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did not occur without subjects being able to verbalise the affective valency of the facial expression following each CS, only two out of the forty-five subjects appeared to be able to correctly verbalise whether either disgust, angry or happy expressions followed the relevant CS. Since EC occurred only to foodstuff CSs followed by the disgust UCS, this suggests that the selective conditioning observed in the present study occurred without many subjects being able to verbalise whether the negatively valenced expression paired with the CS was either an angry or a disgust expression. However, the degree to which specific knowledge of the UCS might have been processed is unclear from the nature of the contingency awareness questions that were asked. Subjects were simply asked whether the CS was followed by faces expressing disgust, anger or happiness; since they were shown four different faces expressing the UCS emotion it is not unreasonable to suspect that they may not have been able to abstract the specific emotion displayed in these faces. But had they been given a recognition task, in which they were shown pictures of all UCS expressions, they may well have been able to identify those faces that did follow each CS. What these findings do suggest is that the selective conditioning between disgust-relevant CSs and facial expressions of disgust can occur in the absence of the subject being able to verbally extract or label the specific emotion being displayed in the facial expression. This is consistent with this type of learning being rapid and selective, and testifies to its adaptive importance in transmitting information about potentially dangerous foodstuffs.

*Evaluative Conditioning*

Second, if the present findings represent an example of evaluative conditioning (EC), then they do not support the view that EC occurs without contingency awareness (e.g. Baeyens et al., 1988, 1990). In the present study, evaluative conditioning with disgust expressions as the UCS did not occur unless subjects were at least aware of the affective value of the UCS that followed each individual CS. In this respect, these findings are more consistent with some other EC studies which have also reported a failure to find EC in unaware subjects (Allen & Janiszewski, 1989; Fulcher & Cocks, 1997).

There may be a number of reasons why the present results deviate from theoretical positions which claim that EC can occur without the subject's awareness of or ability to verbalise the contingencies. First, EC in unaware subjects has been claimed primarily in an EC paradigm which uses liked/disliked faces as the UCSs and neutral faces as the CSs (e.g. Baeyens et al., 1988, 1989, 1990; Baeyens & de Houwer, 1995). Davey (1994b) has argued that there are both methodological and statistical problems with both the paradigm that is used and the studies that have to date been conducted using this paradigm, and these problems make the conclusion that EC occurs without awareness of contingencies a premature one. Secondly, Field & Davey (1997) have used a concept-conditioning paradigm which mimics the EC faces paradigm to show that conditioning without awareness could be an artefact of the stimulus selection procedures inherent in the design of this paradigm. For instance, they found apparent EC effects even in control conditions where the CS had never been explicitly paired with the UCS. In such circumstances, predicted changes in the evaluation of the CS had occurred even though subjects had never experienced the contingencies - so it not surprising that subjects could not articulate the contingencies. Field & Davey (1997) have argued that because the EC faces paradigm requires subjects effectively to choose their own CSs, there is a selection bias towards choosing stimuli whose evaluations shift during the procedure in the affective direction predicted by EC - *even though they need never be paired with the relevant CS*. In the present study, CSs were assigned to subjects in a balanced and experimenter-determined way so that CS-selection biases could not account for any differential evaluative shifts. The present results may thus be more directly comparable with those found in more traditional forms of classical conditioning (e.g. autonomic conditioning), where conditioning tends to occur only when subjects can demonstrate conscious awareness of the contingencies (cf. Dawson & Schell, 1987).

Nevertheless, although evaluative conditioning did not occur without some degree of awareness of the contingencies involved, it was not always clear that subjects were aware of the exact emotion being portrayed in the UCS face. For instance, although EC

meaningful way, whereas the disgust emotion tends to be selective in the stimuli that will elicit it, cf. Barker & Davey, 1995). This may explain the failure to find any differential conditioning effects with angry and happy UCSs. This does not mean that conditioning cannot be achieved with these stimuli - but that they are likely to require significantly more trials than for semiotically-related stimuli such as foodstuffs and disgust facial expressions.

The relative speed with which differential conditioning can be achieved between foodstuffs and disgust expressions has obvious adaptive advantages. Because many substances that can be orally incorporated may be poisonous or illness-inducing, the need to learn rapidly about the properties of such substances is essential, and the selective association effect found with foodstuffs and facial expressions of disgust is an ideal method of rapidly transmitting information about foods between individuals.

Thus, if the disgust emotion does have an evolved communicative function designed to endow a stimulus with negative affect, this function is still very much geared towards selectively transmitting negative affect about foodstuffs.

## Implications for Evaluative Conditioning

Differential conditioning effects between foodstuffs and facial expressions of disgust were found (1) only with measures of like/dislike, and not with measures of positive/ negative or revulsion, and (2) only in subjects who were consciously aware of the contingencies.

First, it is interesting that when conditioning occurs it is found only with the most general of the affective dependent variable measures (i.e. liked/disliked), and not, for example, on dimensions which were more specific to the UCS (i.e. revulsion). The reason for this may be that the pairing of foodstuffs with disgust expressions merely transmits the need to *avoid* such foodstuffs because they might be potentially harmful, and does not transfer more specific responses typical of the disgust emotion (such as nausea) to the CS. Although no measure was taken of subjects' preferences for each foodstuff prior to conditioning, their existing preferences for individual foodstuffs may make transfer of very specific disgust properties (such as revulsion, nausea) to the UCS more difficult, although the most general of the disgust responses (avoidance) can be conditioned more easily. Mere transfer of avoidance through pairing of foodstuffs with the disgust facial expression would fulfil the necessary adaptive function of such pairings.

# Discussion

The results of the present study suggest that (1) presenting a facial expression indicative of disgust can cause negative evaluative shifts in stimuli with which that expression is paired - but only if those stimuli have a disgust relevance (i.e. are representative of those groups of stimuli which might normally be expected to elicit a disgust reaction), and (2) such negative evaluative shifts only occur when the subject is aware of the contingency between the stimulus and the disgust expression.

## Implications for the Communicative Function of the Disgust Emotion

The results confirm that it is possible to influence the affective evaluation of a stimulus if that stimulus is reliably paired with the facial expression of disgust. These effects could not be attributed to other features of the faces portraying the disgust emotion, since each UCS face was used to portray other emotions to the subject, and the disgust expression was portrayed in the case of each individual subject by pictures of four different people. However, the results indicate that the transfer of affective value from a facial expression depicting disgust to a paired CS is selective: only natural disgust-relevant stimuli such as foodstuffs demonstrated this effect, and it did not extend to disgust-irrelevant CSs such as cars. This differential effect may be an example of a broader conditioning phenomenon known as selective association (Seligman, 1970; Lolordo & Droungas, 1989; Davey, 1995), in which CSs and UCSs which demonstrate some natural 'belongingness' exhibit more rapid acquisition and are more resistant to extinction (Seligman, 1970; McNally, 1987; Davey & Dixon, 1996). One of the central factors underlying 'belongingness' between stimuli 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 subject's judgements about the semantic similarity between cue and consequence. Clearly, if CS and UCS have shared facilitated access to common cognitive schemata (for example, relating to food, oral incorporation, or oral rejection), then conditioning is likely to proceed more rapidly and extinction be retarded. Since the disgust emotion develops between 2-3 years of age and becomes associated with foodstuffs at the same time (Petó, 1936; Rozin, Hammer, Oster, Horowitz & Marmona, 1986), then the semiotic relationship between food and the disgust emotion is a significantly ingrained one. While it may be possible to elaborate reasons why angry and happy faces might be associated with cars, or why such facial expressions might also be associated with foodstuffs, these relationships are likely to be less selective (since happy and angry can normally be associated with many types of stimulus in a

subjects were aware or unaware of the CS-UCS contingencies. Disgust-relevant CSs paired with a disgust UCS show a larger post-conditioning shift to the disliked end of the scale in aware subjects. Subjects who were unaware of the contingencies either showed little change in their liking of the stimuli (meat CS condition) or showed a negative shift that was much less pronounced (vegetable CS condition). Shifts in evaluation to disgust-irrelevant CSs (cars) were small in both aware and unaware subjects, but with aware subjects rating the car CSs as more likeable after pairing with a disgust UCS. In order to test whether these differences between aware and unaware subjects were meaningful, a series of Wilcoxon tests[1] were used. Table 2 shows the results of these tests. They show that subjects who were aware of the contingencies showed significant shifts in their liked-disliked evaluations of the meat CSs paired with disgust UCSs compared to meat CSs paired with happy or angry UCSs, and the control CSs. However, the unaware subjects in the meat CS group showed no significant differences between CSs paired with disgust UCSs and those paired with happy or angry UCSs and the control CSs. In the condition where vegetable products were used as the CS a similar pattern emerged. CSs paired with disgust UCSs were rated significantly more negatively after conditioning than those paired with happy or angry UCSs. Again, this was not true of the unaware subjects. However, the same pattern was not observed in the condition where disgust-irrelevant CSs were used (car CS). In this condition there were no significant differences between CSs paired with disgust UCSs or those paired with either happy or angry UCSs in either aware or unaware subjects.

| CS Type | Comparison | Aware Z | Unaware Z |
|---|---|---|---|
| Meat CS | Disgust UCS vs. Happy UCS | -2.09* | -1.10 |
| | Disgust UCS vs. Angry UCS | -2.45** | -1.46 |
| | Disgust vs. Control | -2.05* | 0.00 |
| Vegetable CS | Disgust UCS vs. Happy UCS | -2.20* | -1.57 |
| | Disgust UCS vs. Angry UCS | -2.10* | -0.94 |
| | Disgust vs. Control | -0.84 | -1.36 |
| Car CS | Disgust UCS vs. Happy UCS | -0.56 | -0.52 |
| | Disgust UCS vs. Angry UCS | -1.40 | -1.21 |
| | Disgust vs. Control | -1.40 | -0.31 |

**Table 2**: Wilcoxon tests for awareness data. * = $P < 0.05$, ** = $P < 0.01$.

[1] Although an ANOVA would have been a tighter form of analysis, the unbalanced nature of the aware and unaware groups, and the heterogeneity of variance even after transformation of the data made this analysis inappropriate.

and the vegetable CS group and the car CS group [mean difference of transformed data = -3.21, SE = 1.413, $p < 0.05$] - but only for CSs paired with the disgust UCS. This indicates that while disgust UCSs only had a significant effect on disgust relevant CSs, the other forms of UCS generated statistically similar data across all types of CS.

**Contingency awareness and shifts in evaluative conditioning**: Only 2 out of 45 subjects met the criteria for the *strong* measure of contingency awareness by correctly naming the type emotion expressed on the face that followed each of the three conditioning CSs. However, a total of 27 out of the 45 subjects met the criteria for the 'weak' measure of contingency awareness by being able to articulate the affective value of the UCS that followed each of the three CSs. In order to see whether contingency awareness affected differential evaluative conditioning, like-disliked difference ratings were separated and compared according to whether subjects met the *weak* contingency awareness criteria (aware subjects) or they did not (unaware subjects).

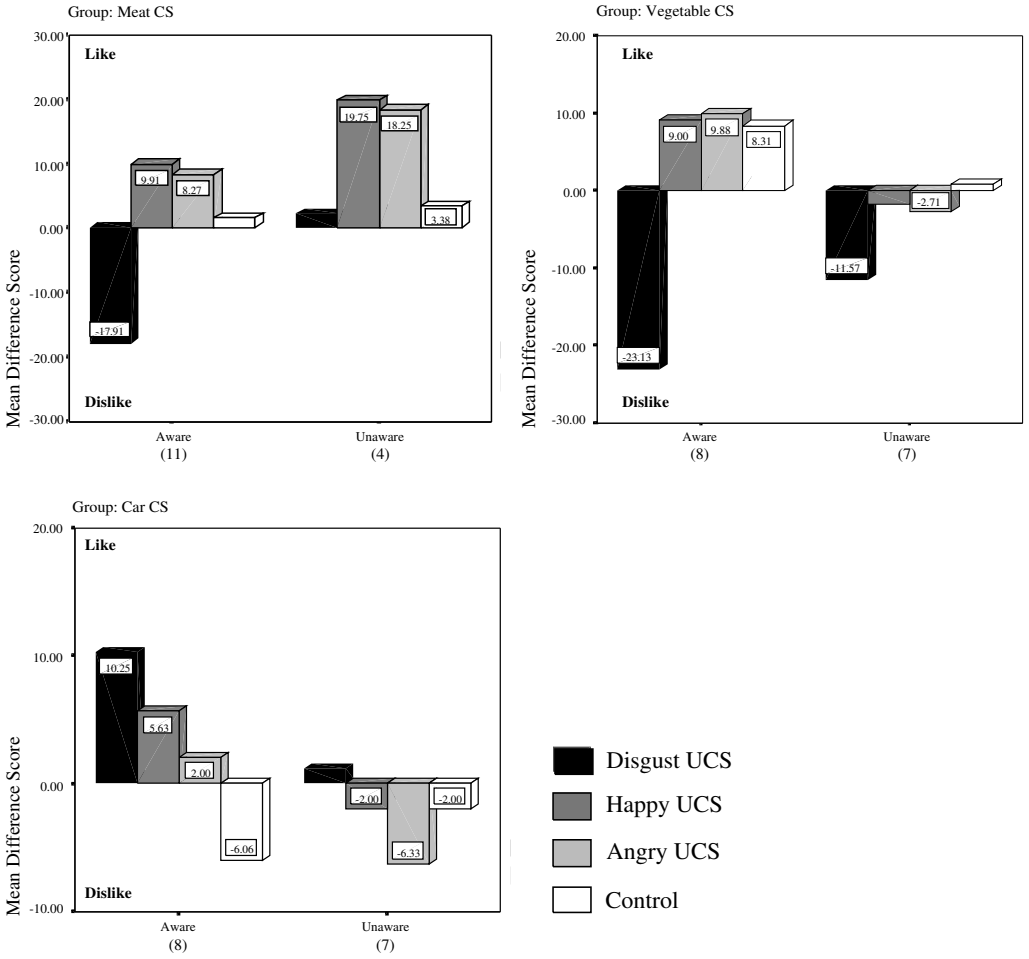


**Figure 4**: Graphs to show the mean change in evaluative response for each type of CS when paired with different UCSs according to subject awareness.

Figure 4 shows the mean difference score for each type of CS according to whether the

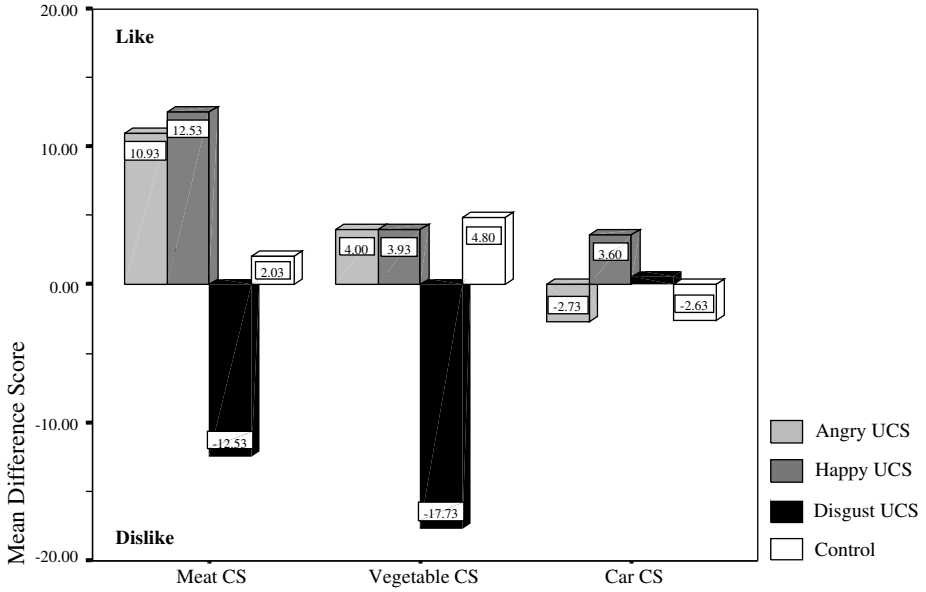


**Figure 3**: Graph to show the mean change in evaluative response (like-dislike) across conditioning for meat, vegetable and car CSs paired with either a disgust, angry or happy face (and the control CSs, which were paired with nothing).

**Like-dislike**: This measure is the one traditionally used to assess the presence of any evaluative conditioning. The mean difference scores on this measure are shown in Figure 3. There were large negative shifts in evaluations to disgust-relevant CSs (meat and vegetable products) when a disgust expression was used as the UCS. A two way CS Type × UCS Type mixed ANOVA with repeated measures on the latter variable was used to analyse the data. This revealed a significant main effect of UCS Type [$F$ (3,126) = 4.34, $p < 0.01$] but not of CS Type ($F < 1$). There was a marginally nonsignificant CS Type × UCS Type interaction [$F$ (6,126) =1.88, $p = 0.089$]. Helmert contrasts on the UCS Type variable revealed a significant difference between difference scores when a disgust UCS was used compared to the other types of UCS [$F$ (1,42) = 10.31, $p < 0.005$]. More importantly, the interaction between CS Type and UCS Type was significant when comparing the disgust UCS to the other UCSs [$F$ (2,42) = 4.76, $p < 0.05$]. No other contrasts reached significance. This demonstrates that, although the CS Type × UCS Type interaction was nonsignificant overall, there was a significant interaction between CS Type and UCS Type when comparing disgust and nondisgust UCSs. Thus, the nature of the evaluative conditioning effect found was different for disgust-relevant CSs when paired with a disgust UCS compared with disgust-relevant CSs paired with disgust-irrelevant UCSs. This pattern was not found in the disgust-irrelevant CS group (where pictures of cars were used as the CSs). Furthermore, a Dunnett *post hoc* test revealed significant differences between the meat CS group and the car CS group [mean difference of transformed data = -3.11, SE = 1.413, $p < 0.05$]

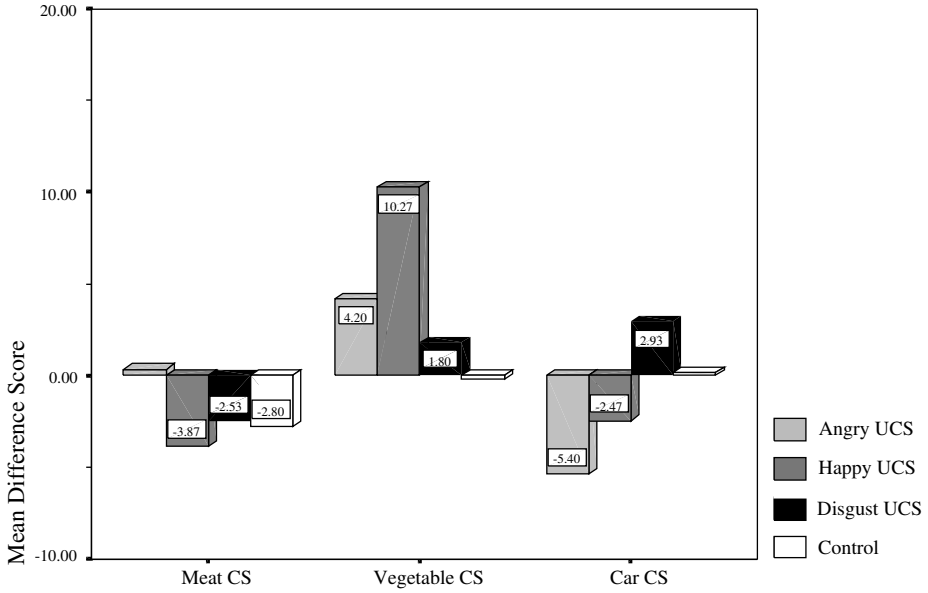


**Figure 1**: Graph to show the mean change in positiveness across conditioning for meat, vegetable and car CSs paired with either a disgust, angry or happy face (and the control CSs, which were paired with nothing).

**Revulsion:** Figure 2 shows the mean difference score in ratings of revulsion to the CSs. Using a two way mixed design CS Type × UCS Type ANOVA, there were no significant main effects of CS Type or UCS Type (both *F*s < 1) and no significant interaction effect [$F$ (6,126) = 1.15, $p$ = 0.34].

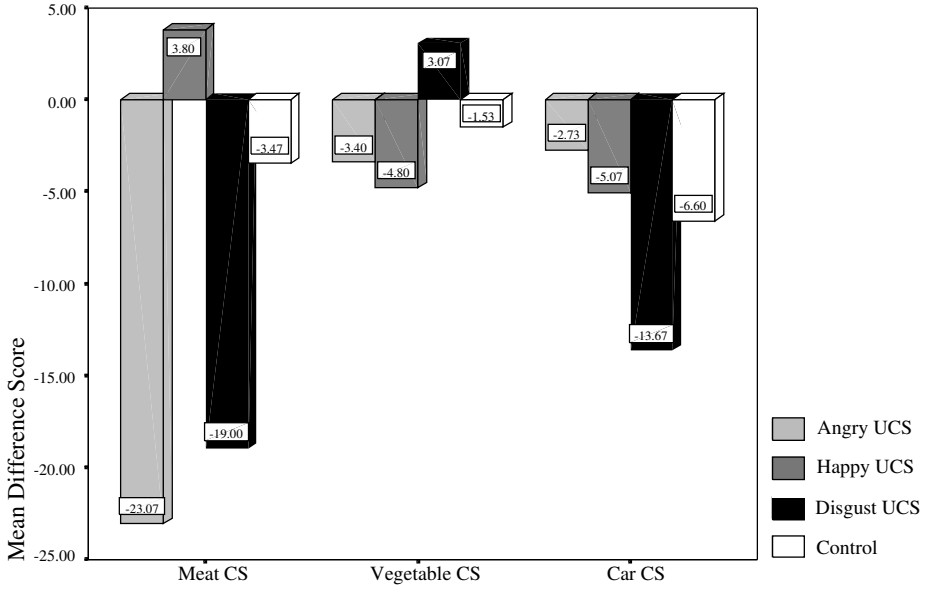


Figure 2: Graph to show the mean change in revulsion across conditioning for meat, vegetable and car CSs paired with either a disgust, angry or happy face (and the control CSs, which were paired with nothing).

*Stage 4: Assessment of contingency awareness*. After the end of Stage 3, all subjects were once more shown the five CS pictures they had seen during the post-conditioning assessment stage. In the case of each CS picture, they were asked to say (1) whether, in the conditioning stage, the CS had been followed by a 'good' face (e.g. happy) or a 'bad' face (e.g. angry or disgusted), and (2) more specifically, whether the CS had been followed by a happy face, an angry face, a disgusted face, or nothing. Both questions included a 'don't know' option. The former is a *weak* criterion measure of awareness of contingencies, in which subjects can verbalise the affective value of the UCS paired with each CS, the latter is a *strong* criterion measure in which subjects can verbalise more precisely the characteristics of the individual UCS paired with each CS. These 'weak' and 'strong' criteria are similar to the criteria used to establish awareness of contingencies in most EC studies (e.g. Baeyens et al., 1988, 1989, 1990).

# Results

**Data reduction and data screening**: Evaluation difference scores for each subject were calculated by subtracting Stage 3 ratings from those in Stage 1 for each scale. Difference scores for ratings to the two control stimuli were combined into a single score. The data for all measures were prone to heterogeneity of variance and slightly skewed distributions on some variables. For this reason, all data were transformed using a square root transformation. Since the data contained negative scores (of which a square root cannot be taken), the transformation was carried out on the absolute data values; the direction of response (i.e. positive or negative) was then re-instated to the transformed data to provide an accurate transition of the initial scores.

**Positive and negative feelings**: The mean difference scores for this first measure are shown in Figure 1. All shifts in ratings were small. A CS Type (meat/vegetable/car) × UCS Type (disgust/anger/happy) mixed ANOVA was conducted (with CS Type as a repeated measure) on the difference scores. There was no significant main effect of UCS Type ($F < 1$) or CS Type [$F$ (2,41)=1.11, $p = 0.34$] or of the two way interaction [$F$ (6,123) = 1.06, $p = 0.39$].

stimulus presentations on each video remained the same for the 5 subjects that viewed that video.

| Type of CS | Video | CS1 | UCS1 | CS2 | UCS2 | CS3 | UCS3 | Control 1 | Control 2 |
|---|---|---|---|---|---|---|---|---|---|
| Meat | 1 | Meat 1 | Disgust Faces | Meat 2 | Angry Faces | Meat 3 | Happy Faces | Meat 4 | Meat 5 |
| | 2 | Meat 1 | Happy Faces | Meat 2 | Disgust Faces | Meat 3 | Angry Faces | Meat 4 | Meat 5 |
| | 3 | Meat 1 | Angry Faces | Meat 2 | Happy faces | Meat 3 | Disgust Faces | Meat 4 | Meat 5 |
| Vegetables | 4 | Veg 1 | Disgust Faces | Veg 2 | Angry Faces | Veg 3 | Happy Faces | Veg 4 | Veg 5 |
| | 5 | Veg 1 | Happy Faces | Veg 2 | Disgust Faces | Veg 3 | Angry Faces | Veg 4 | Veg 5 |
| | 6 | Veg 1 | Angry Faces | Veg 2 | Happy Faces | Veg 3 | Disgust Faces | Veg 4 | Veg 5 |
| Cars | 7 | Car 1 | Disgust Faces | Car 2 | Angry Faces | Car 3 | Happy Faces | Car 4 | Car 5 |
| | 8 | Car 1 | Happy Faces | Car 2 | Disgust Faces | Car 3 | Angry Faces | Car 4 | Car 5 |
| | 9 | Car 1 | Angry Faces | Car 2 | Happy Faces | Car 3 | Disgust Faces | Car 4 | Car 5 |

**Table 1**: Table to show the arrangement of stimuli on each of the nine video tapes.

*Stage 3: Postconditioning assessment.* After viewing the conditioning video, subjects were then shown all five CS pictures in random order and asked once again to rate each stimulus on the three rating scales described in Stage 1.

used pictures of cars.

**Design:** For each CS type there were 5 available images, 3 of these were selected to be experimental stimuli which would be paired with a UCS picture and the remaining 2 were used as unpaired control stimuli. The nine different conditioning videos were constructed so that each of the 3 experimental CSs were paired with different emotionally valenced UCS faces on different videos. This ensured that the CS-UCS presentations were fully counterbalanced across subjects. The two control stimuli were never paired with UCS faces, and were used to assess how ratings might change over successive ratings. Table 1 shows how stimulus presentations were arranged on each video. For example, on video number 1, the first experimental CS (meat picture 1) was presented four times, on each occasion being paired with one of the four different disgust facial expressions. Meat picture 2 was paired with the four angry expressions, and so on. The sequencing of pairings on each video was randomised. This design ensured that all classes of CS were paired with all classes of UCS.

**Procedure:** Subjects were randomly assigned to one of 3 different groups: (1) A meat CS group (who saw only meat products paired with facial expressions), (2) A vegetable CS group (who saw only vegetable products paired with facial expressions), and (3) A car CS group (who saw only cars paired with facial expressions). Once the subject was assigned to a group, they were then assigned to one of the three video conditions for that group. Thus, each of the nine videos was viewed by 5 subjects.

*Stage 1: Baseline Assessment.* Before viewing the conditioning video, subjects were asked to rate each of the 3 CS pictures and the 2 control pictures on three separate 200-point scales which measured (1) whether their feelings to the item in the picture were positive or negative, (2) the extent to which they felt revulsion to the item in the picture, and (3) how much they liked or disliked the item in the picture. All three measures utilised a visual-analogue scale ranging from -100 (very negative/extreme revulsion/ dislike) through zero (neutral in all cases) to +100 (very positive/ no revulsion/like). These scales were based on the 200-point scales normally used in EC studies (e.g. Baeyens et al., 1988, 1990).

*Stage 2: Conditioning.* Each subject then watched the conditioning video. All nine videos followed an identical format. They contained three types of pairings, CS-angry UCS, CS-Disgust UCS, and CS-Happy UCS. Each CS was paired with the four different examples of the UCS to ensure that any effects were the result of the emotional information in the face rather than other specific attributes of the face. Each CS was shown for 2 sec followed by a 1 sec inter-stimulus interval, and then a UCS of the appropriate type for 2 sec. There was a standard 8-sec inter-trial interval before the next pairing. The presentations were made in a quasi-randomised order, but the order of

products) or disgust-irrelevant CSs (pictures of cars) was investigated. The effect of facial expressions of disgust on CS evaluations were also compared with the evaluative effects produced by pairing CSs with two other facial expressions, namely anger and happiness. The study also investigates whether the affective value of a facial expression such as disgust can be transferred to cueing stimuli with which it has been paired in a classical conditioning paradigm.

# Method

## Subjects

Forty five subjects took part in the experiment, 15 in each of the three experimental conditions (see Table 1). There were 27 females and 18 males who were all undergraduate students at the University of Sussex. Because of the nature of the CS material, no vegetarians were used in the study. Subjects were tested individually and were all volunteers who were not paid for their participation.

## Procedure

**Stimuli:** The UCSs used in the experiment were pictures of emotionally expressive faces. Three facial expressions were used: happy, angry and disgusted. Pictures of facial expressions were generated by asking 17 volunteers to pose in a video-recorded session making facial expressions that they considered to reflect happiness, anger or disgust. Video stills were taken of each expression and printed using a colour video printer. All expressions were then shown to 10 further volunteers who were asked to rate each face for expression of happiness, anger and disgust on individual 11-point scales (0-10). The four people whose facial expressions were rated as best differentiating the individual emotions (e.g. in the case of the disgust expression, they scored high on disgust and low on anger and happiness, and the same for anger and happiness respectively), were chosen to represent the UCSs in the study. The UCS facial expressions were hence portrayed by 4 females, each portraying 3 expressions (disgust, anger, happiness), making 12 images in total. There were 3 different types of CS used in the experiment, namely pictures of 5 different uncooked meat products (e.g. sausages), pictures of 5 different uncooked vegetable products (e.g. carrots), and pictures of 5 different makes of car. All 15 images were printed using a colour video image printer.

**Apparatus**: A video recorder and television monitor were used to present the images throughout the experiment. Nine different videos were constructed (each lasting approximately 5 min 30 sec) (see Table 1). Three of these videos used pictures of uncooked meat products as CS, 3 used pictures of uncooked vegetable products, and 3

Templar, 1986), disgust can be elicited by a range of other stimuli including many fear-relevant animals (such as spiders, rats, cockroaches, cf. Ware, Jain & Davey, 1994), various forms of sexual activity, body products (such as body odour, acne, gastro-enteric products), and many types of foodstuffs (Barker & Davey, 1995). In particular, in eating disorders such as anorexia nervosa and bulimia, the disgust reaction becomes associated with a wide range of foodstuffs, and helps to mediate the food rejection responses typical of these disorders (Davey, Buckland & Tantow, 1997).

While the *prima facie* adaptive function of the disgust response has been assumed to be one which enables the avoidance of stimuli which play a role in the spread of disease (e.g. mucus, faeces), it has also been argued that the disgust reaction has developed more recently as a powerful way of transmitting cultural values (Rozin & Fallon, 1987; Davey, 1994a). Disgust is a means of endowing an object or event with potent negative affect that can act as a signal to others that the object or event is unacceptable. For example, the activities of groups which violate accepted social and moral values (e.g. Nazis) are often labelled as disgusting, and colloquialisms for faeces are used almost universally as a derogatory term. Such a communicative function can be used to transmit information about contemporary fashion (e.g. when disgust is associated with unfashionable body shapes), unacceptable social groups (e.g. terrorist activities), or culturally unacceptable activities (e.g. certain sexual activities).

The present study represents an investigation of this possible communicative function of the disgust response using an evaluative conditioning (EC) paradigm (Martin & Levey, 1987; Davey, 1994b). In the standard EC paradigm, a conditioned stimulus (CS) is paired with a liked or disliked stimulus (unconditioned stimulus, UCS) and results in the CS acquiring positive or negative valence depending on the valence of the UCS with which it has been paired (Martin & Levey, 1985, 1987; Baeyens, Eelen & Van den Bergh, 1990; Davey, 1994b). While being a paradigmatic exemplar of classical conditioning, EC possesses some dynamic features which appear to differentiate it from other forms of autonomic classical conditioning (but see Davey, 1994b; Field & Davey, 1997 for an alternative view of these apparent anomalies). First, conscious awareness of the conditioning contingencies does not appear to be a necessary condition for EC to occur (Baeyens, Crombez, Van den Bergh & Eelen, 1988; Baeyens et al., 1990). Secondly, EC appears to be strongly resistant to extinction (Baeyens, Crombez, Van den Bergh & Eelen, 1988; Baeyens, Eelen, Van den Bergh & Crombez, 1989).

In the present study, the effects of pairing pictures of facial expressions of disgust (UCS) with either disgust-relevant CSs (pictures of meat products or vegetable

# Abstract

The present paper describes an evaluative conditioning study in which pictures of facial expressions of disgust (the unconditioned stimuli, UCSs) were paired with either disgust-relevant conditioned stimuli (CSs) (pictures of foodstuffs) or disgust-irrelevant CSs (pictures of cars). The effects of facial expressions of disgust on CS evaluations were also compared with the evaluative effects produced by pairing these CSs with two other facial expressions, namely anger and happiness. The results showed that differential evaluative conditioning was found only when disgust expressions were used as UCSs, and then, only when disgust-relevant CSs were paired with them. In addition, negative shifts in the evaluation of disgust-relevant CSs paired with the disgust expression occurred only when specific criteria were met for the subjects being consciously aware of the contingencies. These findings demonstrate selective associative effects in the conditioning of evaluative shifts using emotional faces as the UCS, and the results are discussed in relation to theories of the communicative function of the disgust emotion.


# Introduction

Disgust has been recognised as a basic emotion for over a century, and like other emotions it has a distinctive facial expression (Ekman & Friesen, 1986), distinctive behavioural and physiological manifestations, and a particular subjective experience (Izard, 1977; Rozin & Fallon, 1987; Davey, 1994a). The subjective experience of disgust can be distinguished by a combination of physiological and behavioural reactions to the eliciting stimulus. The most prominent physiological reaction is a feeling of nausea or sickness, and the most prominent behavioural reaction to disgusting stimuli is avoidance and, in particular, fear of oral incorporation of the disgusting object (Rozin & Fallon, 1987; Davey, 1994a). Rozin & Fallon (1987) have also argued that as the disgust reaction develops it acquires specifically cognitive components such as a fear of contamination.

Rozin & Fallon (1987) and Davey (1994a) have argued that disgust is primarily a global food rejection response which functions to prevent the spread of illness, disease and infection. Hence, disgusting objects tend to be ones which, for one reason or another, the individual has good reason for not wanting to orally consume. Most commonly, therefore, disgusting objects tend to be animals, parts of animals or animal products (such as mucus or faeces), stimuli that have been in contact with animals, or stimuli that resemble animals (Angyal, 1941). While the most potent primary disgust substance is faeces (e.g. Templer, King, Brooner & Corgiat, 1984; Crogiat, Cappelletty, Phillips &

# Evaluative Conditioning Using Disgust Facial Expressions as Unconditioned Stimuli: Evidence for Selective Conditioning Effects

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