before the R-RA curve begins to climb up, i.e., on the 10th day of treatment, 3rd day of training.

Further, if injections of RNase were discontinued, the antibody system would be left in a state of full production with two probable alternatives. It might attack the whole cell structure, whose ultimate destruction would account for the long-term loss of ability to learn, or it could concentrate on the native cell RNase, which is perhaps a more logical probability. If this were the case, the synthesis of RNA would be inhibited. Hadjiolov (1967) feels that one of the roles of cellular RNase is to split the newly formed RNA from its DNA template. Destruction of the RNase, then, would leave the RNA locked to its template, blocking further synthesis.

An "immunity" system could also account for the lack of effect of the RNase administration which began at the same time as training. If protein is involved in short-term memory, as Flexner, Flexner, & Roberts (1967) proposed, then, by the time the existing supply of protein would have expired, the "immunity" system would be in control and more protein would be being synthesized (cf. Fig. 1, P-RA avoidances). The possibility also exists, as Pevzner (1966) has pointed out, that increased neural stimulation would have facilitated RNA synthesis, possibly to the point where the RNase was not bringing about total destruction of RNA. This latter point is probable in light of Dingman & Sporn's (1961) findings that active RNA must be present for learning to take place.

Effects of two FR sizes on the value of information about time to FR*

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Two pigeons were exposed to a situation in which information about time until the onset of a fixed ratio schedule could be obtained by an observing response. Two S— durations were programmed, each following the FR schedule half of the time. An observing response during S— produced a color correlated with the duration of S— currently programmed. Observing responses were maintained when the FR size was FR 30, but were greatly reduced at FR 75.

A previous experiment by the author (Kendall, in press) demonstrated that stimuli differentially associated with periods

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appeared automatically at the end of an S— period. The results were interpreted as being favorable to the information theory of conditioned reinforcement, which says that stimuli that allow the animal to predict the onset of an important event become conditioned reinforcers (Hendry, 1969). In the present experiment, two values of the fixed ratio (FR) schedule were studied to determine if the FR value affected the reinforcement value of informative stimuli.

SUBJECTS

The Ss were two experimentally naive female White Carneaux pigeons.

APPARATUS

A commercial (Lehigh Valley Electronics) pigeon chamber with two keys was located in a room provided with white masking noise. Electromechanical programming and recording equipment was located in an adjacent room. Only one of the keys was used in the present experiment.

PROCEDURE

The pigeons were trained by successive approximation to peck the key, which was transilluminated green. Three seconds of access to grain served as the reinforcing event. When keypecking was established, the number of responses required for reinforcement was gradually increased to 30 (FR 30). The birds were trained on FR 30 in the presence of the green key light for four sessions of approximately 30 reinforcements each. The houselight in the box was illuminated at all times, except during the feeder cycle.

Following the above preliminary training, a period of nonreinforcement (S—) was instituted after each completion of FR 30. During each S— period, the key remained dark unless pecked. Half of the FRs were followed by a 30-sec S— period and the other half by a 90-sec S— period. The two S— durations alternated in an unpredictable order, each being preceded and followed by FR 30. The stimulus for FR 30 appeared automatically at the end of an S— period. A keypeck during S— produced one of two colors, depending on which S— duration was programmed. If the 30-sec duration was programmed, a peck produced a 1-sec flash of white light on the key. During a 90-sec S—, a 1-sec flash of red was produced. Keypecks during S— were designated "observing responses," since their only programmed consequence was to produce stimuli differentially associated with S— duration. This condition of the experiment is called the "informative" condition and abbreviated "I."

Following the informative condition at FR 30, a control procedure was

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Fig. 1. Observing response rates in the I and NI conditions at FR 30 and FR 75.

conducted. In the control procedure, the duration of all S- periods was 30 sec, but white and red lights were still response contingent during S- periods. This procedure is called "noninformative" (NI).

After training in both the informative and noninformative conditions with the FR set at FR 30, the birds were returned to the informative FR 30 condition and the FR value was gradually increased to FR 75. Following exposure to the informative condition at FR 75, the noninformative condition was again introduced. Thus, all procedures conducted at FR 30 were also conducted at FR 75.

Sufficient sessions were run in all conditions of the experiment to insure satisfactory stability of S- response rates. The number of sessions varied from 20 to 40 for the two birds in different conditions of the experiment.

RESULTS AND DISCUSSION

Figure 1 displays four pairs of bar graphs for each animal, showing the rate of observing responses. Each pair is labeled according to whether it comes from the I or the NI condition. The response rates are graphed separately for the two S- conditions, with the duration of the S- period given below a bar and the stimulus produced (red or white) indicated by "R" or "W." Two pairs of bars for each S are taken from the FR 30 phase

and two pairs from the FR 75 phase. Each bar represents the average response rate for the last four sessions under a given condition.

We will first consider the data from the phase of the experiment where FR 30 was the reinforcement schedule. For each bird the response rates in both S- components decreased when they were switched from the informative to the noninformative condition. The decline was not so marked for Bird 2, but the response rates for that bird dropped to about half of the rates in the informative condition. Also, for each bird the response rate is greater in the 30-sec S- period than in the 90-sec S- period. For Bird 2 there was a large difference between responses for red and responses for white in the noninformative condition.

The results from this part of the experiment replicate previous findings in two ways (Kendall, in press). First, the data show that observing responses may be obtained when they produce only stimuli differentially correlated with S- duration. Second, the results replicate the finding that the response rate is greater in the shorter of the two S- periods. In addition, the present experiment used a different type of control procedure. In the above-mentioned experiment, a control procedure was used in which the durations of the S- periods were kept the same as in the informative

phase but in which the stimuli did not reliably predict the duration of S-.

When the FR was set at FR 75, observing behavior in the noninformative condition did not differ greatly from the informative condition. Both rates went down for Bird 1, but only the rate in the S- component producing red went down for Bird 2. Comparing the data from this part of the experiment to the conclusion that the value of information about FR is greatly reduced at FR 75.

Although the results of this experiment and those of a previous experiment can be interpreted by reference to the information theory of conditioned reinforcement (Hendry, 1969), there are some aspects of the data not easily understood in light of that theory. First, there was a rate difference between the two S- conditions. Evidently the stimuli have some value other than that which can be accounted for by information alone. This problem has been noted before in other experiments (Dinsmoor et al, 1969; Kendall, 1969). It is not clear from the point of view of the information theory of conditioned reinforcement why more than one response should occur in either condition, since a single stimulus presentation should give all the information available.

The data from the present experiment do indicate that when stimuli predict the time until the onset of a FR schedule, the stimuli are less valued the larger the size of the FR. This may be because of the conditioned reinforcing value of the light associated with FR. When the FR is small, the color associated with FR has a greater conditioned reinforcing value and the importance of its onset is greater than when the FR is large.

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