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**CHILDHOOD CHOICE MAKING PATTERNS AS A FUNCTION OF  
CONTINGENCY SHAPING VERSUS INSTRUCTIONAL CONTROL**

by

**Nathan Atkin Call**

**Thesis submitted in partial fulfillment  
of the requirements for the degree**

of

**UNIVERSITY HONORS  
WITH DEPARTMENT HONORS**

in

**Psychology**

**Approved:**

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**Dr. Gretchen A. Gimpel: Thesis Advisor**

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**Director of Honors Program**

**UTAH STATE UNIVERSITY  
Logan, UT**

**1998**

## **Introduction:**

The term contingency shaped refers to any response class governed by its direct consequences (Catania, 1973). In a theoretical paper on problem solving Skinner (1966) discriminated between contingency shaped and rule-governed behavior by stating that no matter how similar in form they may appear each have independent controlling variables and functional properties. In a later analysis (Skinner, 1974) he elaborated on rule-governed behavior by pointing out that one distinct form of rule-governed behavior is instruction following. An instructional episode, however, consists of more than any verbal or non-verbal statement of contingencies, but includes the consequences in question as well (Cerutti, 1989). Given this definition, it is apparent that humans are constantly encountering instructional episodes. As a result, all verbal humans clearly have a socially reinforced repertoire of behavior that is under instructional control by the time they reach an early age. As a distinct class of behavior, instruction following often comes to be highly reinforcing as instructions serve to expedite reinforcement or escape from punishment.

Indeed, it is these very consequences which come to control the response class of instruction following (Galizio, 1979). In most cases following instructions results in a consequence that either removes an aversive situation (or the individual from it) or introduces a more favorable one. However, compliance with instructions is often highly variable, as anyone with children will readily admit. Again this is a product of the consequences for compliance to instructions. The matching law dictates the relative frequency of a given behavior will closely approximate the relative frequency of reinforcement for responding in such a way (Hernstein, 1961). If competing non-compliant responses yield a higher frequency of reinforcement they will occur at a higher rate than instruction following.

Yet one of the effects of instructional control is that it often overrides any reinforcing or punishing consequences which are collaterally encountered (Skinner, 1966). That is, some behaviors under instructional control can encounter concurrent but secondary contingencies without coming under control of these contingencies. And while insensitivity has been demonstrated experimentally by demonstrating instructed behavior which persists despite changes in scheduling of collateral

consequences (Galizio, 1979; Lowe, 1979) it is by no means an inevitable property of instructional control. Rather, it arises when some contingencies are put in place concurrently with some instructions. Likewise, the history of compliance or lack thereof on the part of the subject is a critical component of insensitivity.

Hackenberg has shown that compliance with instructions as well as sensitivity to changes in a schedule of reinforcement varies as one comes in contact with contingencies. (Hackenberg & Axtell, 1993; Hackenberg & Joker, 1994). Specifically, instructions only served to control behavior as long as they accurately described the contingencies in place. Even so, this control or lack thereof was not perfectly correlated with accurate or inaccurate instructions respectively.

All of this combines to form a very ambiguous picture of instructional control and compliance with instructions. The variables involved are many and complicated. Perhaps this explains why most studies examining childhood non-compliance simply attempt to ameliorate problems associated with this type of behavior. Meanwhile little has been done to examine the variables influencing and functions of non-compliant behavior itself. This can possibly commence with identifying any patterns in choice making under non-compliant conditions. This study attempted to do this by ascertaining what patterns, if any, exist in choice making when children disobey parental instructions.

A computer game was used in which children made choices to earn points which were exchangeable for tangible reinforcers. Two types of points were available, some of which were exchangeable and some of which were not. Points were also available in differing quantities. After some experience with the game, instructions were given by the subjects' mothers which required them to behave in a manner that would not yield tangible reinforcers.

This study attempted to ascertain how parental instructions altered subject's choice making patterns. Specifically of interest was whether parental instructions would lead the subjects to select the less reinforcing of the options which delivered exchangeable points.

## *Experiment I*

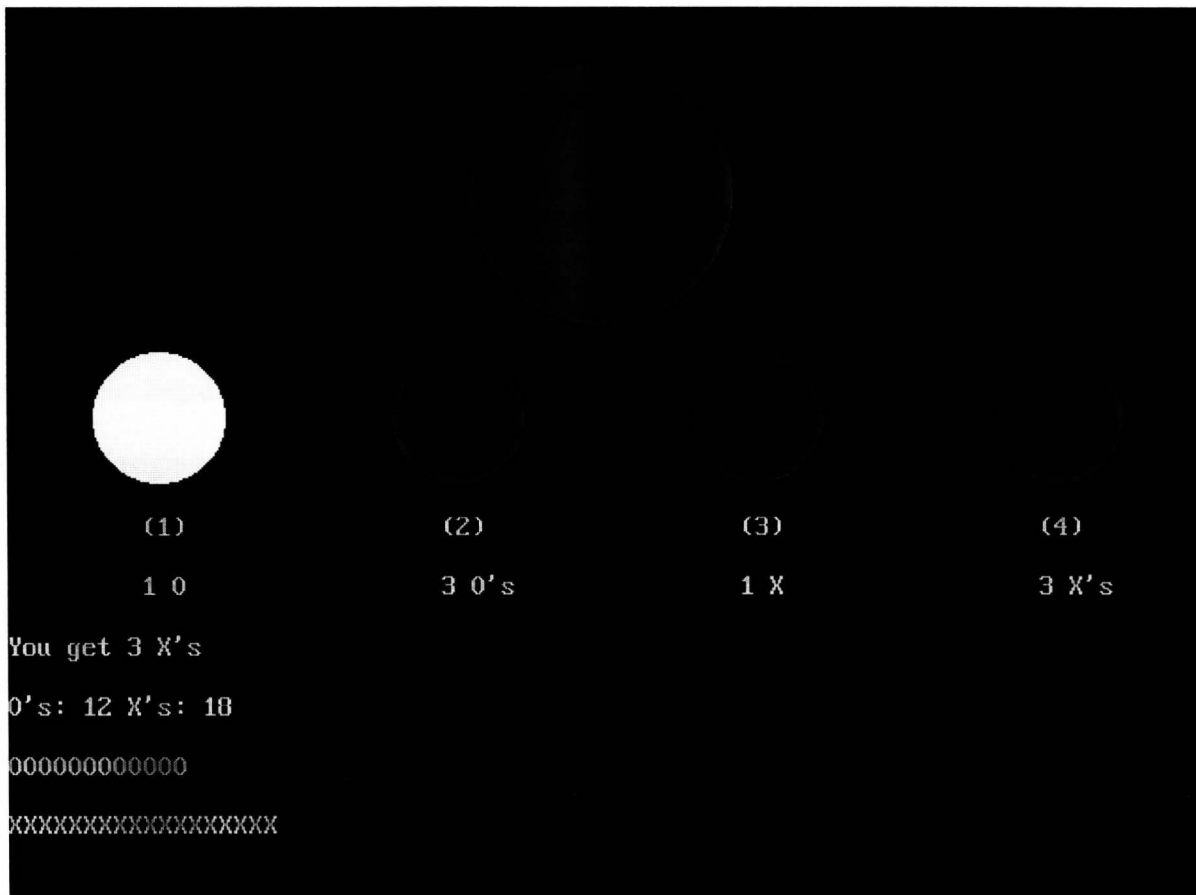
### *Method*

#### **Subjects:**

Four children, between the ages of 6 and 8 served as subjects. The 2 males, (Subjects #1 and #2), and 2 females, (Subjects #3 and #4), were recruited from a list generated by a local elementary school teacher. Parents signed informed consent prior to participation and children were informed that they could terminate the experiment at any time without consequence.

#### **Apparatus:**

All sessions were conducted in an observation room containing a couch, table, chair, and video camera. Also in the room were three identical plastic containers holding an assortment of reinforcers (candy, toys etc.). The room was equipped with a one way mirror allowing observation of subjects during each session.



**Figure 1**

An IBM notebook computer presented a computer game to individual subjects. The keyboard was masked by a cardboard cover to restrict access to only the number keys 1, 2, 3, and 4. The computer simultaneously collected data in terms of options available and option selected.

A computer game was presented on the computer screen and consisted of a larger circle located in the upper center of the screen with four smaller circles in a row below it. (See Figure 1.) On any single trial the color of all circles varied and were either red, yellow, blue or green according to a script generated using a random number chart. Each Subject was presented with the same script, ensuring that each subject received the same sequence of trials, while simultaneously preserving the random order of the presentation.

Each of the smaller circles, or options, was distinguished by a number located directly below it. These options were numbered in ascending order from left to right, so that the leftmost option was designated # 1, the option to the immediate right of that, number # 2, and so on to #4. Options could be selected by pressing the corresponding number key on the keyboard. A trial consisted of one presentation of the target circle and the four options. A trial ended when a numbered key (1, 2, 3, or 4) was pressed by the subject.

The large circle was used to display a target color. The color of at least three of the four options always matched that of the target circle. During 24 trials the remaining option, which was randomly selected, did not match the color of the target, but instead displayed a different color. This option was designated unavailable and provided no points if selected. If an option that was unavailable was selected, a message appeared below the four options which said, "you picked incorrectly". The Subject was not allowed to repeat these trials. Each of the four options was unavailable for 6 trials during each session. During each session there were also 6 trials during which no options were made unavailable and all four options matched the color of the target circle.

Points were available in two types: X's and O's. Each option delivered a specific type and number of points. If selected, Option #1 delivered 1 O, Option #2 delivered 3 O's, Option #3 delivered 1 X, and Option #4 delivered 3 X's. Points were tallied at the bottom left of the screen both

numerically and in pictograph form. The numeric tally simply consisted of a label for the type of points (O's: or X's: ) followed by the number of points accumulated of the corresponding type. The pictographic display consisted of a row of X's and O's which equaled the number of points of each type acquired to that point in the trial.

With the conclusion of each trial, points were awarded as shown by a message "You get (number and type of points) points!" Another trial immediately began until the completion of the session.

### **Procedures:**

Each subject participated in 4-6 consecutive sessions consisting of 30 trials. Sessions generally lasted less than 5 minutes and the entire participation of each subject never required more than 30 min. Each subject was shown into the room by the experimenter and read the following instructions:

"Here is a game for you to play. When the big circle changes colors, pick one of the circles that is the same color. You pick a circle by pushing the key that has the same number on it. When you pick a circle that is the wrong color the screen will go blank for a while. When you pick a circle that is the right color you will get points, either X's or O's. Try to get as many points as you can, because later you'll be able to trade some of them for prizes. Do you have any questions?"

After answering any questions the experimenter left the room and entered the observation booth. When the child had completed 30 trials (1 session), the screen went blank and the experimenter reentered the room. He then checked the number and type of points earned and said:

"You got [number of X's earned] X's! That means you get to choose a prize from this container (indicating appropriate container)".

Each container contained tangible reinforcers of differing value. Those reinforcers of the highest value required the subject to earn 60 X's to be exchanged in a token economy. Those of a moderate value required the subject to earn 45 X's, and those reinforcers of the

lesser value required the subject to earn 30 X's. Up to this point the subject was unaware that points of the O type were not exchangeable at all. If the subject had earned sufficient X type points he/she was then allowed to select a reinforcer from the appropriate container. The experimenter then asked if the subject would like to play the game again. If the subject indicated they would like to attempt the game again, a second trial was begun and the experimenter again left the room.

After the conclusion of the second trial, the experimenter entered the room, stated the number of X's earned, and specified the container from which the subject was to select a reinforcer. Points were exchanged in the same manner, (X's were exchangeable, O's were not).

If, after the second session the subject earned more X's than O's and did not decrease in the number of X's earned, the next stage of the experiment began. If these criteria had not been met, these procedures were continued for a third and fourth session as necessary until criteria were met.

The next stage of the experiment was identical to the first with the exception of instructions given by the subject's mother. Prior to beginning the session, the subject's mother entered the room and stood by the door, called the subject by name, and said the following:

"I want you to try to get as many O's as you can."

If the subject protested, the mother's were asked to repeat their command once more. If protesting continued after giving the command a second time they were to exit the room. The remainder of the session was identical to those sessions in stage 1. After completing 30 trials, the experimenter again entered the room and informed the subject as to how many X's they had earned and which container the subject could select a reinforcer from if any. The subject was again asked if they would like to try the game again. If the subject responded in the affirmative, their mother again entered the room and gave an identical command, calling the child by name and saying "I want you to try to get as many O's as you can". The remainder of the trial proceeded in identical fashion as the others. Upon completion the subject was



informed as to how many X's they had earned and which container they could select from.

Subjects were then thanked and excused.

### Results:

Each subject showed idiosyncratic response patterns and choice making preferences. For this reason, inferential statistical analyses were not performed as individual differences were the most salient feature of the data. Each subject's data are examined individually. Figure 2 displays the individual choice making patterns in percentage obedient versus disobedient.

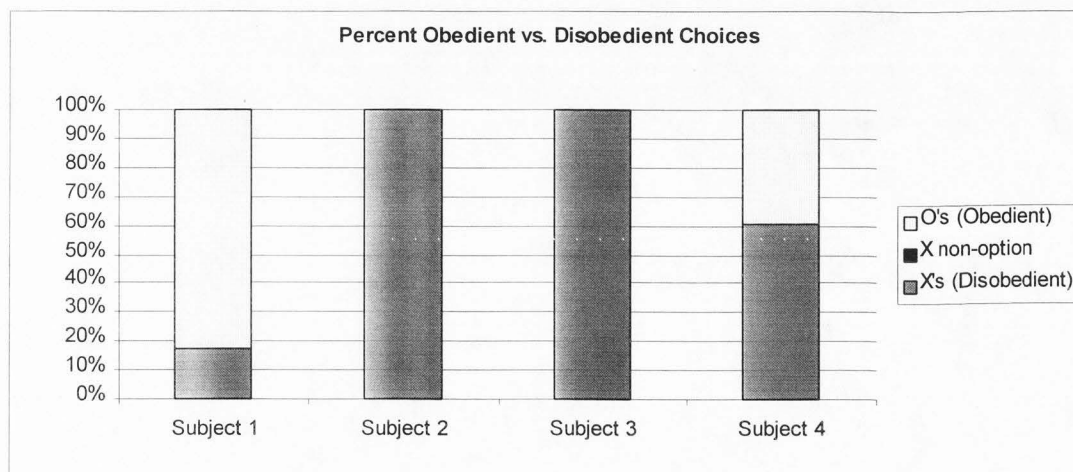


Figure 2

### Subject #1:

The total number and type of points earned was 72 O's and 15 X's. Subject #1 selected exclusively Option #2 (3 O's) except in the five cases (#3, #4, #11, #21, and #27) when it was not available. In those cases when Option #2 (3 O's) was not available, Option #4 (3 X's) was always selected. This was the highest rate of obedience demonstrated by any subject during the course of the study.

### Subject #2:

The total number and type of points earned was 70 X's and no O's. Subject #3 selected Option #4 (3 X's) and Option #3 (1 X) exclusively. In all five cases where Option #4 (3 X's) was unavailable,

(#1, #3, #8, #12, and #20) Option #3 (1 X) was selected. However, Option #3 (1 X) was selected an additional four times when Option #4 (3 X's) was available (#5, #22, #24, and #27).

**Subject #3:**

The total number and type of points earned was 77 X's and no O's. Subject #3 selected Option #4 (3 X's) and Option #3 (1 X) exclusively. In all five cases where Option #4 (3 X's) was unavailable, (#1, #3, #8, #12, and #20) Option #3 (1 X) was selected. However, Option #4 (3 X's) was selected one additional time (#17) when it was unavailable for which no points were awarded.

**Subject #4:**

The total number and type of points earned by Subject #4 was 50 X's and 32 O's. During trials #1-#15, Option #4 (3 X's) was selected except in cases in which it was unavailable. In these instances, (#7 and #10), Option #3 (1 X) was chosen. During trials #16-#26, Option #2 (3 O's) was selected except in cases in which it was unavailable. In these instances, (#18 and #21), Option #1(1 O) was selected. During the final four trials, Option #4 was again chosen with the exception of the final trial (#30), in which Option #2 (3 O's) was again chosen.

**Discussion:**

There are clear differences between many of the subject's response patterns. Subject #1 showed a clear preference for Option #2 (3 O's) demonstrating that responding in a manner consistent with his mother's instructions was more reinforcing than earning exchangeable points. However, were this true, one would expect to see Option #1 (1 O) selected when Option #2 (3 O's) was not available, which was not the case. Instead, when Option #2 (3 O's) was made unavailable, he selected Option #4 (3 X's). This seems to be indicative of a tendency to obtain as many points as possible, regardless of type.

Subjects #2 and #3 both showed a clear preference for those options which delivered the highest number of exchangeable points, similar to the melioration effect shown by Herrnstein et. al. (Commons, Herrnstein, & Rachlin, 1982). In cases where Option #4 (3 X's) was not available, Option #3 (1 X) was usually chosen. This pattern was demonstrated with only 4 exceptions for Subject #2,

and 1 exception for Subject #3. This demonstrates a tendency for these two subjects to respond in a manner that would earn them the greatest number of exchangeable points (X's) possible, in spite of the fact that their mothers instructed them to get as many O's as possible. However, the fact that Subject #2 selected Option #3 (1 X) four times when Option #4 (3 X's) was still available appears to be contradictory to the maximization strategy that seems to be demonstrated for the remainder of the trials.

Subject #4 began the final session by responding in this same manner. The first 15 trials were all made in a manner that would deliver the maximum number of X's. However, following these 15 trials, the next 10 choices were made in a manner that delivered the maximum number of O's. For the remaining four trials, Option #4 (3 X's) was again selected three times and the final trial consisted of the selection of Option #2 (# O's). Anecdotal evidence obtained during debriefing offers some explanation. Subject #4 stated that she wished to earn a reinforcer from the medium point container (45 X's) so she ensured she had enough X's to do so. In light of this, one may surmise that once Subject #4 had come close to the required number of X's to earn the reinforcer she wanted, obeying her mother became more reinforcing than earning exchangeable points. This may be a result of the age of Subject #4, (8 years old), as she was the only subject to respond in the way, and age was the only recorded difference between Subject #4 and other subjects.

## *Experiment II*

As was stated above, non-compliance is in part due to the fact that competing responses yield a higher frequency of reinforcement and therefore occur at a higher rate than instruction following. As such, it was thought it would be beneficial to conduct the same procedure comparing children who had been diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) to a group of non-clinically referred children. Children diagnosed with ADHD are often more non-compliant than their non-clinical counterparts as well as more impulsive and hyperactive. Research has also shown ADHD children are relatively insensitive to changes in contingencies of reinforcement (Kollins, Lane and

Shapiro, 1997). Perhaps their lack of compliance is due to an inability to accurately notice changes in contingencies of reinforcement. Experiment II addressed these issues by conducting identical procedures as Experiment I with two subjects diagnosed with ADHD.

### ***Method***

#### **Subjects:**

Two children, both 6 year old males, were recruited from the University Community Psychology Clinic. Both subjects were seeking services for ADHD and had been referred to the study by their respective clinicians. Inclusion criteria were as follows: 1) DSM-IV diagnosis of ADHD 2) A score on the Impulsive / Hyperactive subscale of the Attention Deficit Disorders Evaluation Scale below 7. Both subjects had been prescribed multiple daily doses of methylphenidate. Subject #1 was given his typical dose prior to participation in this study. Subject #2 was not given any medication the day of participation. Parents signed informed consent prior to participation and children were informed that they could terminate the experiment at any time without consequence.

#### **Apparatus:**

All sessions were conducted in the same observation room as was used in Experiment I. The same computer and computer game were also utilized, as were the type and number of reinforcers.

#### **Procedures:**

Procedures were identical to those used in Experiment I

## Results:

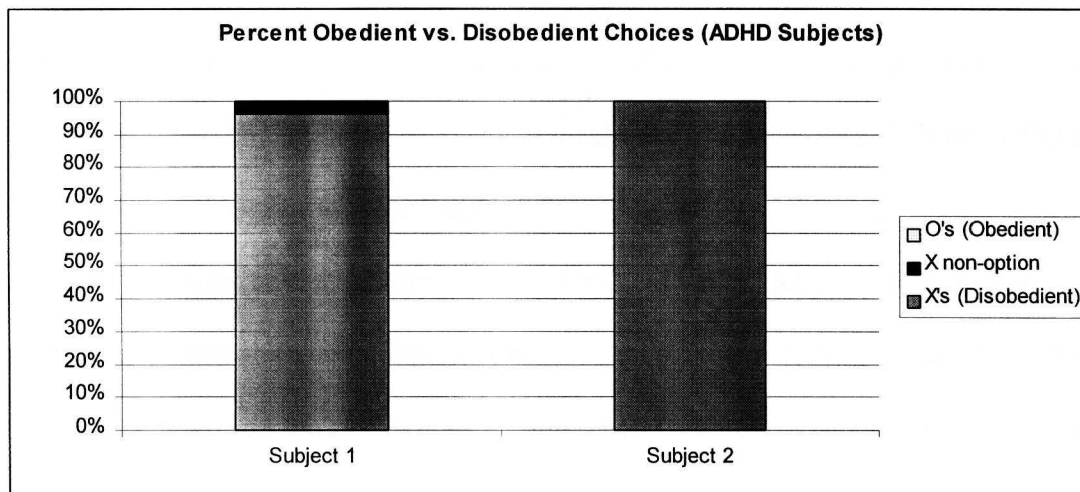


Figure 3

### Subject #1:

The total number and type of points earned by Subject #1 was 102 X's and no O's. All of Subject #1's choices were X's. Option #4 (3 X's) was selected 28 times. On those trials (#10 and #7) when he did not select option #4 (3 X's), he instead selected #3 (1 X). On trials #10 and #7, when option #3 (1 X) was selected, #4 (3 X's) was unavailable, that is, it did not match the target circle in color and would have delivered no points had it been selected. However, Subject #1 did select option #4 (3 X's) four times (#16, #17, #19, and #25) when it was not available, regardless of the fact that no points were delivered for doing so.

### Subject #2:

The total number and type of points earned by Subject #2 during the critical session was 90 X's and no O's. All of Subject #2's choices were X's. Option #4 (3 X's) was selected 24 times, and was always selected when available. In all cases in which Option #4 (3 X's) was unavailable (#1, #2, #6, #9, #12 & #21), option #3 (1 X) was selected.

### Discussion:

Subject #1 showed the maximization pattern of choice making. However, unlike Subjects #2 and #3 in Experiment I, he only selected Option #3 (1 X) in the first two trials in which Option #4 (3

X's) was unavailable. He continued to select Option #4 (3 X's) for the remainder of those trials in which it was designated unavailable, despite the fact that no points were delivered for doing so. This response pattern was unique in that it was not seen in any of the subjects in Experiment I. It is also of interest to note that Subject #1 had been taken his typical dose of methylphenidate while Subject #2 did not take any medication prior to participation.

Subject #2 also showed the maximization pattern. However, unlike Subject #1, on the previous session, (the first session with parental instructions) Subject #2 was perfectly compliant with parental instructions. However, during the subsequent session when parental instructions were repeated Subject #2 was perfectly non-compliant. That is to say, he obtained the maximum possible number of exchangeable points available regardless of parental instructions.

### **General Discussion:**

In all but two cases, instructions and their associated contingencies were insufficient to overcome reinforcement that was available for non-compliance. If there was any reinforcement or punishment for obedience implied by parents either directly or through learning histories of the children the remaining four subjects were insensitive to it. The two subjects from Experiment II were perfectly non-compliant, but this was not unique considering half of the subjects in Experiment I performed nearly identically.

Subjects in Experiment I were evenly split between those who were perfectly noncompliant and those who demonstrated some compliance. No gender differences were seen as non-compliance was split nearly equally amongst subjects by gender. However, the oldest subject (#4) did demonstrate a unique pattern by selecting enough points to earn a medium size reinforcer, thereby demonstrating a "mediation effect", in which some compliance was shown as well as some noncompliance which was consequted by a medium level reinforcer. This may have been a result of the increased age of Subject #4, or it could have simply been an irregular pattern. Likewise, Subject #1 demonstrated another unique pattern of choice making as he was perfectly compliant as long as doing so resulted in earning

the maximum number of O's. When this was not an option, instead of selecting the lower value obedient option he selected the highest value disobedient option (#4, 3 X's). This too could be considered a type of "mediation effect".

Subjects in Experiment II showed higher average rates of non-compliance than those in Experiment I. However, the rates of non-compliance were not noticeably different than those of subjects #2 and #3 in Experiment I. This may indicate that further work needs to be done to determine if subjects #2 and #3 were anomalous and children with ADHD are significantly different from the childhood population at large. Conversely, those subjects in Experiment II may have been anomalous and children diagnosed with ADHD demonstrate similar patterns to non-behaviorally disordered children. Only continued trials with greater numbers of subjects will answer this.

Clearly these subjects demonstrate several unique choice making patterns that need further investigation with a much larger population. As was stated in the introduction, the variables controlling compliance are many and complicated. This study clearly demonstrated this, as well as indicated possible directions for future research. Further work examining differences in populations (clinical vs. nonclinical, age and gender differences, etc.) as well as differences in parents will perhaps shed more light on the individual differences seen in this experiment. Likewise, differences resulting from varying parental commands or parenting styles may provide information as to why children disobey and the function of such behavior.

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