JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR VOLUME 7, NUMBER 4 JULY, 1964

RESPONSE COST EFFECTS DURING EXTINCTION FOLLOWING FIXED-INTERVAL REINFORCEMENT IN HUMANS

HAROLD WEINER[1]

SAINT ELIZABETHS HOSPITAL

This study examined the effects of response-produced cost upon human observer responses during extinction following FI reinforcement. Relative to a no-cost condition, cost produced marked and rapid response attenuation.

Previous studies have shown that response cost (point loss per response) reduces excessive unreinforced responding under positive reinforcement (Weiner, 1962) and aversive (Weiner, 1963b) contingencies. Cost has also been shown to attenuate responding during extinction following avoidance conditioning (Weiner, 1964). The present study examined the effects of response cost upon human observer responses during extinction following a 25-sec fixed-interval (FI 25) schedule of positive reinforcement.

METHOD

Subjects

The first, S13, a 25-year old normal male, was a graduate student with an IQ of 105. He was paid $4.00 for the first hour and $1.50 for each additional hour of testing each day. S55, a 21-year old psychiatric patient, was admitted to the hospital following charges of assaults and thefts. His official diagnosis was anxiety reaction with obsessive-compulsive and depressive features. His full scale IQ was 98. S93, a 37-year old psychiatric patient, was admitted to the hospital following a charge of homicide. His official diagnosis was schizophrenic reaction. He was considered to be in remission from his schizophrenic illness at the time this study was conducted. His full scale IQ was 130. The latter two *Ss* volunteered to participate without financial remuneration.

[1]This study was supported by Grant M-5600 CI from the National Institute of Mental Health, U.S.P.H.S. Reprints may be obtained from the author, Saint Elizabeths Hospital, Washington 20, D.C.

Apparatus, Task, and Instructions

The apparatus, task and instructions employed in this experiment have been described previously (Weiner, 1962). In general, *Ss* were instructed to detect and report red signals which appeared on a scope. Detection of these red signals required the pressing of a lever (with a force of approximately 20 g through a distance of 1 cm). Pressing this lever (observer response) provided the *Ss* with a brief "look" (0.3 sec) at the scope. Repeated "looks" at the scope required repeated release and depression of the observation lever.

When a red signal was detected, *Ss* were instructed to "report" it by pressing once on another lever. A reinforcement bell sounded and a digital counter mounted in front of the *Ss* registered 100 points each time a red signal was detected and reported correctly. The red signals had an "unlimited hold," *i.e.*, they remained available until detected and reported.

The *Ss* were told to "detect and report as many red signals, that is, score as many points as possible." They were told nothing about the purpose of the experiment, the presentation schedule of red signals, or the experimenter's interest in their observer responses.

Transistorized digital elements and networks (Weiner, 1963a) were used to program the experimental contingencies. Observer responses were recorded continuously on a Gerbrands cumulative recorder.

Procedure

Preliminary Conditioning Phase. In a preliminary conditioning phase, the observer re-

sponses of *Ss* were conditioned for 1 hr daily under a 25-sec fixed-interval (FI 25) presentation of red signals (and concomitant 100-point rewards per detection and report) under no-cost. Under no-cost, *Ss'* observer responses were emitted without loss of points. After 3½ hr of FI 25 conditioning under no-cost, a ½-hr one-point cost period was introduced. Under one-point cost, one point was subtracted from an *S*'s score for each observer response. For approximately the next 1⅙ hr, five reinforcements were provided under no-cost followed by five reinforcements under one-point cost. A yellow S^D light was on during the no-cost condition. Both the yellow S^D light and an additional white S^D light were on during the one-point cost condition.

Extinction Phase. The present study commenced when extinction was introduced, without additional instructions, following FI 25 conditioning. The extinction phase consisted of 170 min of alternating 2-min periods of no-cost and one-point cost during which no red signals were presented. The same S^Ds were used in extinction as in the conditioning phase.

RESULTS AND DISCUSSION

The initial portions of the records in Fig. 1 show the final stable FI 25 performances of each *S* under no-cost (1) and one-point cost (2) just before the introduction of extinction. Both S13 and S55 emitted fairly high constant

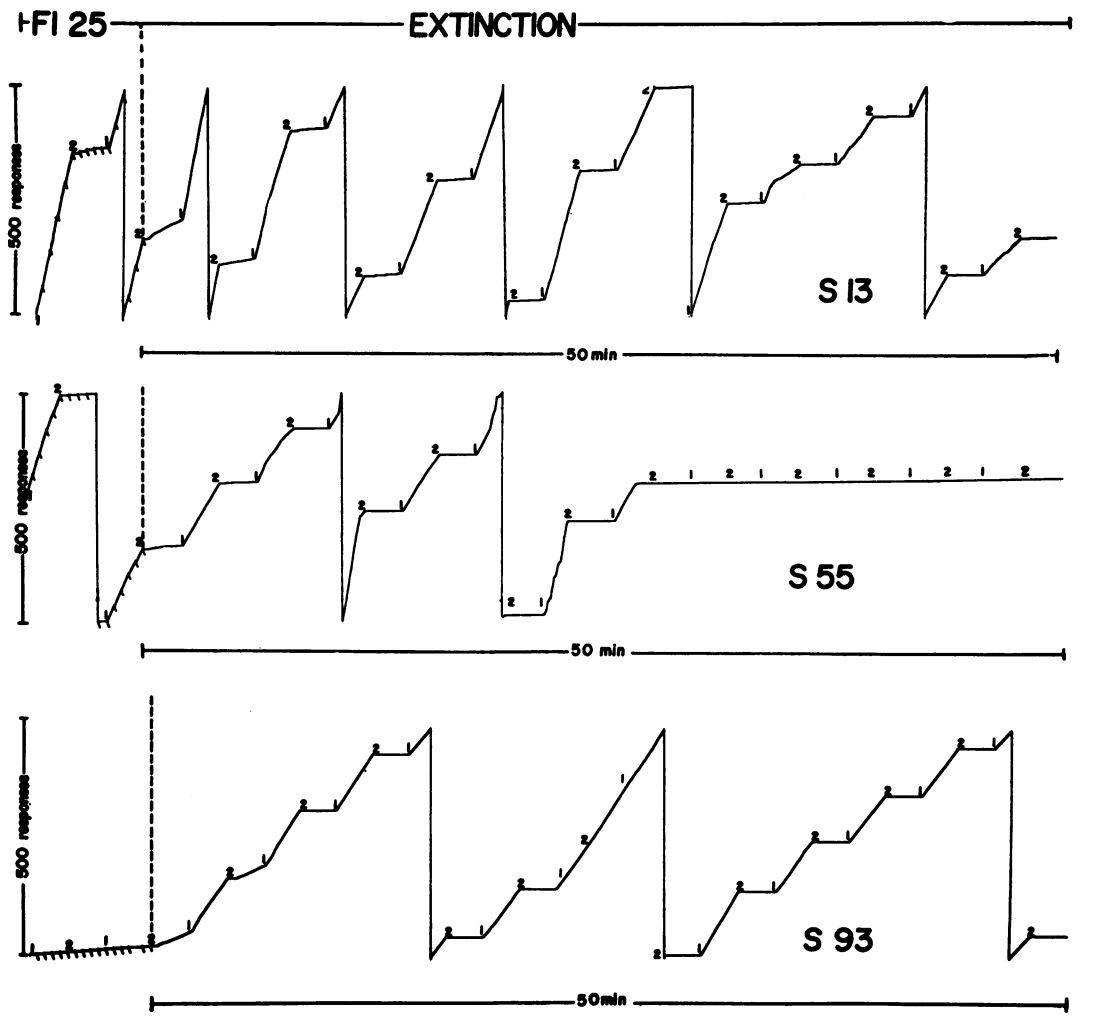

Fig. 1. Effects of no-cost (1) and one-point cost (2) upon responding during extinction following FI 25 reinforcement. Vertical marks on the record indicate the occurrence of 100-point reinforcements.

rates of responding under no-cost. One-point, cost, however, produced extended pauses between reinforcements. S93, on the other hand, paused between FI 25 reinforcements under both no-cost and one-point cost.

The last segments of the records in Fig. 1 show *Ss'* performances under no-cost and one-point cost during the first 50 min of extinction. During the subsequent two extinction hours (not shown), performances were similar to the final no-cost and one-point cost extinction patterns shown in Fig. 1.

During extinction, the three *Ss* showed more marked and rapid response attenuation under one-point cost than under no-cost. Except for the occasional responses of S13, all *Ss* stopped responding under cost during the first 50 min of extinction. Under no-cost, only S55 stopped responding. This occurred after approximately 30 min of extinction, some time after similar response cessation had occurred under one-point cost. The attenuation of responding during extinction following the introduction of one-point cost, is analogous to the effect which occurs in pigeons when response-produced shock punishment is added during extinction following food-reinforced FI conditioning (Azrin and Holz, 1961).

The no-cost extinction performances in the current study differed somewhat from the one reported by Holland (1958). In an extinction procedure most comparable to this no-cost condition, Holland found that the observer responses of a human subject declined gradually from a relatively high rate (approximately 60 responses per min) to a low one (approximately seven responses per min) after approximately 15 min of extinction. In the present study, S55 stopped responding rather abruptly after 30 min of extinction. S13 and S93 continued to respond at relatively high rates under no-cost throughout the 170-min extinction phase.

The individual differences in the no-cost extinction performances of the *Ss* do not appear to be related, unlike the findings of Holland (1958), to differences in their response patterns during FI 25 reinforcement. The no-cost extinction performances of S13 and S55 differed despite their fairly similar FI 25 reinforcement patterns. Furthermore, S93 emitted relatively high no-cost extinction responding despite a very low no-cost FI 25 response rate.

This study adds "extinction-responding-following-FI-reinforcement" to a wide variety of other reinforcement contingencies (Weiner, 1962, 1963b, 1964) under which cost has been shown to attenuate unreinforced responding in humans. Thus, cost appears to be a variable of considerable generality.

REFERENCES

Azrin, N. H. and Holz, W. Punishment during fixed-interval reinforcement. *J. exp. Anal. Behav.*, 1961, **4**, 343-347.

Holland, J. G. Human vigilance. *Science*, 1958, **128**, 61-67.

Weiner, H. Some effects of response cost upon human operant behavior. *J. exp. Anal. Behav.*, 1962, **5**, 201-208.

Weiner, H. Operant programming with transistorized digital elements. *J. exp. Anal. Behav.*, 1963, **6**, 193-195 (a).

Weiner, H. Response cost and the aversive control of human operant behavior. *J. exp. Anal. Behav.*, 1963, **6**, 415-421 (b).

Weiner, H. Modification of "non-adjustive" human operant behavior under aversive control. *J. exp. Anal. Behav.*, 1964, **2**, 166 (abstract).

Received February 14, 1964