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BRIEF REPORT

Cross-modal Preference Acquisition: Evaluative Conditioning of Pictures by Affective Olfactory and Auditory Cues

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In this research, a cross-model paradigm was chosen to test the hypothesis that affective olfactory and auditory cues paired with neutral visual stimuli bearing no resemblance or logical connection to the affective cues can evoke preference shifts in those stimuli. Neutral visual stimuli of abstract paintings were presented simultaneously with liked and disliked odours and sounds, with neutral-neutral pairings serving as controls. The results confirm previous findings that the affective evaluation of previously neutral visual stimuli shifts in the direction of contingently presented affective auditory stimuli. In addition, this research shows the presence of conditioning with affective odours having no logical connection with the pictures.

INTRODUCTION

The evaluative conditioning (EC) theory (e.g. Levey & Martin, 1987) proposes a form of preference acquisition whereby affect is transferred from an hedonic stimulus to a neutral stimulus presented contingently, rather than by expectancy learning, as is the case in classical conditioning. The central role of affect in EC has recently been brought into question by research which suggests that preference shifts could be due to the conceptual highlighting of similar features between paired stimuli (Field & Davey, 1997). Indeed, many studies yielding results consistent with the EC theory have used similar stimuli of the same modality. Although evidence for EC with perceptually dissimilar stimuli (e.g. Baeyens, Eelen, Van den Bergh, &

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Crombez, 1989), as well as stimuli of different modalities (e.g. Bierley, McSweeney, & Vannieuwkerk, 1985) does exist, such studies have primarily made use of visual or verbal stimuli, with relatively little examination of other sensory modalities, such as olfaction.

The relative efficacy of odours compared with other sensory stimuli in affective learning is interesting due to their lower accessibility to language or analytical processes than other (e.g. visual) stimuli. Odours are more often labelled in terms of their hedonic qualities, suggesting at least that odours are processed in a less semantic manner than sounds or visual stimuli (Ehrlichman & Bastone, 1992), and could hence have a more direct, nonsemantic effect on a neutral contextual stimulus. In a series of cross-modal evaluative conditioning experiments using odours as unconditioned stimuli (US), Todrank, Byrnes, Wrzesniewski, and Rozin (1995) found that only odours that could plausibly be connected to humans evoked a shift in preference for persons depicted in the photographs. This finding, and the fact that the participants were explicitly instructed to pay attention to the odour-person pairings, could alternatively be interpreted in terms of a conceptual, overlapping-features transfer mechanism (Field & Davey, 1997).

The experiment described here was designed to determine whether a conditioning effect would occur in a cross-modal paradigm which made use of odours and sounds as US and pictures of abstract paintings as conditioned stimuli (CS), and to examine whether odours lead to larger preference shifts than sounds. In a first phase participants were asked to rate the pleasantness of each item in a series of relatively unfamiliar odours, sounds, and pictures. On the basis of the individual ratings, the most neutrally and affectively rated stimuli were selected for each participant. These were used in a second phase, in which neutrally rated pictures (CS) were presented simultaneously with liked, disliked, or neutral odours or sounds (US). In a third phase, the participants re-evaluated the pictures. An effort was made to divert the participants' attention from the CS-US combinations, by giving them a cognitively demanding task between the presentations of the stimulus pairings, thus making the participant less likely to elaborate actively on a possible link between the stimulus pairs.

METHOD

The study originally consisted of two identical parts, except that in the second part the baseline was preceded with the successive presentation of all the stimuli to acquaint the participants with the stimuli used. As this distinction yielded no significant main effect [$F(1,44) = 1.706$, $P = .198$], nor interaction effects [$F(2,88) = 1.785$, $P = .174$] on conditioning, the data sets of both parts were merged and are presented later as one experiment.

Participants

Fifty female undergraduate students of psychology were recruited, their participation partially fulfilling course requirements.

Materials and Mode of Presentation

Nineteen colour slides of non figurative paintings of relatively unknown painters, 19 synthetic sound effects and 19 odours comprised of odour-components of cosmetic and food products and "essential oils"[1] were chosen based on their expected unfamiliarity (low familiarity was confirmed in a pilot study with nine participants).

Participants were seated in front of a Macintosh LC III computer with a 14-inch colour screen. Sounds were presented through headphones connected to the sound output of the computer via an amplifier. Each odour was presented with a dispenser which delivered compressed air, saturated with the odour from a connected jar, through a 70 cm silicon tube to an outlet attached to a microphone boom on the headphones, such that the air flowed laterally beneath the nostrils.

The participants scored their evaluation of each stimulus on a vertical bar-rating scale, with abstract facial expressions next to the bar portraying happiness, neutral, and unhappiness serving as reference points. Responses were transformed into integer values between +100 (extremely pleasant) via 0 (neutral) to −100 (extremely unpleasant).

Procedure

Baseline Phase. Participants were told that the main interest of the experiment was the influence of pleasant and unpleasant stimuli on the power of concentration and that in order to know exactly which stimuli they regarded as being pleasant or unpleasant, a rating procedure was needed. They were then instructed how to use the response scale and to rely on their first immediate and spontaneous reactions to the stimuli. Participants were then familiarised with the mode of stimulus-presentation and rating, after which the experimenter left the room and the experiment commenced.

The 57 stimuli were randomly presented for a duration of 5 sec with an inter-stimulus interval (ISI) of 20 sec, during which odourless compressed air continued to flow. To avoid mixtures of odours, which might occur when odours are presented successively, odours were always followed by either a sound or a picture. Participants scored their evaluation immediately after presentation of each stimulus.

After the baseline phase, participants left the room for 15 minutes, accompanied by an experimenter. Meanwhile, from each participant's stimulus ratings, the other experimenter selected one high-rated odour and sound, and one low-rated odour and sound, with equal ratings (within 15 points) for the respective odours and sounds (avoiding modality differences caused by the selection of US or unequal valence). Also, one neutral-rated odour and neutral-rated sound were selected to serve as controls. These stimuli were combined with the six pictures rated most closely to zero to form six stimulus pairs; one pleasant odour/sound with a neutral picture, one unpleasant odour/sound with a neutral picture and one neutral odour/sound with a neutral picture.

[1] A detailed list of the stimuli used is available on request.

Acquisition Phase. The six stimulus pairs were presented eight times each in random order, with the two paired stimuli being presented simultaneously, for 5 sec, with an ISI of 40 sec in order to avoid mixture of odours (E.P. Köster, personal communication, 1992). To keep participants mentally occupied during this ISI, a concentration task, consisting of responding to assignments such as "name as many different museums you know as possible", was given after the presentation of each stimulus pair. A beep tone after 40 sec indicated the next stimulus pair presentation, at which time participants were to stop responding.

Evaluation Phase. Each of the 12 stimuli presented pairwise in the conditioning phase was then presented separately and re-evaluated, using exactly the same procedure as in the baseline phase, with the justification to the participant that some stimuli were presented once more thus enabling "forming a good index of their responses".

RESULTS

The data of 4 of the 50 participants could not be used, due to equipment failure. An exit interview confirmed that all participants believed the cover story. The data from all remaining 46 participants were therefore analysed.

Data CS

The mean ratings of the olfactory and auditory US selected for phase 2 are depicted in Table 1.

The evaluative response-scores to the pictures were analysed in a 2 × 3 × 2 Modality of the US (odour/sound) × Valence of US (liked/neutral/disliked) × Measured (pre-test/post-test) analysis of variance with repeated measures on the three factors. The interaction effect of Valence × Measurement was significant [$F(2,90) = 9.7$, $P = .0002$]. The mean evaluative response scores to the CS paired with odour-US and sound-US are shown in Fig. 1.

TABLE 1
Mean Ratings of the Like, Neutral, and Disliked Odours and Sounds in Pre-test (Baseline Phase) and Post-test (Evaluation Phase)

		Pre-test		*Post-test*	
Modality of US	*Valence of US*	*M*	*SD*	*M*	*SD*
Odours					
	Liked	47.26	24.81	22.44	35.94
	Neutral	0.16	5.62	−14.44	42.69
	Disliked	−78.56	21.65	−36.39	48.02
Sounds					
	Liked	53.65	23.05	42.00	33.54
	Neutral	0.96	8.00	3.78	33.31
	Disliked	−76.80	24.45	−51.63	35.65

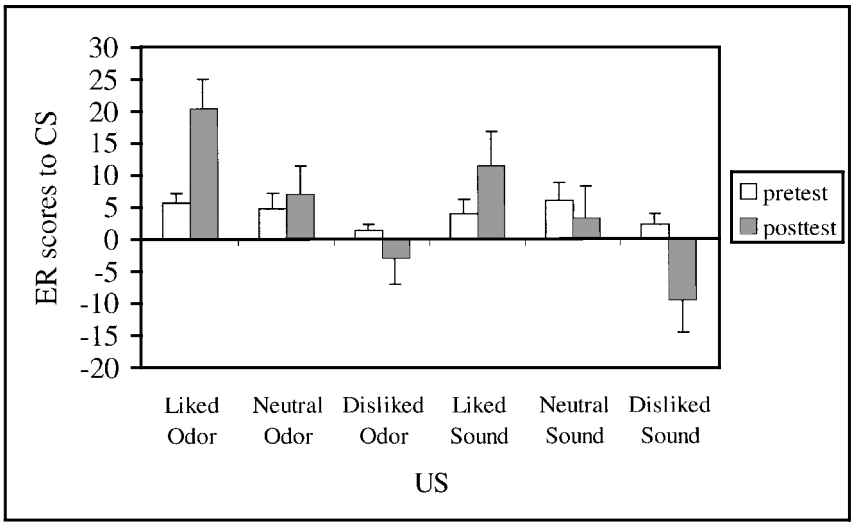

FIG. 1. Mean evaluative response scores of the pictures in the pre-test (white bars) and post-test (grey bars), paired with liked, neutral, and disliked odours, and liked, neutral, and disliked sounds.

Planned comparisons on the mean difference scores confirm that the evaluative response scores shifted in the post-test in the direction of the values of the US. The differences in evaluative responses to the pictures between neutral-liked (N-L) and neutral-neutral (N-N) pairing were significant, [$F(1,45) = 6.861$, $P = .0103$] and between N-N and neutral-disliked (N-D) pairing showed a trend in the predicted direction [$F(1,45) = 3.087$, $P = .0823$]. The mean difference scores obtained after N-L pairing were higher than the scores after N-D pairing [$F(1,45) = 19.151$, $P = .0001$].

With respect to the modalities, it was hypothesised that the odours would have a stronger conditioning effect on the pictures than would the sounds, leading to a significant three-way interaction effect for Modality $\times$ Valence $\times$ Measurement. Such an effect was not found ($F < 1$), although the interaction of Modality $\times$ Measurement was significant [$F(1,45) = 4.267$, $P = .045$], implying some modality difference in the effects of conditioning irrespective of the valence of the US. As Fig. 1 indicates, the significant interaction is due to a stronger negative conditioning effect of sounds and a stronger positive effect of odours.

DISCUSSION

The results show that liked and disliked odours and sounds paired simultaneously with originally neutral pictures evoked preference shifts for the pictures, confirming earlier findings of evaluative conditioning with US and CS of different sensory modalities (e.g. Bierley et al., 1985). The hypothesis that odours might produce a larger preference shift due to more hedonic, less cognitive processing, was not supported. Importantly, our research suggests that sounds and odours which

neither shared features with (apart from their co-occurrence in time), nor had any logical connection to neutral visual stimuli could nevertheless establish an evaluative response for those stimuli. This confirms previous findings by Baeyens et al. (1989) that evaluative conditioning can occur with dissimilar stimuli, and adds to the claim that affect rather than conceptual mechanisms plays a key role in EC.

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