When All Is Still Concealed: Are We Closer to Understanding the Mechanisms Underlying Evaluative Conditioning?

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WHEN ALL IS STILL CONCEALED: ARE WE CLOSER TO UNDERSTANDING THE MECHANISMS UNDERLYING EVALUATIVE CONDITIONING?

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ABSTRACT

Fulcher and Hammerl's (2001) important exploration of the role of contingency awareness in evaluative conditioning (EC) raises a lot of issues for discussion: (1) what boundaries, if any, exist between EC and affective learning paradigms; (2) if EC does occur without awareness does this mean it is non-propositional learning; (3) is EC driven by Stimulus-Response (S-R), rather than Stimulus-Stimulus (S-S), associations and if so should it then surprise us that contingency awareness is not important; and (4) if S-R associations are at the heart of EC, should we automatically assume EC is part of a different learning mechanism to autonomic Pavlovian conditioning (Field, 2000ab)? This article, after a critical review of Fulcher and Hammerl's work, discusses these issues with reference to what can be realistically inferred about the mechanisms underlying EC.

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After reviewing the literature investigating the effects of contingency awareness on evaluative conditioning (EC), Field (2000a) noted that although there was good evidence that contingency awareness was not necessary for learning about tastes, the evidence that learning using visual stimuli could occur without awareness was controvertible. This is a view recently endorsed by Lovibond and Shanks (in press) in a detailed review of the role of contingency awareness in conditioning in general. Field noted that (1) early studies using visual stimuli utilised a paradigm that was subsequently shown to be flawed (Field & Davey, 1999); (2) later studies that did not use this paradigm (such as Baeyens, Crombez, Van den Bergh, & Eelen, 1988; Baeyens, Eelen, Van den Bergh, and Crombez, 1989; Baeyens, Eelen, Crombez and Van den Bergh, 1992; Baeyens, Hermans and Eelen, 1993; Hammerl & Grabitz, 1993) looked at contingency awareness only as a tangential theme; (3) there is an important distinction to be made between demand awareness (a lack of which should not influence conditioning) and contingency awareness (a lack of which could influence conditioning) and some studies cited as evidence for conditioning without awareness probably actually measure demand awareness (e.g. Stuart, Shimp and Engle, 1987; Hammerl & Grabitz, 1993); (4) the majority of studies investigating EC do not use between-group controls to demonstrate that learning is associative (see Field & Davey, 1998; Davey 1994) and if the learning in these studies was non-associative then there is no reason why it should have been affected by contingency awareness; and (5) the validity of post hoc measures of contingency awareness will always be controversial (for reasons detailed by Lovibond & Shanks, in press; Shanks & St. John, 1994) and so systematic attempts to manipulate contingency awareness should

be attempted. Field (2000b) also suggested that like autonomic conditioning, in which evidence for learning without awareness is stronger for certain learning episodes, EC may occur more readily without awareness for certain ecologically-important learning events (such as tastes, touch and odors). The implication is that learning without awareness in the visual domain is particularly important theoretically, because it does not involve life-threatening outcomes (such as ingesting poisons, injury from touching abrasive surfaces, or inhaling noxious gases).

Fulcher and Hammerl (this issue) present attempts to manipulate awareness in a systematic way. Their study is a welcomed advance to our understanding of contingency awareness and EC; nevertheless, this commentary will focus on the extent to which the authors demonstrate associative EC without contingency awareness and the theoretical implications. The main focus will be on the experiment using visual stimuli because these findings more interesting theoretically.

The Experiments: When is Associative Learning not Associative Learning?

Davey, (1994), Field (1996, 1997) and Field and Davey (1997, 1998, 1999) have long advocated the use of between-subject control groups that allow firm conclusions to be made about whether learning effects are associative. The logic is simple: to infer that learning is the direct cause of particular associations between conditioned stimuli (CS) and an unconditioned stimuli (UCS), situations in which CS-UCS associations are present must be compared with situations in which CS-UCS associations are absent. A no-treatment condition is such a situation (CS-UCS associations are absent), but it does not control for exposure and so the BSB control (Field, 1996, 1997) has been advocated, which contains no CS-UCS associations and controls for exposure too. This control is especially important when trying to demonstrate that EC can occur without contingency awareness because this functional characteristic, if shown, would set EC

apart from autonomic conditioning (in which conditioning without awareness is rarely, if ever, found—see Lovibond & Shanks, in press; Dawson & Schell, 1987 for reviews). Autonomic Pavlovian conditioning depends upon stimulus-stimulus (S-S) associations (Rescorla, 1980) and so for differences between this form of learning and EC to be theoretically interesting EC needs to be shown to be associative too; otherwise it would be unsurprising that EC does not rely on contingency awareness whereas autonomic conditioning does—because the latter is driven by an associative process whereas the former is not.

Even those who do not advocate its use acknowledge that the BSB control proposed by Field (1996, 1997) allows unequivocal conclusions about the associative properties of any observed evaluative learning (De Houwer, Thomas & Baeyens, in press; Baeyens, De Houwer, Vansteenwegen, & Eelen, 1998). Fulcher and Hammerl's experiments have no such control because they argue, "Hammerl and Grabitz (2000) show that evaluative learning is also demonstrable in a between-subjects design and that the standard within-subjects control conditions (i.e. N-N stimulus pairs) are an appropriate way to control nonassociative influences". Hammerl and Grabitz do indeed follow Field and Davey's (1998) suggestions and compare effects in experimental conditions to those in a BSB control and this is excellent to see, however, its inclusion in past research in no way precludes its use in research addressing a different question (where, as argued above, it is imperative to demonstrate that learnt responses are associative)—that would be like suggesting that researchers doing clinical drug trials stop using placebo controls just because past research has used them! Also Hammerl and Grabitz (2000) have not shown that the within subject controls are adequate, because this issue is not subject to empirical test. To demonstrate that N-N controls are adequate one would have to show that no associations are formed between the Neutral CS and the Neutral UCS when this

control is employed. In these pairings no shift in evaluative rating is expected anyway (i.e. the null case is predicted), therefore, no change is not necessarily indicative of no CS-UCS association, it could equally be indicative of a CS-UCS association being formed, but having no observable effect (as predicted). The only way to ensure comparison between CS-UCS pairings that have entered into associations and those that have not is to remove the associations by presenting CSs and UCS in such a way that they cannot be associated—something that the BSB control does but the N-N pairings do not do.

Notwithstanding these criticisms, Fulcher and Hammerl do make good use of CSs that are not paired with a UCS in Experiment 3. Although Rescorla (1967) has famously written of how such a control does not remove associations completely (because the CS could still be associated with the absence of a UCS), these pairings make an interesting comparison between CSs that have entered associations with UCSs and CSs that either haven't entered associations, or have entered into associations with the absence of a UCS. However, Fulcher and Hammerl's findings are complicated in that when the results of the group in which effects were found are looked at (the 25ms condition) they report a significant assimilation effect in the normal instruction group with ratings of ideographs paired with smiling faces being higher than ratings of those paired with frowning faces, but that "neither of these differed significantly from the mean rating of ideographs paired with no face". For the participants told to ignore the influence of the faces, there was a contrast effect but only CSs paired with smiling faces showed any difference to CSs paired with no face. In fact this contrast effect is largely the product of an effect for CSs paired with smiling faces because this was the only pairing for which instruction group differences exist. These comparisons are the nearest we have to a comparison between CSs that did enter into associations and those that may, or may not, have done. These comparisons are far from uniformly

significant and so raise some concern about the extent to which we can infer associative learning. The data for the effects of reactance are more promising in that for the low reactance group (at a presentation rate of 12.5ms) a difference was found between CSs paired with smiling faces and those paired with no faces. However, for the high reactance group no differences between CS-UCS pairs and CS-no UCS pairs were observed. At a slower presentation rate (25ms) there were no effects in the low reactance group but this time in the high reactance group a difference was found between CSs paired with smiling faces and those paired with no faces. These results are somewhat puzzling because they collapse across the type of instruction given. On average it might be reasonable to expect half of the participants in each reactance group to have been told to discount the effect of the affective stimuli and half to have been told not to. This will mitigate responses in both groups, and to get a clearer insight into the reactance data it would be useful to know whether reactance interacted with the type of instruction.

To what extent do the results of Experiment 3 support the position that EC conditioning occurs without awareness? The truly unaware group (presentation rate of 12.5ms) showed no effects when the effects of the instructions were analysed, and for the reactance data only the CSs paired with happy faces seemed to differ from those paired with nothing. In the two aware groups (50ms and 125ms) there seemed to be no evidence of any kind of learning at all. Fulcher and Hammerl make much of the apparent contract effects, yet the two aware (by their definition) conditions actually just prevent learning. The main body of significant results lie in the 25ms presentation rate group and recognition rates for this group (taking a conservative estimate of 61% from Fulcher and Hammerl Figure 3) are significantly above chance (Binomial test $\underline{p} < 0.05$). Although the analysis of aware and unaware participants (footnote 2 of Fulcher

and Hammerl) does corroborate their main supposition, the contrasts between CSs paired with faces and those not are absent.

The point here is that the evidence for associative learning is far from clear-cut. There is better evidence when smiling faces are used (in fact there is very little evidence for the frowning faces), yet this was not predicted. A convincing argument that these findings are associative needs to explain these unpredicted inconsistencies.

Further complications arise in Experiment 3 because (1) the valence of the ideographs was not determined pre-experimentally (so it is difficult to establish whether these stimuli were in fact neutral to begin with); (2) the instructions in Experiment 3 may have enhanced demand awareness (by making it apparent that the effect of the valence of the stimuli was important to the experimenters); and (3) the UCSs contained emotional cues (smiles or frowns) so were participants really responding to the emotion elicited by the UCS faces, or responding to the emotional content of the UCSs? This later point is interesting because it questions whether the experiment represents direct learning or the vicarious learning described by Rachman (1977).

The need for appropriate controls and the extent to which any experiment demonstrates conditioning without awareness can be argued from many views: whatever views I might have on their experiments, Fulcher and Hammerl will no doubt provide an eloquent and compelling defence. My intention is merely to illustrate that the room for debate highlights the difficulty in conducting research on issues of awareness in learning (see Shanks & St. John, 1994; Field 2000a). Fulcher and Hammerl have made a substantial advance in trying to systematically manipulate awareness, but even then it is extremely difficult to manipulate experimental conditions such that one group is unaware of all contingencies and another group is aware of all contingencies. Field (2001) and Field and Moore (2001) have similar

experiences and propose that a better analytical strategy is to accept that some participants will be aware of some contingencies and to model the effects of awareness at a per-contingency level. This approach has two advantages (1) information can be analysed about responses to a particular stimulus when participants were aware of the CS-UCS pairing and when they were not; and (2) when participants were aware of some pairings but not others information can be analysed about the relative difference in their responses. The advent of complex statistical procedures such as structural equation modelling (see Hoyle, 1995) makes this form of analysis possible. Indeed, when Field and Moore (2001) used such a technique they found that contingency awareness was not a moderating factor in responses to stimuli, but that attention and association (i.e. paired presentations versus BSB control) were (Field, 2001).

Theoretical Considerations

Leaving methodological reservations aside and taking Fulcher and Hammerl's work at face value, the theoretical implications of their findings are important—but not fully explored. They correctly note the similarity between the paradigm in Experiment 3 and the affective priming paradigm and conclude that "evaluative learning and affective priming may result from common learning mechanisms". What's important here is that some clear distinctions are made between the two processes at procedural and mechanistic levels. At a procedural level there are two main distinctions between affective priming and EC: (1) in affective priming responses are measured 'on-line' whereas in EC responses are measured off-line; and (2) in affective priming the affective stimulus appears before the other stimulus. Fulcher and Hammerl, based on Fulcher's (2000) study, claim there are no differences between on-line and off-line ratings. If so, then the main procedural distinction is the order of stimuli; the priming paradigm (and Fulcher and Hammerl's Experiment 3) represents backwards

conditioning. In the autonomic literature backwards conditioning is typically very hard to establish unless the UCSs are very extreme (see Davey, 1989; Mackintosh, 1983 for reviews) and does not tie in comfortably with expectancy models of conditioning in which the predictability of the UCS is fundamental (e.g. Rescorla & Wagner, 1972). If Fulcher and Hammerl's Experiment 3 represent backwards conditioning then it is unusual and may support the proposition that EC is distinct from Pavlovian learning; however, if the experiment is an example of affective priming then demonstrating conditioning without contingency awareness ceases to be theoretically interesting (because different processes are being compared—it is like comparing apples with pears). If, as Fulcher and Hammerl suggest, affective priming and EC are part and parcel of the same process then presumably researchers will need to explain (at a mechanistic level) several conflicting results: First, why, in previous research, have forward pairings produced strong learning effects (Baeyens, Eelen & van den Bergh, 1990; Hammerl, Bloch & Silverthorne, 1997; Fulcher & Cocks, 1997; Todrank, Byrnes, Wrzesniewski, & Rozin, 1995; Martin & Levey, 1987; Levey & Martin, 1987, 1975), yet are now found to produce weaker learning, no learning or contrast effects (Fulcher and Hammerl, this issue; Fulcher, 2000)? Second, why do backward pairings produce learning comparable to (Todrank, et al., 1995; Krosnick, Betz, Jussim & Lynn, 1992; Stuart, Shimp & Engle, 1987; Martin & Levey, 1978) or stronger than (Fulcher, 2000) forward pairings yet on other occasions produces no such effects (Hammerl & Grabitz, 1993)?

Finally, if EC were an example of associative learning that occurs without conscious awareness of CS-UCS contingencies then what can be said about the underlying mechanisms? Lovibond and Shanks (in press) recently review existing models of Pavlovian learning and make a distinction between single process and dual process models. In essence a single process model is one in which propositional learning

causes contingency awareness which in turn causes the conditioned response. The dual process model is one in which propositional learning causes contingency awareness, but some non-propositional system causes conditioned responding (so contingency awareness need not correlate with learning). If EC were convincingly shown to occur without awareness then, according to Lovibond and Shanks, this implies a dual process model (although as Field & Moore, 2001, point out an absence of awareness does not necessarily rule out the single process model because other factors may drive both awareness and learning). This being so, then EC is a nonpropositional learning process. As early as 1955 Razran proposed a levels-of-learning approach which at the lowest level consists of non-associative learning. Later theorists such as Davey (1983), suggest that lower level reflexive stimulus-response (S-R) associations may be formed when the response is relatively salient and is enough "to overshadow other internal or external stimulation which is contiguous with the CS." Davey suggests such learning should occur when participants can easily discriminate their reactions to stimuli. Responses to noxious tastes (e.g. Baeyens et al., 1988), odors (Stevenson, Boakes & Wilson, 2000; Todrank et al., 1995), touch (Fulcher & Hammerl, this issue; Hammerl & Grabitz, 2000) and extreme visual material (Field, 2001; Field & Moore, 2001) may well be salient, and if so, would not require contingency awareness because S-R associations rather than CS-UCS associations are the driving force behind learnt responses.

For Every Action there is an Equal and Opposite Reaction

Fulcher and Hammerl conclude that: "implicit evaluative learning is not an experimental artifact but is a robust effect". However, the real issue is probably whether implicit evaluative learning is associative and if so what associations are formed (S-R or S-S)? EC research has sadly lacked the theoretical insights necessary to move us forward.

Even with just the issue of contingency awareness, there is evidence that contingency awareness facilitates conditioning (see Field, 2000a; Field & Davey, 1998 for reviews) does not impede learning (e.g. Field, 2001; Field & Moore, 2001; Baeyens et al., 1990; Hammerl et al., 1997; Fulcher & Cocks, 1997; Todrank et al., 1995; Martin & Levey, 1987; Levey & Martin, 1987, 1975), and does impede learning (Fulcher & Hammerl, this issue; Hammerl & Grabitz, 2000; Fulcher, 2000). There is also evidence that EC can occur without awareness (e.g. Fulcher & Hammerl, this issue; Field & Moore, 2001, Experiments 1 and 3; Baeyens et al., 1990) and that EC cannot occur without awareness (Field & Moore, 2001, Experiment 2; and see Field 2000a, Field & Davey, 1998 for reviews). It is imperative that researchers seek to discover why these inconsistent results keep occurring and future research needs to try to do three things: (1) employ inferential techniques that enable firm conclusions about the types of associations formed during EC; (2) achieve some standardization in methodologies; and (3) look at contingency awareness in a more dynamic way by exploring other factors that may drive both awareness and learning (Field & Moore, 2001). Only then can we begin to build theoretical models to explain the diversity of effects found within this intriguing phenomenon.

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