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Choice and self-control in children: A test of Rachlin's model

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Rachlin and Green (1972) proposed a model which analyzed self control as a reversal of preference for two reward values in time. The present study investigated the utility of the model in the investigation of self-control in children. Two boys (ages 9-10) were exposed to a chain of events in which a left alternative *(initial link)* lead to a choice *(terminal link)* between a small, immediate reward (2 tokens) or a large. delaved reward (4 tokens delaved 4 sec). Equal preference was found for both left and right alternatives although once the left alternative had been selected, the immediate reward was chosen on a large percentage of the trials. However, as these choices were moved further into time, preference for the left alternative increased and the children chose the immediate reward almost exclusively. In addition, subjects spent a greater percentage of their daily tokens as time to the choice point increased. These results do not replicate Rachlin and Green's findings with pigeons. However, the subjects did show a reversal of preference as time to the choice point was manipulated, suggesting the model's utility in the investigation of self-control with humans.

Self-control refers to self-regulated behavior change and is defined by Mahoney (1972) as any response made by an organism which modifies the probability of another response. For example, a woman who desires to lose weight can do so if she first makes a commitment to lose the weight, then engages in some behavioral strategy which prevents the occurrence of eating foods which will make her fat. The commitment and eventual behavior change, however, is based on an underlying process which implies a reversal of preferences for two reward values in time (Rachlin & Green, 1972). In the case of the woman who desires to lose weight, she must choose between two behavioral outcomes: the first is an immediate reward of eating the desired food now, and the second is the delayed, but more valued reward of losing weight, staying thin and more attractive. When the immediate reward is readily available, there is a strong tendency for the woman to choose it. However, if she makes the commitment to deter choosing the immediate reward and develops a strategy to insure that the more valued outcome is chosen, she exhibits self-management. The finding that commitments of this type are made is further evidence that there is a reversal of preferences for the two rewards in time.

An experimental analysis of self-management as a reversal of preferences in time has come from only one known source, Rachlin and Green (1972). These investigators proposed a model to investigate commitment, choice, and self-control in pigeons. In their experiment, pigeons were initially offered a choice between a small immediate reward consisting of 2-sec access to grain and a large reward consisting of 4-sec access to grain which was delayed for 4 sec. In this condition, pigeons were found to prefer the small, immediate reward; that is, they did not exhibit self-control. However, when the pigeons were required to wait for certain periods of time before they could choose between the immediate and delayed rewards, the pigeons reversed their preference. As the rewards were moved further into time, the pigeons chose an alternate response which lead to the larger, delayed reward only. This response was considered a measure of self-control since it avoided the temptation of choosing the immediate reward. The commitment to make this self-control response was inferred from the data.

The present experiment applied Rachlin and Green's model to examine self-control in children.

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METHOD

Subjects

Two male children, ages 9 and 10, from middle income families participated in the experiment.

Apparatus

A small dimly lit room housed a chair and a table on which a metal console sat. The console's face contained a row of two IEE (Series 360) in-line stimulus displays. The stimulus displays were used to project colored stimuli to the subject. The display was about 4 x 5 cm and a distance of 10 cm separated displays. A response lever was centered 8 cm beneath the stimulus display window and required a force of 270 g to depress through a distance of 3.5 cm.

The tokens were mexican five-centavo pieces (Osborne, 1969), exchangeable for money (each token = $0.05), and were dispensed by national cash register coin changer. Children could either save or exchange the tokens each day. Those tokens saved could only be exchanged at the end of each week (5 days).

Electronic timers and electromechanical equipment located in a separate room programmed the experimental conditions and recorded the data.

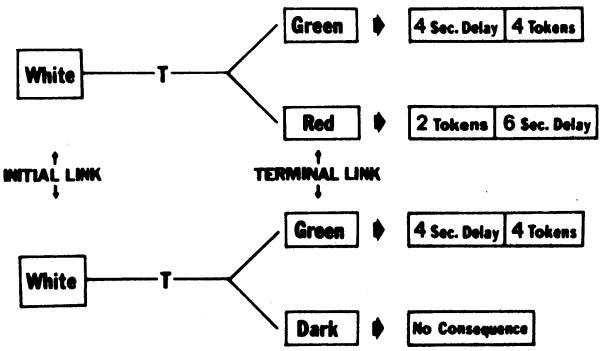

Figure 1. Flow-chart describing the contingencies for each child.

Procedure

Prior to the first experimental session, each child sat before the console and the experimenter read the following instructions: "This is a task in which you can earn tokens. The tokens will be delivered to you from this dispenser. The way to earn the tokens is by pressing one of these two bars. You may *not* press two bars at the same time (the experimenter demonstrated). Choose only one bar to press when these lights come on. Do not press the bars when the lights go out."

The following procedure is largely adapted from Rachlin and Green (1972) with some modification to suit our experimental needs.

Figure 1 is a flow chart which describes the contingencies for each child. In the *initial link*, both left (upper arm) and right (lower arm) stimulus displays were transilluminated with white light. Passage to the *terminal link* depended upon one response made on one of the two levers. If the child pressed the left bar, both display lights were darkened for T sec after which both were reilluminated, one with red light and the other with a green light. Which display lit red and which green was randomly determined for each trial. One response on the lever beneath the green light produced a 4-sec delay followed by the delivery of four tokens, delivered at 1-sec intervals. If the child pressed the right lever in the *initial link* (lower arm) both displays were darkened for T sec followed by reillumination of only one of the displays (randomly determined) with a green light. The other display remained dark. A response on the lever below the green light produced a 4-sec delay followed by the delivery of four tokens delivered at 1-sec intervals. After termination of the consequences in the *terminal link*, the displays were reilluminated with white light and a new trial began. Responses during the delay period had no scheduled consequences and were not monitored.

A session consisted of 24 trials: four fourced trials, in which the two response alternatives were alternately presented, followed by 20 free choice trials. The forced-trial procedure ensured that each arm in Figure 1 was experienced by the subjects at least twice each session.

At the beginning of the experiment, each child received 10 forced trials of the upper and lower arms in Figure 1. In subsequent sessions, both displays were illuminated with white light, and the four forced and 20 free-trial procedure was in effect. Both children began at a T value of 12 sec and were then exposed to the following T values: 0, 4, 8, 12, 16, 32, and

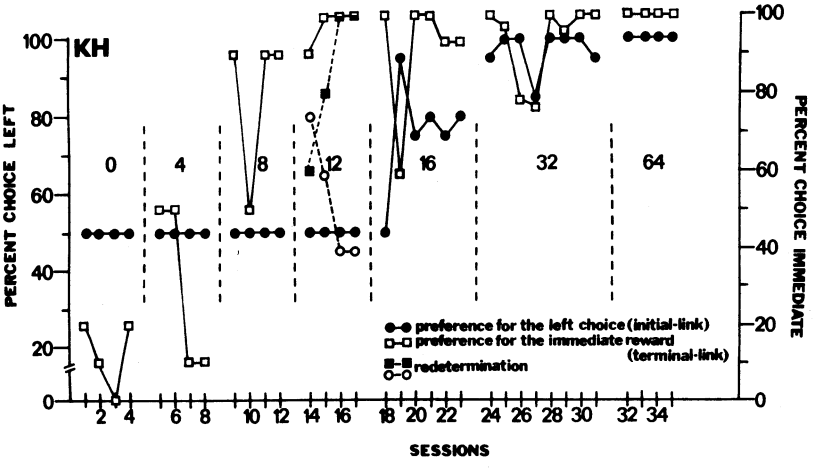

Figure 2. Percent choice for the left alternative in the *initial link* (filled circles) and percent choice for the immediate reward in the *terminal link* (open squares) at all values of T for Subject KH.

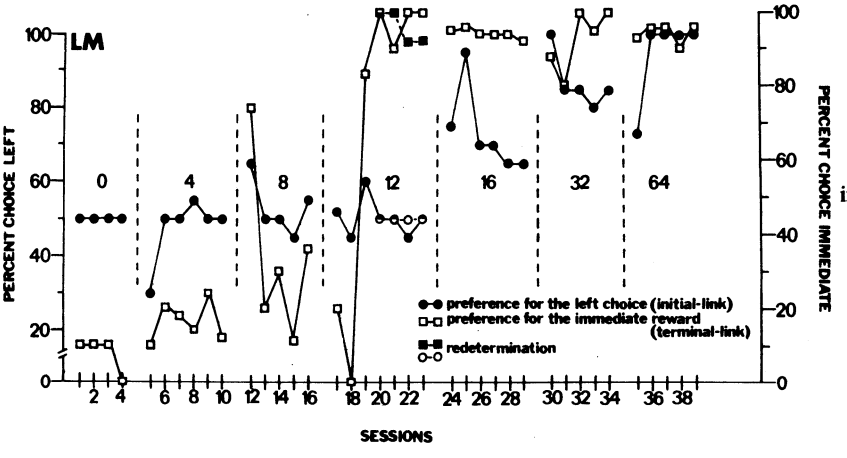

Figure 3. Choice data for LM. Other information as in Figure 2.

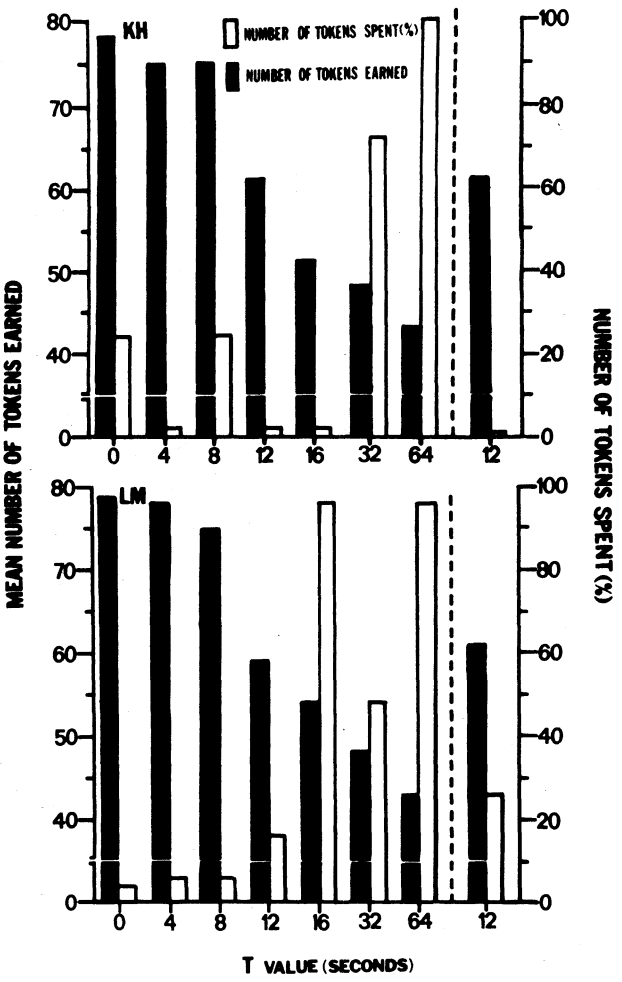

Figure 4. Mean number of tokens earned under each T condition (left ordinate) and percent of those tokens spent for all T values (right ordinate). Data are averages based on the last four sessions under each T condition.

64 sec. Children were exposed to each T value for at least 4 days. Change to the next T value was dependent on 2 successive days in which the subject did not deviate more than 10% in his choices during the *initial link*.

RESULTS

Figure 2 shows the percent choice for the left-alternative in the *initial link* (filled circles) and percent choice for the immediate reward (open squares) in the *terminal link* for all values of T for Subject KH. Note that only the data for choice of the left alternative and choice for the immediate reward in the *terminal link* are presented. Preference for the left alternative in the initial link remained constant at 50% across T values to 12 sec. At a T value of 16 sec, preference for the left alternative was close to 80% and at T values of 32 and 64 sec, preference was virtually 100%.

With respect to the selection of the immediate reward in the terminal link, it can be seen that as T increased, the subject's preference for the immediate reward increased up to a T value of 12 sec where preference reached 100% and stayed there for the remaining T values. The data for the initial exposure to a T value of 12 sec are shown between Sessions 14 to 17 in Figure 2 and connected by dashed lines. Choice data (redetermination) at this value were recovered when the subject was reexposed to a T of 12 sec.

Figure 3 shows choice data for the second subject, LM. These data are very similar to those shown for KH. Preference for the left alternative remained constant at about 50% across T values to 12 sec. Preference for this alternative gradually increased across T values of 16 to 32 sec. Once this subject was exposed to a T of 64 sec, preference for the left alternative rose to 100%. Also, as T increased, preference to the immediate reward increased up to a T value of 12 sec where preference reached 100%. Preference for the immediate reward stayed near 100% across the remaining T values. The redetermination points associated with the first exposure to a T value of 12 sec were recovered for this subject as well.

Figure 4 shows the mean number of tokens earned under each T condition (left ordinate) and the percent of tokens spent for all T values (right ordinate). Generally, the mean number of tokens earned decreased at T increased, while the percent of tokens spent increased as each child experienced increasing values of T. The data appearing to the right of the segmented line shows earning and spending data for the first exposure to a T value of 12 sec. A comparison of these data with the earning and spending data under the T value of 12 sec in the second exposure shows that earning and spending patterns were recovered.

DISCUSSION

The findings of this study do not replicate those found by Rachlin and Green. Unlike the pigeons in their study, as T increased, our subjects' preference for the left alternative in the *initial link* increased, and preference for the immediate reward in the *terminal link* increased. Thus, the children did not utilize the right alternative. This was considered a "self-control" response because it avoided the temptation of the immediately available reward. The finding that these children did not exhibit self-control as the rewards were moved into time is illustrated further in the earning and spending data. As T increased, the children chose the immediate reward of two tokens, thus earning less than before. They also exchanged an increasing percentage of tokens earned each day as T was lengthened.

Although the results of this study do not replicate Rachlin and Green's findings, these children did show a reversal of preference as T was manipulated suggesting the model's utility in the investigation of self-control with humans.

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