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Role of Context in Autoshaping

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Three experiments used an autoshaping procedure in pigeons to investigate the conditioning of the context and of a discrete conditioned stimulus (CS) with a food unconditioned stimulus (US). CS–US associations were measured by directed pecking at the key light CS; context–US associations were assessed by general activity in the context. Experiment 1 investigated the influence of context–US associations on performance to a previously trained CS. The same CS produced greater key-pecking in a context of higher associative strength. Experiment 2 examined the influence of context–US associations on learning of CS–US associations. When tested in a context of fixed associative strength, a CS that had been trained in a context of high associative strength elicited less responding than one trained in a context of low associative strength. Experiment 3 found that signaling a US by a discrete CS interfered with the formation of context–US associations, as measured both in terms of general activity and ability to promote responding to another CS. These results suggest that the context and the CS compete for association with the US. They also suggest that context–US associations facilitate the exhibition of CS–US associations.

Recently, there has been a great deal of interest in how contextual stimuli interact with the conditioned stimulus (CS) in Pavlovian conditioning. Of special concern has been the possibility that during conditioning the contextual stimuli themselves become associated with the unconditioned stimulus (US). Context–US learning has been suggested to modulate responding to the CS in a variety of ways. The most common suggestions have been that contextual learning affects either the learning about the CS or performance to it. For instance, some authors (e.g., Konorski, 1967; Mackintosh, 1975; Rescorla & Wagner, 1972; Tomie, 1981) have argued that context–US associations affect the course of learning about the CS. Konorski (1967) has proposed that associations between the context and the US may facilitate CS–US learning, whereas others (e.g., Rescorla & Wagner, 1972) have viewed them as interfering with CS–US learning. In contrast, other authors (e.g., Gibbon & Balsam, 1981; Konorski, 1967) have suggested that contextual learning has its primary effect on performance to the CS. Konorski (1967) envisioned that context–US associations promoted performance to a discrete CS, whereas Gibbon & Balsam (1981) have recently suggested that they attenuate that performance. The experiments reported here were especially directed at evaluating two of these alternatives, the Rescorla–Wagner model of conditioning and the Gibbon–Balsam model of performance.

In the Gibbon and Balsam model, pairing a CS with a reinforcer has two independent consequences, conditioning of the CS and conditioning of the context in which the CS is embedded. Although both the CS and context develop associations with the US in a noncompetitive way, performance to the CS is governed by the ratio of its conditioned value to that of the context. Consequently, a context that is well conditioned will interfere with performance to an otherwise well-conditioned CS. According to this view, the well-known adverse effects on performance produced by trial massing or separate presentations of the US (e.g., Rescorla, 1968; Terrace, Gibbon, Farrel, & Baldock, 1975; Tomie, 1981) are attributable to differentially conditioned contexts yielding differential performance to the CS.

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By contrast, the Rescorla–Wagner model attributes the effects of context conditioning to its interference with learning about the CS. According to this model, all stimuli present at the time of a US delivery compete for the limited amount of associative strength supported by US. A stimulus acquires less associative strength to the extent that the US is already associated with other concurrent stimuli. For example, if a CS is paired with a US in a context, CS–US learning will be retarded if the context is already associated with the US. However, no role is given to the contextual conditioning in modulating performance to the CS. Consequently, this model ascribes the adverse effects of manipulations that condition the context solely to their impact on CS–US learning.

One can identify two issues that distinguish these approaches. First, does the associative strength of the context in which a trained CS is presented affect performance to the CS? Second, do the context and CS compete for association with the US? Moreover, is that competition symmetrical so that CS–US associations and context–US associations mutually interfere with each other?

Analysis of these alternatives requires a procedure with two features. First, we must be able to assess the level of context conditioning independently of its effects on a CS. Second, we must be able to present a CS in multiple contexts that differ only in their associative strength, so as to separate contextual effects on learning from their effects on performance.

The former requirement was met by a procedure recently developed in this laboratory by Durlach (1982). She exposed pigeons to two visually distinct contexts, only one of which contained grain. She found that birds readily learn to discriminate a reinforced context from a nonreinforced one, exhibiting that discrimination by being more active in the reinforced context. Moreover, the activity differences were removed by extinction and reversed when the reinforcement contingencies were reversed. These results suggest that general activity can be used to assess the conditioning of the context independently of its influence on a discrete CS.

The second requirement was met by exposing the same pigeon to three contexts, two of which were deliberately given different associative strengths. In Experiment 1, a CS was first conditioned in a common context. Performance to that CS was then assessed in two other differently valued contexts. This procedure allows the assessment of prior CS–US learning, conducted in the common context, in two equally novel contexts that differ in only their associative value. Consequently, any differences in responding to the CS in these contexts can be uniquely attributed to the associative value of the contexts differentially affecting performance to the CS. In Experiment 2 a CS was trained in either of two differently valued contexts and tested in the common third context. Under these conditions any differences in responding to the CS can be uniquely attributed to differences in the value of the contexts in which the CS–US learning took place. Experiment 3 used the same methodology to examine whether signaling a US influences its ability to condition the context.

Experiment 1

This experiment was intended to examine the effect of differentially conditioned contexts on performance to previously trained CSs. Pigeons were first given discriminative autoshaping to two key-light stimuli, one reinforced (CS+) and one nonreinforced (CS−). They then received exposure to two distinctive contexts, only one of which contained food presentations. Successful differential conditioning to the contexts was verified by monitoring general activity. Then performance to the pretrained key lights was tested in the differentially valued contexts in order to determine the consequences of context value for performance.

The Gibbon–Balsam model anticipates substantial performance differences to the same CS when tested in the reinforced and nonreinforced contexts. Responding should be greater in the nonreinforced context. By contrast, the Rescorla–Wagner learning model anticipates that performance to the previously trained CSs will not be influenced by the value of the context in which they are tested.

Method

Subjects. Thirty-two female White Carneaux pigeons, obtained from Palmetto Pigeon Plant and maintained at 75% of their ad-lib weight served as subjects. All birds had previously participated in other autoshaping experi-