

COUNTING BY HUMANS ON A FIXED-RATIO SCHEDULES OF REINFORCEMENT

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In a series of experiments on observing behavior (2, 3), a subject is asked to monitor a dial and report deflections of a pointer. The dial is in the dark and can be seen only by pressing a key which briefly flashes a light. This response on the light-flashing key is defined as an observing response since it is essential for detecting the signal. The work has demonstrated that signal detections reinforce the observing response.

In two of these experiments, pointer deflections occurred on fixed-ratio schedules (i. e., the pointer deflected after some fixed number of observing responses had been made). Of 14 subjects on fixed-ratio schedules, all but one showed characteristic fixed-ratio performances (3)-- high rates of responding with occasional short periods of no responding after reinforcement. This one subject was an interesting exception.

As already indicated, the subject's task was to watch a dial for deflections of a pointer. He was instructed to detect as many pointer deflections as he could and to report them as quickly as possible by pressing a second key, which reset the pointer. The dial was made visible (and detections possible) only when the subject pressed a key which provided a 0.07-second flash of light. At the end of each session, he was told how many detections he had made and how long, on the average, the signal remained undetected. Care was taken not to suggest that the experimenter was at all interested in the rate with which the light-flashing key was pressed. However, cumulative records were made of responses on this key.

Deflections were scheduled first on FR36. The ratio was later increased to 60, 84, and finally 108, with six 40-minute sessions on each.

Figure 1 presents segments of records from the last sessions on each of the indicated fixed ratios. The performance on FR36 is like that for the other 13 subjects except for the absence of periods of no responding occasionally found just after reinforcement. During the third session on FR60, however, the pattern of responding begins to change. The rate immediately after reinforcement is rather high but changes to a lower rate after a few responses and returns to a higher rate just before reinforcement. The ratio segment is an inverted S. The subject volunteered the information that he was counting responses between reinforcements in order to report the pointer deflections quickly. He could accurately state the number of responses between deflections. His latency came to be the shortest of all subjects.

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It seems, then, that the subject's verbal count produced the unusual pattern in his response rate. Ferster and Skinner (1) have demonstrated that an added "counter" will exert control over the rate. Using pigeons on FR schedules, they provided a slit of light which changed in length with each response and reset to its original length after the reinforced response. The slit came to exert stimulus control. Changing the rate of growth of the counter during different parts of the ratio resulted in correlated changes in rate. With the human subject in this experiment, the "added counter" was provided by his verbal behavior. The over-all rate is lower than that found in the absence of verbal counting. This might be due to pacing imposed by the verbal count. The rate is slower during the middle of the ratio and finally increases as the count approaches the point of reinforcement.

As a test of the interpretation, two subjects were instructed that they could obtain shorter latencies in reporting pointer deflections by counting the number of times they flashed the light. They were also instructed that while they should make as many detections as they reasonably could, the primary task was to make quick reports of the pointer deflections. One of these subjects, represented in Fig. 2, shows a pattern of responding which differs from the first subject in the absence

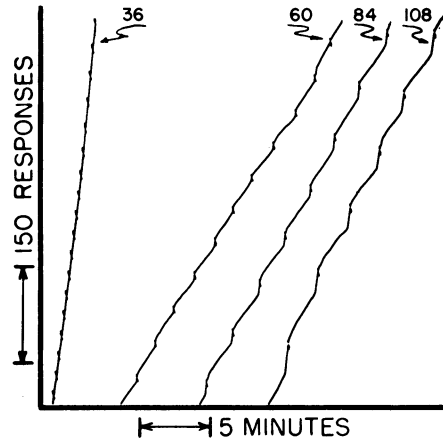


Fig. 1. Segments of cumulative records on FR36, FR60, FR84, and FR108 for Subject 1, who began counting his responses without instructions.

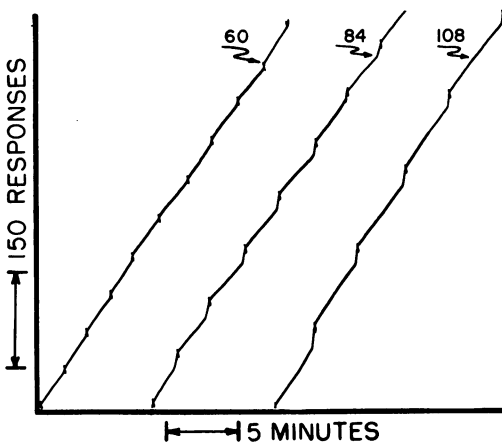


Fig. 2. Segments of cumulative records on FR60, FR84, and FR108, with instructions, for the second subject.

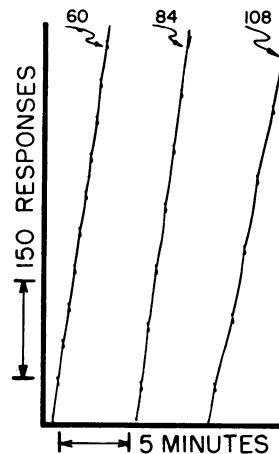


Fig. 3. Segments of cumulative records on FR60, FR84, and FR108, with instructions, for the third subject.

of a higher rate following reinforcement. There is marked positive acceleration as reinforcement approached. Subject 3 in Fig. 3 showed a much higher over-all rate, which tends to obscure the positive acceleration in the record. Nevertheless, the acceleration as reinforcement approaches can be seen by foreshortening the record.

SUMMARY

A verbal counter is demonstrated to control the pattern of response rates on an FR schedule. All three subjects show positive acceleration near the end of each ratio. But, otherwise, there were wide differences among the three subjects--one showing negative acceleration in the early portion of each ratio and another showing a much higher over-all rate. Such differences may well be attributable to differences in the verbal counters which were beyond the control of the experimenter.

REFERENCES

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