Reaction time and choice performance in children's binary choice behavior[1]

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Fifty-five Ss received 150 trials under a 70:30 reinforcement schedule and 150 trials under a 30:70 schedule. RT and choice behavior were observed for each S. The results indicate that RT decreased as a function of trials and there was no change in RT when the probabilities were altered in spite of the fact that Ss' choice behavior did reflect a change.

There are only a few reported studies of reaction time (RT) and choice behavior using young children as Ss (Crandall, Solomon, & Kellaway, 1955; Philips, 1934), although there is considerably more work with children using a simple RT paradigm rather than a disjunctive situation (Goodenough, 1935; Jones 1937; Gilbert, 1894; Clarparède, 1925; Miles, 1931). In general, several findings have emerged from RT studies. RT increases with age although Miles (1931) working with 8- to 80-year-olds found RT to a simple response situation to be curvilinear with RT speeds fastest for the 20-year-olds and slowest for the 8- and 80-year-olds. Secondly, disjunctive RT is directly proportional to the information contained in the stimulus (Hicks, 1952). And finally, the greater the similarity between the choices, the longer the reaction time (Crandall et al, 1955).

The present experiment was interested in the relation between RT and the child's choice behavior, both in an initial binary choice situation and when the binary choice problem was reversed.

Method

Fifty-five fourth grade children, 29 girls and 27 boys, were seated in front of a gray wedge-shaped panel, 18 x 18 in. with two green micro-switch buttons 9 in. apart. Above each of the buttons was a green reinforcement light. Ss were instructed to try to guess the "correct" button as often as possible. Four or five practice trials were held to make sure the S understood how to tell whether he had made a "correct" response. He was told that if he made the correct response, the light would flash above that response. If he did not make a correct response, the opposite light was flashed, making the reinforcement noncontingent upon S's response. The S was informed to wait until a buzzer sounded before he responded, and then to respond as soon after the buzzer sounded as he wished. All the children were able to follow this instruction. The experimenter sat opposite the child and monitored the child's response with his apparatus which consisted of a red and green light indicating S's choice, a Hunter electric timer to record S's reaction time, a button which signaled the onset of the trial and started the electric timer and finally, a set of buttons to reinforce either the right or left choice.

Three hundred trials were then administered. For the first 150 trials, the probabilities were 70:30 with the left side correct (reinforced) 70 percent of the time. The 70:30 ratio was stochastic and it held for each 25 trial block. The second 150 trials occurred immediately after the first 150 trials with no visible break between the sets of trials. For the second 150 trials the probabilities were reversed, the right side then reinforced 70 percent of the time. While there was some variability, the intertrial interval was approximately 2 sec. in duration.

Results

Figure 1 presents the mean proportion of responses and mean response time in sec. for the left side for the first 150 trials as well as for the 150 reversal trials for both sexes in blocks of 10 trials.

Mean Proportion of Responses to Left Side. Figure 1 indicates a significant increase in responses to the left side over the first 150 trials and a significant decrease

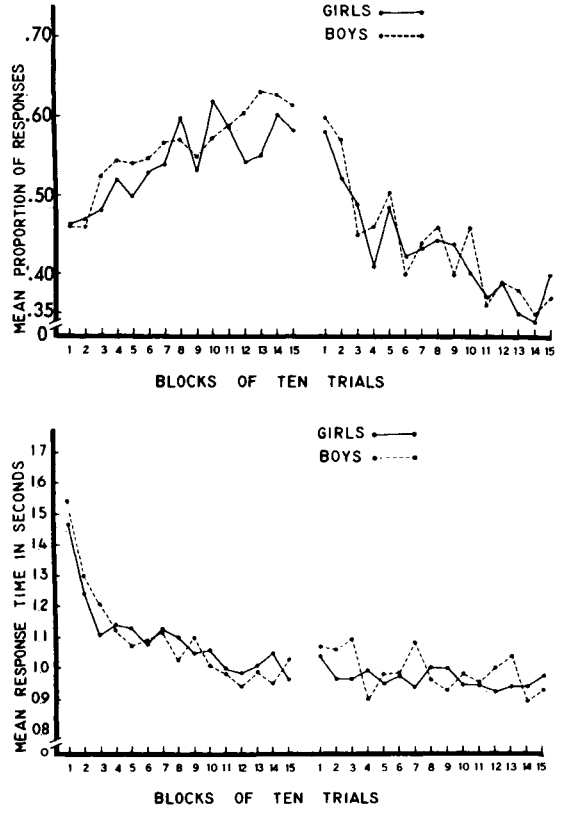

Fig. 1. Mean proportion of responses and response time in seconds to the left side per block of 10 trials for acquisition and reversal.

Table 1. Number of Ss Showing Change in RT at Point of Change in Choice Performance as Compared to the Last 10 Trials Prior to Reversal

	Change in Choice Behavior		No Change in Choice Behavior
	Increased RT	Decreased RT	
Boys	12	10	5
Girls	10	10	8
Total	22	20	13

over the second or reversal 150 trials. An ANOV indicated no sex differences but a significant trial effect ($F = 2.64$, $p < .01$). The choice data indicate that the children learned the initial problem and were able to reverse their choice behavior when the probabilities were reversed. Further, the data indicate that by the end of the first 30 trials of reversal, the frequency of Ss' choice of the left side had fallen below 50 percent. A test of significance of the difference between the last 10 trials prior to reversal and the third block of trials after reversal (trials 20-29) revealed a significant decrease in choices of the left side (Sign Test, $p < .01$). Thus, by the end of 30 trials of reversal, Ss had begun to show a change in their choice behavior reflecting the reversal in the proportion of correct responses.

Reaction Time Figure 1 presents the RT in mean sec. per block of 10 trials for each sex. An analysis of variance over the 300 trials again indicated no sex difference but a significant trial effect ($F = 2.76$, $p < .01$). The data indicate a decrease in the RT over the first 150 trials, reaching an asymptote at about 0.8 sec. Of particular interest is the RT time for the first 30 trials after the reversal of the proportion of reinforced responses. Ss' choice data indicated that within these first 30 trials Ss started to alter their choice behavior, while the RT data fails to indicate any change.

In order to test this result, the mean of the last 10 trials was compared to the mean of the first 30 trials. A Wilcoxon test (Siegel, 1956) was performed and the results indicated that there were no significant differences between the last 10 trials prior to reversal and the first 30 trials of reversal. Finally, the data failed to show any variability differences between the last 30 trials prior to reversal and the first 30 trials of reversal. The variability differences in the boys' RT data reflect only one S's behavior.

It was possible that the lack of RT change was a function of the measurement procedure used. That is, Ss might have shown their biggest choice change at different times and the averaging of the total 30 trials might have eliminated any significant difference. In order to insure that this was not the case, the following analysis was made. Each S's choice behavior was observed and that block of trials during reversal which was thought to represent a change in behavior was marked by two independent scorers. The criterion used for determining change in behavior was the first block of trials which showed a marked drop in the response to the left side (20 percent or more) and which was not followed by a recovery in responses to that side. The interscorer reliability was near perfect, with agreement occurring 96 percent of the time. The point of change could have occurred on any of the 15 blocks during reversal. One block before this point and one after were also used to insure inclusion of that point when S's performance changed. These three blocks were each compared to the last block prior to reversal in order to determine whether there were any RT differences associated with Ss' changed behavior.

Table 1 presents the number of Ss who showed changes in RT at or around the point of change in choice behavior as compared to the last 10 trials prior to reversal. A chi square analysis of these differences is not significant. This individual S analysis, then, indicates that there was no significant likelihood of RT increases around the point of change in S's choice behavior.

Discussion

The data indicate that Ss' choice behavior varied as a function of the probabilities. Ss learned to respond to the left side and then changed to the right side when the probabilities were reversed. Moreover, this reversal in choice behavior occurred within the first 30 trials after the probabilities shifted. RT, however, showed no significant increase when the problem was reversed. Assuming that RT or changes in RT in humans reflects some type of cognitive or thought process with longer RT indicating more thought, the failure of RT to increase as S was solving the reversal suggests that a minimum of cognitive capacity is necessary for such problem solving.

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Note

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