 s. Moreover, an extinction phase consisting of 5 separate presentations of the first stimulus of each pair (CS or neutral stimulus) was inserted between the conditioning and the test phase in one group. The stimuli in this phase were presented for 1 s, with an ITI of 8 s. In contrast to Martin and Levey's (1987) theoretical assertion that the number of acquisition trials is of minor importance for evaluative learning, there is some evidence that learning increases over 2–10 trials and then decreases from 10–20 trials (Baeyens et al., 1992). Doubling the trials (from 5 to 10) may thus increase the

conditioning as well as the spreading attitude effect. Because spreading attitude effects are naturally of small size, a stronger effect might help to make potential extinction effects visible.

Judges of the awareness measurement agreed on all but 1 participant. This case of disagreement was resolved by a third judge. Because an appetitive evaluative conditioning paradigm, which includes strongly liked pictures as USi, was applied in this study, it was necessary that least one picture receive a extremely positive rating (i.e., higher than 80) in the baseline. Accordingly, the data of 4 participants were excluded from the study because these participants rated all pictures in the baseline more negatively than the critical score of 81.

Results and Discussion

Conditioning and Preconditioning Effects

Figure 3 (left part) illustrates the mean effects of appetitive conditioning in the standard and the extinction condition. Stimuli paired with liked faces were obviously rated much more positively than were control stimuli. It is interesting to note that Figure 3 also shows that conditioning effects dropped only slightly in the extinction condition. This observation is corroborated by a 2 (condition: extinction vs. standard) $\times$ 2 (US type: appetitive vs. control) analysis of variance (ANOVA), with repeated measurement on the second factor, which revealed a strong main effect for US type, $F(1, 42) = 13.54$, $p < .001$, but no other significant effect (Fs < 1). As predicted, single presentations of the CS after acquisition did not significantly reduce the effects of evaluative conditioning. Separate simple effects analyses indicated conditioning effects, $t(19) = 2.80$, $p < .006$, in the standard as well as in the extinction condition, $t(23) = 2.45$, $p < .015$. Thus, Experiment 3 replicates previous studies indicating that evaluative conditioning is resistant to extinction (Baeyens et al., 1988). More important, however, Figure 3 (right part) also shows a considerable spreading attitude effect in the standard as well as in the extinction condition. On a descriptive level, the spreading attitude effect in the extinction condition seems to be even higher than in the standard condition. However, a 2 (condition: extinction vs. standard) $\times$ 2 (US type: appetitive vs. control) ANOVA, with repeated measurement on the second factor, indicated that there was no reliable difference between the conditions ($F < 0.01$). Again, only the comparison between appetitive attitude spread and the control condition reached significance $F(1, 42) = 7.53$, $p < .009$. Simple effects analysis indicated a significant spreading attitude effect in the extinction condition, $t(23) = 2.79$, $p < .006$, and a marginally significant effect in the standard condition, $t(19) = 1.51$, $p < .07$.

Awareness Effects

Two participants in the extinction condition realized different phases of the experiment, and 1 student in the same condition was aware of the hypothesis underlying the test. Two participants in the standard condition observed repeated pairings of the same stimuli. However, the experimental findings do not change significantly if the analysis is conducted without the data of these participants.

Three major conclusions can be drawn from this study. First and foremost, spreading attitude effects have a life after conditioning. The extinction procedure apparently affected neither evaluative conditioning nor the spreading attitude effect. In both conditions, faces paired with a positively evaluated picture were judged more favorably than were faces presented contingent to a neutral stimulus, and this effect persisted after acquisition. Whereas the stability of conditioned attitudes has already been demonstrated in previous studies (Baeyens et al., 1989), no single experiment to date has addressed the resistance of effects that were mediated by sensory preconditioning. Because spreading attitude effects are relatively small, there is reason to speculate that extinction might eliminate the effect. However, results of Study 3 show that the spreading attitude effect is by no means reduced in the extinction condition. Second, the number of trials is not irrelevant either for conditioning or for spreading attitude effects. Both effects were a little stronger than the average conditioning and spreading attitude effects obtained in the previous studies. The reliability of this effect, however, must be addressed in future studies. Third, not only conditioning but awareness effects as well increased with the number of trials. In contrast to the two earlier experiments, 5

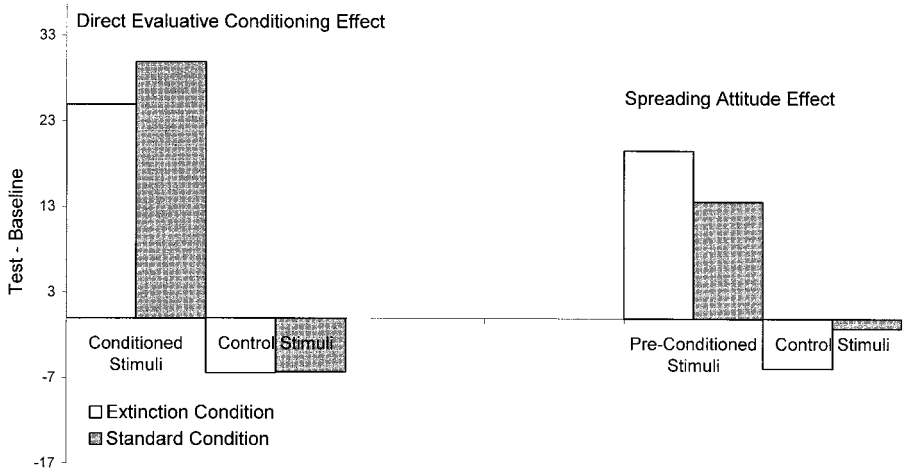

Figure 3. Study 3. Direct evaluative conditioning effects and spreading attitude effects in the standard condition and the extinction condition.

participants reached at least Level 2 on the awareness measurement. It is no surprise that a higher rate of trials helped participants to detect rules or patterns within the stimulus presentation.

Another question referring to the robustness or stability of evaluative conditioning is whether the CS itself acquires the potency to serve as a US. To answer this question, I applied a paradigm very similar to sensory preconditioning that has often been successfully applied in classical human as well as animal conditioning (Barnet et al., 1991; Holland & Rescorla, 1975; Rashotte, Griffin, & Sisk, 1977): second-order conditioning. The procedure by which second-order conditioning is established is identical to that of sensory preconditioning, except that the order of the preconditioning and conditioning phases is reversed: Following conventional evaluative conditioning of a previously neutral stimulus with an affectively positive or negative US, the CS is paired with another neutral stimulus. Second-order conditioning successfully occurs if the neutral stimulus paired with the CS differs from a control stimulus that was paired only with an affectively neutral stimulus. In other words, whereas the sensory preconditioning paradigm examines the backward spreading of attitudes, second-order conditioning investigates forward spread. In more social terms, second-order evaluative conditioning implies not only that Paul's bad company may decrease his likability ratings but also that this negative attitude spreads to other neutral persons in Paul's company (e.g., Patrick). Thus, Paul himself may adopt the affective qualities of a US during conditioning. Evidence that second-order conditioning can be established and assessed in evaluative conditioning is rare. However, second-order conditioning as well as sensory preconditioning imply that the direct contact with a valued event is not a necessary precondition for evaluative conditioning effects to occur. In the next experiment, I tried to demonstrate second-order conditioning in appetitive as well aversive conditioning. Moreover, the experiment was intended to show that evaluative conditioning occurs if there is an overlap in the presentation of CS and US, as might be the case in most social situations.

Experiment 4: Forward Attitude Spread in a Second-Order Conditioning Paradigm

Method

Participants and Design

Thirty students (19 men, 11 women) from the University of Heidelberg participated in groups of up to 4 persons. They were either paid for their participation or given partial credit for a course requirement. Students were assigned to a 2 (conditioning: standard vs. second-order conditioning) × 3 (US type: aversive vs. neutral vs. appetitive) within-subject design.

Materials and Procedure

Experiment 4 differs from the previous experiments in that appetitive as well as aversive USi were used. It was one aim of this study to replicate the aversive evaluative conditioning that was shown in Study 2. Moreover, conditioning and preconditioning phases were reversed, and a delayed conditioning procedure was applied (Akins & Domjan, 1996). Thus, the CS was first paired with an aversive or appetitive US and was subsequently presented contingent to a neutral stimulus. In the delayed conditioning procedure, the CS was presented for 3 s on the left side of the screen and the US was displayed for 2 s on the right side, resulting in a 2-s overlap of both stimuli. There was a space of approximately 4 cm between the pictures when both were on the screen at the same time. The ITI was 5 s. Because I wanted to investigate appetitive as well as aversive conditioning, the computer program selected the most liked stimuli (rated higher than 80) as appetitive USi, the pictures around zero (rated higher than −20 but lower than 20) as neutral USi, and the most disliked faces from the baseline (rated lower than −80) as aversive USi. Judges of the awareness measurement agreed on all but one case, which was resolved by a third judge.

Results and Discussion

Conditioning and Second-Order Conditioning Effects

Figure 4 illustrates the mean evaluative conditioning and second-order conditioning scores in the different conditions. It is

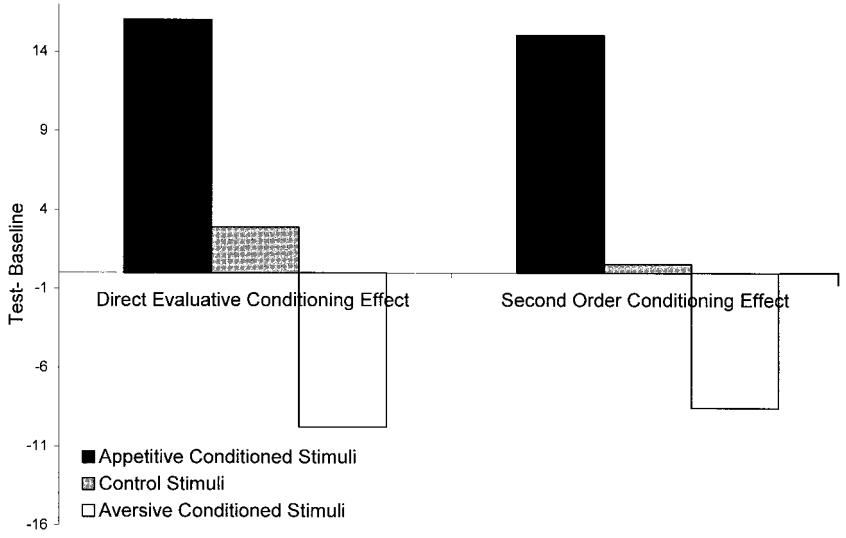

Figure 4. Study 4. Direct evaluative conditioning effects and second-order conditioning effects (forward spread).

evident that stimuli paired with liked faces were rated much more positively than were neutral stimuli presented in contiguity with a disliked face, with neutral–neutral stimuli lying between these extremes. It is interesting that Figure 4 also shows that that there was no strong difference between second-order conditioning effects (i.e., forward attitude spread) and the results of conventional evaluative conditioning. Thus, the 2 (conditioning: standard vs. second-order conditioning) × 3 (US type: aversive vs. neutral vs. appetitive) ANOVA, with repeated measurement on both factors, revealed a strong main effect for US type, $F(1, 29) = 8.48$, $p < .007$. No other effect was significant (all Fs < 1.00). Results also indicate that conditioning effects, $F(1, 29) = 4.12$, $p < .05$, as well as second-order conditioning effects, $F(1, 29) = 6.96$, $p < .01$, reached significance in separate analyses. Whereas simple comparisons indicate a strong difference between the aversive and appetitive CSi in the standard conditioning group, $t(29) = 2.03$, $p < .03$, as well as in the second-order group, $t(29) = 2.64$, $p < .007$, the comparison with the neutral stimuli failed to reach conventional significance (all ts < 1.60).

Awareness Effects

Three participants reached Level 3 on the awareness measurement because they recognized the hypothesis underlying the experiment. More specifically, participants noticed that stimuli were repeatedly paired to change their valence, though they were not able to verbalize the particular contingencies. These findings were somewhat surprising because there was not a single case of demand awareness in the previous spreading attitude experiments. However, contrary to these prior experiments, in which neutral–neutral pairs were shown in the preconditioning phase, the CS in a second-order paradigm already obtained evaluative meaning during the conditioning phase. Thus, it is not implausible that the affective significance of the stimuli might have increased demand awareness. It is interesting to note that subtracting the data of aware students from the analysis leads to a remarkable strengthening of the conditioning effects, $F(1, 27) = 7.80$, $p < .01$, as well as the second-order conditioning effects, $F(1, 27) = 7.36$, $p < .01$. Because of the reduction of variance, even the simple effects between the aversive and the neutral group in the simple conditioning group, $t(26) = 1.50$, $p < .08$, as well as the comparison between the appetitive group and the control condition group, $t(26) = 1.60$, $p < .06$, were almost significant. Also, the second-order conditioning effect was stronger, at least in the appetitive conditioning group, $t(26) = 1.70$, $p < .05$, but failed to reach significance when the neutral pictures were paired with aversively conditioned CSi ($t < 1.00$).

In Study 4, an experimental paradigm (i.e., second-order conditioning) that is often used in classical conditioning research was established in an evaluative appetitive and aversive conditioning experiment. Results indicate the occurrence of forward spreading effects, although there was no direct contact of the neutral stimulus with the US. As Domjan (1998) recently noted, "even the existence of second-order conditioning is of considerable significance because it greatly increases the range of situations in which classical conditioning takes place. With higher-order conditioning, classical conditioning can occur without a primary unconditioned stimulus" (p. 93). The results of Experiment 4 justify the extension of this conclusion to evaluative conditioning effects as well. Learning in general, and social learning in particular, is often characterized by an indirect or mediated contact with a positively or negatively evaluated event. Second-order conditioning shows that a few instances of contact with a (dis)liked person are sufficient to infect an innocent individual with an affective value that is strong enough to spread to others. It is important to note that the effects obtained in both paradigms (i.e., forward and backward spread) are not due to simple generalization. In all studies, spreading attitude effects were rather specific and restricted to stimuli that were actually associated with a valued event but were not overgeneralized to every stimulus presented in the study. Consequently, an association between evaluated and neutral stimuli seems to be a necessary and—as shown by the studies reported above—also a sufficient condition for attitude formation to occur through evaluative conditioning.

However, it is also important to note that even simple evaluative conditioning effects in terms of a comparison with the neutral stimuli were statistically weaker than were the results obtained in the previous experiments. Analysis of the awareness measurement indicated that this might be at least partly due to the demand awareness of certain participants. Eliminating the data of the demand-aware participants increased the obtained findings substantially. As Fulcher and Hammerl (2001) recently found, demand awareness can provoke contrast rather than assimilation effects. Support for this notion comes from several other studies that have shown that an awareness of the influence or the idea underlying the experiment may weaken the results (e.g., Strack, Schwarz, Bless, Kuebler, & Waenke, 1993).

Related to the awareness issue is the question of whether resource-dependent mechanisms may play a role in determining spreading attitudes. Individuals often encounter other people without attending to them. The spreading attitude effect can show how these incidental observations can lead to affective consequences. Support for the hypothesis that evaluative learning is not dependent on cognitive resources comes from other evaluative conditioning studies, in which distraction during the conditioning period facilitated rather than inhibited conditioning (Bakker-De Pree, Defares, & Zwaan, 1970). A test for the idea that spreading attitudes are also not affected by reduced capacity may come from a procedure in which researchers apply cognitive load by asking participants to rehearse an eight-digit number. Past research has shown that this task can be used successfully to deprive participants of processing resources (Gilbert & Hixon, 1991; Sherman & Frost, 2000; Wegner, Erber, & Zanakos, 1993).

Experiment 5: The Spreading Attitude Effect Under Conditions of Mental Load

Method

Participants and Design

Fifty-three students (23 men, 28 women) from the University of Heidelberg participated in groups of up to 4 persons. They were either paid for their participation or given partial credit for a course requirement. Students were assigned to a 2 (preassociation: absent vs. present) × 3 (US type: aversive vs. neutral vs. appetitive) × 2 (cognitive load: absent vs. present) design, with repeated measurement on the first two factors and random assignment to the last factor.

Materials and Procedure

A delayed conditioning procedure similar to that of Experiment 4 was applied.

Load manipulation. In the load condition, a separate set of instructions appeared on the screen prior to all other instructions. It informed participants that the study was about how well people can perform two dissimilar tasks at the same time. The computer program provided participants with an eight-digit number and asked them to remember it until requested to recall it. So that each participant encoded the number successfully, participants had to write the correct number using the keyboard on the next screen. If an incorrect number was typed, the computer presented the instructions with the number again until the participant filled in the correct number.

Manipulation check. After the entire procedure but before the awareness questionnaire was administered, participants were asked to write down the number on a sheet of paper. Two participants in the load condition were excluded from further analysis because they recalled an incorrect number. Data from another student in the no-load condition were also excluded because this person was fully aware of the contingencies and the true purpose of the experiment. A postexperimental interview revealed that this student had already participated in a previous evaluative conditioning study. Judges of the awareness questionnaire agreed in all but two cases, which were resolved by a third judge.

Results and Discussion

Conditioning and Preconditioning Effects

To investigate conditioning effects, I computed a 3 (US type: aversive vs. neutral vs. appetitive) × 2 (cognitive load: absent vs. present) ANOVA with repeated measurement on the first factor, which yielded a main effect for conditioning, $F(1, 48) = 24.22$, $p < .001$. As expected, the pairing with a liked face evoked a more favorable judgment of the previously neutral stimuli, but the co-occurrence with a disliked face led to a more unfavorable evaluation of the stimulus after conditioning. However, the marginally significant interaction effect indicated that conditioning was somewhat stronger in the load condition as compared with the no-load condition, $F(1, 48) = 3.47$, $p < .07$. Of further interest were the effects of the sensory preconditioning manipulation. Figure 5 illustrates the mean difference ratings for the three preconditioned stimuli. It can be seen at first glance that the mean ratings were highly positive in the appetitive sensory preconditioning condition and negative in the aversive condition, $F(1, 48) = 24.77$, $p < 001$. Moreover, it is also apparent that preconditioning effects were much stronger in the load condition than in the no-load condition, which resulted in a significant interaction effect, $F(1, 48) = 4.44$, $p < .04$. It is interesting to note that cognitive load strongly increased the simple associative effects of sensory preconditioning. Quite similar to Study 4, all specific comparisons between the CSi or preconditioned stimuli and the control stimuli reached significance (all ts > 1.70) except the comparison between the aversive preconditioning effect in the no-load group and the control group ($t < 1.00$).

Awareness Effects

As reported above, one participant in the no-load condition had already participated in a similar study. The data of this participant were excluded from further analysis. All other participants were unaware of the presented contingencies and did not recognize the hypothesis underlying the experiment.

The results of Study 5 support the hypothesis that evaluative conditioning is not dependent on cognitive resources. Effects of evaluative learning were not reduced but were even higher when cognitive capacity was occupied by mental load. The fact that distraction increased conditioning effects—at least on a descriptive level—as well as sensory preconditioning effects is a significant indication that evaluative learning is not mediated by attention processes but rather hindered by cognitive operations during the

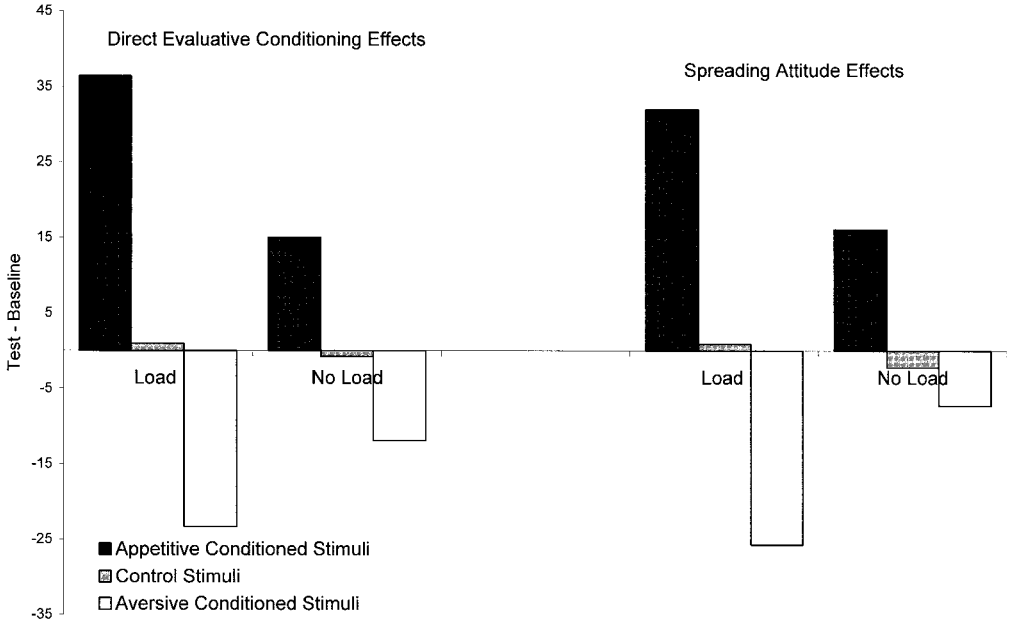

Figure 5. Study 5. The effect of mental load on direct evaluative conditioning and on spreading attitude effects.

conditioning procedure. It is interesting to note that the strongest impact of the load manipulation was obtained in the analysis of the more subtle spreading attitude effects, which were much enlarged when capacity was limited. Too much attention given to the neutral stimuli may presumably block primitive associative learning by triggering higher cognitive processes. Although this explanation may be premature and quite speculative, the conclusion that evaluative conditioning is not dependent on cognitive resources is warranted.

In sum, I found evidence in five studies that the spreading attitude effect is a stable and reliable phenomenon. However, the fact that the effects reached only marginal significance in some analyses may lead to the impression that the spreading attitude effect is rather weak. To address the magnitude of the effects more specifically, I computed the effect sizes of all studies and combined them in a meta-analysis (cf. Johnson, 1993; Johnson & Eagly, 2000). Effect sizes (d = Hedge's sample-size-corrected effect size, which is slightly smaller than Cohen's' effect size) were defined as standardized mean comparisons of each experimental condition against the control condition. The values resulting from this analysis are reported in Table 2. The meta-analysis across studies resulted in a mean weighted $d = 0.45$, with a 95% confidence interval that does not include zero, 0.26/0.63 (Johnson & Eagly, 2000). In terms of Cohen's standards, this means that the magnitude of the effect is of medium size. The equivalent unit-normal z value evaluating the significance of the effect is 4.70 ($p < .001$), indicating that the relation is statistically significant across studies. Moreover, the meta-analysis indicates that the effect size is consistent across the experiments, as shown by a nonsignificant $Q(9) = 4.24$. Generally, the meta-analysis supports the notion that the spreading attitudes had a high degree of homogeneity and were not particularly small in terms of effect size.

General Discussion

The aim of the present research was to demonstrate that attitudes can be formed through simple affective learning mechanisms. Its intent was to show that evaluative learning is not dependent on the (conscious or unconscious) experience of a valued event but can work through associative chains, as realized in paradigms such as sensory preconditioning and second-order conditioning. It was predicated that the mere co-occurrence of a positively or negatively evaluated male face with a neutral face would lead to an evaluative shift of the former neutral picture in a positive or negative direction, respectively. Moreover and most important, it was expected that attitude formation would not be restricted to targets that are directly paired with a liked or disliked face but might spread to other faces pre- (or post)associated with the target and would also be found under conditions of reduced mental capacity.

Table 2
Meta Analysis of Effect Sizes (ds) of Experiments 1–5 and Mean Effect Size Across All Studies

Study and condition	Comparison	Effect size (d)
Study 1	Appetitive vs. control	0.37
Study 2	Aversive vs. control	0.52
Study 3		
Standard condition	Appetitive vs. control	0.32
Extinction condition	Appetitive vs. control	0.48
Study 4	Appetitive vs. control	0.70
	Aversive vs. control	0.22
Study 5		
Load condition		
	Appetitive vs. control	0.81
	Aversive vs. control	0.56
No-load condition		
	Appetitive vs. control	0.31
	Aversive vs. control	0.23
Mean weighted d		0.45
z value of d		4.70[a]

[a] This value is significant ($p < .001$).

The experiments reported here extend—empirically and theoretically—the only prior study that addressed sensory preconditioning in an evaluative conditioning paradigm (Hammerl & Grabitz, 1996). The basic parameters of the spreading attitude effect in terms of trial number, load, valence, and order were investigated through five experiments. Experiment 1 was the first to demonstrate spreading attitudes with socially meaningful target stimuli in an appetitive learning paradigm. In contrast to Hammerl and Grabitz (1996), who used pictures of fountains and sculptures, photographs of human subjects served as stimulus material in the present studies. Experiment 2 supports the prediction that spreading attitude effects are not confined to appetitive USi but can be found with negatively evaluated faces as well. These effects of aversive evaluative conditioning were replicated in Experiment 4 and 5. Experiment 3 indicates that spreading attitudes are a robust and stable phenomenon resistant to extinction. Experiment 4 extends these findings by demonstrating forward attitude spread, indicating that the CS itself can acquire the potency of a US through evaluative learning. Experiment 5 demonstrates spreading attitudes under conditions of reduced mental capacity.

Across five studies, I found that the spreading attitude effect is a reliable and robust phenomenon. In contrast to previous findings (Hammerl & Grabitz, 1996), I was able not only to demonstrate spreading attitudes within different experimental paradigms and procedures but also to show that the spreading attitude effect is resistant to extinction. That means that the positive or negative attitude toward Peter through preassociation with Paul does not fade away if Peter shows up alone after the conditioning phase. That Peter himself acquired a positive or negative evaluation through his association with Paul is further supported by Study 4, in which the previously conditioned stimulus served as a US.

The present findings also shed some light on the conditions that may provoke awareness. A second-order paradigm in which CSi were repeatedly presented after acquisition (Experiment 4) as well as an increasing number of trials (Experiment 3) supports awareness effects. Although all of these experiments provide evidence that evaluative conditioning effects were at least not dependent on higher processes of verbal knowledge and cognitive inferences, the evidence comes only from postexperimental questionnaires and was not put to direct testing. To resolve the ambiguity of the interview data, I applied a cognitive load manipulation in the final experiment. If evaluative learning is mediated by resource-dependent cognitive operations, a distractor task should diminish conditioning effects. Experiment 5, however, reveals that conditioning as well as spreading attitude effects were not reduced but were actually enhanced under mental load. This result supports a

line of research that emphasizes affective as opposed to cognitive factors in attitude formation.

Affective Versus Cognitive Factors in Attitudes

There is substantial agreement among attitude researchers that both affective and cognitive structures (i.e., beliefs) contribute to the explanation of attitudes. However, there is less agreement as to whether affect has a direct influence on attitudes or whether affect itself has no predictive value and is always mediated by or consequent to cognitive factors (Bodur, Brinberg, & Coupey, 2000; Fishbein & Middlestadt, 1995; Kim et al., 1998) Proponents of this latter view consider cognitively based beliefs the core concept in explaining attitude formation (Ajzen & Fishbein, 1980).

However, there is cogent evidence that deductive reasoning is not a necessary precondition for attitudes to develop (Cacioppo et al., 1992; Krosnick, Betz, Jussim, & Lynn, 1992; Niedenthal, 1990). Krosnick et al., for instance, provided evidence for attitude formation in a paradigm in which the CS was preceded by a subliminally presented affect-arousing picture (see also Niedenthal, 1990, for a similar procedure). However, the fact that the US precedes the CS, along with other methodological issues (e.g., lack of neutral control group, absence of baseline condition), makes it hard to distinguish this result from effects of affective priming, in which already existing attitudes were activated. One of the most prominent examples for affective attitude formation, however, is the mere-exposure effect, in which the repeated presentation increases the likability of a stimulus even more when participants are not aware of the presentation (Murphy & Zajonc, 1993). On the basis of these and related findings, Zajonc (1980, 2000) highlighted the primacy of affect in the formation of preferences.

Convergent evidence that evaluation can occur without conscious deliberation comes from evaluative priming studies (Bargh et al., 1992; Fazio et al., 1986; Klauer, 1998). In this paradigm, the prime is presented supraliminally but the presentation intervals are too short to allow conscious consideration. A typical result is that the response latency to a target with the same valence as the prime is usually faster than the response to a target with a different valence, indicating that individuals can respond on the basis of an immediately activated evaluative system that is not dependent on conscious deliberation.

The Contribution of Evaluative Conditioning

Effects of evaluative conditioning contribute to the debate on the origins of attitudes by demonstrating that even the acquisition of preferences can take place without conscious deliberation and presumably without people's verbalizable knowledge. The results of the five experiments suggest that an overwhelming majority of participants were not able to report the presented contingencies and did not even realize that their evaluation of the faces changed during conditioning. The mere paired presentation of subjectively neutral with subjectively liked or disliked faces was sufficient to change the valence of the neutral stimulus in the positive or negative direction. In keeping with previous studies (Baeyens et al., 1989; Hammerl & Grabitz, 1996; Zellner, Rozin, Aron, & Kulish, 1983), I have demonstrated that evaluative conditioning is a robust phenomenon that works with different experimental designs (trace conditioning, delayed conditioning). The classic examples of evaluative learning are, of course, phobias and taste aversion. Many social and animal phobias involve inappropriate dislikes that are highly resistant to therapeutic intervention and are often acquired without contingency awareness (Baeyens et al., 1992). More important, phobic objects themselves often elicit an aversive reaction without signaling a negative event. Extinguishing the contingencies between a spider and a phobic reaction may therefore not alter the negative attitude as such toward a spider. Accordingly, several therapists have applied counterconditioning with positive US, such as music, to change the intrinsic negative attitude toward the phobic object (Eifert, Craill, Carey, & O'Connor, 1988). Also, educational psychology is replete with instances of evaluative conditioning: An almost prototypical example states that even a gifted student might start to hate math because he or she dislikes the teacher.

Elements of evaluative conditioning can also be identified in social psychology. One can speculate that several important effects in social psychology are at least partly due to mechanisms of evaluative learning. The famous kill-the-messenger effect, for example, describes the phenomenon whereby transmitters are inevitably associated with the valence of the message they have to tell (Manis, Cornell, Moore, & Jeffrey, 1974). Effects of evaluative conditioning are even more apparent in the area of persuasion. It is a well-known phenomenon in persuasion research that simple evaluative features of the source, such as the attractiveness (Petty & Cacioppo, 1984) or the credibility and likability of the communicator (Chaiken, 1980; Petty, Cacioppo, & Goldman, 1981), serve as potent persuasion cues, particularly in situations in which participants are distracted, have low motivation, or are low in need for cognition. What this means is that individuals who are unable or unwilling to think about reasons for their attitudes base their attitude on evaluative cues associated with the message. This is not to say that cognitive processes such as intentional processing and deductive reasoning do not play a role in all of theses paradigms. Without denying the contribution of higher cognitive processes in explaining these phenomena, this argument merely states that simple evaluative learning mechanisms may also be involved and may help to explain the origin of attitudes toward individuals and groups. If effects of classical conditioning have not received much attention in temporary attitude research, this is even more true for evaluative conditioning and the spreading attitude effect.

Implications of the Spreading Attitude Effect

Spreading attitudes means that effects of evaluative conditioning are not confined to stimuli that were directly paired with an evaluated event but may have an impact on other stimuli preassociated with this stimulus. The mechanism of this amazing effect is presumably as follows: The contiguous presentation of the neutral stimuli during preconditioning develops an association in memory between the two (N1–N2). In the conditioning phase, one of these former neutral stimuli (N2) serves as CS and acquires positive or negative valence through evaluative learning. The argument that the CS actually acquires qualities of the US in this phase is supported by Experiment 4, which successfully demonstrates second-order conditioning (i.e., forward spread). However, the theoretical suggestion, backed by empirical data, is that the affective tone of the CS influences other (pre)associated stimuli (i.e., N1) that are connected with this stimulus in memory. This finding

not only supports the theoretical notion of an association-based process underlying evaluative conditioning (Baeyens & De Houwer, 1995; Hammerl & Grabitz, 1996), it also opens up a wide range of possible applications in several areas of social and applied psychology.

In contrast to evaluative generalization effects (Tursky et al., 1976; Tursky et al., 1979), the spreading attitude paradigm provides an experimental framework for investigations of how potential, highly specific stimulus associations are established. One implication of the spreading attitude effect is that a negative or positive attitude toward an individual or event does not presuppose a direct evaluative experience. Hardly anybody who is afraid of flying has been actually hurt in an air crash. Bad feelings about a single group member may affect the entire group, thereby maintaining prejudice. However, spreading attitudes may also have (unjustified) positive consequences: The good impression one's older sister made in school may have a favorable impact on teachers' attitude toward one, although none of them are aware of this attitude spread. More evidence for the indirect effect of evaluative learning comes from a series of intriguing studies conducted by Rozin, Markwith, and McCauley (1994), who demonstrated that the aversion toward a person with AIDS is generalized to other objects associated with this person (e.g., a sweater, car, or bed).

Another field of application for spreading attitude effects is advertising and consumer research. For example, the concept of brand extension can only work if the positive attitude toward the brand is extended to other products associated with the brand. Although there is a vast amount of research pertaining to this topic (Barone, Miniard, & Romeo, 2000; Flaherty & Pappas, 2000; Lane, 2000; Till & Priluck, 2000), the underlying mechanisms of the how and when of brand extensions remain unclear. Thus, a theoretical account is needed to explain whether brand extension may be profitable. The spreading attitude effect as a result of sensory preconditioning provides such an account. Of particular interest for this line of research may also be the fact that the spreading attitude effect as a special form of evaluative learning is not dependent on conscious, deliberate attention but turns out to be even stronger when participants are distracted (see Experiment 5).

Taken together, the studies reported in this article provide support for the hypothesis that attitudes toward persons (or at least toward human faces) can be formed through simple processes of evaluative conditioning. Although effects of contingency awareness cannot be entirely ruled out within our experimental paradigm, there is converging evidence that awareness did not play much of a role in these experiments. Moreover, it was shown that sensory preconditioning, a well-known procedure used in a number of animal studies, can be fruitfully applied to social psychology and that the spreading attitude effect can be demonstrated with socially relevant material. I have discussed ways this kind of associative, affective learning may be relevant for several phenomena in social as well as applied psychology. The present work contributes to the field's understanding of attitude formation driven by basic learning mechanisms that often receive little attention in social psychology.

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