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Human Visual Observation as a Function of Stimulus Change

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HUMAN VISUAL OBSERVATION AS A FUNCTION OF STIMULUS CHANGE

by

Richard L. Crandall

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment
of the
Degree of Master of Arts

Western Michigan University
Kalamazoo, Michigan
December, 1972
ACKNOWLEDGEMENTS

I would like to express my sincere appreciation to Dr. Richard W. Malott for his guidance and encouragement throughout the course of this research. I am also grateful to Dr. David Lyon and Dr. Robert Hawkins for their criticism and advice in the completion of this project. Finally, I wish to thank Mr. Richard Atwell, Mr. Frank Jamison, and staff of the television studio for their technical assistance in the production of videotapes used in this study.

Richard L. Crandall
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INTRODUCTION

The present study was designed to investigate human visual observation as a function of stimulus change in television and slide presentations. Observation was measured by performance of one of two incompatible responses associated with specific stimulus presentations. Stimulus change was defined as the presentation of a new slide or cutting from one television image to another. Unlike Berlyne's (1970) suggested discrete-trial methodology with competing stimuli, this study submitted subjects to continuous stimulus presentations and measurement.

Experiments in sensory reinforcement with rhesus monkeys have demonstrated that operant responses and correct color discriminations are maintained with the opportunity for visual exploration as the sole reinforcer (Butler, 1953; 1954; Butler and Harlowe, 1954; 1957; Butler and Alexander, 1955; Moon, 1961). Studies with human subjects have demonstrated that visual images, including television and slide presentations, also maintain an operant response (Lindsley, 1962; Benton and Mefferd, 1967; Greene and Hoats, 1969; Lebenta, 1969).

Butler (1954) found that changes in a monkey's response rate accompanied various categories of visual-auditory stimulation. Lowest response rates were maintained by visual exploration of an empty chamber, and increasingly higher rates were maintained by opportunities to see an array of foods, a moving electric train, and another monkey. Fowler (1965) concluded that animals will explore changes
in environmental stimuli, and the strength of the exploratory response will vary directly with the extent or magnitude of change in stimulation. Studies with human and animal subjects demonstrated that novelty was of critical importance in maintaining attention (Berlyne, 1950; 1951; 1970; 1971). Berlyne (1970) noted that novel stimuli reinforce instrumental responses more effectively and are rated more pleasing by humans than familiar stimuli. From his studies of attention and stimulus change, Berlyne (1951) concluded that a recently changed stimulus maintains a higher probability of response than an unchanged stimulus which has been responded to for some time. Benton and Mefferd (1967) found that human responding for slide presentations soon extinguished when stimulus change was discontinued. Reda (1971) showed that human attention was a function of auditory-visual stimulus change in television viewing.

Animal studies indicate that response rate is more sensitive to the magnitude and frequency of reinforcement in one component of a concurrent schedule than to an identical schedule programmed alone (Herrnstein, 1961; Keesey and Kling, 1961; Catania, 1962; 1963; Revulsky, 1963). Thus, the experiments of the present study were designed to make two sources of visual reinforcement available to the subject simultaneously as in a concurrent schedule (Ferster and Skinner, 1957).
EXPERIMENT 1

Method

Subjects

Thirty undergraduate psychology students volunteered to participate in this experiment in order to earn bonus points for class credit.

Apparatus

Each subject sat in the chair of the two-screen apparatus described in Figure 1. A white noise generator provided a homogeneous sound environment through a headset worn by the subject. Four Kodak Carousel 800 (or 760H) projectors, one Cleary Sound-Slides Dissolvo-tron, and one Kodak Carousel Dissolve Control (Model 1) were used to project 360 slides of various subject matters upon Screens A and B. The dissolve units enabled different slide images to fade into one another without intervening darkness. The subject looked at either screen by pulling back the appropriate curtain. The experimenter received auditory cues recorded on a Ross Mark 2150 Compact cassette player/recorder which signaled his manual operation of the equipment.

Procedure

Each subject was seated in the two-screen apparatus and given written instructions (see Appendix A) describing use of the apparatus. The experimenter answered any questions concerning the apparatus and procedure.
Figure 1. Two-screen apparatus. Subjects sit in the chair beneath the canopy and face the two curtains. Slides are projected on Screens A and B from two pairs of slide projectors. Subjects may observe slides on either screen by pulling back the corresponding curtain.
Each 15-minute session was divided into three 5-minute phases. Slides were concurrently projected on Screen A and Screen B at predetermined fixed rates during Phase 1. During Phase 2, the rates were reversed so that the initial rate of slide presentation on Screen A became the rate on Screen B and vice versa. During Phase 3, the rates of slide presentation on Screens A and B were again reversed to those in Phase 1. Specific rates of slide presentation are presented in Table 1.

The duration of time spent observing the slides on Screens A and B was recorded on an event recorder. A changeover from one screen to another was recorded when the subject raised the curtain of the latter screen.¹

Slides were randomly distributed between four slide trays. These trays were alternately used on Screen A and Screen B between subjects to control for content preference. The 20 sl./min.—20 sl./min. projection rates and the Phase 2 reversal provide additional controls for content and position preferences.

¹Accurate measurement of non-observing behavior occurring while a subject alternated from one screen to another was not possible with the given apparatus. However, natural observation of subjects' responding during the experiment indicated that a minimum amount of time interceded during changeovers between screens.
Table 1. Specific rates of slide presentation in the two components of the concurrent schedule.
TABLE 1

<table>
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<th>PRESENTATION RATES</th>
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<tr>
<td>20 sl./min.—20 sl./min.</td>
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<tr>
<td>20 sl./min.—8 sl./min.</td>
</tr>
<tr>
<td>20 sl./min.—2 sl./min.</td>
</tr>
<tr>
<td>20 sl./min.—.5 sl./min.</td>
</tr>
<tr>
<td>20 sl./min.—0 sl./min.</td>
</tr>
</tbody>
</table>
Results and Discussion

The median percentage of time spent responding to the fixed 20 sl./min. screen for each phase is presented in Figure 2 as a function of the five presentation rates. The curves describing this relationship show that the median percentage of time spent responding to the fixed 20 sl./min. screen increased as the rate of slide projection on the other screen decreased. These curves also indicate the consistency of the findings between phases of the reversal.

The presentation rates were transformed to relative reinforcement densities, and the data were replotted. The median percentage of time spent responding to the fixed 20 sl./min. screen is presented in Figure 3 as a function of the relative reinforcement density of the fixed 20 sl./min. screen. This ratio is described by the formula

\[
\frac{20 \text{ sl./min.}}{20 \text{ sl./min.} + X \text{ sl./min.}}
\]

where \(X\) is the rate of slide presentation on the other screen. This ratio varies from .50 to unity. A ratio of .50 indicates that stimulus change occurs at equal rates on both screens, and a ratio of 1.00 indicates that stimulus change occurs only on the fixed 20 sl./min. screen. The curve describing this relationship shows that the median percentage of time spent

\[\text{The 20 sl./min.--0 sl./min. data were obtained at a date later than data for the other presentation rates. Therefore, data were obtained for 5 subjects at 20 sl./min.--8 sl./min. at this later date and compared to the previous results at these presentation rates. The median percentage time spent responding to the fixed 20 sl./min. screen was 53% compared to 56% from previous sessions. Therefore, it was concluded that no differential effects due to time influenced the data.}\]
Figure 2. Median percentage of time spent watching the fixed 20 sl./min. screen for each phase as a function of the five presentation rates.
Figure 3. Median percentage of time spent watching the fixed 20 sl./min screen as a function of the relative reinforcement density of the 20 sl./min. screen.
responding to the fixed 20 sl./min. screen increased as the relative reinforcement density of the fixed 20 sl./min. screen increased.

The results of this experiment indicate that subjects observe more rapidly changing slide images than those less frequently changed. Thus, our data confirm the previously mentioned findings of Berlyne (1951), Reda (1971), and Benton and Mefferd (1967) regarding stimulus change.

These data also bear resemblance to animal studies of responding during concurrent schedules of reinforcement. For purposes of comparison, one may consider each presentation of a new slide in the present experiment as a reinforcer. For example, we may describe one screen's schedule as 20 reinforcements per minute and the other screen's schedule as 20, 8, 2, .5, or 0 reinforcements per minute. Animal studies indicate that the relative rate of responding on one key of a concurrent schedule is, in part, dependent upon the relative frequency of reinforcement on that key (Herrnstein, 1961; Catania, 1962; 1963). Thus, 

\[ R_1 = \frac{r_1}{r_1 + r_2} \ (R_1 + R_2)k \]

where \( R_1 \) and \( R_2 \) are response rates for each component and \( r_1 \) and \( r_2 \) are reinforcement frequencies for each component. However, the results of the present experiment do not indicate such a linear function.

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EXPERIMENT 2

Skilled film and television directors have often utilized cutting from one image to another for aesthetic and attention-getting purposes. Such cutting usually occurs in relation to content and/or other cinematic considerations. Our purpose, however, was to evaluate the reinforcing effectiveness of cutting, apart from these other variables as much as possible.

Method

Subjects

Twenty-six undergraduate psychology students volunteered to participate in this experiment in order to earn bonus points for class credit.

Apparatus

Two videotapes of the same twenty-minute lecture were produced using three camera positions of equal visual distance from the speaker. The tape which we will call "5-Second Cut" was produced so that cutting from one camera position to another occurred randomly once every five seconds. In the tape called "1-Minute Cut", random cutting occurred between camera positions once every minute. Thus, those viewing 5-Second Cut saw a new stimulus image of the lecturer every five seconds, and those viewing 1-Minute Cut saw a new image every minute. These two tapes and a film, An Occurrence at Owl Creek Bridge, were
televised to an audience on two Magnavox 23-inch screen television monitors in a lecture hall. The subjects' behavior was recorded on film with a Yashica J-7 35 mm camera mounted atop Television #1.

**Procedure**

Twenty-six subjects were assigned to either of two groups. Each group was instructed to attend a televised lecture at a specific time. Upon arrival, subjects of each group were assigned seats in the lecture room, after which the experimenter instructed them of the proceedings to follow (see Appendix A). **5-Second Cut** was televised alone to one group, and **1-Minute Cut** was televised alone to the other group for the first five minutes of each session on Television #1. Five minutes after the videotapes began, the film was simultaneously televised without sound on Television #2. Televising the film was intended to provide a competing source of visual reinforcement, thereby eliminating a ceiling effect in the measurement of subjects' viewing of the videotapes. Thus, subjects were able to observe either the videotaped lecture of the film images.

Data were collected during two sessions of **5-Second Cut** and two sessions of **1-Minute Cut**. The first sessions consisted of eight subjects each, and the second sessions consisted of five subjects each. The subjects were photographed at 30-second intervals for eighteen minutes. Results were tabulated from the photographs by independent observers (see Appendix B).
Results and Discussion

An "eyes-on-the-screen" response was recorded if the subject looked to the vertical plane defined by Television #1 and the camera used for data recording. The median percentages of "eyes-on-the-screen" responses from total measured responses are presented in Table 2 in 5-minute intervals for the group watching 5-Second Cut and the group watching 1-Minute Cut. Inter-observer reliability was recorded at 97% and 98.3

These results indicate little or no relationship between television viewing and rate of stimulus change. These findings appear to contradict those of Reda's (1971) indicating that television viewing is a function of stimulus change. Furthermore, they appear to contradict findings of Experiment 1 and earlier research on novelty and stimulus change. However, review of Reda's procedure and the procedure of Experiment 1 indicate that the image content, inseparable by nature from image cutting, was perhaps more interesting to those viewers. Reda spliced two films, used different camera positions, and included two-person dialogue in her studies. Similarly, Experiment 1 made use of colored images photographed from various angles and distances of different subjects. Thus, novelty may be a function of both content and stimulus change. It may be reasonable to assume

\[ \text{agreement} = \frac{\text{agreements}}{\text{agreements + disagreements}} \times 100 \] for two experimental sessions. Each subject was evaluated in each photograph by two independent observers.

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Table 2. Median percentages of "eyes-on-the-screen" responses from total measured responses recorded for subjects in the group viewing 5-Second Cut and the group viewing 1-Minute Cut. Percentages were calculated for 5-minute intervals. Percentages in the first 5-minute interval describe observation of the videotapes alone. Percentages in the second and third intervals describe observation of the videotapes while the film is simultaneously televised as a competing source of visual reinforcement.
<table>
<thead>
<tr>
<th></th>
<th>TAPE ALONE (5 min.)</th>
<th>TAPE &amp; FILM (5 min.)</th>
<th>TAPE &amp; FILM (5 min.)</th>
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</thead>
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<tr>
<td><strong>5-Second Cut</strong></td>
<td>87%</td>
<td>55%</td>
<td>78%</td>
</tr>
<tr>
<td><strong>1-Minute Cut</strong></td>
<td>86%</td>
<td>78%</td>
<td>82%</td>
</tr>
</tbody>
</table>

TABLE 2

% "EYES-ON-THE-SCREEN" RESPONSES
that the reinforcing effectiveness of stimulus change varies according to the reinforcing effectiveness of the stimulus content.
EXPERIMENT 3

Given the results of Experiments 1 and 2, Experiment 3 was designed to present new slide sets of different subject matters while using the same presentation rates as in Experiment 1.

Method

Subjects

Fifty-one undergraduate psychology students volunteered to participate in this experiment in order to earn bonus points for class credit.

Apparatus

Eighty color slides of nude female models (designated NUDE), eighty black and white slides of a lecturer (designated DULL), and the mixture of slides used in Experiment 1 (designated MEDIUM) were used in this experiment. Subjects viewed slides and their behavior was recorded in the two-screen apparatus described in Experiment 1.

Procedure

Each subject was seated in the two-screen apparatus and given written instructions describing use of the apparatus (see Appendix A). The experimenter answered any questions concerning the apparatus and procedure.

(a) NUDE slides were concurrently projected on Screens A and
B at predetermined fixed rates for three to five minutes with male subjects. Specific rates of slide presentation are presented in Table 3.

DULL slides were concurrently projected on Screens A and B at predetermined fixed rates for three to five minutes. Specific rates of presentation are presented in Table 3.

The alternation of positions for rate presentations between subjects at each set of presentation rates controls for position preferences. The 20 sl./min.—20 sl./min. rates provide additional controls for content and position preferences in this procedure with DULL slides.

(b) Combinations of DULL, NUDE, and MEDIUM slides were projected on Screens A and B without use of dissolve units at a rate of 20 sl./min. The alternation of positions for content presentation between subjects at each content combination controls for position preference.

Results and Discussion

The median percentages of time spent responding to the fixed 20 sl./min. screen with NUDE, DULL, and MEDIUM slides are presented in Figure 4 as a function of the relative reinforcement density of that rate. The figure indicates that the median percentage of time spent responding to the 20 sl./min. screen was lower with DULL slides than with NUDE or MEDIUM slides at all values of the relative reinforcement density. Similarly, the median percentage of time spent responding to NUDE slides was less than that for MEDIUM slides at
Table 3. Specific rates of NUDE and DULL slide presentation in the two components of the concurrent schedule.
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<table>
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<tr>
<th>CONTENT</th>
<th>PRESENTATION RATES</th>
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<tr>
<td>NUDE</td>
<td>20 sl./min. -- 2 sl./min.</td>
</tr>
<tr>
<td>NUDE</td>
<td>20 sl./min. -- .5 sl./min.</td>
</tr>
<tr>
<td>DULL</td>
<td>20 sl./min. -- 20 sl./min.</td>
</tr>
<tr>
<td>DULL</td>
<td>20 sl./min. -- 8 sl./min.</td>
</tr>
<tr>
<td>DULL</td>
<td>20 sl./min. -- 2 sl./min.</td>
</tr>
<tr>
<td>DULL</td>
<td>20 sl./min. -- .5 sl./min.</td>
</tr>
<tr>
<td>DULL</td>
<td>20 sl./min. -- 0 sl./min.</td>
</tr>
</tbody>
</table>

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Figure 4. Median percentages of time spent watching the fixed 20 sl./min. screen with NUDE, MEDIUM, and DULL slides as a function of the relative reinforcement density of the 20 sl./min. screen.
both values of the relative reinforcement density sampled. An analysis of variance on means indicates a significant difference between MEDIUM and DULL slides at the .025 level. Differences between NUDE, DULL, and MEDIUM slides at the two available presentation rates were not statistically significant. Differences between presentation rates for DULL and MEDIUM slides were significant at the .001 level.\(^4\)

The median percentages of time spent responding in the reinforcement evaluation procedure are presented in Figure 5 as a function of slide content. The histogram indicates that subjects' responding was nearly equally distributed between NUDE and MEDIUM slides. Responding was unequally distributed between NUDE and DULL slides in favor of NUDE slides. Likewise, responding was unequally distributed between MEDIUM and DULL slides in favor of MEDIUM slides. The percentage difference is greatest for NUDE—DULL slides, but the percentage difference between MEDIUM—DULL is nearly as great.

The NUDE slides were originally selected to serve as images of high content interest. However, results of the reinforcement evaluation procedure indicate that they were not significantly more reinforcing than MEDIUM slides. Furthermore, the limited data from the two presentation rates with NUDE slides also makes their interpretation difficult.

\(^4\)The analysis of variance for DULL and MEDIUM slides does not include data recorded for the control rates, 20 sl./min—2 sl./min. The analysis of variance calculated for NUDE, DULL, and MEDIUM slides only includes data from 20 sl./min—2 sl./min. and 20 sl./min—.5 sl./min. rates because other data were not available for NUDE slides. The difference between MEDIUM and DULL slides yields \(f=5.67\). Differences between NUDE, DULL, and MEDIUM slides yield \(f=2.77\). Differences between presentation rates yield \(f=7.05\).
Figure 5. Median percentages of time spent watching slides in the reinforcement evaluation procedure as a function of NUDE—MEDIUM, NUDE—DULL, and MEDIUM—DULL combinations of slide content.
The significant difference between the DULL and MEDIUM slides suggests that observation is a function of stimulus content as well as rate of stimulus change. The results indicate that frequent stimulus change was less reinforcing with DULL slides than with MEDIUM slides. Thus, the reinforcing effectiveness of stimulus change varies directly with the reinforcing effectiveness of stimulus content. In other words, as stimulus content is made more reinforcing, stimulus change becomes a more effective reinforcer.

Reda (1971) concluded that observation of a television program may depend more on the method of presentation than what is actually being presented. However, results of the present study suggest that an interaction of stimulus change and stimulus content determines the reinforcing effectiveness of visual presentations.
THEORETICAL ANALYSIS

While Experiment 1 indicates that stimulus change is a powerful visual reinforcer, Experiments 2 and 3 confirm that the reinforcement effectiveness of an image presentation is a multiple function of both stimulus content and stimulus change. Whereas the relationship between observation and stimulus change describes an exponential function, the shape of that curve is dependent upon the reinforcing effectiveness of the content. Thus, as the content's interest value is increased, the stimulus change function will approach a straight line; stimulus change is a more effective reinforcer as the content is more reinforcing to view.

Stimulus change and stimulus content provide two sources of image novelty. Content interest may be a function of the variety of subjects, colors, angles and compositions utilized. Furthermore, if these images are programmed serially, they may provide a cumulative reinforcing effect by generating a common theme from image to image. Such content novelty will be increased progressively as the rate of change is increased. Thus, the total reinforcement deprived from an image presentation varies as a multiple of content and change.

The maximum presentation rate in these experiments was 20 sl./min. or a slide every 3 seconds. It is of interest to consider the limits within which stimulus change and stimulus content can be manipulated to provide maximum reinforcement. Four possible interactions between stimulus change and content will be considered here.
as the rate of change increases beyond 20 sl./min.

First, an absolute ceiling rate of maximally reinforcing stimulus change may exist independent of content, after which reinforcing effectiveness decreases at all content levels. Figure 6a describes this hypothetical relationship. However, the existence of such a ceiling independent of content is contrary to Experiment 3's findings indicating a stimulus content--stimulus change interaction.

Second, perhaps no ceiling rate of stimulus change exists, and all levels of content can be made equally reinforcing by increasing rate of change. Figure 6b describes this hypothetical relationship. However, as rate of change increases, images will be perceived more as a grey blur. At this point, image novelty will decrease as well as reinforcement effectiveness of the image presentation.

Third, a ceiling rate of maximally reinforcing stimulus change may occur according to stimulus content. Images of most reinforcing content may peak at lower rates of change than less reinforcing content after which reinforcement effectiveness decreases. If this is true, reinforcement effectiveness for lower-interest content will not exceed that for higher-interest content at the same rate. Figure 6c describes this hypothetical relationship.

Fourth, the peaking phenomena may occur according to stimulus content as in the previously discussed case. However, the decrease in reinforcing effectiveness may be more rapid with higher-interest content than with lower-interest content. In other words, exceeding the ceiling rate of change with interesting content may suppress the observing response. Furthermore, as content is less interesting,
suppression of the observing response may be less intense when the rate of change exceeds its ceiling. Figure 6d describes this hypothetical relationship.

The third and fourth alternatives appear most reasonable given the stimulus content--stimulus change interaction revealed in Experiment 3. As the image content is more reinforcing, careful observation will be more reinforcing. This may be especially true if the images are programmed serially. Beyond the rate at which careful observation is possible, reinforcement effectiveness will decrease. In fact, if "understanding" the images is highly reinforcing, excessive rates may interrupt such "understanding" and suppress the observing response. However, if content is less reinforcing, "understanding" may be less crucial. Therefore, excessive rates of change may continue to enhance novelty without punishing the observing response.

In summary, stimulus change is a powerful visual reinforcer for human subjects. Increased rates of change maintain higher rates of observation. However, systematically altering the stimulus content alters the stimulus change function. As stimulus content is more reinforcing, stimulus change is a more effective reinforcer up to 20 sl./min. Further investigation is necessary to determine the nature of the stimulus change--stimulus content interaction at rates exceeding 20 sl./min.
Figure 6. Four hypothetical predictions for the reinforcing effectiveness of stimulus change with low, medium, and highly reinforcing stimulus content as a function of the duration of each stimulus image.
Directions (Experiments 1 and 3):

In front of you are two curtains. In a moment, a set of slides will be projected on a screen behind each curtain. You may look at either set of slides by simply pulling back the appropriate curtain. You're free to look at either screen for as long as you wish. However, you may look at only one screen at a time; DO NOT PULL BACK BOTH CURTAINS AT THE SAME TIME.

Please put on the headphones. I'll tap you on the shoulder as a signal to begin.

Do you have any questions?

Directions (Experiment 2):

In just a few moments a lecture presented by Dr. Howard Fletcher of Brown University in Rhode Island and entitled "The Autistic Child" will be televised on this set. While in progress, we ask that you do not leave your seat and remain silent. It is not necessary that you watch this program as you would study an assignment; you will not be quizzed upon the subject matter and in no other way will be responsible for the same.

The program will last approximately 20 minutes. You will note that I will watch you watching this show. Furthermore, you will be photographed at various intervals during the show. This is just some simple research on television viewing behavior; you need not be intimidated by the observation. I am simply evaluating various
programs by evaluating how you watch them. If you have any questions, I'll be glad to answer them after the lecture.

Again, please remain in your seat and quiet during the presentation. Do you have any questions about the procedure?

The program shall begin at any moment.
Sample Photographs from Experiment 2:

+ indicates those subjects watching Television #1
o indicates those subjects not watching Television #1

Row 3
+ 
8.

Row 2
+ + + o
4. 5. 6. 7.

Row 1
+ + +
1. 2. 3.
+ indicates those subjects watching Television #1
o indicates those subjects not watching Television #1

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Data Excluded from the Results of Experiments 1 and 3:

Data recorded for nine subjects in Experiment 1 were excluded from the results. One subject reported that viewing slides on Screen A was physically more difficult given her posture and placement of the chair. Three subjects' data were excluded due to apparatus breakdowns. One subject's data were excluded because she had previously participated in the experiment. Four subjects' data were excluded because neither the white noise generator nor the overhead canopy had been installed in the apparatus.

Data for a single subject in Experiment 3 were excluded from the results because of excessive amounts of non-observing behavior.
Prevention of Cue Effects in Experiments 1 and 3:

The two-screen apparatus was designed so that subjects viewing one screen were unable to hear or see the operation of equipment changing slides for the other screen. Auditory cues were eliminated by use of the white noise generator. Visual cues were eliminated by use of the heavy dark curtains, the overhead canopy, and the high walls on either side of the subject. Thus, these data may be considered free of systematic cue effects.
APPENDIX E
Proposals for Future Research:

Future research should initially implement the reinforcement evaluation procedure with various sets of slides in order to empirically define low, medium, and highly reinforcing slide sets. Subjects' behavior should then be recorded in a two-screen apparatus for various presentation rates in order to replicate the functions described in this study. Also, presentation rates exceeding 20 sl./min. should be utilized if possible.
BIBLIOGRAPHY


Catania, A.C., A baseline for the study of reinforcement magnitude. *Journal of the Experimental Analysis of Behavior*, 1963, 6, 299-300.


Revulsky, S.H., A relationship between responses per reinforcement and preference during concurrent VI-VI. *Journal of the Experimental Analysis of Behavior*, 1963, 6, 518.