



IS EVALUATIVE CONDITIONING A QUALITATIVELY DISTINCT FORM OF CLASSICAL CONDITIONING?

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Summary—This paper contains a critical review of the claim that evaluative conditioning (EC) represents a theoretically distinct form of classical conditioning. A review of the evidence suggests that: (i) while it is claimed that EC can occur without awareness, EC studies have either adopted inappropriate statistical comparisons to demonstrate this or have failed to use the control conditions necessary to indicate that what is being measured is associative conditioning; (ii) there is no theoretical reason why conditioning without awareness might be observed in any conditioning paradigm if a relatively complex covariation assessment procedure such as that adopted in EC studies is used; and (iii) there are a variety of possible explanations for the relative resistance to extinction reported with EC, some of which allude to failure to use appropriate control conditions and others which point to specific details unique to the EC extinction procedure. Until these appropriate procedural and statistical comparisons are made, it is concluded that it is premature to assume that EC represents a form of conditioning that is theoretically distinct from other types of classical conditioning.

Over the past 20 years, classical conditioning in both humans and animals has come to be perceived as a complex cognitive activity, requiring controlled information processing, which results in the formation of referential associations between the conditioned stimulus (CS) and the unconditioned stimulus (UCS) (e.g. Rescorla, 1980; Dickinson, 1980; Davey, 1987, 1989, 1992). This prototypical model supposes that the conditioned response (CR) is mediated by an internal representation of the UCS (Holland & Rescorla, 1975; Davey, 1992), and, in humans at least, the CS–UCS association is formed during controlled processing reflected by conscious awareness of the CS–UCS contingency (cf. Dawson & Schell, 1987; Shiffrin & Schneider, 1977). This model is supported by a substantial literature of studies which have demonstrated that: (i) changes in the evaluation of the UCS immediately influence the strength of the CR, suggesting mediation via a CS–UCS association (Holland & Rescorla, 1975; Rescorla, 1973, 1980; Holland & Straub, 1979; Cleland & Davey, 1982; Davey & McKenna, 1983; Davey, 1983, 1987); and (ii) that in human subjects (Ss), differential conditioning of autonomic CRs does not occur unless the S is able to verbalize the CS–UCS contingency (Biferno & Dawson, 1977; Dawson & Biferno, 1973; Fuhrer & Baer, 1980; Dawson, Catania, Schell & Grings, 1979; Dawson, Schell & Tweddle-Banis, 1986; Öhman, Ellstrom & Bjorkstrand, 1976; cf. Dawson & Schell, 1987, for a review).

Nevertheless, in spite of this accumulation of evidence in favour of signal-based referential learning mediated by controlled information processing, there is one human classical conditioning paradigm which, *prima facie*, has consistently failed to fit comfortably into this model. This is known as evaluative conditioning (EC), and reflects the transfer of affective value from a UCS to a CS (Martin & Levey, 1985, 1987; Levey & Martin, 1983, 1987). In the standard EC study, pairing a subjectively neutral stimulus (CS) with a liked or disliked stimulus (UCS) results in the neutral CS acquiring positive or negative valence depending on the valence of the UCS with which it has been paired. This has been demonstrated with a variety of stimuli, including CSs and UCSs from visual, auditory and gustatory–olfactory modalities (Bierley, McSweeney & Vannieuwkerk, 1985; Stuart, Shimp & Engle, 1987; Zellner, Rozin, Aron & Kulish, 1983; Baeyens, Eelen & Van den Bergh, 1990a; Baeyens, Eelen, Van den Bergh & Crombez, 1989, 1990b; Baeyens, Eelen, Crombez & Van den Bergh, 1992a; Levey & Martin, 1987; Martin & Levey, 1987).

However, what is curious about EC is that it appears to differ from our current conceptions of signal-based learning in two important ways. First, EC appears to occur without the S being consciously aware of the CS–UCS contingencies (in the sense of being able to verbalize the

contingencies either during or after the experiment) (Baeyens, Crombez, Van den Bergh & Eelen, 1988; Baeyens *et al.*, 1989, 1990a, b; Kirk-Smith, Van Toller & Dodd, 1983; Stuart *et al.*, 1987; Zellner *et al.*, 1983). Secondly, evaluative conditioning appears to be strongly resistant to extinction. Post-acquisition presentations of the CS alone fail to modify the valence of the CS that was acquired during EC, and the acquired valence appears to remain unchanged for periods of up to several weeks after acquisition (Baeyens *et al.*, 1988, 1989).

These two anomalies have led to considerable theoretical speculation about the learning processes underlying EC, and to its position within our current conceptions of classical conditioning. One prominent speculation has been that EC represents intrinsic or non-referential learning rather than signal or referential learning (Martin & Levey, 1987; Levey & Martin, 1987; Zellner *et al.*, 1983; Baeyens *et al.*, 1990a, 1992b). To formulate this in terms of associative predispositions, EC would be seen as being mediated by stimulus-response (S-R) associations rather than referential stimulus (CS)-stimulus (UCS) associations; i.e. the CS becomes associated with the affective reaction to the UCS rather than an evaluated representation of the UCS itself. This would explain both why (i) Ss in EC experiments are unable to verbalize the relationship between CS and UCS (because that is not what they learn); and (ii) the acquired CR is resistant to extinction (because non-presentation of the UCS following the CS should be irrelevant to an acquired association between the CS and the S's response to the UCS).

These speculations on the mechanisms underlying EC have led to further surmisings about both the function of such conditioning and its role in affective transfer and psychopathological phenomena. For instance, according to Martin & Levey (1987) EC is a purely automatic, pre-attentive process which constitutes a fundamental part of human development by contributing to the acquisition of new 'likes' and 'dislikes' which facilitate adaptation to the environment. Other writers have suggested that evaluative conditioning can be linked to the 'hedonic shift' that occurs in conditioned food aversion/preference learning (Zellner *et al.*, 1985), and may explain some of the perplexing characteristics of clinical phobias, such as their resistance to extinction and their apparent failure to be modified by knowledge of the contingencies involved (cf. Baeyens *et al.*, 1992a, b).

The present paper represents a critical review of this conception of EC as a qualitatively different form of classical conditioning. I will attempt to argue that those phenomena that are claimed to distinguish EC from other forms of classical conditioning (i.e. conditioning without conscious awareness and resistance to extinction) are of procedural rather than theoretical importance, and that the mechanisms underlying EC need not be considered as qualitatively different from those underlying other forms of classical conditioning. The paper will begin by examining the claims that EC occurs in the absence of conscious awareness and is resistant to extinction, it will then move on to consider how EC might be incorporated within contemporary conceptions of human classical conditioning.

THE EVALUATIVE CONDITIONING PROCEDURE

First of all, it is important to be familiar with the procedural features of evaluative EC conditioning and how these differ from more traditional classical conditioning paradigms. Most representative of this paradigm is that used in the influential studies of Frank Baeyens and his colleagues (Baeyens *et al.*, 1988, 1989, 1990a, 1992a, b). In the baseline phase, Ss sort pictures of faces into liked (L), disliked (D) and neutral (N) by rating them on a scale of +100 (very liked), through 0 (neutral) to -100 (very disliked). A selection of neutrally-rated faces are chosen by the experimenter as CSs. Some of these are then paired with extremely liked faces (N-L), some with extremely disliked faces (N-D) and some with other neutral faces (N-N). At the end of the conditioning phase Ss are asked to reassess their ratings of the neutral faces (evaluative ratings, ERs). Results tend to show that those CS faces paired with liked faces (N-L) exhibit a significant positive increase in ERs between the baseline and the end of conditioning; those CS faces paired with disliked faces (N-D) show a decrease in ERs; and those CS faces paired with neutral faces (N-N) show no significant change in ERs. Conditioning is measured as an appropriate and significant shift in ERs between the baseline evaluation (ER1) and the evaluation taken at the end of conditioning (ER2).

There are also a number of differing procedures for assessing conscious awareness of the contingencies. The most common method is to show *Ss* post-experimentally each CS and ask them if they recognize the face with which each was paired (from a concurrently available portfolio of faces). This measure can be quantified further by asking *Ss* to rate how confident they were of their choice. This is considered to be a relatively 'strong' criterion, because it requires that *Ss* recognize explicit details of the UCS. A second, 'weak' method, is to ask *Ss* if they thought the face that was paired with a CS was a liked, disliked or neutral one. This latter measure gives some idea of whether the *S* is aware of the affective relationship between CS and consequential UCS, even if they cannot recall specific sensory features of the UCS.

EVALUATIVE CONDITIONING AND CONSCIOUS AWARENESS OF CONTINGENCIES

The majority of the literature on autonomic classical conditioning strongly indicates that differential classical conditioning does not occur without conscious awareness of the CS-UCS contingencies (measured in terms of the *S*'s ability to verbalize the contingency) [cf. Dawson & Schell (1987) for a review]. However, EC studies appear to indicate that EC can occur with the *S* able to verbalize only a minor percentage of the CS-UCS relationships (using the 'strong' criterion for contingency awareness) (e.g. Baeyens *et al.*, 1988, 1990a, 1992b; Stuart *et al.*, 1987; Zellner *et al.*, 1983; Kirk-Smith *et al.*, 1983). This percentage increases with the number of acquisition trials (Baeyens *et al.*, 1992a), and with the use of the 'weaker' criterion, where *Ss* merely have to indicate the affective value of the contingent stimulus (Baeyens *et al.*, 1990a, 1992a, b).

While these studies suggest that *Ss* in EC procedures acquire relatively poor contingency awareness, how does this relate to what appears to be relatively good EC in most of these studies? To draw any conclusions about the necessity or not of contingency awareness in EC requires some relatively detailed analysis of the data. For instance, because *Ss* normally learn a percentage of the contingencies suggests that they do possess internal representations of some UCSs. Those CSs to which the *S* cannot recognize paired UCSs may actually activate peripheral features of other established UCS representations, such as its affective value, or they may have become associated with incomplete UCS representations which contain, for example, only information on the affective value of the UCS. In order to control for this possibility, for any clear conclusions to be drawn about the role of contingency awareness in EC: (i) ERs need to be compared between *Ss* who are totally unaware of any contingencies (according to the 'weak' criterion) and those that are aware of some contingencies; (ii) ERs to stimuli paired with affectively different UCSs need to be compared in those *Ss* who are totally unaware of any contingencies; or (iii) a comparison needs to be made between the conditioned ERs to those stimuli for which individual *Ss* claim to be aware of the contingencies (in the 'weak' sense) and those stimuli where those *Ss* are unaware of the contingencies.

Only the study by Baeyens *et al.* (1990a) appears to have made any of these relevant comparisons, albeit with results that support a conditioning without awareness view. They found that: (i) an ANOVA in which comparison was made between ERs for *Ss* who are totally unaware of any contingencies and those that were aware of some contingencies found that ERs did not interact significantly with these two subgroups; (ii) in *Ss* who had been shown to be totally unaware of any contingencies (according to the weak criterion, $n = 5$), ERs paired with affectively different UCSs were significantly different; and (iii) no significant differences were revealed when a comparison was made between ERs to those stimuli for which *Ss* claim to be aware of the contingencies (in the weak sense) and those stimuli where those *Ss* claimed to be unaware of the contingencies. A study of flavour conditioning by Baeyens *et al.* (1990b) also reports differential ERs in a CS-flavour group where none of the *Ss* demonstrated awareness of the contingencies.

Nevertheless, although these statistical comparisons provide initial support for conditioning without awareness in EC, there are still problems in making comparisons of the role of contingency awareness in EC studies and traditional autonomic conditioning studies. One principal problem concerns the criterion for conditioning in these two types of study. In the traditional autonomic paradigm, conditioning is said to have occurred when there is a significantly greater magnitude CR to the CS paired with the UCS than to a control CS which is only randomly paired with the UCS.

Differential conditioning by this criterion has been found to be absent unless the *S* is able to verbalize the contingencies (Dawson & Schell, 1987). Unfortunately, only a very small minority of the studies which have investigated EC have utilized a non-paired or random control condition, and the vast majority have relied upon comparisons between ERs at the outset and the end of acquisition as a measure of conditioning (e.g. Baeyens *et al.*, 1988, 1989, 1990a).

Those EC studies which have utilized a random or non-paired control condition merely complicate the picture, and raise doubts about whether it is actually conditioning that is occurring without awareness in those studies that have claimed to have observed it.

For instance, of those studies that have utilized some form of non-paired control condition, Shanks & Dickinson (1990) report findings which are problematic for supporters of the special status of EC. Shanks & Dickinson (1990) found that the ER ratings profile in an EC group that received pairings of N stimuli with either L or D stimuli was not significantly different to the profile obtained from a group of *Ss* for which these stimuli were explicitly unpaired. At face value, there are two initial implications of this finding for an understanding of the role of contingency awareness in EC. First, if this finding were to be replicated in other EC studies then none of them would find any evidence of conditioning as defined by the traditional differential conditioning criterion. Thus, since there is no conditioning according to this criterion, we would expect to find very little evidence of contingency awareness. Secondly, Shanks & Dickinson (1990) conclude from their study that EC observed in the standard EC procedure is not due to the associative relationships established by the procedure, but may arise "from the CS-UCS assignment procedure which may interact with the effects of stimulus exposure during the so-called conditioning phase" (p. 24). If this is so, then good EC (as measured by ER1-ER2 differences) could quite well be found in the absence of contingency awareness, since according to this account it is not the contingencies that have contributed significantly to the change in ER but the CS-UCS assignment procedure. Nevertheless, it is worth considering the findings of Shanks & Dickinson (1990) with some reservations, mainly because the details of their non-paired procedure are very poorly reported. It does seem that their non-paired procedure was a very unusual one in which 10 individual N presentations were followed by 10 individual L presentations, and then similarly for a second N stimulus and a D stimulus. Intuitively one might suspect that some conditioning might occur in these circumstances, even if it is only because *Ss* experience at least one N and L pairing (when the tenth N stimulus is followed by the first L stimulus).

Two remaining studies which have adopted more conventional non-paired control procedures (where the CS is only randomly associated with the affective UCS) still do not provide convincing support for conditioning without awareness. Bierley *et al.* (1985) found only a non-significant difference between ERs to paired and non-paired stimuli, and, while a study by Stuart *et al.* (1987) did find a significant difference between ERs to paired and non-paired stimuli, they adopted a relatively strong criterion for contingency awareness (i.e. *Ss* had to be able to specify precisely the UCS paired with each CS). This did not allow for the possibility that conditioning might occur with awareness of less specific features of the UCS such as its affective value.

It must be stressed that the evidence discussed so far is not necessarily contrary to the possibility that EC can occur without awareness, merely that it is considerably more confusing and considerably less clear-cut than supporters of the EC position would be happy to admit. However, it is important to put the notion of conditioning without awareness into some kind of perspective. While there is less direct evidence for it than one might be led to presuppose, there is no real theoretical reason why it should not exist.

For instance, currently accepted models of human classical conditioning do not have a theoretical commitment to conditioning only with awareness (e.g. Davey, 1992; Öhman, Dimberg & Esteves, 1989). For example, 'expectancy' models of human conditioning do not specify that these expectancies have to be verbalizable, but merely use the evidence from contingency awareness studies to demonstrate that many expectancies are verbalizable (Davey, 1992)—there is no theoretical reason why CS-UCS expectancies cannot be generated at a subverbal level. Similarly, Öhman *et al.* (1989) argue that some autonomic CRs can be conditioned as a result of pre-attentive analyses activating automatic processing of the CS-UCS relationship. This is important because the claim that EC occurs without awareness is not one which is theoretically orthogonal to existing models of autonomic conditioning. So why do EC studies report relatively poor contingency

awareness compared with the relatively good contingency awareness that occurs in traditional autonomic conditioning procedures? Baeyens *et al.* (1988) speculated that this may be because the UCS in EC studies is relatively innocuous (a mildly disliked picture) when compared with the more aversive UCSs, such as electric shock, that are used in conventional studies. However, even when the aversiveness of the UCSs in EC studies is increased (by using pictures of mutilated faces), the level of contingency awareness is not significantly increased (Baeyens *et al.*, 1988). Nevertheless, what is unusual about the EC procedure is that it constitutes a relatively complex covariation assessment procedure; unlike traditional conditioning paradigms which have one UCS and—at best—two CSs, the EC procedure can contain as many as nine different UCSs and nine different CSs, all differing in the complexity of their sensory properties and the intensity of their affective value. It is perhaps not so surprising that under such circumstances the *S*'s covariation assessments are relatively inaccurate. An important comparison in this respect is therefore to investigate the level of contingency awareness in autonomic conditioning using the range and variety of CSs and UCSs used in EC studies. If conscious awareness of contingencies in autonomic conditioning procedures is a function of the complexity of the covariation assessment problem, then EC is not simply a qualitatively different kind of conditioning.

There is also converging evidence from without the conditioning paradigm that associations may be formed without awareness. First, hidden covariation assessment studies have convincingly demonstrated that *S*s can acquire non-verbalizable encoding biases which significantly influence subsequent judgements (Lewicki, 1986; Lewicki, Hill & Bizot, 1988; Hill, Lewicki, Czyzewska & Ross, 1989). Secondly, there is preliminary evidence that EC can be found even when the UCS is a subliminally presented stimulus which the *S* is unable to consciously perceive (Niedenthal, 1989; Krosnick, Betz, Jussim & Lynn, 1992). (Note, however, that these latter two studies, like most EC studies, failed to utilize nonpaired control conditions.)

In summary, the arguments outlined above suggest that: (i) many EC studies have failed to make the critical statistical comparisons that will indicate conditioning without awareness; (ii) where the appropriate statistical comparisons have been made, these studies have generally failed to use a non-paired control condition which would unequivocally indicate whether differential conditioning had occurred in the absence of contingency awareness; and (iii) the EC procedure represents a relatively complex covariation assessment task, which is quite different to the relatively simple covariation assessment task found in the traditional differential autonomic conditioning paradigm, and this may well indicate that the poor contingency awareness reported in EC studies is the result of procedural rather than theoretical factors. Even so, there appears to be no important theoretical reason why conditioning without awareness should not occur—in EC or any other type of conditioning procedure. But it would seem that any study that is going to convincingly detect conditioning without awareness should: (i) adopt a 'weak' criterion of conscious awareness; (ii) make a variety of appropriate statistical comparisons; (iii) be able to confirm associative conditioning with the use of non-paired comparison conditions; and (iv) use a relatively complex covariation assessment procedure which will make the conscious detection of contingencies difficult.

EVALUATIVE CONDITIONING AND RESISTANCE TO EXTINCTION

Apart from relatively anecdotal accounts, there are two main studies which have investigated the resistance to extinction of EC. Baeyens *et al.* (1988) found that when either 5 or 10 non-reinforced presentations of conditioned faces followed acquisition, ERs taken at the end of extinction did not differ significantly from those ERs taken at the end of acquisition. In addition, when *S*s were recalled to the laboratory 2 months after the experiment their ERs had still not changed significantly from those recorded at the end of acquisition. In a second study, Baeyens *et al.* (1989) followed EC by dividing the conditioned CSs into three groups: the first group of CSs were presented for 10 non-reinforced trials (extinction); the second group of CSs were paired over 10 trials with a UCS of opposite valence to that used during acquisition (counterconditioning); and the third group were not presented at all during this second phase (no treatment). They found that subsequent ERs to those CSs subjected to 10 extinction trials did not differ significantly from those ERs in the no-treatment group, suggesting a resistance to extinction. However, those CSs in the

counterconditioning group did exhibit a significant shift in valence when compared with the no treatment CSs. Baeyens *et al.* conclude that while EC does appear to be significantly resistant to extinction, it is not resistant to change by other means (i.e. counterconditioning).

Nevertheless, while these findings seem impressive at first glance, they do raise questions about the validity of ERs as a measure of conditioning, and also about the appropriate methods for measuring rate of extinction.

First, one problem with the measurement of extinction in the form of ERs is that it can generate demand characteristics which will mitigate against change in ERs across phases of an experiment. For instance, in the Baeyens *et al.* (1988) study ERs were taken at the end of acquisition and again at the end of extinction. However, as the authors themselves were aware, *Ss* might simply be remembering their evaluations at the end of acquisition and repeating them at the end of extinction simply to appear consistent. This would have been facilitated by the experimental subterfuge which, at the time of the last ER (at the end of extinction) informed the *S* that this last ER was needed in order to unambiguously interpret the ER taken at the end of conditioning. In order to take this factor into account in their subsequent study, Baeyens *et al.* (1989) took only one ER at the end of the extinction period and compared this with ERs to counterconditioned CSs or no-treatment CSs (see above for details of the procedure). However, just because *Ss* did not make an explicit ER at the end of acquisition does not mean that they were not making implicit ERs throughout the experiment, nor that at later points in the experiment they were not able to project themselves back to make 'hindsight' evaluations of their reactions at various points in the experiment. Since in the experimental subterfuge *Ss* were told that the measurements from the final phase of the experiment (both ERs and skin conductance responses, SCRs) were being taken in order to interpret measurements from the first phase (acquisition), it is quite possible that *Ss* would have compared their explicit ER at the end of extinction with a retrospective ER from the end of the first phase (the latter is exactly what their ERs to the no-treatment CSs would have been). Where *Ss* would have been aware that something significantly different was happening in the second phase (e.g. counterconditioning), one would not expect that the ER at the end of the second phase should be comparable to that at the end of the first. It is also true that this argument should also apply to those *Ss* in the extinction condition who had been aware of conditioning during acquisition, i.e. if they were aware that something significantly different was happening (in this case extinction), then their ERs should be modified (i.e. extinguish). However, while those *Ss* who were aware of the extinction procedure did still exhibit differential ERs (in terms of N-L, N-D comparisons), all this indicates is that total extinction of differential ERs had not occurred—it is still quite possible given these kinds of comparisons that some extinction *had* occurred.

At least some of these problems of deciding whether some extinction has occurred or not reside in the failure to utilize non-paired control conditions. Traditionally, classical conditioning studies measure rate of extinction to a previously conditioned CS by comparing that CR with the CR to a control CS which has only been randomly paired with the UCS during acquisition [the truly random control (Rescorla, 1967)]. Extinction is said to have occurred when the magnitude of the CR to the previously conditioned CS is indistinguishable from that to the randomly paired control CS (cf. Mackintosh, 1974). Unfortunately, none of the studies which have investigated resistance to extinction of ERs have adopted random control conditions but have relied on comparisons with ERs taken at the end of acquisition (Baeyens *et al.*, 1988, 1989). The use of the random control comparison is given added importance in this context because of the Shanks & Dickinson (1990) finding that when N stimuli are presented with L and D stimuli in an explicitly unpaired procedure, they obtained a very similar rating profile to that found with paired stimuli. There are at least two implications of this finding for ER extinction studies. First, using an unpaired control procedure as a comparison baseline means that the comparison is not zero, but, from the results of the Shanks & Dickinson (1990) study, would appear to be very close to the ER ratings obtained by paired stimuli. Thus, according to this definition of extinction, the ERs in the Baeyens *et al.* (1988, 1989) studies would probably be deemed to have extinguished! Secondly, from a slightly differing point of view, Shanks & Dickinson (1990) point out that the results of their study suggest that the pairing of N stimuli with either L or D stimuli during acquisition cannot be unambiguously identified as the source of EC, since similar rating profiles are obtained even when N stimuli are not explicitly paired with L or D stimuli during acquisition. If something other than the pairing of N stimuli

with L and D stimuli is the cause of EC, then it is not surprising that ERs are not changed by the non-pairing that occurs during extinction [however, see the criticisms of the Shanks & Dickinson (1990) study outlined in the previous section].

Finally, while the above criticisms are largely problems involving the interpretation of EC extinction studies, there are in fact two procedural factors peculiar to the EC paradigm which might favour resistance to extinction. First, one factor that might spuriously contribute to a perceived resistance to extinction is the duration of the CSs. In EC, the CS duration is usually as brief as 1 sec, which is considerably shorter than the duration of the CSs used in the majority of other human conditioning paradigms (with the possible exception of eye-blink conditioning). This is important when it is considered that resistance to extinction appears to be inversely related to CS duration (Sandin & Chorot, 1989; Kaloupek, 1983; Miller & Levis, 1971; Stone & Borkovec, 1975; Sue, 1975).

Secondly, the conditioning procedure used in EC extinction studies (Baeyens *et al.*, 1988, 1989) has been rather different to that used in traditional autonomic conditioning studies. Traditional conditioning procedures tend to use a delay conditioning procedure in which CS-onset occurs prior to UCS-onset and either overlaps marginally with UCS presentation or is followed immediately by UCS presentation. However, the studies of Baeyens *et al.* (1988, 1989) both used a trace conditioning procedure during acquisition in which the UCS followed the CS after an interstimulus interval of 4 sec. This is important for our conception of the subsequent extinction process because using a trace conditioning procedure means that the immediate post-CS period is identical during both acquisition and extinction (i.e. in this case the CS is followed by 4 sec of nothing in both acquisition and extinction). This is important in this context since this similarity in the immediate post-CS period between acquisition and extinction is likely to mitigate against extinction of the ER because at least part of the immediate post-CS stimulus configuration is maintained even in extinction. This is quite different from the transition from acquisition to extinction in traditional delay conditioning, where the immediate post-CS period in extinction is marked by the clear absence of the UCS that had previously been contiguous with CS-offset. Furthermore, these arguments are consistent with other findings from the conditioning literature which suggest that CRs generated by trace conditioning show significantly more generalization to other stimuli and situations than do CRs generated by delay conditioning (Ellison, 1964; Pavlov, 1927).

In conclusion, the factors outlined above suggest that further controlled studies may be necessary before there is compelling evidence supporting the resistance to extinction of EC. The studies available do not contain control procedures which would unambiguously identify resistance to extinction, and conversely, there are clearly procedural factors inherent in the EC extinction procedure which might themselves facilitate resistance to extinction. Studies which would resolve these ambiguities would include: (i) containing EC studies within experimental subterfuges which do not promote the stability of the ER as being implicitly desirable; (ii) making explicit comparisons in extinction studies between ERs to paired and non-paired control CSs; (iii) using parametric studies to examine whether CS duration does play any significant role in resistance to extinction of ERs; and (iv) comparing the resistance to extinction of ERs when either trace or delay procedures are used during acquisition.

EVALUATIVE CONDITIONING AND ASSOCIATIVE LEARNING

Notwithstanding the criticisms outlined above, the view that EC could occur without awareness and was resistant to extinction gave rise to the belief that EC was not an example of referential signal learning but represented intrinsic or non-referential learning (Martin & Levey, 1987; Levey & Martin, 1987; Zellner *et al.*, 1983; Baeyens *et al.*, 1990a, 1992b). This view assumes that subjects in EC procedures do not learn associations between the CS and UCS (signal learning), but acquire some other non-referential association such as an association between the CS and the affective response to the UCS (S-R learning).

However, a study by Baeyens *et al.* (1992b) clearly and elegantly demonstrates that EC is mediated by CS-UCS associations. They adopted a UCS-revaluation procedure which changes the S's evaluation of the UCS after conditioning (cf. Dickinson, 1980; Rescorla, 1980; Davey, 1992). The logic of this inferential procedure is that, if the CR is mediated by internal

representations of the UCS, then any off-the-baseline changes in the *S*'s evaluation of the UCS will also affect the CR. Baeyens *et al.* (1992b) carried out normal EC using pictures of faces as the CSs and UCSs. After conditioning, they altered the *Ss*' evaluations of the UCS by associating a liked UCS face with negatively valenced adjectives purportedly describing the personality of the person in the picture (and *vice versa* for disliked faces). They found that this post-conditioning UCS-revaluation did indeed affect the acquired value of the CS, suggesting that ERs were mediated by CS-UCS associations.

This study indicates that the associative substructure underlying EC appears to be similar to that found in other autonomic preparations (Davey, 1983, 1987, 1992; Davey & McKenna, 1983; White & Davey, 1989), and provides further evidence against EC as a qualitatively different kind of classical conditioning.

CONCLUDING REMARKS

This paper has carried out a critical review of EC and, in particular, the claim that EC is a qualitatively distinct form of classical conditioning. A review of the evidence suggests that: (i) further controlled studies are necessary before there is compelling evidence supporting the resistance to extinction of EC; and (ii) further statistical and procedural comparisons are required before it can be unequivocally concluded that EC occurs without awareness. Furthermore, procedural differences may account for the relatively poor contingency awareness in EC when compared to the relatively good contingency awareness reported in traditional autonomic paradigms. The fact that CS-UCS associations appear to underlie both autonomic and evaluative CRs further suggests that EC may not represent a theoretically distinct form of classical conditioning.

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