Learning and Motivation 47 (2014) 30–38

Contents lists available at ScienceDirect

Learning and Motivation

journal homepage: www.elsevier.com/locate/l&m

Is the salience of the distinctive features of similar stimuli affected by stimulus preexposure schedule and length?

Rocío Angulo*, Gumersinda Alonso

Universidad del País Vasco, UPV/EHU, Spain

ARTICLE INFO

Article history:
Received 4 March 2014
Received in revised form 16 May 2014
Available online 19 June 2014

Keywords:
Conditioning
Stimulus salience
Perceptual learning
Taste aversion

ABSTRACT

Following intermixed or blocked preexposures to two similar stimuli (AX and BX), rats received a single taste aversion conditioning and test trial with a compound composed of the distinctive flavors of the stimuli (AB). AB consumption was lower after intermixed than blocked preexposures (Experiments 1 and 2), regardless of whether rats received few (4) or many (12) stimulus presentations during preexposure, while overall consumption of AB was not affected by the length of preexposure (Experiment 2). Furthermore, consumption of the AB compound in a control group not receiving any preexposure trial was similar to that found for the intermixed preexposure condition but lower than that found for the blocked condition (Experiment 3). Conditioning to the AB compound was always successfully established, but it seemed to be unaffected by the preexposure schedule or its length. These findings are discussed in terms of whether salience is the stimulus property being modified by the preexposure schedule.

Differentiation between similar stimuli, for example AX and BX, requires the detection of their unique features (A and B) among all the remaining elements (X) that will be common to both and irrelevant for stimulus differentiation. Thus, in one of the earliest accounts of perceptual learning (Gibson, 1969), it was proposed that increments in stimulus differentiation would rely on attentional shifts toward the distinctive elements of the stimuli and away from those held in common. This general hypothesis has survived in more recent accounts of perceptual learning, and salience modulation mechanisms have been proposed to explain how attention could be biased to the distinctive elements of the stimuli during repeated exposure (see Hall, 2003; but also McLaren, Kaye, & Mackintosh, 1989; McLaren & Mackintosh, 2000; Mitchell, Nash, & Hall, 2008). Although the precise mechanisms of salience modulation vary in nature between the different accounts, they all share the general assumption that stimulus salience will decline over repeated preexposures, though there are circumstances under which the specific preexposure schedule provided by the stimulus presentations would preserve or increase such salience.

The general benefit of preexposure to similar stimuli (AX and BX) on subsequent stimulus discrimination (e.g., Bennett, Wills, Wells, & Mackintosh, 1994; Honey & Hall, 1989; Mackintosh, Kaye, & Bennett, 1991) is based on the fact that the common elements of the stimuli (X) are presented twice as often as the distinctive ones (A and B). Salience would then be lower for the common than the distinctive elements and attention would be turned to the latter, thus improving stimulus differentiation. In terms of the preexposure schedule effects, it has been repeatedly found that intermixed preexposure to the stimuli (e.g., AX, BX, AX, BX,. . .) increases subsequent discrimination (both in humans, e.g., Lavis & Mitchell, 2006; Mundy,

* Corresponding author at: Facultad de Psicología, Universidad del País Vasco, UPV/EHU, Avda. de Tolosa, 70, San Sebastián 20018, Gipuzkoa, Spain.
E-mail address: r.angigle@gmail.com (R. Angulo).

http://dx.doi.org/10.1016/j.lmot.2014.05.001
0023-9690/

Honey, & Dwyer, 2007, 2009; and non-human animals, e.g., Honey & Bateson, 1996; Honey, Bateson, & Horn, 1994). In one particular version of this effect, intermixed exposure to AX and BX reduces the subsequent generalization of a conditioned response (CR) between them (e.g., Mondragón & Hall, 2002; Symonds & Hall, 1995, 1997) to a greater extent than an equivalent amount of preexposure in which the stimuli are presented in separate blocks (e.g., AX, AX,. . ., BX, BX,. . .). According to the accounts just mentioned, this would be because mechanisms able to increase (e.g., Gibson, 1969; Hall, 2003) or preserve (Hall, 2003; McLaren et al., 1989; McLaren & Mackintosh, 2000; Mitchell et al., 2008b) salience of the distinctive elements of the stimuli—otherwise expected to decline over preexposure—would be operating during intermixed but not during blocked preexposures (the specific mechanisms are proposed directly in the respective accounts).

Salience could be characterized as an attentional attribute of the stimuli, the more salient stimulus receiving the greater level of attention (e.g., Le Pelley, 2004; Mackintosh, 1975; Pearce & Hall, 1980). The more salient stimuli would be more effective in eliciting both conditioned or unconditioned responses as well as acquiring new learning. Thus the hypothesis that the "intermixed-blocked effect" relies on greater salience and attention to the distinctive elements of the stimuli after intermixed than blocked preexposure has been tested by assessing both the magnitude of the conditioned and unconditioned responses, as well its conditioning rate for the various stimulus elements following different kinds of preexposure. Studies of this sort have revealed differences in the intensity of the responses to the distinctive elements of the stimuli following intermixed and blocked preexposures. In humans, for example, longer gaze fixations on such elements have been found after intermixed than blocked preexposure (Wang & Mitchell, 2011). The studies conducted with rats and conditioning preparations seem to indicate that distinctive elements of the stimuli are more effective in interfering with the expression of a conditioning response, eliciting an unconditioned response, or serving as a reinforcer, following intermixed than blocked preexposure (e.g., Blair & Hall, 2003a,b; Blair, Wilkinson, & Hall, 2004).

To the best of our knowledge, however, it has yet to be clearly demonstrated that intermixed preexposure results in better acquisition of new learning for the distinctive elements of the stimuli compared with blocked preexposure. While there have been several attempts to find this effect (e.g., Blair et al., 2004; Contel, Sansa, Artigas, & Prados, 2011; Mondragón & Hall, 2002), only indirect evidence for it has been found in subsequent extinction and generalization tests (e.g., Artigas, Sansa, Blair, Hall, & Prados, 2006; Artigas, Sansa, & Prados, 2006; Contel et al., 2011; Dwyer, Bennett, & Mackintosh, 2001; Mondragón & Hall, 2002). Some authors have therefore concluded (e.g., Blair & Hall, 2003b) that such results might not neatly reflect the level of conditioning acquired and could be open to alternative explanations. Only one experiment conducted by Blair et al. (2004, Experiment 3b, but see also Experiment 3a) provided evidence of greater conditioning to the distinctive elements of the stimuli after intermixed preexposure (compared with blocked exposure) during the acquisition of conditioning itself. Unfortunately, this experiment was conducted with very unusual parameters with which the basic intermixed-blocked effect had not been demonstrated. According to the standard associative learning theories (e.g., Rescorla & Wagner, 1972; Wagner, 1981), salience should affect not only the magnitude of the responses elicited by the stimulus but also any subsequent learning about the stimulus. Thus, given that the notion of salience modulation seems to be of prime importance for any perceptual learning account, the results reported by Blair et al. (2004) deserve to be replicated with more standard parameters.

The principal aim of the present study, then, was to assess the acquisition of a conditioned response to the distinctive elements of similar stimuli following intermixed and blocked preexposure, in order to detect the hypothetical difference in salience according to the preexposure schedule. It was expected that the use of an intense stimulus would increase the likelihood of detecting the salience changes expected to occur during preexposure relative to a weaker one. Thus, instead of conditioning only the distinctive element of one of the pre-exposed stimuli (A or B) as was the case in other previous studies (e.g., Blair et al., 2004; Mondragón & Hall, 2002), here the distinctive elements of two pre-exposed stimuli, AX and BX, were assembled in a single compound (AB) to be jointly conditioned in a taste aversion preparation. To avoid interpretative problems related to generalization and extinction tests (e.g., Contel et al., 2011; Mondragón & Hall, 2002), only a single conditioning and test trial with the same AB compound was administered here and, unlike in the Blair et al. (2004) study, the flavors used here that constituted the AB compound were saline and sucrose (counterbalanced as the elements A and B), similar to those used in the majority of previous studies reporting the intermixed-blocked effect (e.g., Dwyer et al., 2001; Mondragón & Hall, 2002; Symonds & Hall, 1995).

Experiment 1

According to standard associative learning theories (e.g., Rescorla & Wagner, 1972; Wagner, 1981), there is a direct relationship between the salience of a stimulus and the strength of conditioning to such a stimulus, there being faster or greater conditioning to more salient stimuli. Thus, if the distinctive elements of similar stimuli were more salient after intermixed than blocked preexposure, as has been suggested from different theoretical approaches to perceptual learning (Gibson, 1969; Hall, 2003; Mitchell et al., 2008b), such elements should be more readily conditioned in the former than in the latter case. The principal aim of this experiment was to directly explore this possibility by conditioning a compound involving the distinctive elements of two pre-exposed stimuli. Subjects received either intermixed or blocked exposure to AX and BX, before being given a conditioning trial in which the AB compound was followed by an injection of LiCl. Lower consumption of the AB compound (stronger acquisition of the aversion) following conditioning would be expected for subjects given the intermixed preexposure compared with the blocked preexposure condition, if the compound is more salient in the former case.