THREE EXPERIMENTS DEALING WITH THE PERCEPTION OF TIME

by

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STATEMENT BY AUTHOR

APPROVAL BY THESIS DIRECTOR

This thesis has been approved on the date shown below:

[signature] May 15 1980

Neil Bartlett, Professor of Psychology — Date

I would like to thank my committee members, Dr. William Ittelson and Dr. Terry Daniel, and especially my committee chairman, Dr. Neil Bartlett, for their support, insights, and kindness during the preparation of this project. I also would like to especially thank my wife Judi for her constant love, support and patience that made this paper possible.

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ABSTRACT

Two different display types (analogue and digital) were compared to each other under two different vigilance tasks and six varied interval sizes. They were measured along the dependent measures of total time for completion of the interference task, accuracy of responding to the display, glance rate, ability to estimate intervals without the display present, scores on the interference tasks, and subjective impressions of speed and comfort. Overall, the research does not substantiate the previous notion that clock type drastically effects the subjects' abilities, irregardless of response set or interval size. Subjectively, subjects view one display (analogue) as faster yet rated the clocks equally on the measure of comfort. The measure of glance rate did support the hypothesis of an interaction between display type and interference task, but at a low significance level ($p < .05$) and small N(20), suggesting avenues for further research.

CHAPTER 1

INTRODUCTION

Time-recording has become a necessary part of our modern daily life, and recent research has tried to designate one type of dial which can be read with the greatest accuracy in the shortest period of time. The standard circular, or analogue display has given way in many settings to the newer digital display, which has become much more prevalent as its cost has decreased. The digital display is becoming popular everywhere, in automobiles, clocks, airplanes, and in fact, the calculator which helped speed the analysis of the data in this paper. Previous work in the field has shown digital-type dials to be superior in both speed and accuracy of recording. Zeff (1965) and VanNess (1972) indicate that digital displays can be read 3.8 times more quickly and ten times more accurately than comparable analogue displays.

In Zeff's experiment, the subject was shown either display for a short interval of time and was requested to record the time precisely. In VanNess's later experiment, both types of displays were presented at once and the subject was requested to subtract and record the exact difference between the displays. The higher incidence of error and longer retrieval time for analogue displays seem to indicate some type of differential coding of information in the brain. By examining their experimental design, however, we find that they tested the subject's ability to tell <u>precise</u> time. In both cases, the experimentors were simply asking for retrieval of information as presented by the digital display. As Zeff states in his experiment:

> However, one might expect it (the time) would still remain significantly longer than for the digital clock because the conventional clock reading involved analogue digital conversion as compared with the direct number tranfer from the digital clock (Zeff 1965, pg 343).

In most real life situations, we are more interested in relative than absolute time. We want to know if we are late, if we have time for an errand, etc. We are less interested in whether or not it is 9:52 or 9:53, rather we are interested whether or not we are going to miss the 10:00 movie. Under these settings, it is the experimentor's viewpoint that these previous studies break down in their explanations. VanNess states in his conclusion:

> However, digital time displays also have their drawbacks. For instance, one generally does not observe a clock accurately, but only casually, because what is wanted as a rule is a rough impression of time spent since, or time left before, some fixed "easy" point on the time scale, like a full or half hour. For this purpose a subtraction of limited accuracy is performed, with one of the displays only mentally available, probably in analogue form. The experience of at least some users of digital watches seems to indicate that such a subtraction is easier when the actually available display is analogue rather than digital (VanNess 1972, pg 78).

Thus, we are faced with two situations. In the first, absolute time is needed. A reading is given by a display, and the subject records it in similar form. In this situation, the digital display has been shown to be superior in regards to the subject's speed and accuracy of responses. In the second case, a more complex situation faces the individual, he/she needs to concern themselves with the readout in relation to the overall sequence of time. VanNess alludes to the fact that subjects seem to feel more comfortable with an analogue display in this setting, and frequent comments to this author in regards to people having to "get used to" their new digital watches seem to in some way collaborate these subjective findings. In the first phase of this experiment, the author will endeavor to measure the subject's abilities in this more complex situation in regards to the two differing displays.

The second and third parts of this experiment done simultaneously with the first, concern the brain-behavior relationship and interaction between two differing interference tasks and the two different clock displays. Reitan (1955) describes at length the different behaviors that manifest themselves with people with selective damage to either the right or the left hemisphere. In very simplistic terms, the right hemisphere is more associated with spatial tasks, while the left hemisphere is more responsive to verbal stimuli in most people. The Halstead-Reitan Test Battery stresses the individual with various tasks that either detect lateralizing differences or help form a concept of the general integrity of the brain. One of the earlier tests of this battery concerned what Reitan called "time sense," or the person's abilities to estimate increments of time after having the time intervals displayed on an analogue clock. Although this was shown to be a significant test of overall integrity of the brain, the large variance in scores made it useless in the clinical setting. The question was raised by the author whether the variance in estimations was due to the nature of the task, the length of the interval estimated, or with the display itself. Similarly, it was questioned whether response set would influence the subject's ability to estimate increments of time under each display type. As Hogan (1978) indicates, theories of time estimation range from Ornstein (1969) who views time estimation as positively linearly correlated to stimulus complexity, to Priestley (1968) who sees it as negatively linearly correlated with stimulus complexity, and Hogan himself, who feels it as a curvilinear U-shaped function of stimulus complexity. Previous research has shown at length that two simultaneous similar tasks interfere with each other much more than two divergent tasks, so it was questioned whether two lateralizing complex interference tasks would interact with the display types, allowing us to introduce the possibility of differences in processing. Thus, the third point of the experiment is to detect differences in the subject's abilities of speed, accuracy, and estimation in regards to their interference task, the size of the interval they are working with, and their display type.

CHAPTER 2

METHOD

One hundred and twenty subjects volunteered from introductory classes to participate in this study. No subject was screened out of the procedure, and all were included into the study. Subjects were given no knowledge of expected outcomes and all their prior knowledge concerning the project is contained on the consent form they each signed a few minutes before the session (Appendix A).

The two displays were made from the following: A) The analogue display was made from a variable speed motor with a five-segment clock-face measuring 6½" in diameter. A black single sweep hand moved across the five intervals on the flat white face. The speed did not match normal "real" time, and the unusual number of intervals was hoped to diminish effects of previous learning on other clocks. B) The digital display had been made from a red LED display measuring ½" by ½" with a single readout from one to five. The speed was varied to match the analogue clock. The subject's distance from the displays differed slightly in order to balance for legibility. The intervals of time used for this study were 7.5, 10.5, 13.5, 16.5, 19.5 and 22.5 seconds.

The two vigilance tasks presented were the Block Design subtest of the WAIS, which has a strong literature base to show it cues into spatial learning areas of the brain (Anderson, 1950), and the Reitan Word Finding Task (Reitan, 1972), designed and tested to stress the left hemisphere strongly (Appendix B). An alteration was made in the procedure of the administration of the Word Finding Task to better suit it as an interference task. In his original study, Reitan used an audio tape of the various sentences, while in this experiment the sentences were typed on individual multicolored cards so as to better capture the person's vigilance to the visual task, and to force them to look away from the clock displays. The task was scored along two measures, total time to complete it and the subject's ability to guess the answer quickly (eg. if the subject answered correctly on the first card, he/she was given a score of 5, the second card a 4, and so forth. The subjects were never informed when they had obtained the correct answer. Also, in regards to the Block Design, it was noted that many people could not complete the last design, so it was dropped from everyone's total score. Rarely, a subject did not complete the next hardest design and they were assigned the score of 200 seconds, slightly above the the next largest score (191) these subjects occurred randomly and rarely (seven in 120 trials).

The subjects were given one of the vigilance tasks and seated in a room so that the clock (either analogue or digital) was above them. They were instructed to do the task as quickly and as accurately as possible while at the same time pushing another button each time the clock reached the digit number "1". (See instructions in Appendix C) When they had finished with the first half of that task (split even vs. odd and counterbalanced accordingly), the clock was stopped and the subject was asked to estimate the length of the intervals by again continuing to press the button as if the clock was on again. After a consistent reading was established (at least five estimations) the subject was then introduced to the second clock and asked to do the other half of the task similarly to the first, the only difference being the clock type. Clock order was appropriately counterbalanced, and the subject's task was prechosen in a random fashion. Dial type, speed of clock, and vigilance task were the independent variables; glances, error rate, speed and accuracy on vigilance task, and subjective impressions of speed and comfort were the dependent variables. Two judges were used to estimate the number of glances, and the inter-rater reliability was .93. The hypotheses were that 1) the longer the interval of time, the less favorable the digital information will be viewed. This effect should decrease as function of interval size. 2) Interferences will be noticed between the spatial task and the analogue display (which is itself a spatial task), and between the verbal task and the digital display. This

would lead to a type of inference of the ability of using dial-types as a function of hemispheric differentiation.
3) Subjects will be able to subjectively report their progress as a function of their comfort level.

CHAPTER 3

RESULTS

The data, compiled in the appendix, show the following results:

In regards to the first part of our experiment concerning the subject's abilities to do a real life situation while attending to the displays, it was found that:

1. No difference was found in the subject's accuracy in tracking the movement on the display as measured by the average deviation of their responses, nor in the total time it took the subject to complete the task, nor in the frequency of glances up to the display.

2. Interval size had no effect on subject's abilities to track the movement on the display, nor any effect on their total time.

3. Subjectively, the clocks were viewed equal in comfortability (50.8% felt the digital perception of comfort compared to 49.2% who preferred the analogue); however it seemed that the analogue was more often preferred for moderate time intervals, and the digital was more often selected for the extremes (Tables 1, 2 and 3, Figure 1).

4. Subjectively, 76.3% of the subjects felt the analogue went faster, compared to 23.7% who felt the digital was the quicker. As the interval size increased, more people

TABLE 1

SUBJECTS SUBJECTIVE RATINGS OF MOST COMFORTABLE DISPLAY PER THEIR RATINGS OF FASTEST DISPLAY

	Count / Row Pct / Col Pct / Tot Pct	More Comfortable Display: Analogue	More Comfortable Display: Digital	Row Total
Fastest Display	Analogue	21	40	61
		34.4	65.6	76.3%
		63.6	85.1	
		26.2	50.0	
	Digital	12	7	19
		63.2	36.8	23.8%
		36.4	14.9	
		15.0	8.8	
	Column Total	33	47	80
		41.3%	58.7%	100%

TABLE 2

SUBJECTS' RATINGS OF MOST COMFORTABLE DISPLAYS
FASTEST PER SEX

	Count Row Pct Col Pct Tot Pct	Subjects' Subjective Rating of Most Comfortable Display Analogue	Digital	Row Total
Sex	Male	24 55.8 39.3 20.0	19 44.2 32.2 15.8	43 35.8%
	Female	37 48.1 60.7 30.8	40 51.9 67.8 33.3	77 64.2%
	Column Total	61 50.8%	59 49.2%	120 100.0%

TABLE 3

SUBJECTS' SUBJECTIVE RATINGS OF MOST COMFORTABLE DISPLAY PER INTERVAL SIZE

Interval Size (Seconds)	Count Row Pct Col Pct Tot Pct	Analogue	Digital
	7.5	12 60.0 19.7 10.0	8 40.0 13.6 6.7
	10.5	9 45.0 14.8 7.5	11 55.0 18.6 9.2
	13.5	8 40.0 13.1 6.7	12 60.0 20.3 10.0
	16.5	4 20.0 6.6 3.3	16 80.8 27.1 13.3
	19.5	12 60.0 19.7 10.0	8 40.0 13.6 6.7
	22.5	16 80.0 26.2 13.3	4 20.0 6.8 3.3
	Column Total	61 50.8%	59 49.2%

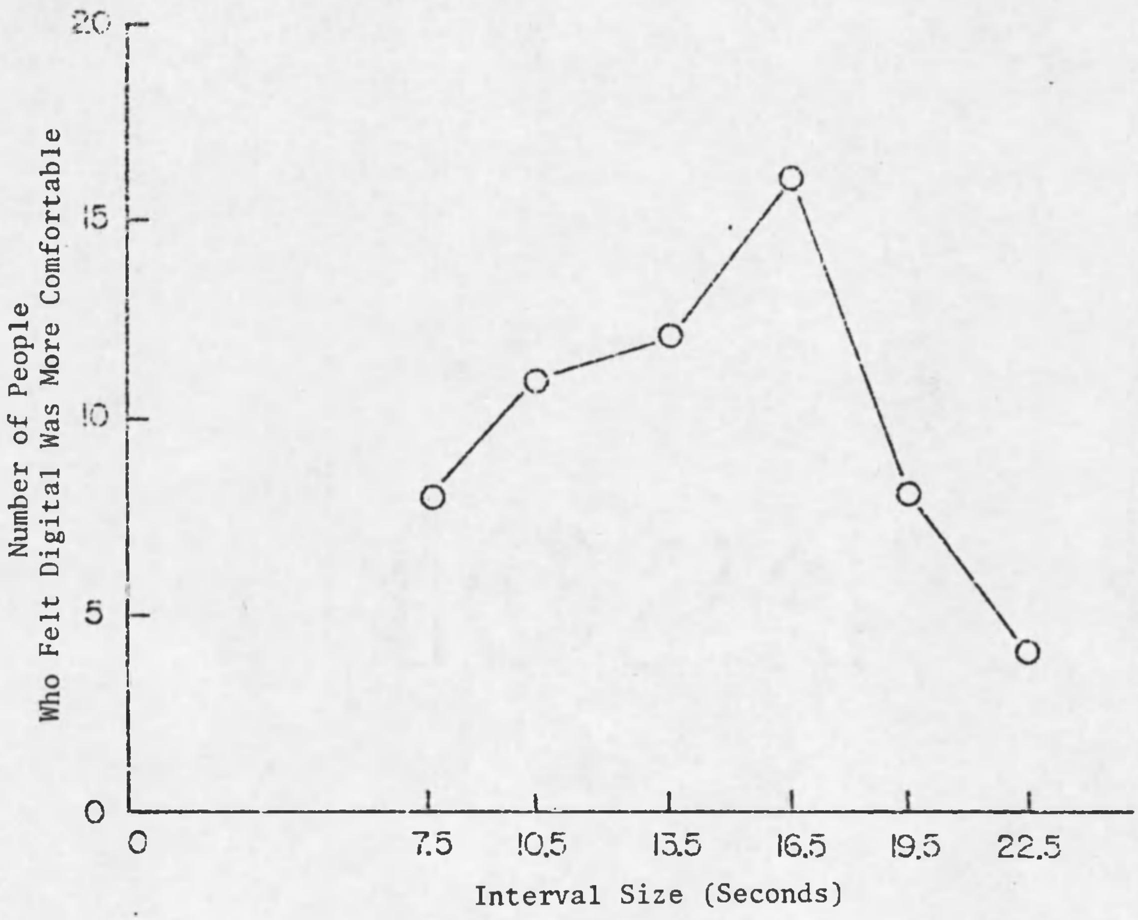

Figure 1. Subjects' Subjective Ratings of Most Comfortable Display Per Interval Size

felt the analogue clock was faster compared to the digital. (Tables 4 and 5, Figure 2).

5. Sixty-five percent of the subjects felt that the slower clock was more comfortable.

6. Although a pattern seemed to develop ($P < .1$), people did not have a better (shorter) task time under the clocks they viewed as more comfortable.

In summary, objectively nothing was found to substantiate previous claims of a differential of abilities concerning these two displays. Subjectively, there was no difference overall in subjects' perceptions of comfort, however, a large percentage felt that the analogue went faster, and there seemed to be an interaction between the perceptions of speed and comfort. Finally, subjects' subjective reportings were a poor indicator of abilities per clock display.

The next part of the experiment dealt with the subjects' abilities to utilize the memory of the clock motion in order to correctly estimate the interval size. It was found that:

1. Estimating increased correspondingly with the interval size (as expected) as did their deviations from the standard. However, they held constant according to Weber's Law $\Delta I/I$ across the different interval sizes, with a slight decrease in deviation at the smallest interval size. This

TABLE 4

SUBJECTS' RATINGS OF MOST FASTEST DISPLAYS PER SEX

	Count Row Pct Col Pct Tot Pct	Subjects' Subjective Rating of Fastest Display Analogue	 Digital	Row Total
Sex	Male	22 68.8 36.1 27.5	10 31.3 52.6 12.5	32 40.0
	Female	39 81.3 63.9 48.7	9 18.8 47.4 11.2	48 60.0
	Column Total	61 76.3%	19 23.8%	80 100.0

Table 5

SUBJECTS' SUBJECTIVE RATINGS OF FASTEST DISPLAY PER INTERVAL SIZE

Interval Size (Seconds)	Count Row Pct Col Pct Tot Pct	Analogue	Digital
	10.5	12 60.0 19.7 15.0	8 40.0 42.1 10.0
	13.5	15 75.0 24.6 18.8	5 25.0 26.3 6.3
	16.5	17 85.0 27.9 21.2	3 15.0 15.8 3.7
	19.5	17 85.0 27.9 21.2	3 15.0 15.8 3.7
	Column Total	61 76.3%	19 23.8%

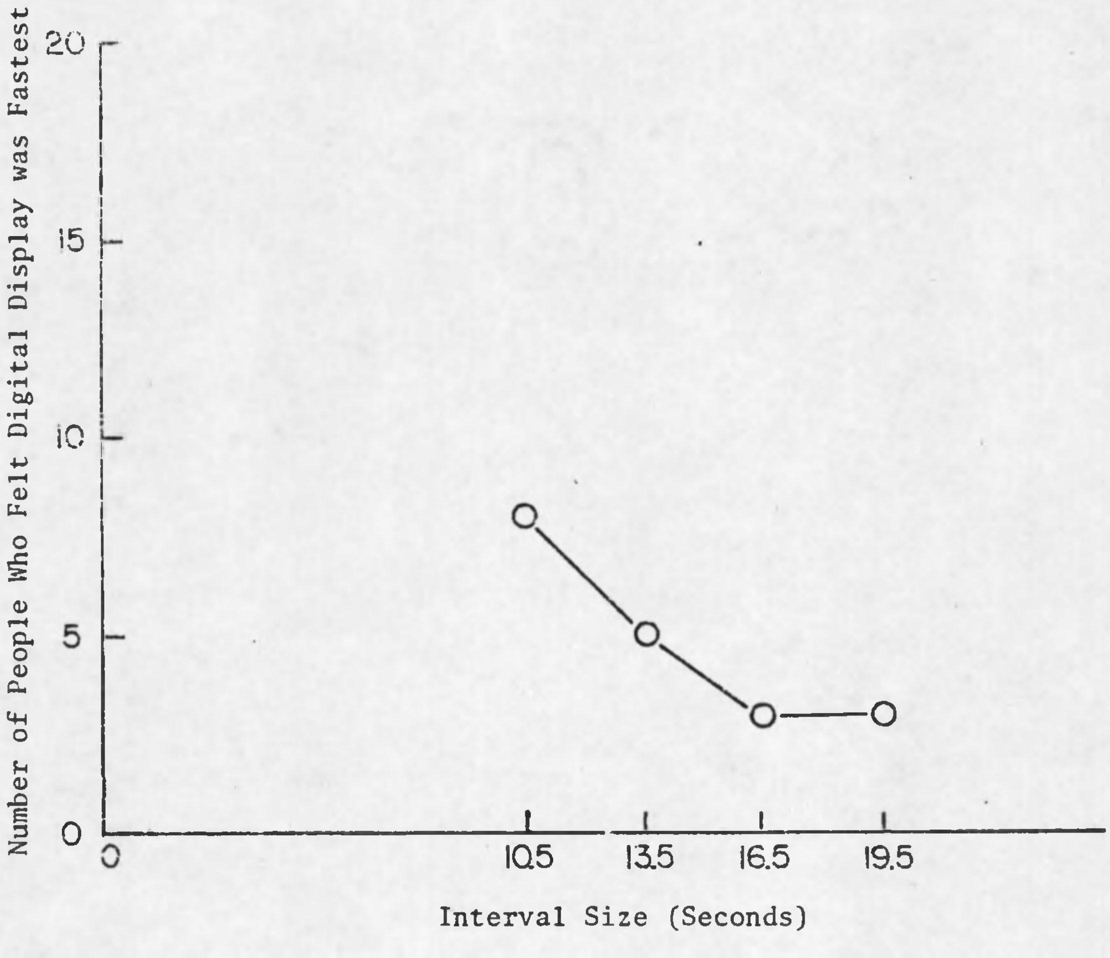

Figure 2. Subjects' Subjective Ratings of Fastest Display Per Interval Size

can be attributed to the fact that we are approaching zero and negative deviations are not possible (Table 6, Figures 3 and 4).

2. Sex of subject had no significant effect on estimation abilities.

3. Eighty-five and three-tenths percent under-estimated the interval size, and the over-estimators were distributed randomly across interval size, task, and clock type.

4. Clock type had no significant effect on the subjects estimations. Again we find nothing to support the notion that display type influences the subject's productivity nor their ability to process the temporal information, nor that interval size effects the variance of people estimates of temporal increments.

The final part of the experiment dealt with the subject's abilities in regards to two different interference tasks, each designed to more heavily stress their given hemisphere of the brain. It was hoped that an interaction would be found between clock type and interference task. The results showed that:

1. No difference of interaction was found in regards to the total time it took the subject to complete the task (Table 7, Figures 5 and 6).

TABLE 6

ESTIMATION OF INTERVAL SIZE BY CLOCK TYPE, TASK, INTERVAL SIZE
ANALYSIS OF VARIANCE

Source of Variation	Sum of Squares	Df	Mean Square	F	Significance of F
Clock Type	22.794	1	22.794	.695	-
Task	.010	1	.010	.000	-
Interval Size	1539.088	5	307.818	9.380	P<.001
Clock Type by Task	33.814	1	33.814	1.030	-
Clock Type by Interval Size	93.454	5	18.691	.570	-
Task by Interval Size	247.414	5	49.483	1.508	-
Clock Type by Task by Interval Size	50.756	5	10.151	.309	-
Residual	3150.480	96	32.817		

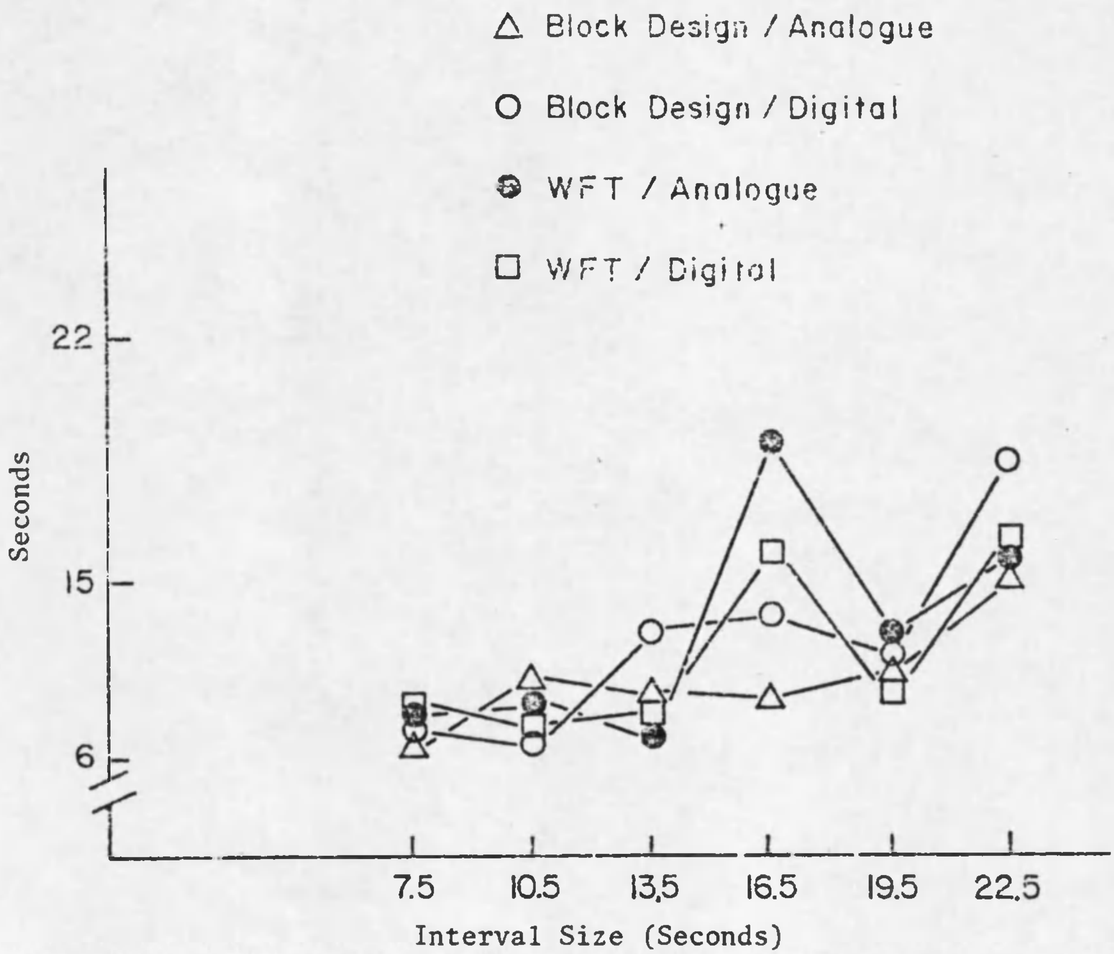

Figure 3. Time Estimation by Clock Type, Task Type, Interval Size

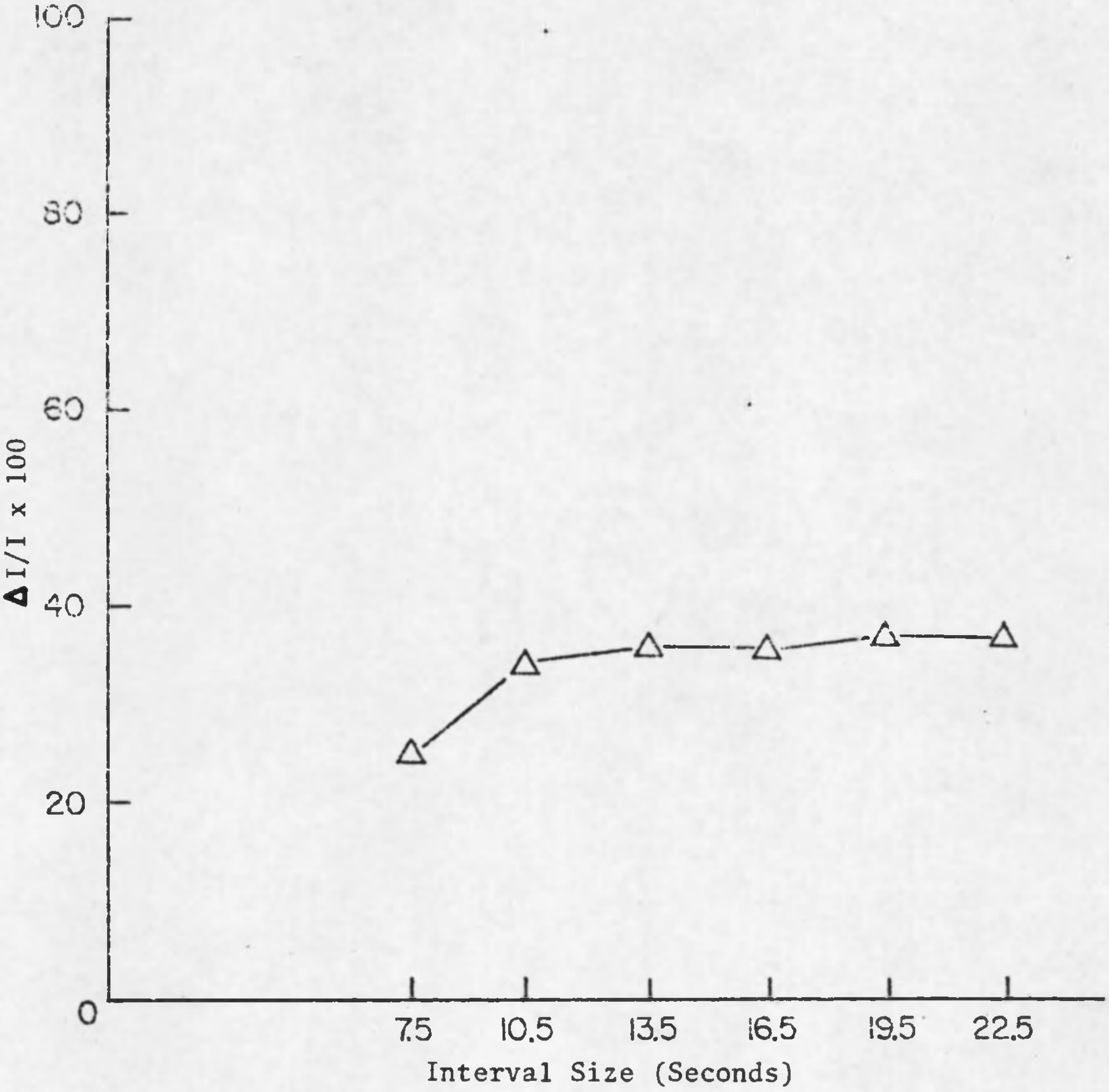

Figure 4. Time Estimation as Percent of Deviation From True Score Averaged Across Interval Size

TABLE 7

TOTAL TIME BY CLOCK TYPE, TASK INTERVAL SIZE
ANALYSIS OF VARIANCE

Source of Variation	Sum of Squares	Df	Mean Square	F	Significance of F
Clock Type	4092.00417	1	4092.00417	1.32784	-
Task	908847.33750	1	908847.33750	83.99108	P<.0001
Interval Size	14368.57083	5	2873.71417	.26557	-
Task by Clock Type	3132.03750	1	3132.03750	1.01634	-
Interval Size by Clock Type	9623.07083	5	1924.61417	.62453	-
Task by Interval Size	31172.03750	5	6234.40750	.57615	-
Task by Interval Size by Clock Type	11418.93750	5	2283.78750	.74108	-
Error 1	1168642.0500	108	10820.75972		
Residual	332822.4500	108	3081.68935		

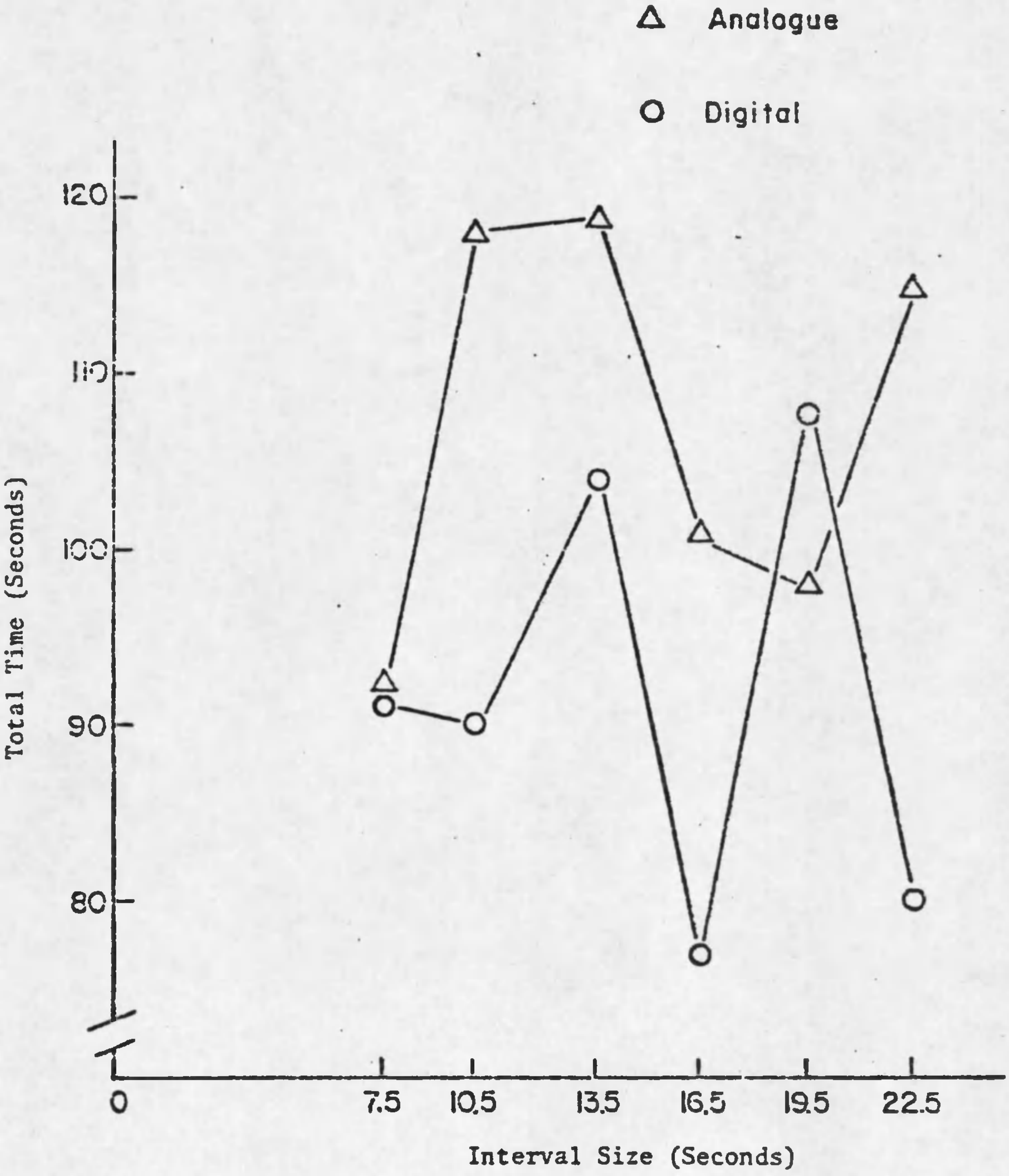

Figure 5. Total Time Necessary to do Task by Task, Clock, Interval Size - Block Design

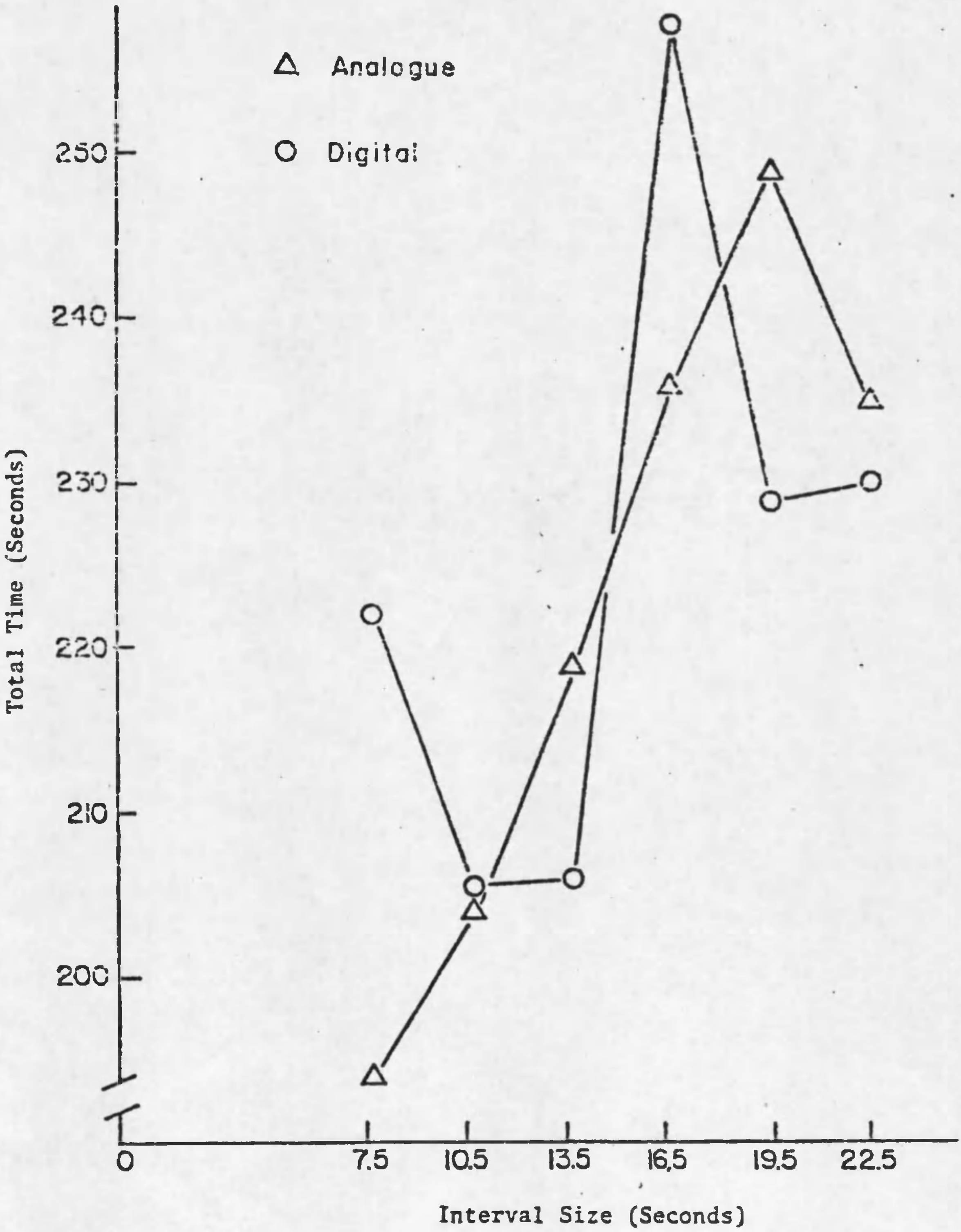

Figure 6. Total Time Necessary to do Task by Task, Clock Interval Size - Word Finding Task

2. A significant difference was found ($P < .01$) concerning the subject's abilities in following the display sequence. The people concerned with the word finding task were significantly more accurate than the subjects engaged in block design. This unfortunately may be a function of the task, which has more regular breaks than block design (Table 8, Figure 7).

3. Subjects received higher scores ($P < .05$) on the word finding task under more moderate intervals than on the extremes (Table 9, Figure 8).

4. There were significantly ($P < .01$) less glances per unit of time by those subjects focusing on the word finding task than those engaged in the block design. Further, a significant interaction was found ($P < .05$) between clock type and task type. People under the digital clock engaged in the word finding task looked up at the clock less often as the people under the same clock and a different task, or a different clock and a same task. Similarly, people under the digital clock doing the block design looked at the clock more often than anyone else. Although the significance of this phenomenon is low ($P < .05$) it should be noted that the measure of glances was only introduced for twenty subjects. Further testing would be useful to see if this effect holds true through different interval sizes (Table 10, Figure 9).

TABLE 8

ACCURACY (AVERAGE DEVIATION FROM ACTUAL LENGTH OF INTERVAL)
BY CLOCK TYPE, TASK, INTERVAL SIZE

Source of Variation	Sum of Squares	Df	Mean Square	F	Significance of F
Clock Type	1.33504	1	1.33504	.313133	-
Task	105.47004	1	105.47004	11.63194	P<.01
Interval Size	23.50771	5	4.70154	.51852	-
Task by Clock Type	.65104	1	.65104	.15270	-
Task by Interval Size	20.77671	5	6.41394	.70737	-
Task by Clock Type by Interval Size	17.90571	5	3.58114	.83996	-
Error 1	979.26650	108	9.06728		
Residual	460.45650	108	4.26349		

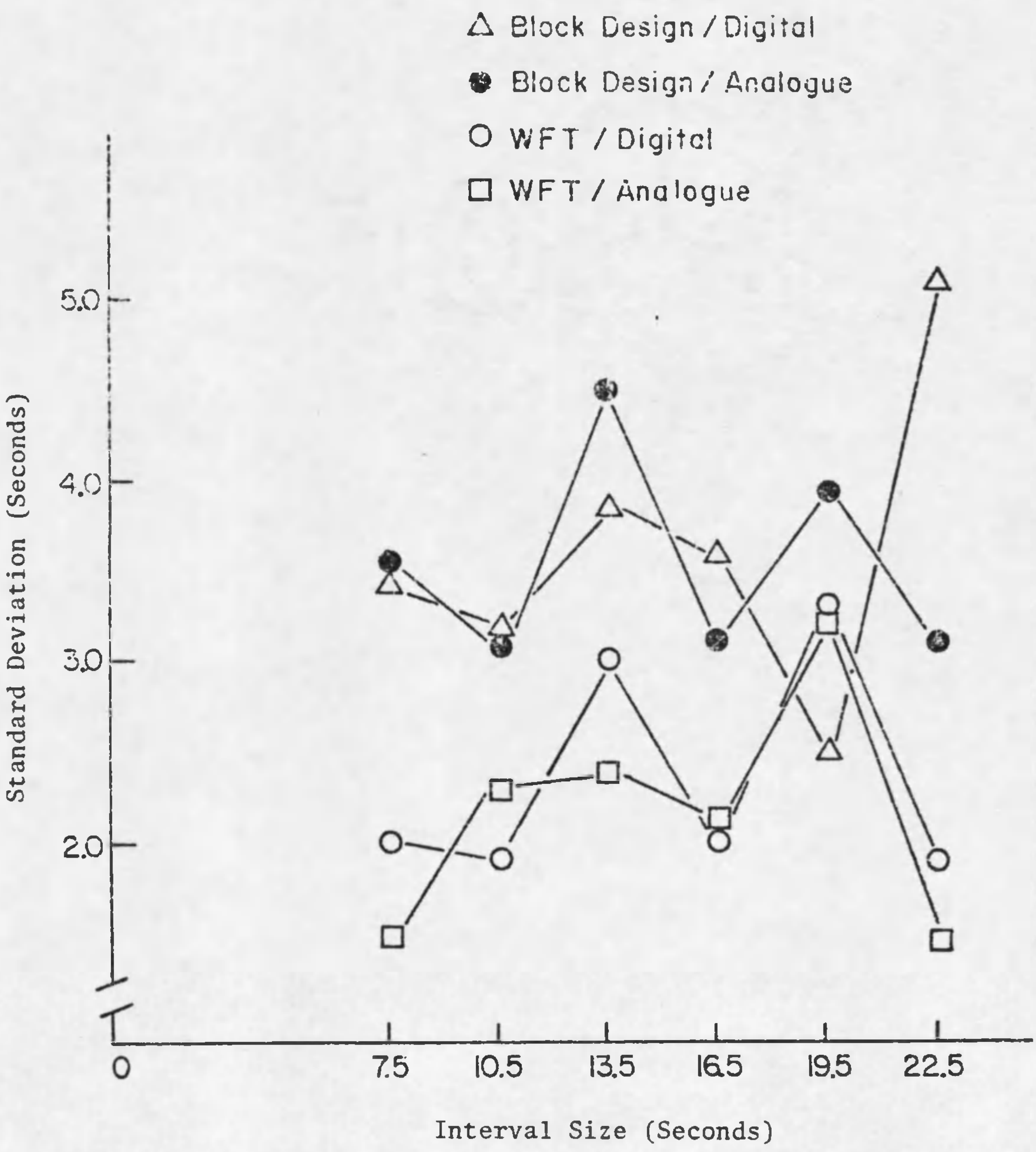

Figure 7. Accuracy Deviation From Actual Length of Interval) by Task, Clock Type, Interval Size

TABLE 9

SCORES ON WORD FINDING TASK BY CLOCK, INTERVAL SIZE
ANALYSIS OF VARIANCE

Source of Variation	Sum of Squares	Df	Mean Square	F	Significance of F
Clock Type	4.40833	1	4.40833	.38792	-
Interval Size by Clock Type	10.44167	5	2.08833	.18377	-
Interval Size	313.44167	5	62.68833	2.66412	P<.05
Error 1	1270.65000	54	23.53056		
Residual	613.65000	54	11.36389		

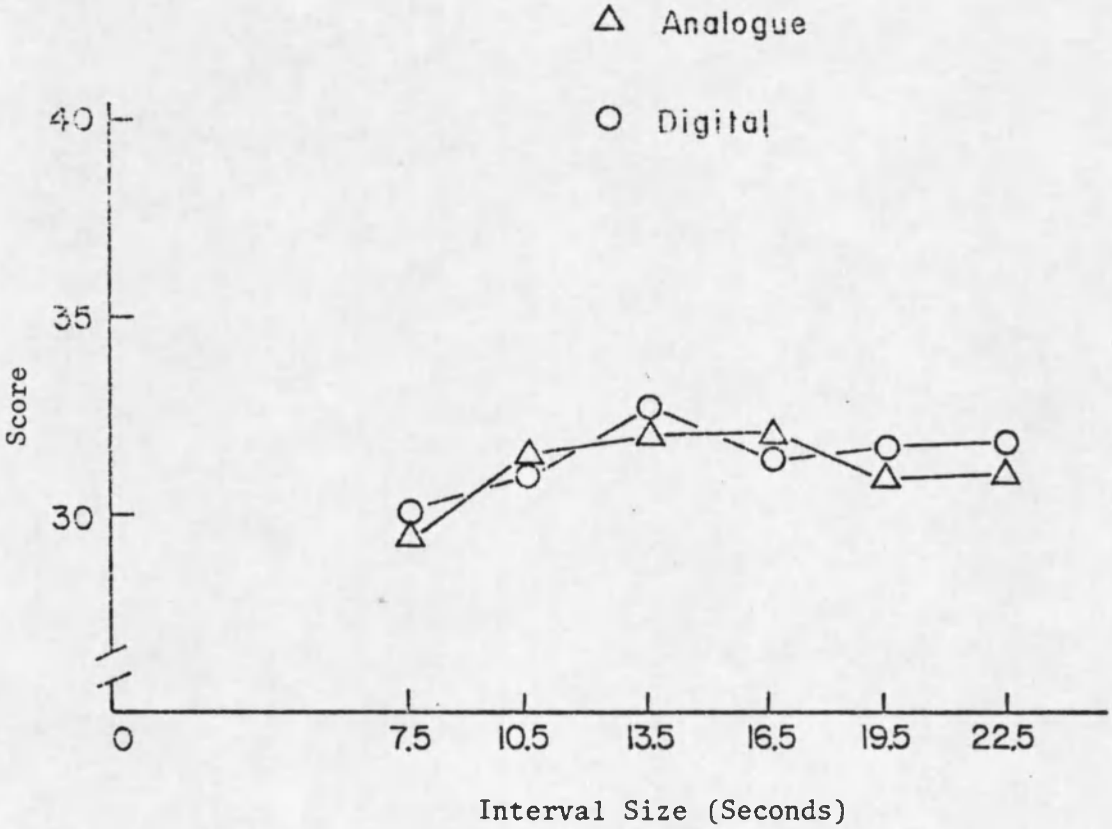

Figure 8. Score on Word Finding Task by Clock Type, Interval Size

TABLE 10

NUMBER OF SECONDS BETWEEN GLANCES BY CLOCK TYPE AND TASK
ANALYSIS OF VARIANCE

Source of Variation	Sum of Squares	Df	Mean Square	F	Significance of F
Clock Type	2.771	1	2.771	1.921	-
Task	77.193	1	77.193	9.454	P<.01
Clock Type by Task	10.162	1	10.162	7.05	P<.05
Error 1	146.973	18	8.165		
Residual	25.964	18	1.442		

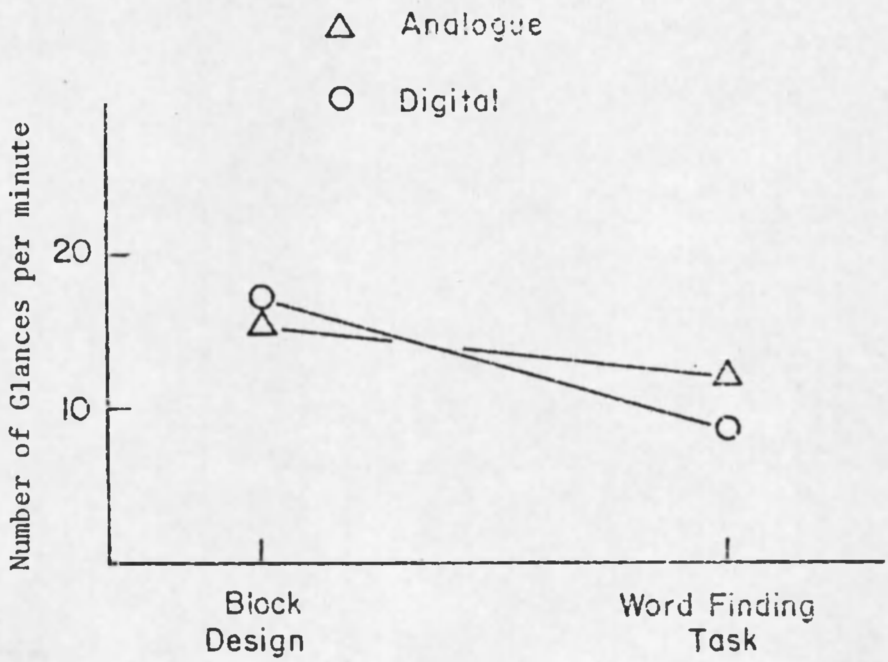

Figure 9. Number of Glances Per Minute by Task, Clock Type.

5. Subjectively, no difference was found in comfort or speed ratings in comparison to the overall trend (50% picking the analogues as more comfortable, 76.3% picking it faster) (Tables 11 and 12).

TABLE 11

SUBJECTS' SUBJECTIVE RATINGS OF MOST COMFORTABLE CLOCK PER TASK

Count Row Pct Col Pct Tot Pct	Analogue	Digital	Row Total
Block Design	31 51.7 50.8 25.8	29 48.3 49.2 24.2	60 50.0%
Word Finding Task	30 50.0 49.2 25.0	30 50.0 50.8 25.0	60 50.0%
	50.8%	49.2%	120 100%

TABLE 12

SUBJECTS' SUBJECTIVE RATINGS OF FASTEST CLOCK PER TASK

Count Row Pct Col Pct Tot Pct	Analogue	Digital	Row Total
Block Design	32 80.0 52.5 40.0	8 20.0 47.5 10.0	40 50.0%
Word Finding Task	29 47.5 36.3	11 52.5 13.7	40 50.0%
	61 76.3%	19 23.8%	80 100%

CHAPTER 4

DISCUSSION

These two different display types were compared to each other under two different vigilance tasks and six varied interval sizes. They were measured along the dependent measures of total time for completion of the interference task, accuracy of responding to the display, glance rate, ability to estimate intervals without the display present, scores on the interference tasks, and subjective impressions of speed and comfort. Overall, the research does not substantiate the previous notion that clock type drastically effects the subjects' abilities, irregardless of response set or interval size. Subjectively, subjects see no difference in comfort, nor was comfort a good measure of the subject's abilities on their task. One clock, the analogue, was seen to be faster but this also was a poor indicator of the subject's abilities. The measure of glance rate did support the hypothesis of an interaction between clock type and interference task, but at a low significance level ($P<.05$) and low N(20). Our measure of accuracy did show a significant difference between the two tasks ($P<.01$), but this may be a function of the task, not the type of processing needed to complete the task. Further research needs to be done to indicate whether these two most sensitive measures of the experiment are indeed finding a real difference between the displays and tasks, which would lead to inference of brain-behavior relationships, or whether the effects are due to the natures of the tasks.

APPENDIX A

THREE EXPERIMENTS DEALING WITH THE PERCEPTION OF TIME

SUBJECT CONSENT FORM

I am requesting your voluntary participation in the completion of this project. The purposes and objectives of this study are to determine various peoples' speed and accuracy on various tasks under set conditions in order to tell us a little more about how people work in different situations. It will involve you completing two simple tasks while under a time limit. The tasks include block manipulation and word search, and the total time should run about twenty minutes, with no other costs or risks to the subject. All data received will be treated with anonymity and confidentiality, and you are free to withdraw from the study at any time without incurring illwill nor affecting your university standing. This consent form will be filed in an area designated by the Human Subjects Committee with access restricted to the principal investigator, authorized representatives of the Psychology Department, or the subject upon request. If you have any questions, feel free to ask the experimentor at any time and he will be happy to help you.

____
Subject Date

____
Witness Date

APPENDIX B

SAMPLE ITEMS FROM THE WORD FINDING TASK

Item 1. (cats)

1. Most grobnicks have long tails.
2. Gronicks of a certain breed have very short tails.
3. Grobnicks can climb trees.
4. Birds are afraid of grobnicks.
5. Grobnicks are said to have nine lives.

Item 2. (ties)

1. Most men wear grobnicks.
2. Grobnicks are more ornamental than useful.
3. Grobnicks come in many colors.
4. A knot is usually employed to fix the grobnick in place.
5. Gravy spots are often found on grobnicks.

Item 3. (vacations)

1. Grobnicks are supposed to be fun.
2. However, recovery from a grobnick may take some time.
3. The summer months are the most frequent time for grobnicks.
4. Often times people try to cram too much into their grobnicks.
5. Many husbands and wives argue about going to the seashore or the mountains for their grobnicks.

Item 4. (light bulb)

1. The grobnick is a very useful invention.
2. Without electricity the grobnick would not operate.
3. The grobnick has no moving parts.
4. The grobnick is especially useful at night.
5. Thomas Edison invented the grobnick.

Item 5. (sun)

1. Without the grobnick we would not live very long.
2. The grobnick is very big.
3. The grobnick is very far away.
4. We cannot see the grobnick at night.
5. The grobnick is hot and bright.

APPENDIX C

INSTRUCTIONS FOR THE BLOCK DESIGN

You see these blocks. They are all alike. On some sides they are all red; on some, all white; and on some, half red and half white. I am going to put them together to make a design. Watch me. You see how it is like the drawing on the picture? Now you make one like it. Tell me when you have finished each design so I can record it. In the rest of this task I am going to show you similar cards and I want you to reproduce the designs as quickly and as accurately as possible. In some designs you will need more blocks, and I will provide these when necessary. If for some reason you get stuck, or stumped by any design for an extra long time, I will signal you to continue to the next design. Do you have any questions?

Now notice the clock display. It moves at a constant rate but is not going at the same speed as a normal clock. Now notice the button on the table. Everytime the display pointer reaches the top or the display shows the number "1" I want you to press the button like this. Try it. Now try to do design #1 over again while attending to the task of pressing the button. Remember, neither task is more important, it is necessary to do both as accurately as possible. Remember, hit the button each revolution, even if you missed the exact mark for some reason you should press the button to register for that revolution. Do you understand? When you have completed the last design in this sequence, I will ask you to do a short task which I will explain later. Do you have any more questions? OK--begin the clock signals its time for you to press the button.

Now all I want you to do is press the button at intervals you feel are equal to the intervals of time previously shown by the display. OK?

These designs are similar to the previous ones, only our display will be different. Do you see the display? Everytime the display reaches 1 or gets to the top, press the button. Try this with the first design. Any questions? OK--begin.

Now I would like to ask you which clock was more comfortable to work with. Also, which seemed to go faster or slower than the other?

APPENDIX D

INSTRUCTIONS FOR THE WORD FINDING TASK

This experiment deals with your ability to do two tasks simultaneously as quickly and as accurately as possible. Look at the cards in front of you. You will notice that there are a set of five cards in each color. These sets of cards will give you 5 clue sentences, and your task is to find the missing word identified by the nonsense word "Grobnick". Look at the first card. This gives you a certain amount of information about the missing word. If you can guess and answer now, you would state the answer. You would then turn to the next card either to get more information to make an answer or to strengthen your confidence of your first hypothesis. You would then continue until you ran out of cards for that set. If you cannot arrive at an answer, simply state "I don't know" at the termination of the final card and continue to the next set. Do you understand? You will be scored both on speed and accuracy. Try to do set "1".

Now observe the clock display. Notice that it runs at a constant rate but does not run at the same speed as a normal clock. Your second task is to press this button each time the display pointer reaches the top (or the display shows the number "1") like this. Try it. Now try to do set

"1" over again while attending to the task of pressing the button. Remember, neither task is more important, it is necessary to do both as accurately as possible. Remember, hit the button each revolution, even if you missed the exact mark for some reason you should press the button for that revolution. Do you understand? When you have completed the last set of cards in this sequence, I will ask you to do a short task which I will explain later. Do you have any questions? OK--begin when the clock signals it is time for you to press the button.

Now all I want you to do is press the button at intervals you feel are equal to the intervals of time previously shown for the display. OK?

These cards are similar to the previous ones, only our display will be different. Do you see the display? Everytime the display reaches 1 (or gets to the top) press the button. Try this with the first set. Any questions? OK--begin.

Now I would like to ask you which clock was more comfortable to work with. Also, which seemed to go faster or slower than the other?

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