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Kristy R R Lescelles, Andy Field, Graham C L Davey

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USING FOODS AS CSs AND BODY SHAPES AS UCSs: A PUTATIVE ROLE FOR ASSOCIATIVE LEARNING IN THE DEVELOPMENT OF EATING DISORDERS

By

Kristy R. R. Lascelles, Andy P. Field & Graham C.L. Davey

Professor Graham C. L. Davey
Psychology Group
School of Cognitive and Computing Science
University of Sussex
Falmer
Brighton
BN1 9QH
UK

Tel: +44 (0)1273 678485
Fax +44 (0)1273 681100
Email grahamda@cogs.susx.ac.uk

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AUTHOR FOOTNOTE

Correspondence concerning this article should be addressed to Graham C. L. Davey, Psychology Group, School of Cognitive and Computing Sciences, University of Sussex, Falmer, Brighton, East Sussex, BN1 9QH. Electronic mail may be sent to grahamda@cogs.susx.ac.uk.

ABSTRACT

The present paper reports the results of two experiments exploring possible changes in the affective ratings of foodstuffs as a result of their pairing with pictures of differing types of female body shapes. Experiment 1 reports the results of a visual evaluative conditioning (EC) experiment in which pictures of food stuffs (CSs) were paired with pictures of either obese, normal or thin female body shapes (UCSs). The results suggested that selective EC effects could be obtained when pictures of foods were used as CSs and pictures of different body shapes as UCSs. Specifically, pairing obese body shape UCSs with food CSs resulted in a significant post-conditioning negative evaluative shift in those foods. Experiment 2 suggested that the selective conditioning effects found in Experiment 1 could be explained in part by an *a priori* CS-UCS expectancy bias in which participants exhibited a significantly greater bias towards expecting food CSs to be paired with obese rather than thin body shape UCSs. These findings have implications for our understanding of eating disorders, and, in particular, how conditioned shifts in the affective valences of foodstuffs can occur through their pairing with particular types of negatively valenced body images.

Evaluative conditioning (EC) is considered to be a form of classical conditioning in which affect can be transferred from one valenced stimulus (the unconditioned stimulus, UCS) to a non-valenced stimulus (the conditioned stimulus, CS) by contiguously pairing the two stimuli. Usually, an affectively neutral stimulus (the CS) is paired with either a liked or disliked stimulus (the UCS), resulting in the CS acquiring the same valence as the UCS with which it was paired (Levey and Martin, 1975; Baeyens, Eelen & Van den Bergh, 1990a; Davey, 1994a; and De Houwer, Thomas & Baeyens, 2001, for a recent review). In the frequently used visual paradigm (picture-picture conditioning), participants rate pictures (e.g. pictures of human faces) on a scale ranging from -100 (disliked) through 0 (neutral) to +100 (liked). Neutrally rated pictures are then selected as the CSs that are paired either with liked pictures or disliked pictures (UCSs). After several pairings of CS pictures with UCS pictures many studies report that the affective rating of the CS shifts in the direction of the affective value of the UCS with which it was paired (e.g. Martin & Levey, 1985, 1987; Baeyens et al., 1990a; De Houwer, Baeyens, Vansteenwegen & Eelen, 2000). Evaluative conditioning of this kind has also been reported using flavour-gustatory (e.g. Baeyens, Eelen, van den Bergh & Crombez, 1990b; Baeyens, Crombez, Hendrickx & Eelen, 1995a; Zellner, Rozin, Aron & Kulish; Stevenson, Boakes & Wilson, 2000), olfactory (van Reekum, van den Berg, & Frijda, 1999; Todrank, Byrnes, Wrzesniewski, & Rozin, 1995; Baeyens, Wrzesniewski, De Houwer, & Eelen, 1996); and haptic (Hammerl & Grabitz, 2000; Fulcher & Hammerl, 2001) stimuli.

Evaluative conditioning has frequently been cited as an important mechanism by which individuals acquire their affective likes and dislikes (Rozin & Fallon, 1987;

Baeyens, Eelen & Crombez, 1995b; Rozin, Wrzesnieski & Byrne, 1998), and may even be an important process by which some individuals acquire inappropriate or pathological emotional responses to stimuli or events (Merckelbach, de Jong, Arntz, & Schouten, 1993).

For example, many theories of specific fears and phobias allude to associative conditioning as being a significant process through which individuals acquire fear of previously neutral stimuli or events (Davey, 1992a, 1997). Evidence suggests that fears such as dog phobia, accident phobia, and dental phobia primarily result from the phobic having experienced a pairing of their phobic stimulus (CS) with a traumatic consequence (UCS) (di Nardo, Guzy & Bak, 1988; Doogan & Thomas, 1993; Kuch, 1997; Kuch, Cox, Evans & Shulman, 1994; Davey, 1988). In addition, there is a significant literature on the laboratory conditioning of fear, indicating that fear can be readily transferred to a previously neutral stimulus (CS) through contiguous pairing with a traumatic fear-evoking UCS such as a loud noise or a mild electric shock (e.g. Davey, 1992b; Dawson & Schell, 1987). As well as classical conditioning processes facilitating the transfer of the fear response from one stimulus to another, there is also evidence that classical conditioning processes are also involved in the transfer of the disgust emotion from a disgust-evoking UCS to a previously neutral CS. For example, Schienle, Stark & Vaitl (2000) found that when neutrally-rated pictures were paired with pictures depicting disgusting scenes, some sub-groups of participants subsequently exhibited components of the facial disgust response to the previously neutral CSs. Although these conditioning effects were limited, female participants who had been identified as mildly blood phobic developed the typical disgust face with the retraction of the upper lip while viewing CSs paired with the disgusting UCS.

The present study attempts to expand our knowledge of the ways in which classical conditioning might be involved in the transfer of affective value across

psychopathologies, and specifically investigates whether conditioned shifts in the affective valences of foodstuffs can be effected through their pairing with particular types of body shapes. In particular, the experiments described in this paper investigate the putative role of EC processes in changing affective ratings of foodstuffs in female participants as a result of pairing them with different body shapes (thin, normal and obese). Normal female development involves weight gain during adolescence, and in many cultures young females strive to achieve an 'ideal of thinness' which bestows more obese body shapes with negative affect generally, and may drive individuals to avoid perceived obesity through dieting, starvation, or bingeing and purging (Simmons & Blyth, 1987; Thelen, Powell, Lawrence & Kuhnert, 1992; Nevenon & Broberg, 2000). Virtually all current conceptualisations of eating disorders make reference to body dissatisfaction as an important factor in the aetiology and maintenance of the disorder (see Polivy & Herman, 2002), and negative evaluations of body shapes which are perceived as being even marginally overweight have been shown to be acquired through a variety of processes, including exposure to idealized thin media images (Russell, 1992), peer pressure and maternal influence (Stice, 1998; Levine, Smolak, Moodey, Shuman & Hessen, 1994), teasing (Lunner, Werthem, Thompson, Paxton, McDonald & Halvaarson, 2000), and the judgment-biasing effects of negative or depressed mood (Kulbartz-Klatt, Florin & Pook, 1999). Given that perceptions of one's own or others body shapes can acquire negative affect through such a variety of sources, it is then quite possible that this negative perception of certain body shapes might become associated with either food or the eating of food, and consequently lead to negative perceptions of food.

A plausible mechanism that may relate disliked body shapes to food rejection is classical conditioning, and in particular, EC, in which food may become associated with weight gain and distorted body image (Cooper & Fairburn, 1992; Dritschel,

Williams & Cooper, 1991). Self-schemas relating negative evaluations of shape, weight and eating are more commonly found in individuals suffering eating disorders than in those without such disorders (Nauta, Hospers, Jansen & Kok, 2000), suggesting that individuals suffering such disorders as anorexia nervosa (AN) or bulimia nervosa (BN) may have a predisposition to associate food and body shape. If EC processes become involved, then this schematic organisation of food with eating and body shape will facilitate the transfer of affective valence and negative attitudes to food.

This evidence indicates that eating disorder symptoms might be precipitated in two steps: (1) perceived non-idealized body shapes may acquire negative valency through a variety of social, familial or cognitive processes, and (2) these disliked body shapes transfer their negative valency to foods through a form of associative learning.

The present paper reports the results of two studies exploring whether such an associative learning account is plausible. Experiment 1 reports the results of a visual EC experiment in which pictures of food stuffs (CSs) were paired with pictures of either obese, normal or thin female body shapes (UCSs). Experiment 2 uses a simulated 'thought' conditioning procedure to investigate whether pre-existing *a priori* UCS expectancies (Davey, 1992b, 1995) mediate any differences in conditioning effects found in Experiment 1. The results are then discussed in relation to both the aetiology of eating disorders and the associative learning mechanisms involved.

EXPERIMENT 1

Experiment 1, in line with an exploratory pilot study conducted to reveal any potential methodological or technical limitations, uses a picture-picture evaluative conditioning paradigm to condition food pictures (CSs) with pictures of obese, normal and thin female body shapes (UCSs). The pilot study found that females rated food

CSs paired with obese body shape UCSs as more disliked following conditioning. However, the food CSs paired with the thin body shape UCSs showed comparatively little change following conditioning. A nearly significant overall conditioning effect was obtained ($F(2,64) = 3.07, p = .053$). Moreover, further statistical analyses determined that evaluative ratings from pre-conditioning to post-conditioning in CSs paired with obese UCSs compared to normal UCSs showed a significant change ($F(1,32) = 6.57, p < .05, r = 0.41$), whereas no such change was found when comparing obese UCSs with thin UCSs ($F(1,32) = 2.36, n.s., r = 0.26$) and thin UCSs with normal UCSs ($F(1,32) < 1, r = 0.12$). These results indicated some tentative evidence for learning in that CSs paired with obese UCSs became relatively disliked (compared to those paired with normal UCSs) after conditioning.

To ensure that any results can be attributed to associative learning, the present picture-picture procedure differs from that used in the pilot study and more traditional picture-picture EC paradigms (e.g. Baeyens et al., 1990a). Field & Davey (1999) have demonstrated that the traditional picture-picture EC paradigm has two problematic features. First, the traditional paradigm allows participants to effectively select their own CS-UCS pairings as a consequence of the pre-conditioning stimulus rating procedure. That is, after initial ratings of all available stimuli, stimuli rated by the individual participant at the extremes (liked and disliked) of the rating scale are chosen as UCSs and those rated close to neutral are used as the CSs. This effectively prevents the experimenter from adopting a truly counterbalanced design in which all potential CSs are paired with all potential UCSs across participants. It has been argued that true conditioning effects can only be isolated if the pairing of a particular CS with a particular UCS is counterbalanced across participants. If this criterion is not met, then it is possible that any conditioning-like effects could be due to nonassociative factors arising from the paradigm or the biased stimulus-selection

procedure (Shanks & Dickinson, 1990; Field & Davey, 1999). Secondly, Field & Davey (1998) have suggested that to demonstrate that EC effects are the result of specific CS-UCS associations rather than the result of biases in the way that stimuli are selected, a necessary control condition must be used. They suggest a block-sub-block control (Field, 1996) in which CSs and UCSs are presented the same number of times as in the relevant experimental condition, but are never explicitly paired together. It is important to show that conditioning effects are absent in such a condition because conditioning-like effects can be found, even in procedures in which the CS and UCS had never explicitly been paired (Field & Davey, 1999). As such, conditioning effects found in traditional picture-picture EC procedures could probably be ascribed to the pre-conditioning stimulus-selection procedure rather than the explicit CS-UCS pairing operation. To be sure that EC effects are the clear result of associative learning processes, Field & Davey (1999) advised that all future EC studies should adopt a fully counterbalanced design in which stimulus selection processes could be effectively eliminated, and that a BSB control condition be employed.

Thus, Experiment 1 investigates further whether pairing a picture of food with an obese female body shape will influence the affective rating of that food in female participants, as suggested by the pilot study. To ensure that any effects can be attributed to associative learning, the procedure uses a fully counterbalanced stimulus-selection design, and, in contrast to the pilot study, also compares EC effects in a group receiving CS-UCS pairings with such effects in a group receiving nonpaired presentations of CSs and UCSs (a BSB control condition). Other procedural issues were also highlighted by the pilot study and corresponding adjustments are made in Experiment 1. In the pilot study the female body shape pictures were not altered in any way, so they appeared in the pilot study on the same background as they were placed in the media source from which they were taken. All the female body shape

UCSs in Experiment 1 are instead placed on a white background and their faces are covered by a white rectangle to prevent any potential confounding effects of background and facial expression on participants' evaluative ratings of them; this should also increase the likelihood that evaluative ratings are based on the body shape. In addition, Experiment 1 uses a larger range of possible UCSs from which the most obese, normal and thin UCSs can be selected by a number of female participants not taking part in the main experiment. In comparison to the pilot study, in which the experimenter selected the UCSs, this selection procedure is designed as a more objective measure of selecting perceptually obese, normal and thin body shapes. As an extra measure, also not used in the pilot study, obesity ratings from each participant are recorded at the end of the experiment to ensure that the participants did actually perceive the body shape UCSs as obese, normal and thin. Other features of the pilot study, in particular the presentation times and number of CSs and UCSs, are maintained in Experiment 1 as the pilot study indicated that these parameters were suitable for obtaining conditioning effects.

Method

Participants

One hundred and four female participants completed the experiment. The participants had not taken part in the pilot study, or any other experiments of a similar nature. The participants were sampled from a non-clinical population, in which the proportion of participants who may have suffered from any form of eating disorder was extremely unlikely to have been large enough to have had any significant bearing on the results obtained. Sixty-six participants were assigned to the experimental condition and thirty-eight to Field's (1996) block-sub-block (BSB) unpaired control condition. The age of the participants ranged from 17 to 50 with a mean of 23.82 (SD

= 6.12). Of the 104 participants, 38.46% completed the experiment for no payment and 61.54% completed the experiment for a £5 payment.

Stimuli

The UCSs used in the main experiment were different to those used in the pilot study: a more thorough selection process that aimed to increase the likelihood of participants perceiving the body shapes as obese, normal and thin was employed in the main experiment. The UCSs were 15 pictures of naked or semi-naked women on a white background. These pictures were selected from a range of media sources such as the Internet and magazines, in order to enhance ecological validity. However, females to which participants may have had prior exposure, such as famous females or females from advertisements were not used. Nude, or nearly nude pictures were selected to maximise visibility of the body shape so that the degree of thinness or obesity was not ambiguous. The faces of the women were covered by a white rectangle to prevent confounding effects of facial expressions on evaluative ratings. The effects from extraneous variables such as the age of the females in the pictures and their posture were minimised by ensuring the pictures were all of young females and that the postures tended to be front facing. Other variables such as ethnicity and hair colour were varied. From these 15 pictures of women, 10 females, who did not participate in either the pilot or the main experiment, were each asked to select the 3 women they thought were the most obese, the 3 women they thought were the thinnest¹ and the 3 women they thought had the most normal body-shapes. The most frequently selected

¹ It should be noted that this selection process resulted in the chosen thin body shapes being recognisably anorexic and quite unlike the idealised slim physiques portrayed normally in Western magazines. Hence, participants evaluated these thin body shapes as negative rather than positive.

pictures in each category were then used as the obese UCSs, normal UCSs and thin UCSs in the main experiment.

The experiment also used 9 food CSs (stir-fry, salad, chocolate cake, ice cream, bread and jam, prawn noodles, pork chop, fry-up, and pizza) also selected from various media sources such as the Internet, magazines and cookery books, again to maximise ecological validity. These pictures were selected to provide a range of different food types, often eaten in Western society. To reduce potential disgust responses, none of the foods in the pictures had been partially eaten and the food was presented on plates, as though it was about to be served. No pre-experimental selection procedure was employed, although the pictures were selected so that the food type was clear and was generally photographed from above looking down at the food.

Apparatus

The experiment was conducted using specifically adapted software: *Ectests version 1.2* (Lascelles, Stevens, Field, Matthias, Siddens-Corby & Ives, 1999) on a Viglen Genie P3500 PC with a 17" monitor.

Design

Each participant was assigned to a condition containing 6 CS-UCS presentation pairs (6 of the 9 food CSs, and 2 of the 3 obese, 2 of the 3 normal and 2 of the 3 thin UCSs). The pairings were fully counterbalanced such that all CSs were paired with all UCSs across participants. This ensured that any effects could be attributed to the pairing of CSs with UCSs, rather than any nonassociative effect of the stimuli themselves, or any imbalances in the frequency of CS-UCS pairings across participants (see Field & Davey, 1999; Shanks & Dickinson, 1990). Participants were randomly assigned to either the experimental condition or the BSB control condition.

Procedure

Participants were initially told that all instructions would be presented to them on the computer and that they should follow these instructions through until the computer explicitly stated that the experiment had finished.

Stage 1: Baseline Assessment (pre-conditioning)

This stage was identical to that described for the pilot study.

Stage 2: Acquisition

Once the participants had rated all the CSs and UCSs, they were instructed that they would be presented with some pictures, and that they would not be expected to do anything during this stage of the experiment except watch the pictures carefully and think about how they made them feel.

Experimental group: As in the pilot study, each of the CS-UCS pairs was presented in random order with the restriction that the same pair could not be shown more than twice in a row. Each pair was presented 3 times. Each CS was presented for 7000ms followed by an ISI of 200ms, and the corresponding UCS was then presented for 7000ms followed by an ITI of 8000ms.

BSB Control Group: In Field's (1996) BSB control procedure CS-UCS pairs were assigned as in the experimental condition, however, during the acquisition phase the CSs and UCSs were not presented in pairs. Each CS was presented first, but was not followed by the UCS. Instead, the CS was followed by another presentation of that CS. These CS-CS self-pairings were repeatedly presented until the total number of presentations of that CS was the same as the total number of presentations as in the experimental group. So, if there were 10 CS-UCS pairings in the experimental condition then there would need to be 5 CS-CS (and 5 UCS-UCS) self-pairings in the BSB control condition so that the CS (and UCS) would be shown a total of 10 times. The stimulus presentation time, ISI and ITI remained the same as in the experimental

condition. Once all the CS-CS self-pairings of one CS had been presented then the CS-CS self-pairings for the next CS were presented and so on until all the CS-CS self-pairings had been presented. Then UCS-UCS self-pairings for all the UCS were presented in the same way. So each sub-block of CS-CS self-pairings was presented in random order in a block before each sub-block of UCS-UCS self-pairings was presented in random order in a second block for half the participants. For the other half of participants, each sub-block of UCS-UCS self-pairings was presented in random order in a block before each sub-block of CS-CS self-pairings was presented in random order in a second block. This prevented any associations being made between the CSs and UCSs and therefore controlled for 1-trial conditioning which could occur in previously used control procedures such as a random control procedure (where CS-UCS presentations are randomised).

Because in the present experiment the number of presentations used in the experimental condition was odd (3) the total number of presentations for each stimulus in the BSB control condition would not match the total number of presentations in the experimental group. So, the parameters for the BSB control group changed so that the total amount of time that each stimulus was presented for in the BSB control condition was the same as the total amount of time that the stimulus had been shown for in the experimental condition. Each of the CS-CS and UCS-UCS self-pairings were presented twice. Previous studies in the authors' laboratory suggest that this difference in number of trials between the experimental condition and BSB control condition has no significant effects on EC. Each stimulus was presented for 10500ms followed by an ISI of 300ms, then a presentation of that stimulus for another 10500ms followed by an ITI of 12000ms.

Stage 3: Post Acquisition Assessment (post-conditioning)

Each of the CSs and UCSs were presented in random order. Participants rated each of the pictures in exactly the same way as in the baseline-rating phase.

Stage 4: Measure of contingency awareness

Because previous research has indicated that EC can occur in the absence of conscious awareness of the contingencies (Baeyens et al., 1990a; Purkis & Lipp, 2001; Field & Moore, 2001), post-conditioning measures of contingency awareness were taken.

Strong Measure: The participants were presented with each of the CSs randomly in turn on the left hand side of the computer screen. On the right hand side of the computer screen were all 6 UCSs. The participant was required to “click” on the UCS they thought had been paired with the particular CS during the conditioning phase. For each CS, the UCSs were presented in different positions to prevent position effects. Once the participant had indicated which UCS they thought the CS had been paired with, they were required to indicate whether they were “completely sure”, “rather sure”, “rather unsure” or “completely unsure” about their decision before continuing to the next CS. This method was repeated six times, once for each of the six different CSs.

Weak Measure: The participants were again presented with each of the CSs randomly in turn, but this time they were required to indicate whether they thought the CS had been paired with a “liked”, “disliked” or “neutral” UCS in the conditioning phase. Once the participant had indicated the valence of the UCS they thought the CS had been paired with they were again required to indicate whether they were “completely sure”, “rather sure”, “rather unsure” or “completely unsure” about their decision before

continuing to the next CS. This method was repeated six times, once for each of the six CSs.

Stage 5: Obesity Measures

In a final phase participants were given a colour A4 printout of each of the UCS pictures. A booklet containing a 200-point scale for each picture was used to record the ratings. The scale ranged from -100 "very thin indeed" through 0 neutral through to +100 "very obese indeed". This was used to ensure that participants perceived the UCS types as obese, normal and thin. Participants were required to indicate their rating for each picture by marking a cross on the scale and writing the number this cross represented (e.g. -55) beneath each scale.

Results

UCS Obesity Ratings and Data Exclusion

Mean obesity ratings were calculated for each of the 9 UCSs. These showed that all 3 obese UCSs were rated as more obese than the normal and thin UCSs in the experimental condition ($M = 66.97$, $SE = 3.09$) and in the BSB control condition ($M = 76.04$, $SE = 3.19$). All 3 normal UCSs were rated as more neutral than the obese and thin UCSs in the experimental condition ($M = -7.28$, $SE = 2.62$) and in the BSB control condition ($M = -8.20$, $SE = 2.89$). However, despite that the 3 thin UCSs had been selected as the 3 thinnest women from the original 15 pictures, 1 of the 3 thin UCSs was not rated as more thin than the obese and normal UCSs (Mean = -26.65). For this reason, data for this UCS was excluded from further analysis and all future data is taken from the 2 remaining thin UCSs. These were rated as thinner than the obese and normal UCSs in the experimental condition ($M = -85.42$, $SE = 3.99$) and in the BSB control condition ($M = -90.68$, $SE = 3.64$). A two-way 3 (UCS type: obese, normal, thin) x 2 (Condition: experimental condition vs. BSB control condition) mixed ANOVA was conducted on the obesity ratings. Greenhouse-Geisser corrected

estimates are reported for the main effect of UCS type because this was found to violate the sphericity assumption ($\underline{W} = 0.90$, $\chi^2(2) = 9.94$, $p < .01$). A significant main effect of UCS type ($F(1.81, 172.68) = 1222.36$, $p < .001$) was obtained. Bonferroni contrasts revealed a significant difference between the obese and normal UCS obesity ratings ($t(96) = 25.73$, $p < .001$, $CI_{.95} = 72.04$ (lower), 84.08 (upper)), a significant difference between obese and thin UCS obesity ratings ($t(96) = 43.45$, $p < .001$, $CI_{.95} = 150.64$ (lower), 165.06 (upper)), and a significant difference between normal and thin UCS obesity ratings ($t(96) = 29.00$, $p < .001$, $CI_{.95} = 74.33$ (lower), 85.26 (upper)). No other significant main effects or interactions were obtained. This showed that there were significant differences in obesity ratings for the obese, normal and thin UCSs and that these differences were consistent across the experimental and BSB control conditions. Chronbach's alphas were calculated for the 3 obese body shape UCSs ($\alpha = 0.73$), the 3 normal body shape UCSs ($\alpha = 0.76$) and the 2 thin body shape UCSs ($\alpha = 0.69$) were large, further validating the consistency of obesity ratings within each UCS body shape type.

UCS Evaluative Ratings

Pre-conditioning mean evaluative ratings of the UCS showed that the obese UCSs were rated as disliked in the experimental condition ($\underline{M} = -53.71$, $\underline{SE} = 3.92$) and the BSB control condition ($\underline{M} = -70.26$, $\underline{SE} = 4.29$). The thin UCSs were also rated as disliked in the experimental condition ($\underline{M} = -73.03$, $\underline{SE} = 2.84$) and the BSB control condition ($\underline{M} = -77.96$, $\underline{SE} = 4.00$). The normal UCSs were rated as neutral in the experimental condition ($\underline{M} = 12.05$, $\underline{SE} = 2.99$) and the BSB control condition ($\underline{M} = 20.13$, $\underline{SE} = 5.76$). A two-way 3(UCS type: obese, thin, normal) \times 2(Condition: experimental condition, BSB control condition) ANOVA on the UCS ratings revealed a significant main effect of UCS type ($F(2, 204) = 363.45$, $p < .001$). Planned contrasts showed that the thin UCSs were significantly more disliked than the obese UCSs

($F(1,102) = 15.38, p < .001$) and that both the obese and thin UCSs were significantly more disliked than the normal UCSs ($F(1,102) = 637.94, p < .001$). A significant interaction of UCS type and condition was also obtained ($F(2,204) = 5.65, p < .005$). Planned contrasts were conducted to break down this interaction (see Field, 2000a, chapter 9). In the first contrast ratings of the thin and obese UCSs were compared to ratings of the normal UCSs in the experimental group relative to the BSB control. There was no significant difference ($F(1,102) = 2.85, ns$). This indicates that the degree to which normal UCSs were rated as more positive (relative to the obese and thin UCSs) was the same in both experimental and control groups. The second contrast broke apart the thin and obese UCSs by looking at the difference in ratings between these two UCS types in the experimental group and comparing this to the difference in BSB control. This contrast was significant ($F(1,102) = 7.86, p < .01$). This reflects the fact that in the BSB control the ratings of obese and thin UCSs were fairly similar (difference = 7.70) but in the control group obese UCSs were rated relatively more positive than thin ones (difference = 19.32). If anything, the relatively more positive ratings of obese UCSs in the experimental condition means that conditioning effects to this type of UCS should be reduced. No main effect of Condition was obtained.

CS Evaluative Ratings

Throughout this paper effect sizes (expressed as Pearson's r) are reported for tests with degrees of freedom of 1. This is because tests with degrees of freedom greater than 1 do not allow clear interpretation of what the effect size represents (see Rosenthal, 1991) and r is probably the most commonly used and easily understood measure (see Field, 2001a). All effect sizes are evaluated against Cohen's (1988) criteria of 0.1 (small effect), 0.3 (medium effect) and 0.5 (large effect) for r .

Figure 1 shows the mean pre-conditioning and post-conditioning ratings for the CS food pictures paired with obese, normal and thin UCSs for the experimental and BSB control conditions. In the experimental condition, ratings of CSs paired with obese UCSs became more disliked from pre-conditioning ($M = 28.67$, $SE = 4.70$) to post-conditioning ($M = 23.30$, $SE = 4.77$) measures. The ratings of CSs paired with normal UCSs showed little change from pre-conditioning ($M = 23.75$, $SE = 4.38$) to post-conditioning ($M = 24.02$, $SE = 4.46$). The ratings of CSs paired with thin UCSs also showed little change from pre-conditioning ($M = 16.78$, $SE = 5.12$) to post-conditioning ($M = 16.02$, $SE = 4.73$). For the BSB control condition, there was little difference between pre-conditioning ratings for the CSs paired with the obese UCSs ($M = 27.57$, $SE = 6.01$) and post-conditioning ratings ($M = 32.50$, $SE = 6.09$), pre-conditioning ratings for the CSs paired with the normal UCSs ($M = 28.42$, $SE = 5.99$) and post-conditioning ratings ($M = 25.39$, $SE = 5.64$), or pre-conditioning ratings for the CSs paired with the thin UCSs ($M = 34.01$, $SE = 6.98$) and post-conditioning ratings ($M = 28.49$, $SE = 7.09$).

A three-way 3 (UCS type: obese, thin, normal) \times 2 (Time: pre- vs. post-conditioning) \times 2 (Condition: experimental condition vs BSB control) ANOVA was conducted on the CS ratings. Greenhouse-Geisser corrected estimates are reported for the main effect of UCS type ($\underline{W} = 0.91$, $\chi^2(2) = 9.24$, $p < .01$) and the UCS type \times time interaction ($\underline{W} = 0.87$, $\chi^2(2) = 13.66$, $p < .001$) as these were found to violate the sphericity assumption. A significant interaction of UCS type, time and condition ($F(1.76, 181.10) = 3.24$, $p < .05$) was obtained. Planned contrasts were used to break down this interaction (see Field, 2000a, chapter 9). The first contrast looked at the change in CS ratings across conditioning for CSs paired with obese UCSs compared to those paired with thin and normal UCSs in the experimental group relative to the same changes in the BSB control. This contrast was significant ($F(1, 102) = 5.25$, $p < .05$). This

represents a small to medium effect size ($r = 0.22$). The second contrast then separated the thin and normal UCSs by looking at the change in CS ratings across conditioning for thin UCSs compared to normal UCSs in the experimental group relative to the same changes in the BSB control. This contrast was not significant ($F(1,102) < 1$) and produced an effect size close to zero ($r = 0.02$). This indicates a conditioning effect in the experimental group relative to the BSB control, for CSs paired with obese UCSs compared to those paired with thin or normal UCSs. For the experimental condition, the CSs paired with obese UCSs became rated as significantly more disliked following conditioning, the CSs paired with normal UCSs did not show any significant change, and the CSs paired with the thin UCSs also showed no significant change. This was despite the fact that the thin UCSs were rated as significantly more disliked than the obese UCSs. These findings do not simply reflect an effect mediated by differences in ratings of the UCSs across the experimental and control conditions (see above) because the changes in CS ratings over time in the experimental and BSB control conditions were in different directions to the UCS ratings. No other significant main effects or interactions were obtained.

The mean overall ratings for the CSs paired with the thin UCSs in the experimental group were lower than that for the CSs paired with the obese and normal UCSs. This anomaly could, at first glance, explain why no conditioning was obtained for the CSs paired with the thin UCSs. It could also reflect a problem with the counterbalancing. However, the fact that no significant main effect of UCS type ($F(1.84, 187.60) < 1$) was obtained demonstrates that there was no significant difference between the ratings of CSs paired with thin UCSs compared to CSs paired with obese and normal UCSs so this difference is unlikely to explain the lack of conditioning for CSs paired with thin UCSs. Further, a 3 (UCS type: obese, thin, normal) \times 2 (Time: pre-conditioning vs. post-conditioning) \times 2 (Condition: experimental condition vs. BSB

control condition) \times 32 (Counterbalanced condition) ANOVA on the CS ratings revealed no significant interaction of UCS type \times Time \times Condition \times Counterbalanced condition ($F(40, 53, 92.10) = 1.25, ns$) demonstrating that there were no rating anomalies resulting from the counterbalancing procedure.

Data from 10 independent females who rated the perceived fat content for each of the food CSs on a scale ranging from 1 (no fat content) to 10 (extremely high fat content) was used to assess whether foods with different perceived fat content showed differential conditioning. A 3(UCS type: obese, normal, thin) \times 2(Condition: experimental, BSB control) between subjects ANOVA was conducted on the index of evaluative change (post-conditioning evaluative ratings – pre-conditioning evaluative ratings) and effect sizes were calculated for the conditioning interaction UCS type \times condition for each of the 9 food CSs. The food CSs with lower perceived fat content (stir-fry, $M = 3.79, SE = 0.38$; salad, $M = 1.93, SE = 0.79$; bread and jam, $M = 4.64, SE = 0.46$), showed comparable conditioning effect sizes (range: $\eta^2 = 0.003$ to $\eta^2 = 0.165$) to the food CSs with higher perceived fat content (chocolate cake, $M = 8.21, SE = 0.42$; ice cream, $M = 7.57, SE = 0.44$; prawn noodles, $M = 5.14, SE = 0.43$; pork chop, $M = 6.21, SE = 0.35$; fry-up, $M = 9.64, SE = 0.23$; pizza, $M = 7.36, SE = 0.62$), conditioning effect sizes (range: $\eta^2 = 0.009$ to $\eta^2 = 0.171$), indicating that the overall conditioning effect was influenced uniformly by high and low perceived fat content food CSs

Awareness Measures

For the strong awareness test each participant scored a point for each UCS they correctly identified as having been paired with each CS during the acquisition phase. For the weak awareness test the participant scored a point if they correctly identified

the valence of the UCS that each CS had been paired with during the acquisition phase. The total number of correct responses given by each participant was calculated for both the strong awareness test (out of a possible score of 6) and the weak awareness test (out of a possible score of 6). As in Field and Moore (2001) the most frequent scores found for participants in the BSB control condition were used as thresholds of contingency awareness for the experimental condition because participants in the BSB control condition could not logically be aware of the CS-UCS contingencies. The most frequent score for participants in the BSB control condition on the strong awareness test was 1 and the most frequent score for participants in the BSB control condition on the weak awareness test was 3. Participants in the experimental condition were therefore classified as contingency aware in the strong awareness test if they scored above 1 and contingency aware in the weak awareness test if they scored above 3. Significant agreement was obtained on the classification of aware and not aware participants between the strong and weak awareness tests for the experimental condition ($\kappa = 0.85$, $p < .01$). Participants in the experimental condition were classified as aware overall if they (i) were classified as aware in the strong awareness test, or (ii) failing that, were classified as aware in the weak awareness test. The number of aware participants was 37 and there were 29 participants who were not aware. These figures refer just to the 66 participants in the experimental condition as participants in the BSB conditioning could not logically have been aware of any CS-UCS contingencies. Figure 2 shows the mean pre-conditioning and post-conditioning ratings for the CS food pictures paired with obese, normal and thin UCSs for aware and not aware participants.

A three-way 3 (UCS type: obese, thin, normal) \times 2 (Time: pre- vs. post-conditioning) \times 2 (Awareness: aware vs. not aware) ANOVA on the CS ratings for participants in the experimental condition revealed no significant interaction of UCS type, time and

awareness ($E(2, 128) < 1$). This indicates that the same pattern of conditioning was found in both the aware and unaware groups. No other significant main effects or interactions were obtained.

Discussion

The results of Experiment 1 indicate that pairing pictures of obese body shapes (UCSs) with pictures of foods (CSs) produces a significant negative shift in the affective evaluation of those food CSs in female participants. This finding could not be ascribed to any nonassociative artefacts that might have been inherent in the conditioning procedure (see Field & Davey, 1999) because (1) significant conditioning effects were not found when a nonpaired block-sub block (BSB) control condition was used, and (2) the procedure utilised a design which counterbalanced pairings of CSs and UCSs across participants. This counterbalanced design rules out artifactual conditioning-like effects which could have resulted either from CS selection biases resulting from participants choosing their own CSs and UCSs through pre-conditioning rating procedures (Field & Davey, 1998, 1999), or through an imbalance in the types of food CSs paired with the obese body shape UCS. Although measures of conscious awareness of contingencies were taken post-experimentally, there was no conclusive statistical evidence to indicate whether conscious awareness of the contingencies was either a necessary or sufficient condition for EC to occur.

While the specific conditioning effect found in Experiment 1 appears to be a basic example of evaluative conditioning, in that the affective value (disliked) of a UCS is transferred to the CS, it also appears to represent an example of selective association (Seligman, 1970, 1971; Lolordo & Droungas, 1989; Davey, 1995). In particular, food CSs paired with pictures of a thin body shape failed to show any evidence of affective transfer—even though the thin body shape UCSs were rated pre-

experimentally by participants as significantly more disliked than the obese body shapes. Selective associations are characterised by occasions where CSs and UCSs appear to demonstrate some natural “belongingness” through exhibiting more rapid acquisition and greater resistance to extinction (e.g. Seligman, 1970, 1971; McNally, 1987). One of the central factors underlying CS-UCS “belongingness” is semiotic similarity. For example, Hamm, Vaitl & Lang (1989) have demonstrated that angry faces (CSs) become selectively associated with human screams (UCSs) and that this selective association depends on the individual’s judgements about the semantic similarity between cue and consequence. Clearly, if CS and UCS have shared facilitated access to common cognitive schemata, then conditioning is likely to proceed more rapidly and extinction will be retarded—if only because these common cognitive schemata lead the individual to have a higher expectation of the CS and UCS being associated (Davey, 1992b, 1995). In the case of the present experiment, an argument can be made for female participants perceiving a higher level of semiotic similarity between food CSs and obese body shapes rather than between food CSs and thin body shapes—especially if current culture and fashion norms lead females to associate eating food with negatively valenced body images (Cooper & Fairburn, 1992; Dritschel, Williams & Cooper, 1991; Nauta, Hospers, Jansen & Kok, 2000).

Finally, the failure to condition negative affective shifts to food CSs with a thin body shape UCS cannot be because of the thin body shape UCSs’ lack of affective intensity: in pre-experimental ratings participants rated the thin body shape as significantly more negative than the obese body shape, and the latter did act as an effective UCS in conditioning negative affective shifts in CS evaluation. An alternative explanation for the selective conditioning effects reported in Experiment 1 may be found in differential pre-conditioning predispositions to associate the CSs with the respective UCSs. This type of explanation suggests that the failure to condition

negative affective change to food CSs with a thin body shape UCS is not because of its ineffectiveness as a UCS, but because there are pre-existing UCS-expectancies that may contribute to these selective conditioning effects (Davey, 1992b, 1995). This explanation is tested in Experiment 2.

EXPERIMENT 2

Davey (1992b, 1995) has argued that many selective association effects in humans can be explained in terms of a pre-conditioning expectancy bias in which individuals judge aversive or appetitive outcomes to be more likely following cues (CSs) which already have some semiotic or conceptual relationship to the outcome. This CS-UCS expectancy bias leads to faster conditioning and to a resistance to extinction. For example, Davey (1992b) showed that participants begin a classical conditioning procedure with an inflated estimate of the probability of fear-relevant CSs being followed by aversive consequences. In a 'threat' conditioning procedure (in which participants are told they might receive electric shock following some stimuli but in fact receive none), participants began the experiment with a significantly higher expectancy of aversive UCSs following fear-relevant stimuli (in this case, pictures of snakes and spiders) than fear-irrelevant stimuli (pictures of cats and pigeons). This UCS expectancy bias results in greater magnitude skin conductance CRs to CSs with the highest pre-experimental UCS expectancy ratings, and a greater resistance to extinction in CRs elicited by those CSs (Davey, 1992b; Honeybourne, Matchett & Davey, 1993; McNally & Heatherton, 1993; Diamond, Matchett & Davey, 1995).

The UCS expectancy model can be applied to the findings from Experiment 1. Given that a variety of social, familial and cognitive processes can lead females in Western societies to associate eating food with negatively valenced body images (Cooper & Fairburn, 1992; Dritschel, Williams & Cooper, 1991; Nauta, Hospers,

Jansen & Kok, 2000; Polivy & Herman, 2002), those participants may perceive greater semiotic similarity between food CSs and obese body shapes rather than between food CSs and thin body shapes. This, according to the model, will result in a UCS expectancy bias in which participants will be more likely to expect pictures of foods to occur in conjunction with pictures of obese body shapes rather than thin body shapes. This UCS expectancy bias is assumed to facilitate the acquisition of CS-UCS associations, and to facilitate differential robust CRs to the CS. Experiment 2 examines the possible contribution of UCS expectancy biases to the selective conditioning effects found in Experiment 1 by using a simulated 'thought' conditioning procedure (Davey & Dixon, 1996; McNally & Heatherton, 1993) to reveal any pre-conditioning UCS expectancy biases.

Method

Participants

Questionnaires were allocated to forty-two female participants and thirty-seven of these questionnaires were completed and returned. Data was again sampled from a non-clinical population. Thirteen of the participants completed questionnaire 1, 10 completed questionnaire 2 and 14 completed questionnaire 3. The age of the participants ranged from 19 to 44 ($M = 24.35$, $SD = 4.62$). All participants completed the questionnaire for a £2.50 payment.

Stimuli

The stimuli were the 3 obese UCSs, 3 normal UCSs, 3 thin UCSs and 9 food CSs used in Experiment 1.

Apparatus/Procedure

Each participant was given one of 3 different questionnaires to complete in their own time. Each questionnaire contained 2 of the 3 obese body shape UCSs, 2 of the 3

normal body shape UCSs and 2 of the 3 thin body shape UCSs each paired with the 9 food CSs to give a total of 54 CS-UCS pairs. The UCSs used for each of the questionnaires were counterbalanced across questionnaires to provide the 3 different questionnaires (Questionnaire 1 presented the UCSs: obese1, obese 2, normal 1, normal 2, thin 1 and thin 2. Questionnaire 2 presented the UCSs: obese 2, obese 3, normal 2, normal 3, thin 2 and thin 3. Questionnaire 3 presented the UCSs: obese1, obese 3, normal 1, normal 3, thin 1 and thin 3.).

On the first page of the questionnaire the participants were instructed:

“We would like you to imagine you are in a particular psychology experiment. In this experiment the participant is asked to rate how much they like or dislike pairs of pictures presented on a computer screen. The pairs of pictures are not presented simultaneously, but one follows the other after a very short interval (less than 1 second). We would like you to imagine you are in this experiment and are shown pairs of pictures. Your task in this questionnaire is not to judge whether you like or dislike the pictures, but to estimate, given the first picture, how much you would expect the second picture to follow it. Please mark a cross (X) on each scale to indicate your estimation.”

The CS-UCS pairs were presented in random order on the following pages. Each food CS was labelled “Picture A” and each body shape UCS was labelled “Picture B”. The UCS was presented to the right of the CS. Underneath each CS-UCS pair, the participant was asked to indicate how much they would expect Picture A to be paired with picture B by marking a cross on a 100mm visual analogue scale ranging from 0 (not at all likely) to 100 (extremely likely). The distance (mm) from the start of the line to the marked cross gave an expectancy measure for how likely each participant thought each CS was likely to be paired with each UCS. Two CS-UCS pairs and their corresponding visual analogue scales were presented on each A4 page.

Results

Data Exclusion

As one of the 3 thin body shape UCSs had been found not to be rated as thinner than the obese and normal body shape UCSs in Experiment 1, data from CS-UCS pairs containing this UCS were excluded from further analysis and all future data are taken from the 2 remaining thin body shape UCSs.

Expectancy Ratings

The mean expectancy ratings for each UCS type across the 9 different food CSs were calculated. The expectancy ratings for the obese UCSs ($M = 52.32$, $SE = 2.39$) and normal UCSs ($M = 50.55$, $SE = 1.99$) showed that these body shapes were rated as more likely to be paired with the food CSs than the thin UCSs ($M = 29.54$, $SE = 2.42$) (see Figure 3). A 3 (UCS type: obese, normal, thin) \times 3 (questionnaire: questionnaires 1, 2 and 3) mixed ANOVA on the expectancy ratings revealed a significant main effect of UCS type ($F(2, 68) = 40.94$, $p < .001$). Planned contrasts were used to break down this interaction (see Field, 2000a, chapter 7). The first compared expectancy ratings for the thin UCSs paired with food CSs with those for obese and normal UCSs paired with food CSs. This contrast revealed that expectancy ratings of thin UCSs paired with food were significantly lower than normal and obese UCSs paired with food ($F(1, 34) = 66.09$, $p < .001$). The associated effect size was extremely large ($r = 0.81$). The second contrast separated the normal and obese UCSs by comparing expectancy ratings for obese UCSs paired with food CSs with those of normal UCSs paired with food CSs. This contrast was not significant ($F(1, 34) < 1$) and the effect size was small ($r = 0.10$). These contrasts indicate that there is an expectancy bias towards pairing obese and normal body shapes UCSs with food CSs compared to thin UCSs. No significant main effect of Questionnaire ($F(2, 34) < 1$) or the UCS type \times questionnaire

interaction ($F(4,68) < 1$) was obtained indicating that the different counterbalancing of UCSs across questionnaires had no effect on the CS-UCS expectancy ratings.

Discussion

The results of Experiment 2 indicate that female participants exhibit a significantly greater bias towards expecting food CSs to be paired with an obese body shape UCS than with a thin body shape UCS. This suggests that when these stimuli occur in conditioning episodes, there is likely to be a significant pre-conditioning bias towards associating food CSs with obese body shape UCSs rather than thin body shape UCSs. This bias is likely to facilitate any EC effects observed to pairings of the former compared to the latter. Interestingly, the results show that there is no difference in UCS expectancy ratings between both obese and normal body shape UCSs, but that the critical difference lies in female participants exhibiting a significantly *lower* expectancy rating when thin body shapes are the UCS. This suggests that if results from the normal body shape UCSs are used as the comparator, participants do not have an inflated expectancy of obese body shape UCSs following food CSs. Rather, participants have a weaker tendency to associate food CSs with thin body shape UCSs. These findings are not consistent with the putative explanation of the selective EC effects found in Experiment 1 which alludes to female participants having an *inflated* expectancy of obese body shapes following food CSs (perhaps resulting from the tendency of Western females to associate eating food with weight gain and distortions of body image, e.g. Nauta, Hospers, Jansen & Kok, 2000). What appears to be the case is that a relatively high UCS expectancy with the obese body shape UCS combines with its high negative affectivity rating to facilitate conditioning.

Nevertheless, participants in this study consisted of a non-clinical, non-selected female population. It is quite reasonable to assume that those who have begun to

acquire eating disorder symptoms (e.g. persistent dieting) may have an inflated expectancy bias to associate foods with disliked or obese body shapes in particular. Self-schemas relating negative evaluations of shape, weight and eating are more commonly found in individuals suffering eating disorders than in those without such disorders (Nauta, Hospers, Jansen & Kok, 2000). This suggests that individuals suffering such disorders may have a predisposition to associate food and negatively valenced body image, which is greater than the expectancy bias already displayed by the non-clinical female population used in Experiment 2.

GENERAL DISCUSSION

The results from the two experiments described in this paper indicate that evaluative conditioning effects can be obtained when using pictures of food as CSs and pictures of obese body shapes as UCSs. The use of a counterbalanced stimulus design plus a BSB control comparison group ruled out the possibility that these conditioning effects may have been the result of nonassociative artefacts (cf. Field & Davey, 1998, 1999). Nevertheless, the conditioning effects observed were selective. Specifically, pairing pictures of obese body shape UCSs with food CSs produced a significant shift in the affective evaluation of those CSs in female participants. A similar EC effect was not observed in food CSs paired with thin body shape UCSs, even though the thin body shape UCSs were rated pre-experimentally as having significantly greater negative affect than the obese body shape UCSs. The results of Experiment 2 suggested that the selective conditioning effects found in Experiment 1 were consistent with the hypothesis that female participants exhibited a differential pre-conditioning UCS-expectancy bias. Participants exhibited a significantly lower tendency to expect the thin body shape UCSs to be paired with the food UCS, than either the obese or the normal body shape UCSs.

Implications for eating disorders

These findings suggest that evaluative conditioning can play a plausible role in the aetiology and maintenance of eating disorders. If a body image has acquired a negative valence, then this negative evaluation can be transferred through a process of associative learning to foodstuffs with which the body image is paired. However, this conditioning process is only effective if food is paired with a negatively valenced obese body shape, and does not occur when it is paired with a negatively valenced thin body shape. The successful evaluative conditioning effects found with the obese body shape UCS appeared to result from a combination of the *a priori* expectancy that obese body shapes will be associated with food CSs plus the pre-conditioning negative evaluation that participants had already acquired to obese body shapes. The present findings indicate that, even when foods are initially relatively positively evaluated, pairing them with obese body shapes results in a significant negative shift in evaluation. Such basic associative learning may be influential in triggering the dieting and dietary restraint that is frequently associated with body dissatisfaction and perceived overweight (e.g. Stice, 2001), and with the purging that follows binge eating of what is frequently viewed by the bulimic as negatively valenced foods.

There are two interesting features of this associative learning process that have implications for our understanding of the development of eating disorders. First, while almost all conceptualisations of eating disorders make reference to body dissatisfaction as an important factor in the development of eating disorders (cf. Polivy & Herman, 2002), it is clear that body dissatisfaction alone is not sufficient to trigger eating disorders because many women who are dissatisfied with their own

body image fail to acquire any eating disorder. The present series of studies suggest that while females in general may have negative evaluations of obese body shapes, this may only be an effective factor in influencing attitudes to food if the disliked body shape becomes reliably paired with food. In turn, the potential for this association to occur will depend on the conceptual or semiotic similarity between food/eating and the disliked body shape and the strength of any pre-existing food (CS)-body shape (UCS) expectancy bias. This latter bias may be particularly strong in those with eating disorders because of the strong self-schemas that relate negative evaluations of body shape, weight and eating (Nauta, Hospers, Jansen & Kok, 2000). Secondly, what is particularly interesting about the current findings is that negative shifts in food evaluations could be found in a non-selected sample of female participants when food was reliably paired with a negatively evaluated obese body shape. This suggests that, in modern Western cultures, all females are potentially vulnerable to negative shifts in food evaluations if such foods are regularly paired with overweight, negatively evaluated body images. Whilst in most cases this may only lead to selective eating or minor bouts of dieting, it may in some cases be the first step towards precipitating an eating disorder.

Implications for mechanisms of evaluative conditioning

In addition to their relevance to psychopathology, these results also have implications for theoretical accounts of EC. They indicate that EC, like autonomic classical conditioning, may be influenced by UCS expectancy effects, and the ecological relevance of the learning episode may influence the UCS expectancies that an individual has about a given CS. Experiment 2 found that participants exhibited a

significantly lower *a priori* expectation of a thin body shape UCS following food CSs than either obese or normal body shape UCSs. This factor alone could have accounted for the selective conditioning effects in Experiment 1 in which, while both thin and obese body shape UCSs were significantly negatively evaluated, only food CSs paired with the obese body shape UCS showed differential conditioning. The findings suggest that the extent to which participants demonstrate an *a priori* pre-experimental expectancy of the UCS following the CS may determine whether EC effects will be exhibited. At the very least, if a CS evokes very low *a priori* UCS expectancy, then EC would require more trials to acquisition, be less robust, and as a result may, in many cases, fail to demonstrate any evidence of conditioned evaluative transfer of affect.

Finally, these findings suggest that the ecological relevance of CS and UCS (see Field, 2000b, 2001b) and *a priori* UCS expectancy biases may be variables worth further consideration as mediators of EC effects. Future studies might examine the relationship between *a priori* or on-line UCS expectancies and changes in evaluative responses (e.g. Davey, 1992b; Dawson, Schell & Banis, 1986), or examine whether experimentally manipulating UCS expectancy influences subsequent EC (e.g. Davey & Craigie, 1997). If UCS expectancy is as important a determinant of conditioning strength as it has been shown to be in autonomic conditioning studies (cf. Davey, 1992b), then pre-experimental facilitation of UCS expectancies may generate EC effects where previously only failures had been reported.

FIGURE CAPTIONS

Figure 1 Graph showing the mean change in evaluative ratings from pre- to post-conditioning (and SEMs) to CSs paired with obese, normal or thin UCSs in both control and experimental conditions.

Figure 2 Graph showing the mean change in evaluative ratings from pre- to post-conditioning (and SEMs) to CSs paired with obese, normal or thin UCSs in the experimental condition only, for both participants aware of the CS-UCS contingencies and those unaware.

Figure 3 Graph showing the mean UCS expectancy ratings (and SEMs) to CSs paired with obese, normal or thin UCSs.

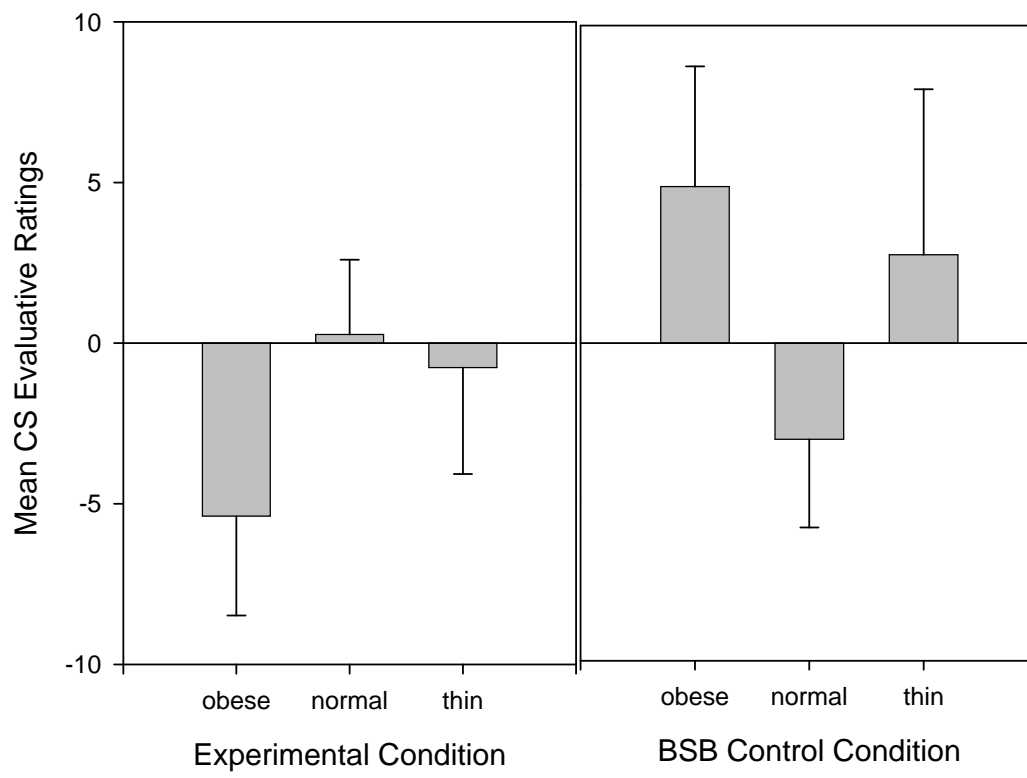


FIGURE 1

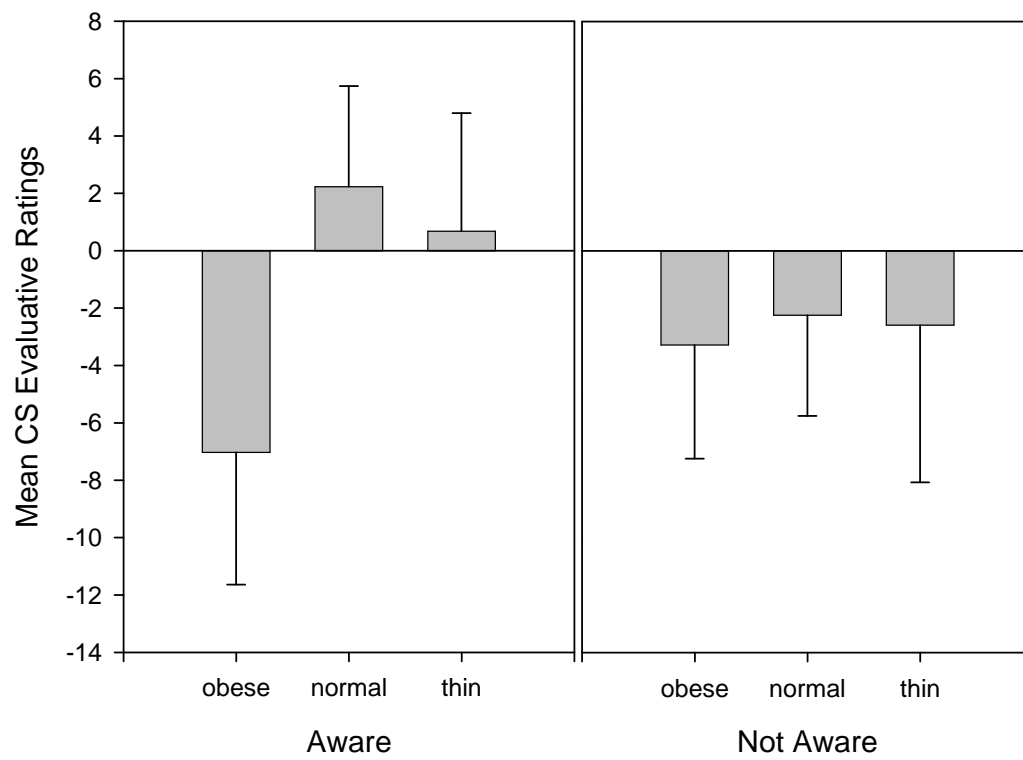


FIGURE 2

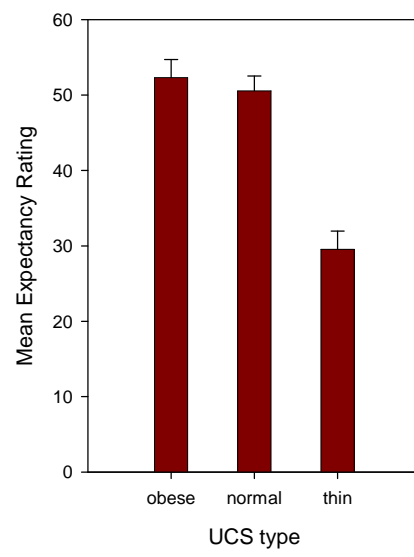


FIGURE 3

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