A Conceptual and Theoretical Analysis of Evaluative Conditioning

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Evaluative conditioning is best defined as an effect, that is, as a change in the valence of a stimulus that results from pairing the stimulus with another stimulus. This definition has several advantages that are made explicit in this paper. One of the advantages is that it clarifies that evaluative conditioning can be due to multiple processes. Therefore, the conditions under which evaluative conditioning is observed can depend on the processes that underlie a particular manifestation of evaluative conditioning. This could explain why there are so many conflicting results about the conditions under which evaluative conditioning can be found. Future research should adopt a meta-conditional approach that focuses not only on whether a certain condition is crucial for obtaining evaluative conditioning but should also examine when a certain condition is crucial.
Keywords: evaluative conditioning, associative learning, attitudes, attitude formation

El condicionamiento evaluativo se define como un efecto, es decir, un cambio en la valencia de un estímulo que resulta de emparejar ese estímulo con otro. Esta definición tiene varias ventajas que se explicitan en este trabajo. Una de las ventajas es que aclara que el condicionamiento evaluativo puede deberse a múltiples procesos. Las condiciones bajo las cuales se observa el condicionamiento evaluativo dependen, concretamente, de los procesos que subyacen a cada manifestación particular del mismo. Esto podría explicar por qué hay tantos resultados conflictivos referidos a las condiciones bajo las cuales se puede encontrar el condicionamiento evaluativo. La investigación futura debe adoptar un enfoque meta-condicional que no solo se centre en si una condición determinada es crucial para obtener el condicionamiento evaluativo, sino que examine también cuándo esa condición es crucial.
Palabras clave: condicionamiento evaluativo, aprendizaje asociativo, actitudes, formación de actitudes

One of the most influential ideas in psychology is that preferences are an important determinant of behavior (e.g., Allport, 1935; Martin & Levy, 1978). To give just a few examples from daily life, people tend to seek the company of persons they like and avoid being in the company of persons they do not like; they buy products that they like more often than those that they do not like; people vote for the politicians that they find sympathetic but not those that repel them; they will pay to do the things they like but need to be paid to do the things that they dislike. Furthermore, preferences influence attention, memory, and judgments, and form the basis of our emotional life. In order to understand, predict, and influence behavior, it is thus crucial to understand how preferences are formed and can be influenced. Evaluative conditioning is generally considered to be one of the approaches to influence liking. Studies on evaluative conditioning have shown that the liking of a neutral stimulus can be changed by pairing it with another, liked or disliked, stimulus. The first stimulus is often called the *conditioned stimulus* or CS whereas the second stimulus is often called the *unconditioned stimulus* or US. Typically, a CS will become more positive when it has been paired with a positive US than when it has been paired with a negative US. Well known real-life examples of evaluative conditioning are the "have-a-Coke-and-a-smile" ads of the Coca-Cola Company. In these ads, the Coke brand name (CS) is repeatedly presented together with images of smiling people having fun (US). It is assumed that this will increase the liking of the brand.

Evaluative conditioning has been examined in a large number of studies (see De Houwer, Thomas, & Baeyens, 2001, for an extensive review, and De Houwer, Baeyens, & Field, 2005, for an update). Nevertheless, our understanding of the phenomenon is still very limited. There now is general agreement about the fact that evaluative conditioning is a genuine phenomenon (an agreement that has been reached only recently; see De Houwer, Baeyens, et al., 2005). It also seems safe to conclude that evaluative conditioning can be found with various kinds of stimuli and procedures. At the same time, genuine failures to find evaluative conditioning suggest that certain boundary conditions need to be fulfilled before evaluative conditioning can emerge (see De Houwer et al., 2001, for a review). There is little else that evaluative conditioning researchers agree about. For instance, whereas some results suggest that the effect can be found even when participants are not aware of the CS-US contingencies (e.g., Baeyens, Eelen, & Van den Bergh, 1990; Dickinson & Brown, 2007), the results of other studies suggest that evaluative conditioning does crucially depend on contingency awareness (e.g., Pleyers, Corneille, Luminet, & Yzerbyt, 2007). Likewise, whereas some argue that evaluative conditioning is unaffected by extinction (i.e., presentations of the CS in isolation after the CS-US pairings; e.g., Baeyens, Crombez, Van den Bergh, & Eelen, 1988; Diaz, Ruis, & Baeyens, 2005), others have reported data showing that extinction does affect evaluative conditioning (e.g., Lipp, Oughton, & LeLievre, 2003).

In the current paper, I present a conceptual and theoretical analysis that clarifies why so little progress has been made in the study of evaluative conditioning and how this can be remedied in future research. I will first argue that evaluative conditioning is best defined as an effect rather than as a specific procedure or theoretical process. This conceptual analysis has important theoretical implications. When defined as an effect, it becomes clear that different kinds of processes could produce evaluative conditioning effects (also see De Houwer, Baeyens, et al., 2005). This insight sheds new light on many contradictory findings that have been reported in the literature. It also implies that future research should not only test *whether* a certain condition is crucial for obtaining evaluative conditioning but should also examine *when* a certain condition is crucial.

A Conceptual Analysis

The Distinction between Procedure, Effect, and Theory

The starting point of the present analysis is the distinction between procedure, effect, and theory (see Bolles, 1979; Eelen, 1980). Before applying this distinction to the concept "evaluative conditioning," I will try to explain the distinction and illustrate it with regard to the well known concept "priming". A *procedure* is simply an objective list of actions, a set of guidelines about what to do. It specifies the manner in and conditions under which stimuli are presented and responses registered. For example, a priming procedure most often involves: (a) presenting on each trial a prime stimulus and a target stimulus that are either related (e.g., NURSE-DOCTOR) or unrelated (e.g., WALL-DOCTOR) and (b) registering how long participants need to respond to the target. An *effect*, on the other hand, is the result of a procedure. More specifically, it is an observation that is attributed to a certain abstract, core feature of the procedure. For instance, the observation in priming tasks that responses to the target DOCTOR are fast when it is preceded by the prime NURSE can be labeled a priming effect if this observation is attributed to the relatedness of the prime and target. The core feature "relatedness" is abstract in that it applies to a range of stimuli under a variety of conditions. An observation becomes an effect only when there is evidence showing that the core element of the procedure is responsible for the observation. In the case of a priming effect, this implies comparing reaction times on trials with related prime-target pairs to reaction times on trials with equivalent prime-target pairs that are not related in the same manner. In practice, using the term effect thus requires a comparison of observations in situations that differ only with regard to the core procedural element that is thought to be crucial for the effect. Finally, the term *theory* can be

understood in this context as referring to the theoretical processes that are assumed to be responsible for an effect. For example, priming effects are often attributed to activation that spreads in a semantic network from the representation of the prime to the representation of the target, thus facilitating responses to the target. A theory therefore implies not only that a certain observation is due to a core element of a procedure (e.g., relatedness of prime an target), it also makes assumptions about the processes by which the core elements of the procedure lead to the observed behavior (e.g., spreading of activation).

Because concepts can be used to refer to a procedure, effect, or theoretical process, it is important to always make explicit the manner in which a term is used. For instance, saying that NURSE primes DOCTOR can mean that the word NURSE is presented briefly before the word DOCTOR (priming as a procedure), that the presentation of NURSE speeds up responses to DOCTOR because the two words are related (priming as an effect), or that NURSE speeds up responses to the related word DOCTOR because activation spreads from the representation of the concept "nurse" to the representation of the concept "doctor" (priming as a theoretical process). To avoid confusion, one needs to clarify which of the three meanings is appropriate.

Applying the Distinction between Procedure, Effect, and Theory to Evaluative Conditioning

Like the concept "priming," the concept "evaluative conditioning" can be used to refer to a procedure, an effect, or a theoretical process. Let us return to the example of the "have-a- Coke-and-a-smile" ads. To say that this is an example of evaluative conditioning can mean several things. First, it could imply that the marketeers behind the ad campaign used a certain *procedure* that is in essence identical to the procedure used in evaluative conditioning studies. Both in the ads and in lab studies, stimuli (e.g., a brand name and pictures of smiling people) are presented together in a certain manner and it is assessed whether this leads to changes in liking. In this sense, evaluative conditioning simply refers to what a marketeer does. Second, saying that the Coke ads provide an example of evaluative conditioning can mean that the pairing of the brand name and the smiling

faces actually produces a change in the liking of the Coke brand. Evaluative conditioning is now understood to be an *effect* of (a core element of) the procedure rather than the procedure itself. It refers to the effect of the ads, not to the ads as such. More generally, evaluative conditioning as an effect refers to an actual change in the liking of stimuli that is due to the fact that stimuli were paired in a certain manner. The third and final way in which the concept "evaluative conditioning" can be used is in terms of a theoretical process. Although rarely made explicit, many researchers regard evaluative conditioning as an automatic, bottom-up, and low-level process that involves the formation and updating of associations between representations in memory. Saying that the "have-a-coke- and-a-smile" ads are an example of evaluative conditioning could thus mean that the pairing of Coke and smiling faces lead to an increase in liking because an association was automatically formed between the representation of the brand Coke and the representation of the positive smiling faces. In the following sections, I will discuss the advantages and disadvantages of each of the three possible definitions.

Evaluative Conditioning as a Procedure

When labeling a certain procedure as evaluative conditioning, a criterion is needed that can be used to decide whether the specific procedure classifies as an evaluative conditioning procedure. One option would be to restrict the term "evaluative conditioning" to one specific procedure. For instance, it could be reserved for the picture-picture conditioning procedure that Levey and Martin (1975) used when they introduced the term "evaluative conditioning." In that case, however, the term cannot be used to refer to highly similar paradigms in which other types of stimuli such as tastes are used as CSs and USs (e.g., Baeyens, Eelen, Van den Bergh, & Crombez, 1990). Hence, such a use of the term would fail to highlight the core similarity between a variety of specific procedures as well as the core differences with other types of procedures[1].

A second option is to use a set of core procedural elements as the defining criterion. As noted above, core elements of the procedure refer to abstract procedural properties that apply to a range of stimuli under a range of

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[1] The fact that such an identification of a concept with concrete aspects of the procedure can take place is illustrated by the standard use of the term "Simon task." In a typical Simon task, participants are asked to press a left key or right key on the basis of the color of stimuli that are presented on the left or right side of a screen (e.g., Craft & Simon, 1970). Responses are faster when the irrelevant spatial position of the stimulus and the relevant position of the response match than when they mismatch. What few researchers realize is that Simon tasks do not necessarily involve spatial information. For instance, De Houwer and Eelen (1998) introduced an affective Simon task in which participants were to say GOOD to nouns and BAD to adjectives (or vice versa). Results showed that participants were faster when the valence of response and the stimulus matched (e.g., say GOOD to SUNSHINE because it is a noun) than when this differed (e.g., say GOOD to CANCER because it is a noun). Structurally, both spatial and affective Simon tasks involve the manipulation of the match between an irrelevant stimulus feature and a relevant response feature (see De Houwer, 2003). They thus share the same core procedure.

conditions. Hence, many specific procedures can share the same core procedure (i.e., a set of defining core procedural elements). The question is what core procedural elements should be selected as defining for evaluative conditioning procedures. For reasons of simplicity and coherence, I suggest to select those core procedural elements that are also used to define evaluative conditioning effects. Given that evaluative conditioning effects can be described as changes in liking that are due to the pairing of stimuli, an evaluative conditioning procedure can be described as a procedure in which stimuli are paired and it is examined whether this changes the liking of those stimuli.

This definition of an evaluative conditioning procedure provides an important heuristic tool in that it allows one to see what a wide range of evaluative conditioning procedures have in common and how they differ from other types of procedures. First, all evaluative conditioning procedures have in common that (a) stimuli are paired and (b) it is examined whether this leads to changes in valence. Different evaluative conditioning procedures can differ with regard to the specific stimuli that are presented, the way in which liking is measured, and the conditions under which these stimuli are presented and liking is measured. Second, evaluative conditioning procedures are a subclass of Pavlovian conditioning procedures. As in other Pavlovian conditioning procedures, stimuli are paired. Evaluative conditioning procedures are unique in that they focus on changes in valence rather than changes in other responses (e.g., salivation, skin conductance). Third, evaluative conditioning procedures are a subclass of all procedures that focus on changes in valence. Evaluative conditioning procedures differ from those other procedures in that stimuli are paired rather than presented in a non-contingent manner (i.e., on their own as in mere exposure procedures) or in relation to a certain behavior (as in operant conditioning procedures).

Evaluative Conditioning as an Effect

In terms of an effect, evaluative conditioning can be defined as an observed change in liking that is due to the pairing of stimuli. Like other effects, there is an observation (i.e., a change in liking) that is attributed to a core element of a procedure (i.e., the fact that stimuli were paired in a certain manner). In the previous section, I pointed out that defining evaluative conditioning as an effect provides a criterion for classifying procedures. In this section, I will discuss a number of other advantages of defining evaluative conditioning as an effect.

Defining evaluative conditioning as an effect clarifies the similarities and differences with other effects. Just as defining evaluative conditioning procedures in terms of a core procedure provides a heuristic for classifying procedures, defining evaluative conditioning effects in terms of a core procedure provides a heuristic for classifying

effects. First, all changes in liking that are due to the pairing of stimuli can be regarded as evaluative conditioning effects. This is regardless of the types of stimuli that are used, the conditions under which these stimuli are presented, and the way in which liking is measured. Second, evaluative conditioning effects constitute a subclass of all Pavlovian conditioning effects. Like all other Pavlovian conditioning effects, evaluative conditioning effects concern changes in the response to a stimulus that result from pairing this stimulus with another stimulus. What is unique to evaluative conditioning effects is that they concern changes in one particular type of response to the stimuli, namely changes in the liking of the stimuli. Third, evaluative conditioning effects are a subclass of all observed changes in liking. A change in liking can be called evaluative conditioning only if it can be established that the change is due to pairing stimuli. There are several other possible reasons for why the liking of a stimulus could change. For instance, research on the mere exposure effect has demonstrated that the repeated non-contingent presentations of a stimulus (i.e., repeatedly presenting the stimulus on its own) can change the liking of the stimulus (see Bornstein, 1989, for a review). Liking can change also as the result of a procedure in which a behavior is paired with an outcome. Assume, for instance, that pressing a lever leads to food when a certain light is present. The behavior "pressing a lever" could become more positive because it is paired with the reward. Likewise, the liking of the light could increase because it signals the opportunity to receive a reward. These changes in liking are not evaluative conditioning effects because the changes in liking are not due to the pairing of stimuli. One could refer to these changes as operant evaluative conditioning effects because they result from a core procedure in which the presence of stimuli depends on the behavior of the individual (whereas in Pavlovian procedures, the presence of the stimuli is independent of the behavior of the individual). In contrast to mere exposure and evaluative conditioning effects, there is very little research on operant evaluative conditioning effects (see Beckers, De Houwer, & Eelen, 2002, for an exception).

There are clear criteria for determining the presence of evaluative conditioning effects. Defining evaluative conditioning as an effect implies that a change in liking can be classified as an evaluative conditioning effect once it is demonstrated that it is due to the pairing of stimuli. This can be done by including appropriate control conditions that differ from the experimental condition only with regard to the way stimuli are paired. In a within-subject design, for instance, some CSs are paired with a positive US whereas other CSs are paired with a negative US. If the liking of the two sets of CSs differs after presenting the pairings, then this difference can be called an evaluative conditioning effect provided that the two sets of CSs are entirely equivalent except for the USs with which they were paired. For instance, the two sets of stimuli cannot differ in how often they have

been presented or in how similar they are to the different USs (see Field & Davey, 1999, for a discussion of a possible confound). In a between-subjects design, some participants receive paired presentations of the CSs and USs whereas other participants receive unpaired presentations of the same stimuli. If the first group of participants shows larger changes in liking of the CSs than the second group, then the changes in liking can be called an evaluative conditioning effect provided that the groups differ only in how the stimuli were paired (see De Houwer et al., 2001, for a discussion of within-subjects and between-subjects controls).

One complication should be noted, however. Although it is possible to implement appropriate controls in a laboratory environment, outside of the laboratory, such controls are often absent. For instance, when confronted with someone who genuinely dislikes spiders, it is difficult to be certain that this dislike results from the fact that spiders have been paired with negative stimuli in the past. Other sources of liking such as genetic factors could also have been important (e.g., Poulton & Menzies, 2002). Likewise, when a certain advertisement is found to increase the liking of a brand, it is difficult to know whether this is due to the repeated presentation of the brand or the fact that the brand was repeatedly paired with positive stimuli in the advertisement. In such cases, labeling the change in liking as an evaluative conditioning effect is merely a hypothetical causal attribution.

Defining evaluative conditioning as an effect helps to organize research. The fact that a procedure can be classified as an evaluative conditioning procedure does not mean that it will actually generate an evaluative conditioning effect (i.e., that pairing stimuli will lead to changes in the liking of those stimuli). Whether it does can depend on at least three aspects of the procedure: (a) the manner in which stimuli are paired, (b) the specific stimuli and measures, and (c) the enabling conditions under which the stimuli are presented or liking is measured. Virtually all research on evaluative conditioning has examined the impact of at least one of these three aspects of the procedure on evaluative conditioning effects. Each aspect will now be discussed in more detail.

The first set of studies looks at how stimuli need to be paired in order to result in a change in liking. These studies try to come to a better understanding of the core procedure

that is necessary for obtaining changes in liking. They focus on factors such as the impact of the order and timing of the CS and US on a trial (e.g., forward vs. backward conditioning), the number of CS-US pairings, the contiguity between the CS and US, the strength of the statistical contingency between the presence of the CS and US, changes in the CS-US contingencies (e.g., extinction, US-postexposure, CS-preexposure, US-preexposure, counterconditioning, US-revaluation), whether a CS and US are paired directly or indirectly (i.e., sensory preconditioning, higher-order conditioning), whether information about the CS-US relation is presented through experience, observation, or instruction[2] (see Rachman, 1977), interactions between different contingencies (e.g., blocking), and whether the degree of contingency between the CS and US is signaled by another stimulus (i.e., occasion setting) (see De Houwer et al., 2001, for a review). All these factors deal with the abstract procedural properties of how stimuli are paired. These properties are abstract in that they can be implemented with multiple stimuli in multiple ways.

The second set of studies focuses on the generality of evaluative conditioning effects. They examine whether, given a certain core procedure, changes in liking can be observed with specific kinds of stimuli and measures. Evaluative conditioning effects have been found with a range of stimuli including pictures of faces, pictures of statues, flavors, tactile stimuli, and biologically significant stimuli (see De Houwer et al., 2001, for a review). Effects have also been observed with a variety of measures of liking, including sorting stimuli into piles of liked, disliked, and neutral stimuli, ratings on a Likert scale, physiological indices that are thought to reflect liking, and reaction time measures of liking (see De Houwer et al., 2001, for a review)[3]. Hence, evaluative conditioning (as an effect) appears to be a general phenomenon.

The third set of studies focuses not on the nature of the core procedure, nor on the specific stimuli or measures that are used to implement the core procedure, but on the abstract enabling conditions that could modulate the effect of the core procedure. Again, abstract means that the enabling conditions can be implemented or manipulated in multiple ways. Examples of enabling conditions are awareness of the CS-US contingencies, the availability of time and attentional resources, and the presence of goals. Most if not

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[2] Note that changes in liking as the result of verbal information about the relation between stimuli can also be regarded as evaluative conditioning effects. Such effects can be submitted to the same experimental analysis as other evaluative conditioning effects. This raises the interesting question of whether experienced pairings lead to other changes under other conditions than instructed pairings.

[3] Because the core procedure of evaluative conditioning involves not only the pairing of stimuli but also measuring changes in liking, one could argue that studies examining variations in how liking is measured belong to the first set of studies on the nature of the core procedure. This is especially true when abstract features of the measure are manipulated (e.g., verbal vs. nonverbal, direct vs. indirect, ...) and when the objective of the studies is to better understand what it means to say that one is measuring (changes in) liking. However, when the aim is merely to examine whether evaluative conditioning effects generalize over different types of specific measures, the studies do belong to the second set of studies.

all of these enabling conditions fall under the umbrella of the concepts automatic or non-automatic (see Moors & De Houwer, 2006a, for a detailed discussion). The conditions refer to whether and in what way basic psychological functions such as awareness, attention, and motivation are required to enable the impact of stimulus pairings on liking.

Note that the classification of research that is offered here differs from the classification that De Houwer et al. (2001) used in their review of the evaluative conditioning literature. They made a distinction between, on the one hand, studies on the generality of evaluative conditioning and, on the other hand, studies on the functional characteristics of evaluative conditioning. The section on generality included studies with different kinds of stimuli (e.g., visual, tactile) and different procedural parameters (e.g., order of CS and US, number of pairing, the way in which CSs were assigned to USs). The section on functional characteristics summarized studies on extinction, contingency, awareness, occasion setting, amongst others. It is not clear, however, what distinguishes studies on generality from studies on functional characteristics. Although they did not provide an explicit definition, De Houwer et al. (2001, p. 854) implied that "functional characteristics of evaluative conditioning" refer to the conditions under which evaluative conditioning can be observed. In this sense, research on the generality of the effect can also be seen as research on the conditions under which evaluative conditioning can be found. The categorization that is proposed in the present paper does provide a meaningful distinction between three types of conditions: those related to the core procedure, those related to the specific stimuli and measures, and those related to enabling conditions. By providing a meaningful distinction between different types of conditions, it also leads to the interesting question of how these three types of conditions interact. For instance, do conclusions about the core procedure depend on the enabling conditions that are present? As will be discussed later on this paper, such interactions might well exist.

Defining evaluative conditioning as an effect allows one to entertain multiple theoretical accounts. The final advantage is probably the most important one. When evaluative conditioning is defined as an effect, the observed change in liking is related only to a core aspect of the procedure, being the pairing of stimuli. There is no commitment with regard to the processes that explain why the pairing of stimuli leads to a change in liking. It could be that stimulus pairings automatically lead to the formation of associations in memory and that the changes in liking result from these newly formed associations. However, this is not necessarily the case. Other processes might equally well be responsible for "translating" the input of stimulus pairings into an output of changes in liking. All theoretical options are open. This also implies that evaluative conditioning as an effect does not depend on the validity of a particular theoretical view on evaluative conditioning.

When evaluative conditioning is defined in terms of an observation that is attributed to core procedure rather than to a theoretical process, it becomes clear that the validity of one particular theoretical process account has no bearing on the validity or existence of evaluative conditioning as an effect. As we will see in the next section, problems can arise when evaluative conditioning is defined as a theoretical process.

Evaluative Conditioning as a Theoretical Process

When defined as a theoretical process, the concept "evaluative conditioning" implies not only that a change in liking is attributed to the pairing of stimuli but also that the change is due to certain theoretical processes. Evaluative conditioning as a theoretical process therefore constitutes a more restrictive use of the term than evaluative conditioning as an effect. It entails that not all evaluative conditioning effects (i.e., changes in liking that are due to the pairing of stimuli) are "genuine" cases of evaluative conditioning. "True" evaluative conditioning has occurred only when the changes in liking were due to a certain process. As noted above, many researchers assume that evaluative conditioning depends on an automatic, bottom-up, and low-level process that involves the formation and updating of associations between representations in memory and that results in automatically produced changes in liking (e.g., Gawronski & Bodenhausen, 2006, p. 697; Walther, Nagengast, & Trasselli, 2005, p. 191). In this section, I will argue that defining evaluative conditioning as a theoretical process carries at least two risks. First, it renders it difficult to determine whether evaluative conditioning has occurred. Second, it hinders theoretical research.

How to determine the presence of evaluative conditioning as a theoretical process? Defining evaluative conditioning as a theoretical process renders it difficult to determine whether evaluative conditioning has occurred, that is, whether an observed change in valence is due to a particular process such as the automatic formation of associations in memory. Psychological processes are theoretical constructs that cannot be observed directly and do not necessarily have a reality value. For instance, nobody has ever seen an association in memory. It is simply a theoretical assumption that could help understand and organize existing empirical facts (i.e., the heuristic function of theoretical concepts) and that could help generate predictions about new empirical facts (i.e., the predictive function of theoretical concepts). It is tempting to forget that associations in memory are merely theoretical constructs because associations are superficially similar to neural links between neurons in the brain. This similarity, however, is misleading. One can observe dendrites developing between neurons, but this is completely different from the associations between mental representations that are assumed to underlie conditioned changes in valence. Neurons are not mental representations and neural dendrites

are not associations through which one representation can activate another representation. The similarity is purely superficial or metaphorical.

Although a theoretical process cannot be observed directly, it could be inferred indirectly. To the extent that a process theory allows one to make unique predictions about the conditions under which a phenomenon can be observed, observing the phenomenon under those conditions can be taken as evidence for the operation of the hypothetical processes. For instance, because association formation is assumed to be automatic, one can predict that evaluative conditioning effects can be observed in the absence of awareness of the CS-US contingencies. Hence, observing an evaluative conditioning effect in the absence of contingency awareness can be taken as evidence for automatic association formation and thus be used to infer that "real" evaluative conditioning has occurred. Although feasible in principle, this approach has certain disadvantages and limitations. First, it depends on the assumption that the process account makes unique predictions. If a competing account can also explain that effects can occur given certain conditions, then the presence of the effect under those conditions is no longer diagnostic for the underlying process. This is particularly problematic because one cannot foresee which theories will be developed in the future. Second, the approach requires a lot of work. In order to decide whether evaluative conditioning has occurred, one not only needs to establish that the change in liking is due to the pairing of stimuli (otherwise associations could not have formed), it also needs to be demonstrated that certain conditions were met (e.g., that participants were unaware of the CS-US contingencies). Whereas the former requires only the presence of adequate controls, the latter can prove difficult (e.g., how to demonstrate that participants were entirely contingency unaware; see Shanks & St. Johns, 1994). Third, the approach works only for those effects that are observed under a limited set of conditions (e.g., when participants are unaware of the contingencies). It does not allow one to classify effects that are observed under standard conditions because the effects under those conditions could be due to multiple processes.

In sum, when evaluative conditioning is defined as a theoretical process, it becomes difficult to determine whether evaluative conditioning has occurred and thus to study evaluative conditioning. This is because it is impossible to observe the crucial process directly and because there are difficulties and limitations with assessing the presence of a process indirectly.

Defining evaluative conditioning as a process hinders theoretical research. When evaluative conditioning is defined as changes in valence as the result of a particular process such as the automatic formation of associations in memory, there is little point in examining the processes underlying evaluative conditioning simply because the definition already specifies what the crucial processes are. Related to this,

entertaining (either implicitly or explicitly) a theoretical definition of evaluative conditioning reduces the probability that one will consider the possibility that other processes can also underlie conditioned changes in stimulus valence. Because of this, theoretical definitions of evaluative conditioning effects are likely to slow down the development of new theories.

Another problem arises when the process theory turns out to be wrong. For instance, defining evaluative conditioning as a change in valence due to automatic association formation implies that changes in valence that are not due to automatic association formation are not "real" cases of evaluative conditioning. Therefore, if research would raise doubts about the validity of the idea that associations are automatically formed in memory, this would also raise doubts about the existence of evaluative conditioning as such. The possibility that automatic association formation might once be abandoned as a useful theoretical idea is not that far fetched. Calls to this end have already been made (e.g., Lovibond, 2003). Moreover, if even renowned theoretical principles such as Newton's law of gravity have been surpassed, it seems unlikely that a simple process theory such as that of automatic association formation would stand the test of time.

In the past, there have been cases in which interest in an empirical phenomenon dwindled because a particular theoretical view on that phenomenon was questioned. In 1974, for instance, Brewer published a highly influential chapter entitled "There is no evidence for classical conditioning in humans." This conclusion was based on evidence showing that the pairing of stimuli changes the responses to these stimuli only when participants are aware of the contingencies between the stimuli. Importantly, the reported evidence did not question the empirical phenomenon that pairing stimuli can lead to changes in responding to those stimuli. The evidence did, however, question the dominant theoretical view of the time according to which classical conditioning is based on the automatic formation of associations in memory. Because this theoretical approach to classical conditioning was so dominant, the term "classical conditioning" was often defined (implicitly or explicitly) in terms of this one particular theoretical view. That is, many researchers did (and still do) define "true" classical conditioning as conditioned changes in behavior that are due to the automatic formation of associations in memory. This is why evidence against the dominant theoretical view led to doubts about the existence of classical conditioning effects in humans. As a result of Brewer's chapter, many researchers lost interest in the phenomenon of classical conditioning. This was a very unfortunate evolution because the evidence reviewed by Brewer did not change the fact that human behavior can be influenced by pairing stimuli. Classical conditioning as an empirical phenomenon remains important regardless of the validity of one type of process account of classical conditioning. In a similar way, evaluative

conditioning as an empirical phenomenon remains important regardless of the validity of one type of process account of evaluative conditioning. For this reason, it is important not to define evaluative conditioning in terms of a theoretical process.

A Theoretical Analysis

The conceptual analysis that was presented above leads to the conclusion that the concept "evaluative conditioning" would best be defined as an effect rather than as a specific procedure or theoretical process. Perhaps the main advantage of defining evaluative conditioning as an effect is that it allows for the possibility that more than one process can underlie evaluative conditioning effects. In this section, I will first discuss two possible processes that could produce evaluative conditioning effects. Next, I will point out that a multiple-process perspective sheds new light on the existing literature and leads to new predictions.

A Multiple-Process Perspective

Many researchers implicitly or explicitly entertain the assumption that evaluative conditioning effects are due to the automatic formation and updating of associative links between representations. Take the example of the "have-a-Coke-and-a-smile" ads. Because the Coke brand is paired with images of smiling people, it is assumed that the representation of the Coke brand in memory will become associated with the representation of smiling people or with the positive affect that is evoked by these smiling people. When people see the Coke brand after being exposed to the ads, this will activate the representation of smiling people or positive affect, leading to positive feelings. Different associative models differ in their assumptions about the type of representations that are associated (e.g., stimulus or response representations), the rules that govern the formation of associations (e.g., spatiotemporal contiguity or reduction of prediction error), and the conditions under which associations influence behavior (e.g., direct translation or comparison of different associations). But all are based on the idea that conditioning effects are due to the automatic formation and updating of associations in memory.

The dominance of associative models in research on evaluative conditioning is not surprising given that such models have always been prominent in conditioning research. However, there is no a priori reason why evaluative conditioning effects can be due only to association formation. Evaluative conditioning effects are by definition associative in nature (i.e., due to the procedure of the pairing of stimuli) but they are not necessarily due to the automatic formation of associations in memory. For instance, De Houwer and colleagues (De Houwer, Baeyens, et al., 2005) pointed out that people might intentionally use conscious propositional knowledge about contingencies between stimuli as a basis for their evaluation of those stimuli. Assume that you receive an electric shock every time you see a picture of a triangle but never after seeing a picture of a circle. Afterwards you are asked to indicate how much you like the triangle and how much you like the circle. Probably you will say that you like the triangle less than the circle. When asked why, you can point to the fact that the triangle signals the shock as a justifiable reason for disliking the triangle. In this case, the change in liking is due to the pairing of the triangle and the shock (i.e., it is an evaluative conditioning effect) but it is not produced by automatic associative processes. Rather, it is a genuine change in liking that is based on the fact that you have acquired conscious propositional knowledge about the relation between the triangle and the shock and that you have used this knowledge as a basis for evaluating the triangle. Note that these changes are not due to demand compliance. Demand compliance also entails that participants have conscious propositional knowledge about the stimulus contingencies, but in the case of demand compliance, participants use this knowledge because they believe that this is what the experimenter wants them to do. Both types of effect thus depend on the use of propositional knowledge about stimulus contingencies, but the knowledge is used for different reasons (i.e., to arrive at a genuine evaluation of the stimuli versus to comply with the expectations of the experimenter; see Meersmans, De Houwer, Baeyens, Randell, & Eelen, 2005). Whereas associations in memory merely encode that events or concepts are related, propositions also specify the type of relation (e.g., "*is a*") and thus imply a truth value (Strack & Deutsch, 2004). It is also assumed that associations in memory can be formed and activated automatically whereas propositions can be formed and activated only in a controlled, non-automatic manner (e.g., Strack & Deutsch, 2004).[4]

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[4] There are probably still other processes that could underlie evaluative conditioning effects. For instance, Davey (1994) argued that pairing stimuli makes salient the features that these stimuli have in common. When pairing a neutral stimulus with a liked stimulus, this could make salient the liked features of the neutral stimulus and thus lead to an increase in the liking of the originally neutral stimulus (and vice versa for a neutral stimulus paired with a disliked stimulus). According to this explanation, evaluative conditioning is due to the pairing of stimuli but not to the formation of associations. Instead, evaluative conditioning is assumed to be based on a change in the representation of the conditioned stimuli.

A Possible Explanation for Conflicting Results in the Literature

At the beginning of this paper, I noted that there are many conflicting data about the conditions under which evaluative conditioning effects can be observed. These concern both conditions related to the core procedure of evaluative conditioning as well as enabling conditions. For instance, whereas some studies found evidence for extinction, others showed that evaluative conditioning effects are unaffected by CS-only presentations after the CS-US pairings (see Diaz et al., 2005 vs Lipp & Purkis, 2006, for recent conflicting evidence). Likewise, whereas some studies found that evaluative conditioning depends on awareness of the CS-US contingencies, others found no link between evaluative conditioning and contingency awareness (see Dickinson & Brown, 2007, and Walter & Nagengast, 2006, vs. Pleyers et al., 2007, for recent conflicting evidence).

One way to explain this puzzling mixture of results is to assume that different evaluative conditioning effects can be due to different processes. For instance, the formation of conscious propositional knowledge about contingencies by definition implies awareness of the contingencies. Also, such knowledge is likely to reflect changes in contingencies such as those that occur during an extinction procedure. Hence, evaluative conditioning effects that are due to the use of conscious propositional knowledge about contingencies should depend on contingency awareness and be sensitive to extinction. It is often assumed, on the other hand, that the automatic formation of associations occurs independently of contingency awareness and reflects only the spatiotemporal contiguity between stimuli rather than the statistical contingency (e.g., Baeyens & De Houwer, 1995; Gawronski & Bodenhausen, 2006; Walther et al., 2005). Therefore, in studies where evaluative conditioning effects are based on the automatic formation of associations, effects might well occur independently of contingency awareness and be unaffected by extinction[5].

Implications for Future Research

Although this explanation of past conflicting results is post-hoc, it does lead to interesting new predictions. Most importantly, it can be predicted that the impact of certain enabling conditions will tend to covary with the impact of certain core procedural conditions. For instance, from the previous paragraph, it can be inferred that evaluative conditioning effects that do not depend on contingency awareness should also be resistant to extinction. The reverse should also hold (i.e., evaluative conditioning that does depend on contingency awareness should show extinction). To the best of my knowledge, these predictions have not yet been tested in the literature. The reason probably is that researchers have until now regarded evaluative conditioning as a unitary phenomenon that relies on one type of processes. Based on this view, the purpose of research becomes to elucidate the conditions under which evaluative conditioning occurs and to clarify the processes that underlie evaluative conditioning effects. From the viewpoint that two or more processes can produce evaluative conditioning effects, research should clarify not only whether but also when certain conditions are necessary to observe evaluative conditioning effects and when certain processes are important. The aim is thus to find the conditions under which certain conditions are important. In other words, the multiple process view implies a meta-conditional approach that attempts to identify clusters of conditions that tend to co-occur.

Until now, I have limited the discussion to the enabling condition of contingency awareness and the core procedural condition of extinction. More generally, one can predict that non-automatic evaluative conditioning effects should reflect the statistical contingency between the CS and US whereas automatic evaluative conditioning effects should reflect spatiotemporal contiguity[6]. This prediction is derived from the following assumptions. First, propositional processes are non-automatic and thus can produce evaluative conditioning effects only when participants are aware of the contingencies, have time and resources to form and use propositions, and have control over the formation and use of propositions (but

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[5] I do not exclude the possibility that evaluative conditioning effects are based exclusively on the operation of propositional processes (see De Houwer, Vandorpe, & Beckers, 2005). In that case, evidence for evaluative conditioning effects that are resistant to extinction and independent of contingency awareness might indeed result from methodological problems. However, at present, it is too early to exclude the possibility that the automatic formation of associations might be important in some instances of (evaluative) conditioning.

[6] Although I would discourage researchers from defining evaluative conditioning in terms of a theoretical process, it would be possible in principle to define it in terms of enabling conditions. For instance, one could argue that only automatic evaluative conditioning is "true" evaluative conditioning. Such a definition would imply not only that changes in liking are attributed to the pairing of stimuli but also that this effect occurred under a certain set of enabling conditions (e.g., that participants were not aware of the contingencies). A definition in terms of enabling conditions is more complex than a definition in terms of core procedure only, but in principle, it should be possible to verify such a definition empirically. Also, it does not completely restrict ideas about possible underlying processes. It does restrict, by definition, research with regard to the enabling conditions that are necessary for evaluative conditioning. If one chooses to restrict attention to automatic evaluative conditioning, this should be made explicit. One should be also aware of the limitations that this implies.

see Moors & De Houwer, 2006b). Second, under optimal conditions, conscious propositional knowledge about contingencies reflects the actual statistical contingency between the CS and US (e.g., Shanks, 1995). Third, association formation is automatic and can thus produce evaluative conditioning effects even when participants are unaware of the contingencies, do not have time or resources to engage in effortful processing, and do not have control over the formation and use of associations. Fourth, associations are assumed to reflect the spatiotemporal contiguity between the CS and US. Note that a strong version of this logic also implies that the presence of one enabling condition can determine the role of another enabling condition. For instance, when participants do not have time or resources to use propositions, the observed effects would not depend on contingency awareness. This follows from the assumption that different enabling conditions are related (but see Moors & De Houwer, 2006a, 2006b).

Although the meta-conditional approach will help elevate conditioning research beyond the current boundaries, it will not make research easier. There are several potential pitfalls that should be taken into consideration. First, past research has shown that it is not easy to establish whether a certain condition is important for observing evaluative conditioning effects. For instance, hundreds of pages of text have been devoted to how one should establish whether (evaluative) conditioning depends on contingency awareness (e.g., Shanks & St. John, 1994). Likewise, there have been debates about how to establish whether evaluative conditioning defies extinction (e.g., Lipp et al., 2003). The meta-conditional approach proposed in this paper implies that one establishes the impact of not just one but two or more conditions simultaneously (e.g., not only whether evaluative conditioning depends on contingency awareness but also whether extinction has occurred) and establishes a relation between the impact of those conditions. Fortunately, a lot has been learned in the past decades about how to establish whether enabling or core procedural conditions are important. Moreover, the emphasis is not on how to establish that a certain condition is crucial but on whether the impact of different conditions is related. For instance, if one can consistently observe that extinction occurs when evaluative conditioning depends on contingency awareness but not when evaluative conditioning is independent of contingency awareness, this would be a valuable observation regardless of whether one agrees that the criterion for establishing the effect of extinction or the role of contingency awareness is the ultimate criterion. If one can observe such a systematic link between the effect of different conditions, this could actually be taken as evidence for the validity of the criteria that were used to establish the impact of the conditions.

A second potential pitfall of the meta-conditional approach is that specific predictions about clusters of conditions depend on multiple, often ill specified theoretical assumptions. The value of (the predictions of) the approach thus depends on the validity and specificity of the theoretical assumptions. For instance, it is often assumed that associative knowledge can be expressed automatically whereas propositional knowledge can influence behavior only in an intentional, controlled manner (e.g., Gawronski & Bodenhausen, 2006; Strack & Deutsch, 2004). Therefore, one way to exclude an impact of propositional knowledge on evaluative conditioning is to use measures of liking that cannot be controlled. Recently developed implicit attitude measures such as affective priming effects and the Implicit Association Test (IAT) effects are typically considered to provide such an uncontrollable measure of liking (e.g., Hermans, Baeyens, & Eelen, 2003; Mitchell, Anderson, & Lovibond, 2003; but see De Houwer, 2006a, 2006b). Research has shown, however, that propositional knowledge can influence at least one popular implicit attitude measure, namely IAT effects (De Houwer, 2006b; De Houwer, Beckers, & Moors, in press). This demonstrates that the IAT does not provide a failsafe method for excluding the impact of propositional processes. If future research shows that other implicit measures are also influenced by propositional knowledge, this might even indicate that propositional knowledge can influence behavior in an automatic manner. This example illustrates that one should always be aware that theoretical assumptions underlying (meta-conditional) research might well be invalid. Such assumptions thus need to be tested empirically.

Summary and Conclusions

Humans and other organisms tend to want, do, and buy more often the things they like than the things they do not like. To understand and control human behavior, it is therefore imperative that we understand how likes and dislikes are acquired. Evaluative conditioning research has shown that the preference for a stimulus can be influenced by pairing that stimulus with another stimulus. Understanding evaluative conditioning can thus provide many insights in human behavior. Unfortunately, we still do not know much about this important phenomenon. To make matters worse, the current literature on evaluative conditioning contains many conflicting results that have not been reconciled in a satisfactory manner.

In the present paper, I have argued that progress in our understanding of evaluative conditioning is hampered by confusion regarding the meaning of the concept "evaluative conditioning". It can be used to refer to a procedure (i.e., pairing stimuli and checking whether this produces changes in liking), an effect (i.e., an actual change in liking as the result of pairing stimuli), or a theoretical process (i.e., the process by which pairing stimuli results in changes in liking). Problems arise when evaluative conditioning is defined in terms of a particular process. Not only is it difficult to determine whether a particular change in liking is due to a particular process (and thus to determine whether evaluative

conditioning has occurred), such a view also tends to narrow theoretical thinking about evaluative conditioning in general. Most importantly, it detracts attention from the possibility that several processes can be responsible for evaluative conditioning effects, that is, for a change in liking that is due to the pairing of stimuli. It is therefore advisable to define evaluative conditioning in terms of an effect and to allow for the possibility that such effects can be due to at least two types of processes: the automatic formation of associations in memory and the non-automatic use of propositional knowledge about stimulus contingencies. The conflicting results that have been reported in the literature could have been due to the fact that the observed conditioning effects were in some cases due to one process and in other cases due to the other process. This multiple process view leads to a meta-conditional approach in which the aim of research is to examine not only which conditions are necessary for evaluative conditioning but also when these conditions are relevant. Although one should be aware of potential pitfalls of this meta-conditional approach, it is my firm belief that this approach is the best way to move evaluative conditioning research forward.

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