



Why Do We Like the iPhone? The Role of Evaluative Conditioning in Attitude Formation

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Abstract

Evaluative conditioning (EC) is the change in liking due to the pairing of an affectively meaningful and a neutral stimulus. Starting with the exemplary question of why we like the iPhone, this article provides an overview of past and present research and gives an outlook to future research on this topic. We outline four different theoretical EC accounts and discuss how each account is consistent with current empirical evidence.

Introduction: Why Do We Like the iPhone?

Everyday behavior is guided by and large by our preferences. We approach things we like and we avoid things we dislike. Some preferences seem to be almost universal. Many people like a smiling face better than a frowning face, a sweet taste better than a bitter taste, a hug better than a kick to the shin. Some preferences, however, appear to reflect individual learning history (Rozin & Millman, 1987). Whereas some people like the iPhone, others have no particular attitude towards it. However, the question that remains is how these individual attitudes are acquired. In other words, why do we (or at least some of us) like the iPhone?

One experimental answer to this question comes from so-called evaluative conditioning (EC) research (for reviews, see De Houwer, Thomas, & Baeyens, 2001; Walther, Nagengast, & Trasselli, 2005). EC refers to “the observed change in liking that is due to the pairing of stimuli” (De Houwer, 2007, p. 233). According to this so called effect definition of EC we like the iPhone because it was paired with another stimulus in the first place, for instance, with a person we like.

The effect definition ended a long lasting discussion in EC research about which phenomenon should be called EC and which not (see De Houwer, 2007). Having the definition in mind, an effect is called EC when (dis-)liking results from the pairing of stimuli. As such the effect definition helps to distinguish EC from other sources that lead to (dis-)liking such as mood (e.g., Christensen & Brooks, 2006), mere exposure (Zajonc, 1968, 2001), or preparedness (Seligman, 1971). If the iPhone is perceived as likeable because the perceiver is in a happy mood, this is not an instance of EC because the liking is not the result of the pairing of stimuli.¹

Likewise, the repeated mere exposure of the iPhone might increase its' liking (Zajonc, 1968) but this would not be considered an instance of EC either, because the iPhone is presented alone and not paired with another stimulus. Genetic factors may contribute to (dis-)liking, as well. For instance, a negative reaction (i.e., disliking) towards a spider may occur spontaneously because of the genetic preparedness of the organism to react to this stimulus in a certain way (Seligman, 1971). No other stimulus except the spider itself

elicits this reaction, and no repetition is necessary to produce the effect, that is why it is not called EC.

Despite this helpful function of the effect definition in differentiating EC from other effects there are also some aspects that need further clarification. First, the definition states that EC refers to *changes* in liking. However, in a prototypical EC study, a neutral picture of a human face (conditioned stimulus; CS) is repeatedly presented with a liked or disliked human face (unconditioned stimulus; US). The common result is a substantial shift in the valence of the formerly neutral CS, such that it acquires the evaluative quality of the US. Facing this prototypical study example, it becomes clear, that EC, strictly speaking, refers to the *formation* of liking rather than to the change of liking because the CS is neutral before the pairing of stimuli took place. Second, the question remains of what is meant by *observable* changes in liking? Does this include cases in which a stimulus is perceived positively or negatively in a certain context but does not elicit an affective response in another context? This case might still be considered as a change in liking because the evaluation of the stimulus in one context differs from another context. If we like the iPhone in the context of a birthday party better than in the context of a funeral, should this effect be called EC? Evidence for these context-based changes in liking is manifold. For instance, Hebl and Mannix (2003) describe the phenomenon that the mere presence of a stigmatized person (US) affects the evaluation of a simultaneously present target (CS). This evaluation of the target occurred only in the specific context. Similar evidence of mere context dependent changes in valence comes from Wittenbrink, Judd, and Park (2001). These authors found that negative attitudes towards blacks were reduced when black people were presented in a favorable context (family barbecue) as compared to a negative context (gang related incident). Although, these effects fall in the effect definition of EC, many EC researchers would expect that a CS alone, independent of a certain context, must elicit an affective reaction after the CS-US pairing to be called EC. That is why in standard EC studies, the CS is tested alone after repeated pairing with a US for its' property to elicit affective reactions. Consequentially, EC should be restricted to cases in which the CS itself acquires an affective meaning and is not presented in the context of the US anymore.

This latter aspect points to a related third issue, the question what *pairing* means? In most EC studies CSs and USs are repeatedly paired in order to obtain an effect. For instance, Baeyens, Eelen, Crombez, and van den Bergh (1992) found that EC increases with the number of trials and reaches the asymptote after 20 pairings (Baeyens et al., 1992). Similar results are reported by Hofmann, De Houwer, Perugini, Baeyens, and Crombez (2010) in a recent meta-analysis. But there might be also special cases in which a single CS-US co-occurrence is sufficient to produce EC. In clinical psychology (Seligman, 1971), it is often assumed that (negative) emotional reactions like phobias can be acquired by a single incident. Imagine a case in which a person suddenly experiences a light electrical shock when charging the iPhone. This single experience might be sufficient to (at least slightly) change her attitude towards it.

The one-trial discussion points to the question which impact EC might have in real life settings? In many cases, it can be assumed that people do not observe repeated pairings of stimuli. Rather, people might observe two stimuli for a certain period of time, for instance, an adored colleague fiddling with the iPhone on a conference. The question then is whether this relatively long lasting single trial experience is sufficient to induce an attitude towards the iPhone. An inspection of the literature reveals that experimental evidence for one-trial learning in human subjects is rare. However, the questions whether a single long lasting trial may lead to EC should be addressed in future research.

Based on these considerations referring to EC, it can be assumed that people like the iPhone because it is accompanied by a positive stimulus. For instance, repeatedly perceiving the iPhone used by an adored colleague may elicit a positive reaction towards this object. Despite its ambiguities, the effect definition of EC is helpful because it distinguishes EC from other similar phenomena. Due to the broad array of phenomena that fall under the EC definition, however, the question remains of how specific EC actually is?

EC Characteristics

Beside the question how EC can be defined, past debates refer to the characteristics that can be attributed to EC. Early EC researchers Martin and Levey (1978) made observations from which they inferred that EC differs in some characteristics from classical conditioning. One of these findings was that EC seems to be not dependent on the CS-US contingency. It is well known that classical conditioning only occurs when there is a negative or positive correlation between the CS and the US but not when USs and CSs co-occur on a random basis (Rescorla, 1988). EC, however, appears to be not dependent on the CS-US correlation. Rather, it is apparently the case that EC occurs on the basis of mere contiguity, that is, on spatio-temporal CS-US co-occurrences. Hence, even if now and then the adored colleague is perceived without the iPhone and the iPhone is observed without the colleague, EC may occur on the basis of the iPhone-colleague contiguity. The mere fact that they sometimes co-occur seems to be sufficient to produce EC. A recent meta-analysis conducted by Hofmann et al. (2010) supported the assumption that EC is relatively robust against violations of the contingency rule.

A further phenomenon often considered as being unique for EC is resistance to extinction. In classical conditioning studies, if a skin conductance reaction (SCR) towards a tone that was previously paired with a shock is acquired, the SCR degrades when the shock is not applied anymore (i.e., extinction). Referring to EC, however, it is assumed that CS-alone presentations do not impair the effect (Baeyens, Crombez, van den Bergh, & Eelen, 1988). Sticking to our example, EC once established would therefore not decrease if the iPhone is presented in different settings, for instance, in an apple store. However, Hofmann et al. (2010) recently qualified the absolute assumption that EC is resistant to extinction. They found that EC indeed decreases after CS alone presentations. Nevertheless, they report that substantial EC remained even after an extinction procedure. One reason for the difference concerning extinction between EC studies and classical conditioning studies is that in most EC studies indirect or direct evaluative responses (i.e., attitudes) are assessed as the dependent variable whereas most classical conditioning studies use autonomic physiological responses (e.g., SCR, startle response) as an index of learning. Thus, it can be speculated that physiological reactions are indeed susceptible to extinction whereas subjective evaluative responses are not sensitive to extinction or at least not to the same degree as physiological responses. This idea was put to an empirical test by Vansteenwegen, Francken, Vervliet, De Clercq, and Eelen (2006). In these studies, participants underwent a conditioning procedure, in which pictures of humans served as CSs and electric shocks as USs. Different from previous studies, however, the authors not only assessed physiological reactions (SCR) but also evaluation measures (affective priming) before and after extinction. Interestingly, they found a decrease in physiological reactions due to extinction but a stable reaction when implicit attitudes were assessed. Thus, the often mentioned discrepancy in sensitivity to extinction between EC and other forms of conditioning may at least be partly explainable by the difference of dependent measures and their inherent (in-)sensitivity to detect extinction effects.

Beside this, the most debated topic is the question of whether EC is dependent on contingency awareness. On the one hand, there are studies in which EC could be observed independent of contingency awareness (e.g., Custers & Aarts, 2005; Dijksterhuis, 2004; Hammerl, 2000; Ruys & Stapel, 2009; Walther & Nagengast, 2006). On the other hand, there are studies in which only participants aware of the contingencies exhibited EC (Fulcher & Cocks, 1997; Ghuman & Bar, 2006; Pleyers, Corneille, Luminet, & Yzerbyt, 2007; Shimp, Stuart, & Engle, 1991; Stahl & Unkelbach, 2009). In their recent meta-analysis, Hofmann et al. (2010) found that although awareness generally seems to increase EC, there are experimental examples of (weaker) EC when awareness was not given.

One issue inherent in the awareness debate is that there is no agreement on how awareness should be assessed (Baeyens, Hermans, & Eelen, 1993; Dawson & Reardon, 1973; Field, 2000, 2001; Field & Moore, 2005; Hammerl, 2000; Lovibond & Shanks, 2002). Of course, the way contingency awareness is measured strongly determines whether an individual is categorized as aware or unaware (see Walther & Nagengast, 2006). A further issue is that all conclusions regarding EC and awareness rest only on correlational data which limits conclusions about the causal relation between contingency memory and EC (see Gawronski & Walther, forthcoming, for a discussion).

Cognitive representation of CS and US

Another important question is whether the repeated CS-US pairing leads to an intrinsic change of the CS or not. Intrinsic changes mean that, for example, the iPhone itself acquires positive meaning through its co-occurrence with the colleague and is not only associated with a valenced source (an US). Generally, there are two possible effects resulting from the repeated co-occurrence of CS and US. The first is the development of a connection between the CS and the US at the response level. Accordingly, the CS acquires its own response that mimics the unconditioned response (UR) elicited by the US (stimulus–response ‘S–R’ learning). The second possibility is that EC reflects a mental connection between the cognitive representations of the CS and the US (stimulus–stimulus ‘S–S’ learning). A straightforward test of these two possibilities is the US-revaluation paradigm (Rescorla, 1974). US-revaluation means that changes in the valence of a US after the conditioning procedure lead to corresponding changes in the valence of preassociated conditioned stimuli (CSs). Walther, Gawronski, Blank, and Langer (2009) paired positive USs with negative information and negative USs with positive information after an initial conditioning phase. This revaluation not only led to a reversal in the valence of the US but also changed the affective quality of the preassociated CS in the direction of the revaluated US. Thus, if the iPhone is linked to a likeable colleague and he suddenly falls from grace, the evaluation of the iPhone would only become less positive if S–S learning but not if S–R learning took place.

However, despite the demonstration that one learning form occurs and the other does not, the question is what determines S–S or S–R learning? Sweldens, Van Osselaer, and Janiszewski (2010) found that whether S–R or S–S learning occurs is determined by certain learning parameters, like whether the CS is presented simultaneously with the US or not and whether the CS is paired with only one or with different USs. If the difference between these types of learning is indeed determined by the various degrees of learning parameters (e.g., the inter-stimulus-interval ‘ISI’, or the inter-trial-interval ‘ITI’) as Sweldens et al. (2010) suggest, it is important to address these parameters and their influence on EC in future research.

The debate of S–S versus S–R learning as well as the relation between EC and awareness is reflected in the accounts formulated to explain EC. In the following section, we

will give a short overview of these potential mechanisms that are proposed in order to explain EC. These accounts differ with respect to the assumptions they make regarding EC and to the degree to which they are (in-)consistent with the above mentioned EC characteristics.

EC Accounts: A Critical Review

Holistic account

According to Martin and Levey (1994), the co-occurrence of a US and a CS triggers the formation of a 'holistic representation' that consists of stimulus elements of the CS and the evaluative nature of the US. Based on their findings that most participants were unable to recall which pictures had been paired with others, Martin and Levey (1994) concluded that the formation of such a holistic representation does not require contingency awareness. If, for example, the iPhone co-occurs with the adored colleague, the iPhone might (unconsciously) acquire valenced aspects of this colleague. The holistic account does not exclude one-trial learning because it is not specified how often CS and US must co-occur before a holistic representation is formed. Yet, it can be assumed that the probability that a holistic representation is formed increases with the number of CS-US co-occurrences. The holistic account is consistent with CSs' resistance to extinction because the CS is intrinsically changed during conditioning in a way that the CS itself acquires aspects of the US. Thus, the holistic account assumes S-R rather than S-S learning. However, because the fusion of two stimulus' aspects is assumed, this account might not be universally applicable to EC. Although not explicitly stated by Martin and Levey (1994), it can be assumed that a certain degree of CS-US similarity is necessary for the formation of a holistic representation. However, the many instances of cross-modal EC (Hofmann et al., 2010) suggest that CS-US similarity is not a necessary precondition for EC to occur. Another issue is that the holistic account is rather vague with respect to the question of how and which characteristics are fused into a holistic representation.

Referential account

This account falls into the category of associative process models. As such, the referential model (Baeyens et al., 1992) claims that EC is based on an unconsciously formed associative link in memory between representations of the CS and the US. Accordingly, this account assumes S-S rather than S-R learning as an underlying mechanism of EC. Because the link is assumed to be formed unconsciously, contingency awareness is not a necessary prerequisite for EC to occur. If the CS is presented after conditioning, the CS automatically activates the US representation. This is how the referential account explains EC's resistance to extinction. From the referential account perspective, one-trial EC is very unlikely because the association strength between stimuli increases with the number of trials. Therefore, one trial might be insufficient to establish associations between stimuli. The referential model is similar to models of classical conditioning like the R-W model (Rescorla & Wagner, 1972). Different from this model, however, it is not assumed that an expectancy is generated that the US is going to occur in the presence of the CS. Accordingly, it is not assumed that the adored colleague would postconditionally appear if the iPhone is present. Unfortunately, in this account, it is not explained why the CS does not attain a predictive quality. A further problem is that it is not clear what exactly the substance of the CS-US association is.

Implicit misattribution account

The implicit misattribution model of EC (Jones, Fazio, & Olson, 2009) assumes that a CS is liked or disliked to the extent that people misattribute the valence which was actually elicited by a US to the co-presented CS. For instance, if an adored colleague is perceived along with the iPhone some of the positive feelings towards him may be assigned to the iPhone. This transmission characteristic implies S–R rather than S–S learning. Different from all other accounts the implicit misattribution model states that contingency awareness would counteract EC. If people are aware of the fact that the CS's evaluation is due to the pairing with the US no misattribution whatsoever would occur. That is why the model is called an 'implicit' misattribution model. Evidence for such (implicit) affective misattribution processes is widespread in the literature. For instance, the mood-as-information research has shown that people misattribute their current mood to life satisfaction judgments, but only if the source of the mood (the weather) has not been made salient (Schwarz & Clore, 1983). If people are reminded of the correct source, no influence of mood on judgments could be observed. The implicit misattribution model is consistent with the finding that EC is robust against violations of the CS-US contingency rule because misattribution can work on the basis of mere co-occurrences. It is further assumed that all variables that enhance misattribution, like distraction or novelty of the US, should enhance the effect. An issue related to this account is that attribution is mostly assumed to be a process that works in an all-or-none and not in a graduate manner (Kelley, 1972). This means that implicit misattribution deals well with one-trial learning. That EC increases with the number of trials can be explained by the fact that more trials enhance the chance of misattribution from the US to the CS. On the other hand, however, contingency awareness and therefore the possibility of counteracting EC increases with trial number as well. Future research should investigate the critical amount of learning trials that are optimal for EC within the implicit misattribution account.

Propositional account

Despite the long tradition in learning theory to explain conditioning effects by means of associative process models, propositional accounts have recently become more popular (Mitchell, De Houwer, & Lovibond, 2009). Different from associative models propositional accounts assume that changes in liking due to the co-occurrence of stimuli are solely driven by conscious beliefs about these stimuli (see De Houwer, 2009). "...whether and in which way relations between events influence behavior (i.e., whether and which associative learning effects will occur) depends on the extent to which statements about those relations (i.e., propositions) are considered to be true" (De Houwer, 2007, p. 3). Thus, this account states that propositional knowledge about the CS-US correlation underlies EC. The formation of these propositions is assumed to be a conscious and effortful mental process that involves the assignment of truth values (Mitchell et al., 2009). For instance, the proposition [p (adored colleague/iPhone)] > 0 can be true or false. The propositional account is inconsistent with studies showing EC independent of awareness because awareness of the CS-US relation is per definition a necessary prerequisite of the assessment of this relation as true or false. Propositional learning is not consistent with an intrinsic transfer of valence from the US to the CS as it is implied in S–R learning. Therefore, resistance to extinction is hard to explain from a propositional point of view. A further problem of the propositional account is that EC sometimes cannot be distinguished from demand effects (Orne, 1962). In an EC study, participants may exhibit

evaluative responses towards a CS because they infer that this stimulus co-occurred with a US (e.g., people start to like the iPhone because it is observed along with an adored colleague). Alternatively, however, participants might simply exhibit the expected response without having any authentic affective reaction. Being confronted with repeated pairings of USs and CSs participants may feel obliged to evaluate a CS similar to the US. Moreover, it is not clear how propositional knowledge is translated into affective liking. For instance, if one knows that the iPhone co-occurs with the colleague, how and when does this knowledge transform into affective liking of the iPhone?

In sum, there are different theories formulated to explain EC (see Table 1). The most pronounced differences between these accounts are the assumptions regarding contingency awareness and whether S–S or S–R learning is implied. Whereas the holistic and the referential account can deal with EC dependent and independent of awareness, the propositional model critically implies contingency awareness and the misattribution model requires the absence of awareness. The referential and the propositional account are more consistent with S–S, the holistic and the implicit misattribution accounts are more consistent with S–R learning. Facing the fact that EC empirically occurs with and without awareness of contingency and that evidence for S–S and S–R learning is given, one way to solve the dilemma is to postulate that different processes may lead to EC.

Process Variables and Outcomes

Process variables

Assuming different processes underlying EC may be one way to explain the conflicting results in the literature. The mere pairing of stimuli can presumably lead to evaluative changes in many different ways. One of the biggest issues in EC is that effects obtained in one particular paradigm are generalized to the EC phenomenon as such. However, the conflicting results in the literature suggest that EC can be based on different processes. Based on this multi-process perspective, it can be expected that some processes, for instance, propositional learning processes go along with certain process variables, e.g., contingency awareness, whereas other processes like implicit attributions do not dependent on this variable but rely on others, e.g., CS–US similarity. Depending on varying learning contexts, then, different variables are present that might be related to particular processes. Thus, it can be hypothesized that the variables present in the learning context determine the process involved in evaluative changes of a stimulus.

Attention. Generally, in learning psychology there is agreement that attention determines learning (Rescorla & Wagner, 1972). This preassumption is also pertinent in the advertis-

Table 1 Overview of EC accounts and their implications

	S–S learning	S–R learning	One-trial learning	Resistance to extinction	Contingency necessary?	Awareness necessary?
EC accounts						
Holistic		x	x	x		
Referential	x			x		
Implicit misattribution		x	x	x		
Propositional	x				x	x

ing context, in which attention is often considered as the first step in a process that leads to purchase (e.g., Chandon, Hutchinson, Bradlow, & Young, 2009; Pechmann & Stewart, 1990). If the iPhone is presented with a celebrity, like Madonna, the idea here is that the star attracts attention that is useful for iPhone marketing. Attention plays the same prominent role in learning theories. For example, the Rescorla–Wagner Model (1972) assumes that associative learning is a function of stimulus processing, that is, the processing of the US and the CS. However, it is important to differentiate between attention and awareness. Whereas attention is related to the arousing function of stimuli, awareness is concerned with the content (e.g., the relation) of the presented stimuli. In order to test the ‘automaticity’ of EC, a dual task procedure that does not distinguish between awareness and attention is used in many EC studies. However, that this distinction is of critical importance, has been reported by Field and Moore (2005) who dissociated awareness from attention by using backward masked US presentations (Experiment 2). Interestingly, they found that not a lack of awareness but a lack of attention reduces EC. Similar results have been obtained by Pleyers and colleagues (Pleyers et al., 2007) who showed that performing a demanding secondary task (the two-back task) effectively reduces EC. That attention might play a specific role in EC was also examined in the context of the misattribution account (Jones et al., 2009). The logic here is that only if the CS received a certain amount of attention misattribution might occur. The authors tested this assumption in an eye-tracking study, in which patterns of eye gaze during conditioning were assessed. EC happened to be increased when participants’ eye gaze shifted frequently between a CS and a US and when the CS was more salient than the US. Based on the assumption that the US automatically attracts attention due to its’ affective meaning, there is consensus in all EC accounts that attention towards the CS plays an important role in producing EC. However, the implicit misattribution account implies that too much attention to the US (instead of the CS) might hamper misattribution. From this perspective, a too salient celebrity might hamper rather than increase affective learning towards the product.

Intention. Do people intend to form an impression when they first recognize the iPhone? A further characteristic that may contribute to the question which process produces EC is intention. According to Bargh (1994), ‘intentionality has to do with whether one is in control over the instigation or “start up” of processes’ (p. 16). That intention is a necessary precondition for EC to occur would fit well into the propositional account but is not consistent with the implicit misattribution account or any of the other accounts. Support for the notion that intention is presumably not a necessary precondition for EC to occur can be derived from the Olson and Fazio’s studies (e.g., Olson & Fazio, 2001, 2002, 2006) in which the surveillance task is applied. Within this task participants are asked to respond to target stimuli embedded in many distractor stimuli. In fact, the distractor stimuli are the CSs and USs. In this case, in which participant’s explicit goal is to process stimuli different from the CSs and USs, the authors nevertheless obtained EC effects. Based on these findings, it can be concluded that an intention to process CSs and USs is not required to observe EC. However, it might also be the case that intention is not a necessary precondition for EC in the surveillance task and that in other EC paradigms intention is actually needed. Corneille, Yzerbyt, Pleyers, and Mussweiler (2009) found that participants primed with the goal of processing similarities exhibited stronger EC than participants asked to look for differences. However, the fact that similarity priming only increased EC and that the effect was still present in the dissimilarity condition suggests that intention might enhance EC in this specific task but is not a necessary

precondition in order to produce the effects. One way to test the role of intention would be to instruct participants not to form an attitude in an EC context. If EC is nevertheless obtained it would strongly speak for an unintentional process. As Dijksterhuis and colleagues noted: “Sometimes we do what we want, but oftentimes we just do what we see” (Dijksterhuis, Aarts, Bargh, & van Knippenberg, 2000, p. 532).

Stimulus novelty. Is it easier to attach affective meaning to a new or to a known product? Novelty plays an important role in the classical conditioning literature. According to the Rescorla–Wagner Model (1972) the surprisingness or novelty of the US is a core variable in the learning process, because the organism tries to reduce surprisingness by means of predictive learning (i.e., conditioning). In EC research, Ruys and Stapel (2009) recently investigated the relation between CS novelty and contingency awareness in an evaluative conditioning paradigm. They found that participants needed to be aware of the CS-US contingency when CSs were more familiar (consumer products) but not when they were novel (polygons). One potential reason for these effects might be that more familiar stimuli already possess a certain meaning or are associated with a certain context which makes the acquisition of affective meaning more difficult. From this perspective, EC with familiar CSs represents a form of counter-conditioning rather than simple conditioning. One highly speculative interpretation then might be that counter-conditioning demands higher cognitive processes than conditioning.

That the degree to which a stimulus already possesses meaning matters in EC was also found in recent studies by Walther, Ebert, and Meinerling (2011). Their results indicate that EC is stronger if fictitious brand names rather than product visuals were used as CSs. Again, one explanation might be that conditionability decreases with the meaningfulness of the CS. The misattribution account could accommodate with this CS novelty effect because the degree to which the US valence can be misattributed to the CS can supposedly be a function of the CSs’ own meaning.

Inter-stimulus-interval. Does Madonna need to be simultaneously presented with the iPhone, or does her affective quality influence the iPhone even when she is presented shortly after the iPhone is shown, for instance, in a different commercial? A vast amount of studies investigated and substantiated the dependence of classical conditioning on the ISI. Hawkins, Carew, and Kandel (1986), for example, found in animal studies that conditioning occurred only in delayed conditioning but not in simultaneous or backward conditioning. From an expectancy learning perspective, which is often held in classical conditioning, this makes perfect sense because the US can only be predicted by a preceding CS but not when the CS occurs along with the US or even after it. In the EC literature, however, a different picture emerged. In their meta-analysis, Hofmann et al. (2010) reported no particular influence of the ISI on the amount of EC. However, Sweldens et al. (2010) recently proposed that different ISIs would instigate different types of learning. They reported empirical evidence that sequential CS-US presentation enhances S–S learning and that simultaneous CS-US presentation fosters (intrinsic) S–R learning. Note that the idea of intrinsic affective learning comes very close to the implicit misattribution account in which some of the USs’ valence is attributed to the CS. Similarly, intrinsic learning is also assumed in the holistic account. Thus, it can be stated that the implicit misattribution as well as the holistic account might rely on a certain CS-US overlap whereas the propositional account can deal with any ISI as long as contingency awareness between CS and US exists. The referential account can deal with all ISI variations as long as stimulus co-occurrence is given.

Repetition. In commercials, products are endlessly repeated in a certain marketing context. Different from classical conditioning in which learning usually increases with the number of trials unless the asymptote is reached, a mixed picture emerged in the EC literature. Whereas Hofmann et al.'s (2010) meta-analysis did not result in a significant correlation between the amount of trials and conditioning, Baeyens et al. (1992) reported a reversed U-shaped function between EC and trial number. In a recent study, Bar-Anan, De Houwer, and Nosek (2010) experimentally varied the number of pairings (0, 12, 22, or 32) in a between subject study. They found that EC increases with the number of trials but only up to 12 pairings. From a propositional point of view more trials should enlarge EC because awareness should increase with the number of trials. That more trials enhance EC is also consistent with the notion of referential learning because more trials strengthen the association between CS and US. From an implicit misattribution and from the holistic account perspective, there is principally only one trial necessary in which US valence is fused into/misattributed to the CS. On the one hand, more trials would increase the probability for these misattribution/fusion processes. On the other hand, because more trials would presumably change the degree of awareness and therefore lead to correct US attribution, many CS-US repetitions should not enhance EC from an implicit misattribution perspective.

Intensity of the US. In most classical conditioning studies, negative and relatively intense USs are used, like white noise or electrocutaneous stimulation. Moreover, aversive instead of appetitive USs are almost always applied in classical conditioning research. In most EC studies, however, relatively mild USs (e.g., pictures) and positive as well as negative USs are applied. Hofmann et al. (2010) found in their meta-analysis that EC is stronger when electrocutaneous stimulation is used as a US than when other USs are applied. This result is consistent with the propositional account and the referential account because both would assume that stronger US intensity would motivate for better learning. The holistic account and the implicit misattribution account, however, would not predict such a finding, because from their point of view EC relies on a certain degree of CS-US similarity. Moreover, it can be speculated that awareness increases with US intensity which counteracts at least the misattribution process. Consistent with this notion, Jones et al. (2009) found that mild USs were more effective than stronger USs in producing EC.

There are other process variables like the ITI or CS-US similarity that are presumably related to EC processes and that are discussed elsewhere (Hofmann et al., 2010). The most important aspects, however, are that a) the process variables vary from EC paradigm to EC paradigm and that b) they do interact with each other. For instance, it is not implausible to assume that awareness changes with US intensity (Jones et al., 2009), therefore promoting propositional learning more than implicit misattribution. One issue that hinders theoretical insight in EC research is that those variables are hardly ever systematically varied or even controlled in experiments. Ruys and Stapel's (2009) work is one of the rare exceptions in which this interaction of process parameters is investigated. Future research should address these process parameters more systematically in order to obtain more in-depth theoretical insights into EC.

The outcome level: can EC be elicited automatically?

The question of how EC is acquired or whether and how S-S or S-R relations are represented in memory should be distinguished from the question of under which conditions EC can be observed. Bargh and colleagues (Bargh, Chaiken, Gendler, & Pratto, 1992), for example, assumed that attitudes are automatically activated given the mere presence of the

attitude object, irrespective of how this attitude is formed. In attitude measurement, direct self-report measures can be distinguished from indirect measures that are usually based on response latencies in a categorization task. Although continuously debated it is widely assumed that indirect measures rest on less controlled processes (e.g., less intention) than self-reports (e.g., De Houwer, 2006). That these measurement conditions, however, are presumably not related to formation processes in EC can be derived from many EC studies. For example, although Jones et al. (2009) propose an implicit misattribution account in order to explain their results, EC was exclusively measured with direct ratings in their studies. Likewise, Pleyers et al. (2007) used an affective priming task (Experiment 3) despite the fact that their account rests explicitly on awareness. Beside the question of how indirect these attitude measurements actually are, which is extensively discussed elsewhere (De Houwer & Moors, 2007; Gawronski & Bodenhausen, 2007), the important suggestion here is that the retrieval of EC should be theoretically and paradigmatically differentiated from EC formation.

Concluding Remarks

The present article started with the exemplary question of why some people like the iPhone. We have tried to give some preliminary answers to this question. Based on EC research, it can be assumed that people like the iPhone because it co-occurred with a pleasant stimulus (e.g., an adored colleague) in the first place. After years of debate how to define EC, there is by now more or less agreement that the core of the EC definition is exactly this co-occurrence of stimuli. However, disagreement is still present with respect to the question which characteristics should be attributed to EC (e.g., whether it occurs with or without contingency awareness) and how the change in liking could be explained. We presented four EC accounts, tried to delineate their theoretical differences and discussed in which respect they are consistent with empirical research. Finally, we argued that the formation of EC should be theoretically distinguished from its' assessment. Concerning the iPhone it is interesting to note that some special aspects of EC are given in this product. Facing the fact that the self-evaluation (the 'I') is highly positive in most people, it is a remarkable observation that the iPhone carries a positive evaluation directly by means of the 'i' with it. Thus, the usually positive self is inevitably incorporated in the iPhone evaluation and may therefore determine a positive attitude towards it.

Short Biographies

Eva Walther's research addresses the interplay of cognitive and affective processes broadly defined. She has authored or co-authored papers in these areas in *Journal of Personality and Social Psychology*, *Personality and Social Psychology Bulletin*, *European Journal of Social Psychology*, *Journal of Experimental Psychology: Animal Behavior Processes*, among others. Her paper "Guilty by mere association: Evaluative conditioning and the spreading attitude effect", published 2002 in *Journal of Personality and Social Psychology* argued that attitudes can spread unconsciously from one attitude object to another. Current research involves both theoretical and empirical research on attitude formation and change, reactions towards existential threat, balance theory, constructive memory, and consumer behavior. She has held a fellowship from the German Science Foundation. Before coming to Trier University, where she presently teaches, Eva Walther taught at the University of Heidelberg. She holds a Diploma in Psychology from the University of Giessen and a PhD in Psychology and a Habilitation from the University of Heidelberg.

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Tina Langer holds a Diploma in Psychology from the University of Heidelberg and a PhD in Psychology from the University of Trier. She currently works at the University of Bielefeld. Her research interests lie in the area of psychological distance, attitude formation and change, especially indirect attitude change, the consequences of discrimination, and consumer psychology. She has authored and co-authored papers in the *Journal of Experimental Social Psychology, Cognition and Emotion*, and the *European Journal of Social Psychology*.

Endnotes

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¹ One might argue that internal stages like mood can be considered as stimuli as well. However, for the sake of clarity we use the term 'stimulus' only for entities observable in the environment.

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