Non-contingent positive and negative reinforcement schedules of supersitious behaviors

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Abstract

The role of schedules of reinforcement on the development of superstitious conditioning was investigated in a college age population. Participants were randomly assigned to one of eight operant schedules and instructed to remove (escape), prevent and/or remove (avoidance and escape) or produce (positive) the appearance of a computer generated stimulus using a response pad. Results from the experiment indicate that concomitant (escape and avoidance) schedules of reinforcement are most effective in facilitating acquisition of superstitious behavior as measured by self-reports of participants.
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Personal superstitions represent a large group of beliefs and actions that are not culturally bound, but instead held only by a single individual. Skinner (1948) first presented operant explanation for personal superstitions. Pigeons were exposed to non-contingent presentations of an appetitive stimuli. Every 15 s (fixed time-15 s; FT-15) food was presented to deprived pigeons irrespective of the behavior the pigeons displayed. Six of the eight pigeons demonstrated individual patterns of behavior following exposure to the paradigm. Skinner proposed that accidental juxtapositions of reward and a response establish an apparent contingency. Skinner generalized this result to human individual superstitions comparing a pigeon's circular head motion to a bowler swaying his/her hips in attempts to guide the ball to the center of the lane (Skinner, 1948).

Catania and Cutts (1963) first demonstrated superstitious conditioning in human subjects by utilizing a unique methodology. The authors described a new form of superstition, which they entitled "concurrent superstition". Concurrent superstitions are learned when concurrent contingencies are in effect. If one response is reinforced and the other is ineffective, any acciden-

tal reinforcements that coincide with the ineffective response are superstitiously maintained. Humans responded on the non-reinforced operandum as if there were a contingency in effect for that operandum.

Weisberg and Kennedy (1969) investigated "accidental schedules of reinforcement" in children. After training children in a response-dependent schedule, the response contingency was removed to assess how response rates differed. Like many earlier animal studies, the children continued to respond after the contingency was removed. Continued responding in the absence of a reinforcement contingency was identified by the authors as "superstitious" responding. Although these studies are interesting applications of non-contingent schedules, they are not demonstrative of free-operant acquisition as devised by Skinner. Although these studies are interesting applications of non-contingent schedules, they are not demonstrative of free-operant acquisition as devised by Skinner and could simply be a result of other operant processes such as resistance to extinction (Davis et al., 1973). Thirty years would pass before a true human application of Skinner's original operant paradigm would be carried out. Two studies in 1987 sought to recreate Skinner's superstition experiment in human subjects. Ono (1987) investigated non-contingent schedules in adults, while Wagner and Morris (1987) used children as participants. In both

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instances, fixed time schedules successfully produced individualized behaviors in a portion of the participants (3/20, 7/12, respectively).

Aeschleman et al. (2003) note astutely that studies have focused on positive reinforcement paradigms when investigating superstitious behaviors. Whereas positive reinforcement paradigms present appetitive stimuli as reward, negative reinforcement paradigms focus on the removal of an aversive stimulus as a reinforcer of behavior. Aeschleman et al. (2003) compared the acquisition of superstitious behaviors under rich (FT-6 s) and lean schedules (FT-6 min) of appetitive and aversive stimuli. The authors concluded that participants in negative reinforcement paradigms believed that they had more control over non-contingent stimulus presentation. Further, under lean schedules, this effect was even more demonstrable. Though the findings are interesting, they fail to truly address the comparison of positive and negative schedules. Careful investigation of the paradigms utilized by Aeschleman et al. (2003) reveals that the schedules utilized were not purely positive and/or negative reinforcement.

> Your task is to make the word "GOOD" appear on the screen as many times as possible, and/or to keep it on the screen for as long as possible after it appears. Use the 6 keys on the keyboard in front of you to try and determine a method to control the presentation of "GOOD." Do you understand your task is to make the word "GOOD" remain on the screen? (p. 40)

A paradigm in which the participant is tasked with bringing about the presentation of an appetitive stimulus is indeed positive reinforcement. However, the directions fail to stop there. They further task the participants with preventing the positive stimulus from being removed. The directions actually describe a paradigm that is both positive reinforcement and active avoidance. The subjects are encouraged to not only produce the stimulus presentation via their behavior but also to prevent it from being removed once it has appeared. Preventing the removal of an appetitive stimulus is defined as avoidance (Catania, 1987).

Similar confusion can be seen in the directions provided by Aeschleman et al. (2003) in the negative reinforcement condition.

> Your task is to keep the word "BAD" from appearing on the screen as few times as possible, and/or to remove it from the screen as quickly as possible after it appears. Use the 6 keys on the keyboard in front of you to try to determine the method to control the presentation of "BAD". Do you understand that your task is to keep the word "BAD" from appearing and to remove it from the screen? (p. 40)

The authors describe this condition as reflecting negative reinforcement, but careful inspection demonstrates that another, more complex paradigm is in effect. Negative reinforcement, or escape, requires the presence of an aversive stimulus. The stimulus can be removed via the action of the organism. The authors have instructed their participants instead to avoid the presentation of an aversive stimulus, another example of active

avoidance. The participants are also instructed that they should attempt to remove the aversive stimulus from the screen when it appears. In doing so, the participants are indeed tasked with a negative reinforcement paradigm. Rather than a single negative reinforcement paradigm, the experimenters have created a concomitant paradigm combining negative reinforcement and avoidance. The problem is exacerbated by the way in which the stimuli were presented. Aeschleman reports that in both the "GOOD" and "BAD" conditions, the stimuli were presented for 3 s in accordance with the time schedule for the session (every 6 s for the FT-6 s condition; every 6 min for the FT-6 min condition). Although this type of procedure is appropriate for the positive reinforcement condition, it is problematic for the negative reinforcement paradigm. In negative reinforcement, the removal of the aversive stimuli serves as the reinforcer. For this to have been a true negative reinforcement paradigm, the "BAD" stimuli should have disappeared for 3 s, serving as a reinforcer, rather than appearing for 3 s. Indeed, the experimental condition as described, is not negative reinforcement at all but instead avoidance.

In both experimental paradigms, Aeschleman et al. (2003) have inadvertently tested concomitant paradigms. Instead of comparing positive and negative reinforcement they have compared two more complex paradigms. In each case, the intended operant schedules are contaminated by active avoidance. In the "positive" condition, participants can actively avoid the removal of an appetitive stimulus. In the "negative" condition, participants can actively avoid the presentation of an aversive stimulus. Though the findings are still of interest, the authors have not addressed the hypothesis they initially posed, i.e., to compare positive and negative reinforcement paradigms in human superstitious conditioning.

The purpose of the present paper is to address the original hypothesis proposed by Aeschleman et al. by correcting the instructions and stimuli presentations provided to participants. By doing so, the role of positive and negative reinforcement in human superstitious conditioning will be addressed. Further, the role of active avoidance in non-contingent reinforcement will be elucidated by comparing the concomitant paradigms presented inadvertently by Aeschleman with positive and negative reinforcement paradigms.

1. Method

1.1. Participants

Participants were 66 (36 female, 30 male) undergraduate students at a Midwestern state university with an average age of 21.6 ($M = 21.6$). Subjects were recruited for participation from an introductory psychology class and had no previous courses in learning theory or exposure to operant laboratory experiments.

1.2. Apparatus

Participants were placed at a desk with a monitor attached to an IBM personal-computer and a response pad, the Nostromo n50 speedpad.