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The effect on amplitude of accommodation, positive relative accommodation and negative relative accommodation when their test sequence is varied

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The effect on amplitude of accommodation, positive relative accommodation and negative relative accommodation when their test sequence is varied

Abstract

The problem was to determine the effect on the magnitude of the amplitude of accommodation, positive relative accommodation and negative relative accommodation when their test sequence is varied. The solution of this problem would enable clinicians to better determine the best possible testing sequence for examination.

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Master of Science in Vision Science

Committee Chair

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THE EFFECT ON AMPLITUDE OF ACCOMMODATION, POSITIVE RELATIVE
ACCOMMODATION AND NEGATIVE RELATIVE ACCOMMODATION WHEN THEIR
TEST SEQUENCE IS VARIED.

A thesis

Presented To The Faculty

Of The College Of Optometry

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In Partial Fulfillment

Of The Requirements For The Degree

Doctor Of Optometry

by

Ronald I. Cole

and

Kenneth E. Korek

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PROBLEM

The problem was to determine the effect on the magnitude of the amplitude of accommodation, positive relative accommodation and negative relative accommodation when their test sequence is varied.

The solution of this problem would enable clinicians to better determine the best possible testing sequence for examination.

Procedure

The experiment to determine the effect on amplitude of accommodation, positive relative accommodation and negative relative accommodation when their sequence is varied, employed the standard optometric extension program testing techniques as procedure. This method of testing was used in order to be of the greatest clinical importance possible.

The illumination was kept constant at 40 foot-candles by using a 75 watt bulb at a distance of $18\frac{1}{2}$ inches from the target. The distance from the subject to the test target was kept constant at 13 inches for the amplitude of accommodation tests and at 16 inches for the positive relative accommodation and negative relative accommodation tests.

Two subjects were tested thirty times for each of the three findings in six different sequences. One hour was allowed between each of the findings on each subject to allow for a suitable time elapse between the findings.

The Bausch and Lomb Green's refractor was used and the sequences were employed in the following order;

A. #19, #20, #21

B. #19, #21, #20

C. #20, #19, #21

D. #20, #21, #19

E. #21, #19, #20

F. #21, #20, #19

The above numbers and sets of sequence are all variances of the present sequence used by the Optometric Extension Program to signify as follows; #19 - amplitude of accommodation, #20 - positive relative

accommodation, #21 - negative relative accommodation.

Henceforth the numbers referred to in the preceding paragraph will be used to indicate the test performed.

Subject A was tested in the following manner. The #19 test was conducted with the test target (0.62 M) letters at 13 inches from the subject with the illumination set at 40 foot-candles. This target was of the standard type with black letters printed on a white cardboard background. Minus lenses were introduced before the subject's eyes until a definite blur was reported. By a definite blur is not meant one which prevented the subject from reading the letters, but one which made reading uncomfortable. To the gross phoropter reading, -2.50 diopters was added to compensate for the testing distance and this total was recorded. The #20 test was conducted with the test target (reduced Snellen) at 16 inches with the illumination set at 40 foot-candles. Minus lenses were introduced before the subject's eyes until he could no longer read the smallest letters on the reduced Snellen chart. This was then recorded as the #20 finding. The #21 finding was taken in exactly the same manner as the number 20 finding as far as the testing set was concerned. However, plus lenses were now increased before the subject's eyes until a noticeable blur was found.

The tests taken on Subject B were taken in exactly the same manner as those performed on Subject A. The tests were taken at the same time, with a minimum of one hour intervals between a sequence, with Subject A and B interchanging as observers. No other observers were employed in this testing situation.

Subject A was tested through habitual prescription, which is 1.25 diopters of minus lens before the right and dominant eye and 0.75 diopters before the left and non-dominant eye. Subject B also was tested through his habitual prescription which is 0.75 diopters of minus sphere before both eyes.

GRAPHICAL ANALYSIS

— OF —

EXPERIMENTAL FINDINGS

GRAPH #1   5

Subject A

Legend:
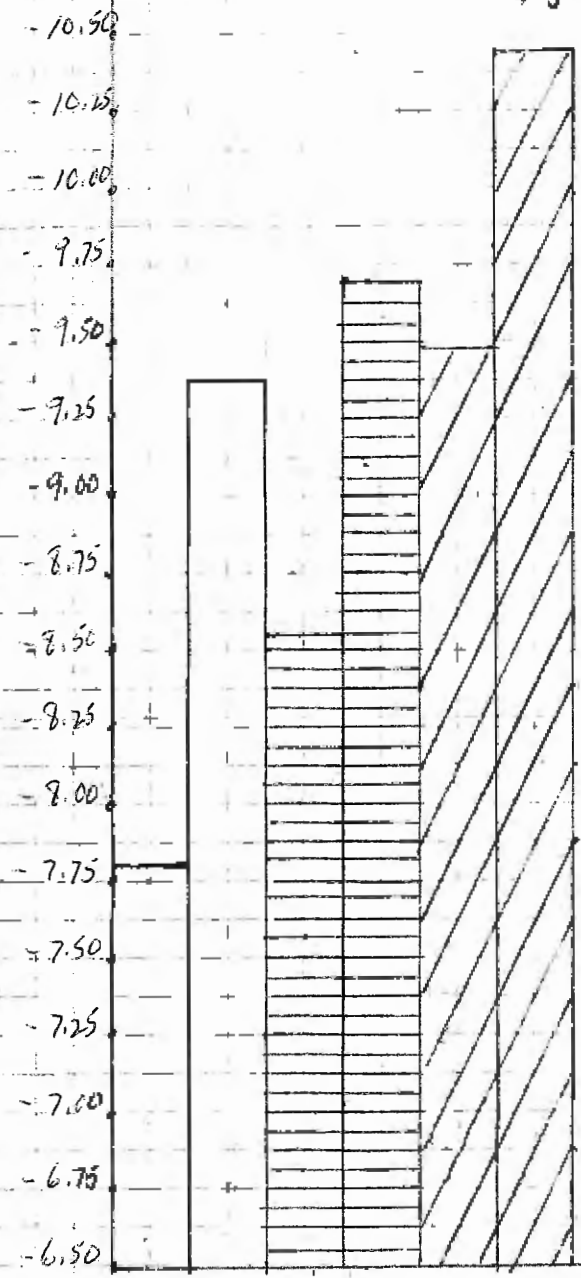
- ☐ #19 first in sequence
- ☰ #19 after stimulatory testing
- ▨ #19 after inhibitory testing

Subject A

GRAPH #2

5.75
5.50
5.25
5.00
4.75
4.50
4.25
4.00
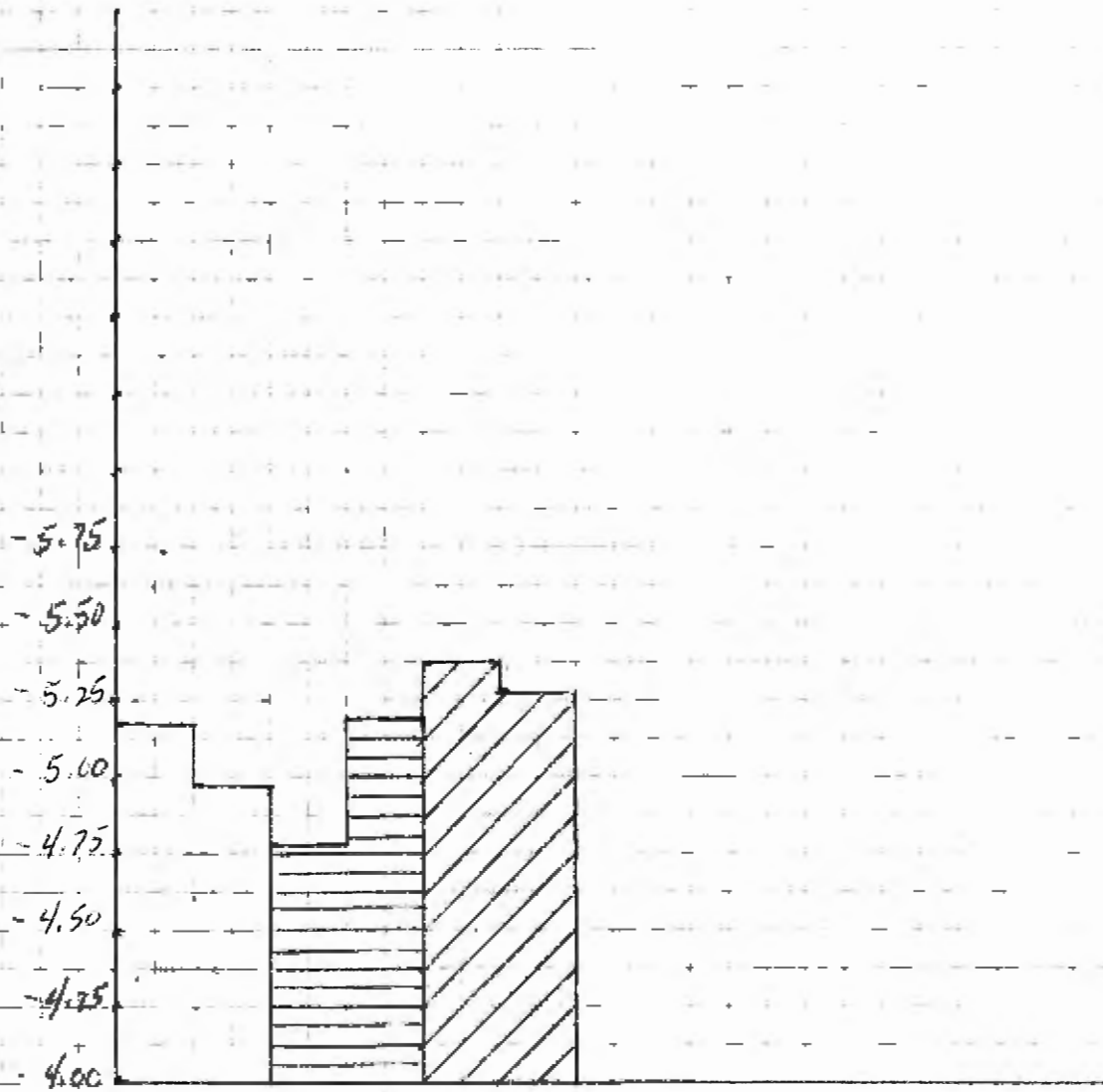
☐ #20 first in the sequence

☰ #20 after stimulatory testing

▨ #20 after inhibitory testing

GRAPH #3

Subject A

+3.25
+3.00
+2.75
+2.50
+2.25
+2.00
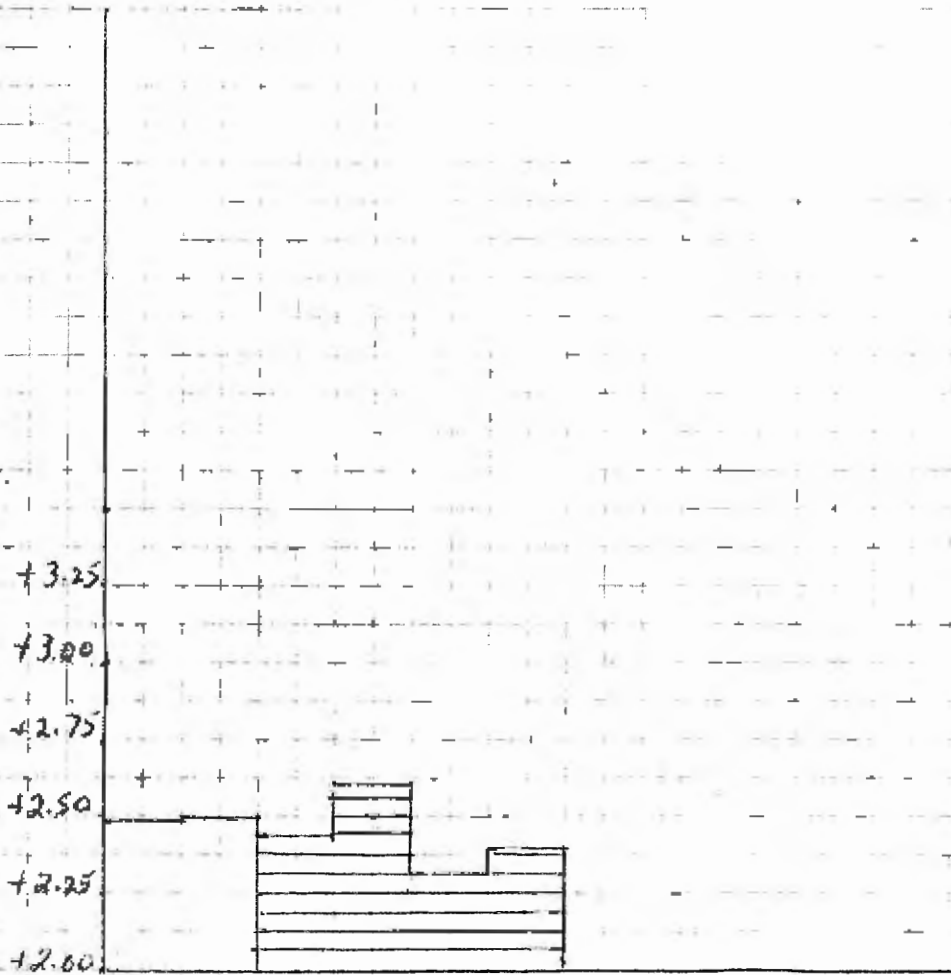
☐ #21 first in the sequence

☰ #21 after stimulatory testing

SUBJECT B   GRAPH #1.

8
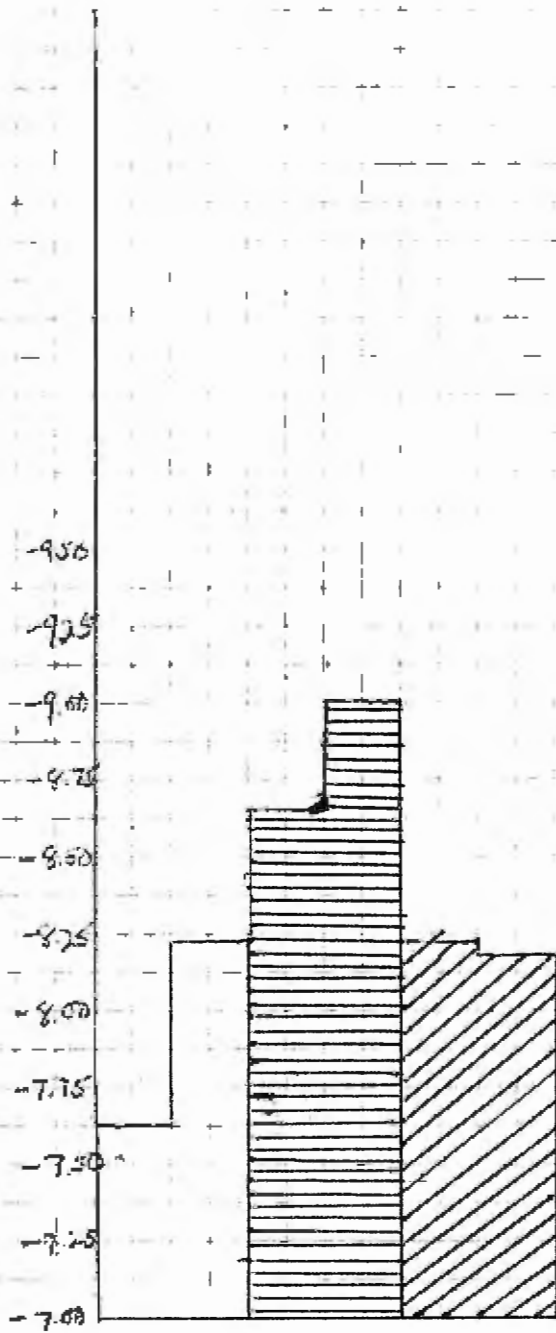
19 FIRST IN SEQUENCE A-B
19 FOLLOWING STIMULATORY PHASE C-F
19 FOLLOWING INHIBITORY PHASE D-E

GRAPH # 3.

SUBJECT B

+4.00

+3.75

+3.00

+3.25

+3.50
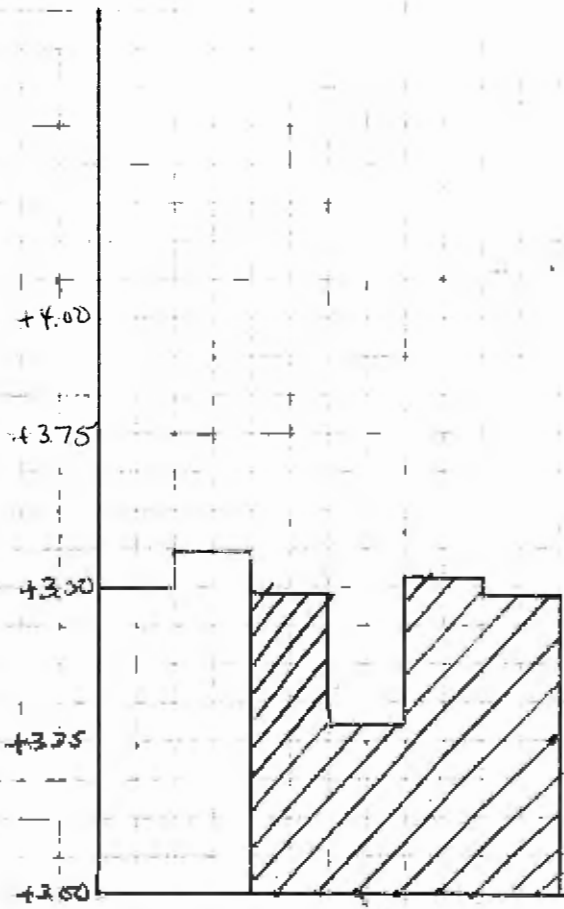
☐ #21 FIRST IN SEQUENCE EE

▨ #21 FOLLOWING STIMULATORY PHASE — CDEF.

GRAPH #2.

SUBJECT B

- 6.00
- 5.75
- 5.50
- 5.25
- 5.00
- 4.75
- 4.50
- 4.25
- 4.00
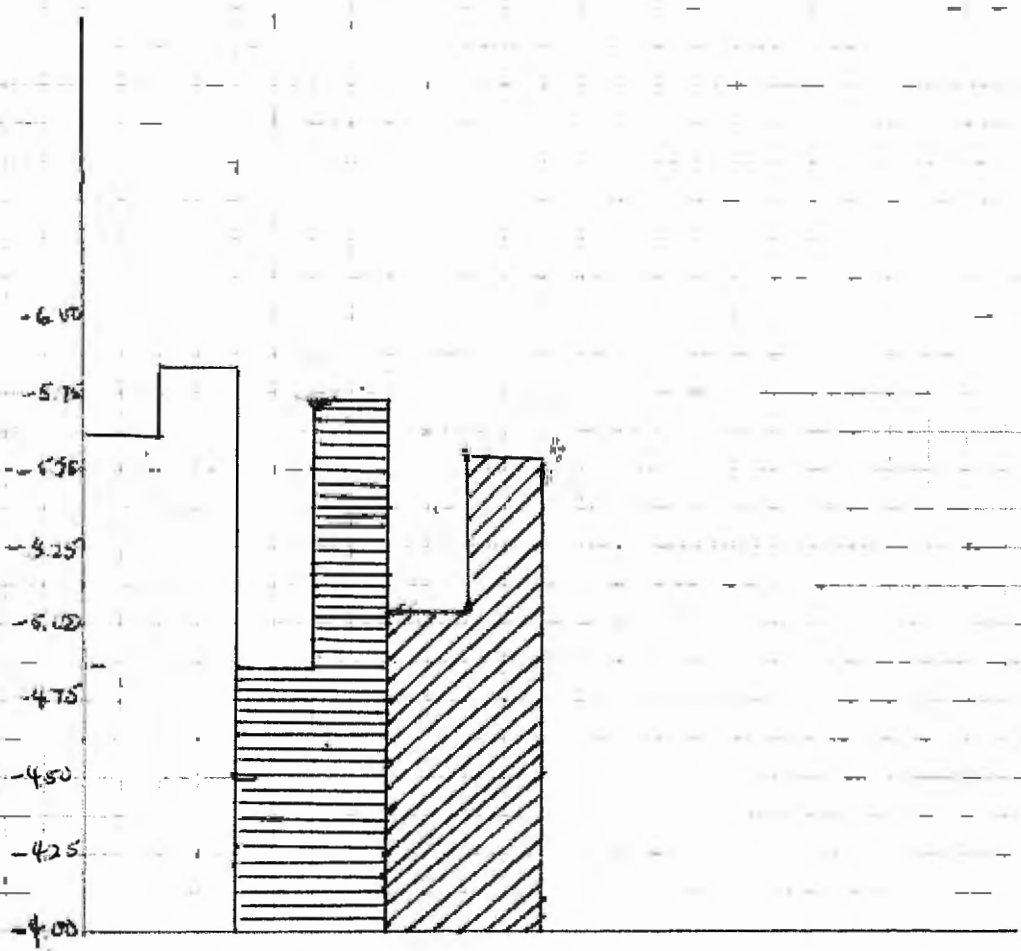
☐ # 20 FIRST IN SEQUENCE

▤ # 20 FOLLOWING STIMULATORY PHASE

▨ # 20 FOLLOWING INHIBITORY PHASE

GRAPH OF FINDINGS FOR # 19 NORMS
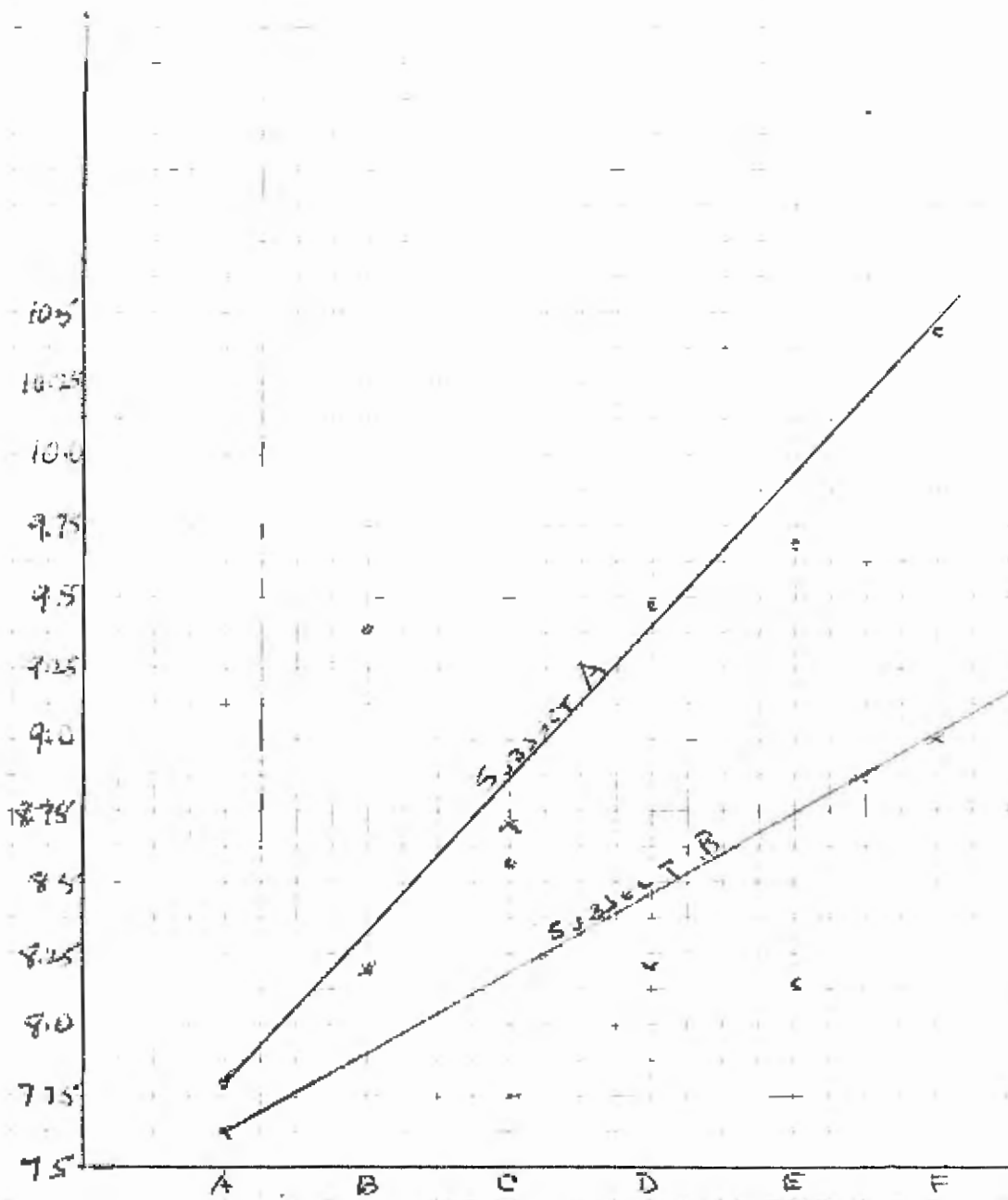
GRAPH OF FINDINGS FOR #20 NORMS

6.5
6.25
6.0
5.75
5.5
5.25
5.0
4.75

SUBJECT B

SUBJECT A

A   B   C   D   E   F
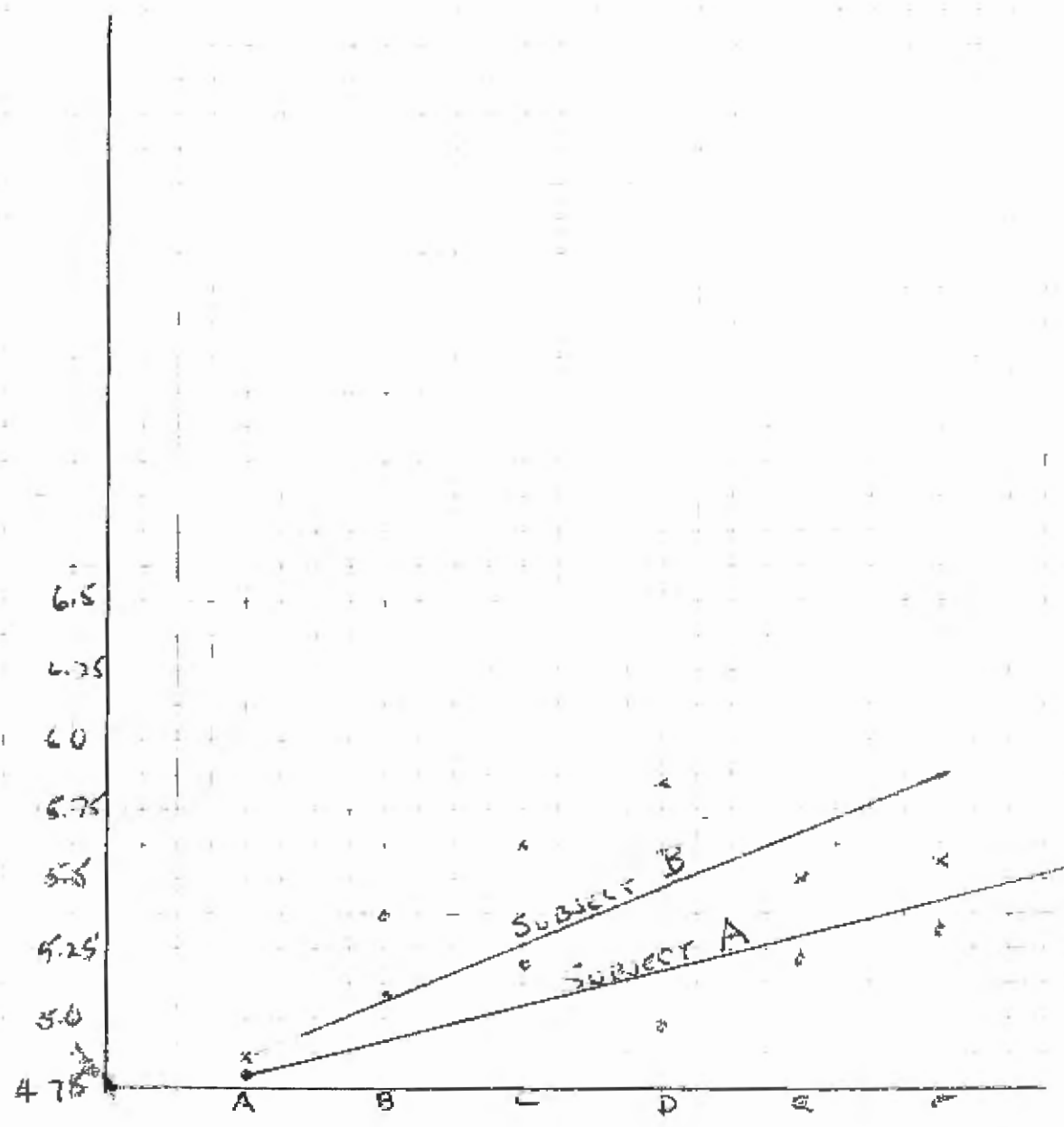
GRAPH OF FINDINGS FOR #31 NORMS
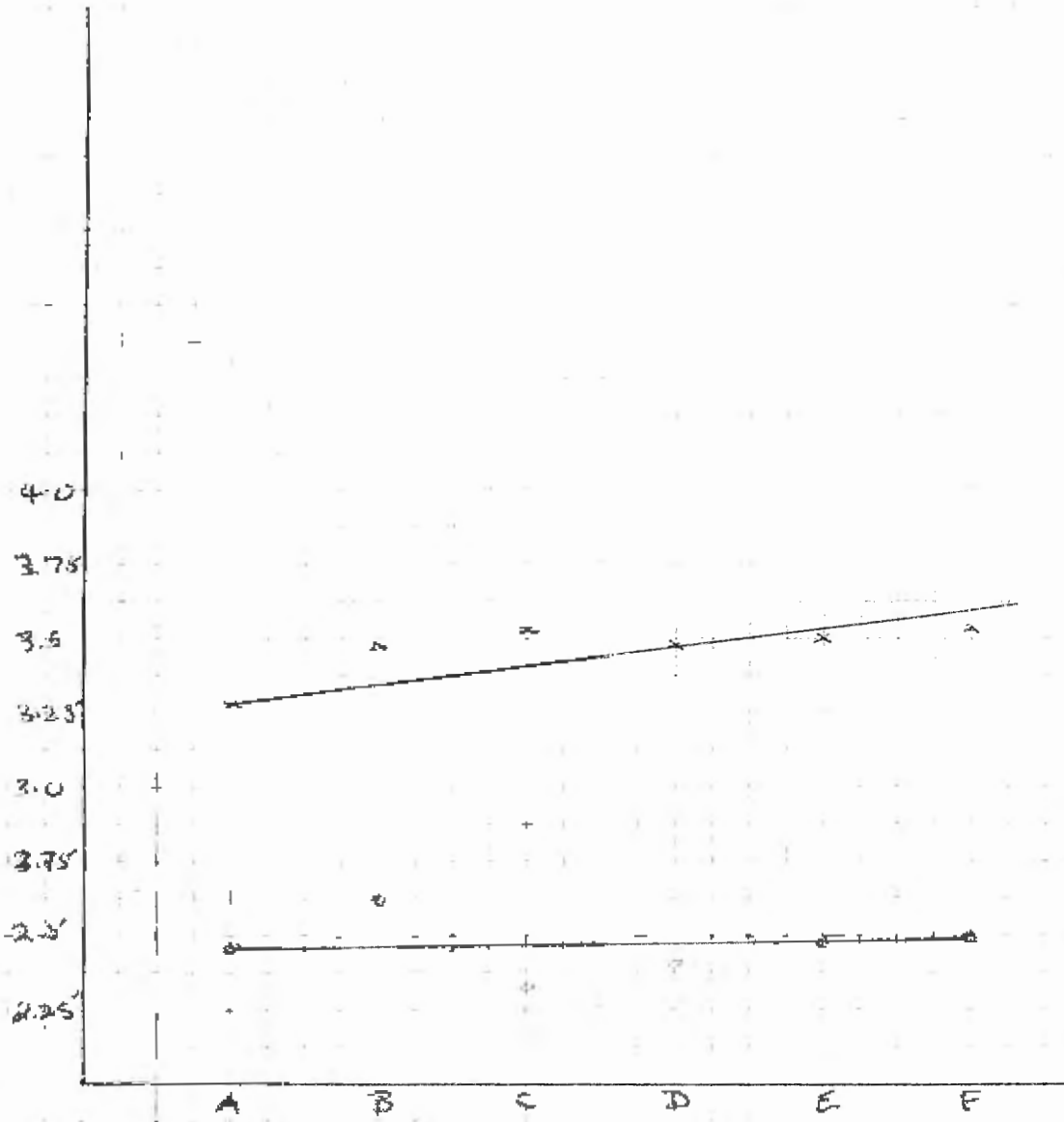
RESULTS

The data obtained from this experiment were included in the appendix of this paper, appearing on pages 19 - 36. The graphs computed from the data were plotted on pages 5 - 13. Data sheets 19 - 30 indicated the actual dioptric values obtained from each test on both subjects. Data sheets 31 and 32 indicated the means for each test in every sequence were determined and also the order of sequence and the letter which designated that sequence. Data sheets 33 - 36 showed the high, low, mean and standard deviation findings for each test in each sequence for both subjects.

The ordinate of each graph represented the lens diopters as reported by the individual subjects. The abscissa of each graph represented the sequence in which the test was performed.

Graph # 1 indicated the relationship between means of the dioptric values found for the # 19 test and the sequence in which the # 19 was taken with respect to the # 20 and # 21 findings. Graph # 2 showed the relationship between the # 20 findings and the sequence. Graph # 3 showed the relationship between the means of the findings and the sequence.

DISCUSSION OF RESULTS

Subject B showed evidence that the #19 finding increased in magnitude after stimulatory testing had preceeded it. This was also found for the #20 finding for Subject B. The #21 finding showed toolittle variability in magnitude in different suquence to draw any such positive conclusion from the findings.

Subject A showed no definite trend for any of the findings, regardless of whether they followed the inhibitory or the stimulatory phase.

Subject B also indicated a decrease in the #19 findings might be expected after an inhibitory phase of testing. This also was found in the #20 findings, however, there was less of a positive indication in this direction than found in the #19 findings.

Subject A showed a negative correlation to those found in subject B. Instead of an increase following a stimulatory phase the #19 and #20 findings showed a tendency to drop. There was also an opposite rise in the stimulatory phases following an inhibitory phase of the #21 finding. The #21 findings also did not show a positive correlation as no definite relationship between there position in the sequence and magnitude could be determined.

The majority of findings forboth subjects showed a definite increase in magnitude as the testing continued. This factor might well be taken into consideration in any further testing associated with this problem. The #21 finding was the only one not showing an increase in magnitude for both subjects. A possible explanation for this occurence might be the training effect of continued application of lenses causing a rise in the amplitude. This, however, does

not explain why #21 findings did not rise accordingly and, since, a lapse of at least one hour was allowed between single sequences this does not appear to fully account for the increase.

The differences between the high and low findings, individually, show a relationship, in that, as the magnitude of the findings increased the difference between the high and low increased.

No explanation is offered as reason for the differences between Subject A and B regarding high and low findings, standard deviations and means, other than subject A was a less particular observer than subject B. The slightly higher amount of myopia of subject A does not appear to have any bearing on the difference of the fings.

None of the findings are consistant enough to warrant applying statistical analysis to. This may be in part due to the small number of subjects tested.

CONCLUSION

From the results obtained in this paper, it can be stated, that there is no statistically significant difference in the value of the findings # 19, # 20, and #21, regardless of the order in which they were taken. However, there was some individual variability, one of the observers showed some increase in the #19 and #20 findings when they followed a stimulatory phase of the sequence. No change in the #21 finding was noted, whether there was any change in sequence or not.

SUMMARY

The problem was to determine the effect on amplitude of accommodation, positive relative accommodation and negative relative accommodation when their test sequence was varied. An experiment was prepared and performed using the standard procedure of the testing prescribed by the Optometric Extension Program and varying the sequence of the tests in all possible combinations. It was found that an increase in the amplitude of accommodation and the positive relative accommodation resulted when the tests were preceded by the stimulatory phase of the testing. Negative relative accommodation remained unchanged regardless of the preceding phase of testing. From the conclusion, therefore, it may be stated that the order of sequence did not change the findings a statistically measureable amount.

SUBJECT A

	Date	Time	#19	#20	#21
1.	2/25/54	9:00	-9.25	-5.50	≠2.75
2.	2/25/54	10:00	-8.75	-4.75	≠2.25
3.	2/25/54	11:00	-8.50	-5.00	≠2.00
4.	2/25/54	12:00	-8.75	-4.50	≠2.25
5.	2/25/54	1:00	-8.75	-6.00	≠2.00
6.	2/25/54	2:00	-7.75	-5.00	≠2.50
7.	2/25/54	3:00	-8.25	-4.75	≠2.00
8.	2/25/54	4:00	-8.00	-5.00	≠2.50
9.	2/26/54	9:00	-7.50	-5.00	≠2.75
10.	2/26/54	10:00	-7.50	-4.50	≠2.50
11.	2/26/54	11:00	-8.50	-5.25	≠2.75
12.	2/26/54	12:00	-7.50	-4.50	≠2.25
13.	2/26/54	1:00	-7.75	-4.25	≠2.50
14.	2/26/54	2:00	-7.50	-4.00	≠2.50
15.	2/26/54	3:00	-8.00	-4.25	≠2.50
16.	2/26/54	4:00	-7.25	-5.50	≠2.50
17.	2/26/54	5:00	-7.75	-5.25	≠2.75
18.	3/1/54	9:00	-8.00	-4.75	≠2.50
19.	3/1/54	10:00	-7.25	-4.25	≠2.50
20.	3/1/54	11:00	-7.75	-4.75	≠2.75
21.	3/1/54	12:00	-7.50	-4.50	≠2.50
22.	3/1/54	1:00	-7.75	-4.25	≠2.50
23.	3/1/54	2:00	-7.75	-4.50	≠2.75
24.	3/1/54	3:00	-8.00	-4.75	≠2.25
25.	3/1/54	4:00	-7.50	-4.75	≠2.50
26.	3/2/54	9:00	-7.25	-4.50	≠2.00
27.	3/2/54	10:00	-7.50	-5.00	≠2.25
28.	3/2/54	11:00	-7.75	-4.75	≠2.50
29.	3/2/54	12:00	-8.25	-4.50	≠2.75

	Date	Time	#19	#20	#21
1.	2/25/54	9:00	-7.75	-5.25	/2.75
2.	2/25/54	10:00	-7.75	-5.75	/3.25
3.	2/25/54	11:00	-7.25	-5.50	/3.25
4.	2/25/54	12:00	-7.25	-5.00	/3.25
5.	2/25/54	1:00	-8.50	-4.25	/3.25
6.	2/25/54	2:00	-7.75	-6.00	/3.00
7.	2/25/54	3:00	-7.00	-5.00	/3.00
8.	2/25/54	4:00	-8.25	-5.25	/3.00
9.	2/26/54	9:00	-8.25	-5.75	/3.25
10.	2/26/54	10:00	-7:00	-4.75	/3.25
11.	2/26/54	11:00	-8:00	-5.25	/2.75
12.	2/26/54	12:00	-7.50	-5.50	/3.25
13.	2/26/54	1:00	-7.25	-5.25	/2.75
14.	2/26/54	2:00	-8.25	-5.25	/3.25
15.	2/26/54	3:00	-8.50	-4.50	/3.25
16.	2/26/54	4:00	-7.00	-4.25	/3.25
17.	2/26/54	5:00	-7.25	-4.75	/3.25
18.	3/1/54	9:00	-7.25	-4.00	/3.50
19.	3/1/54	10:00	-7.25	-4.75	/3.00
20.	3/1/54	11:00	-7.75	-4.50	/3.50
21.	3/1/54	12:00	-7.50	-4.75	/3.00
22.	3/1/54	1:00	-8.00	-4.50	/3.25
23.	3/1/54	2:00	-7.75	-5.00	/3.00
24.	3/1/54	3:00	-7.50	-4.75	/3.25
25.	3/1/54	4:00	-8.25	-4.75	/3.50
26.	3/2/54	9:00	-7.75	-4.50	/3.25
27.	3/2/54	10:00	-7.75	-4.25	/3.25
28.	3/2/54	11:00	-7.50	-4.75	/3.25
29.	3/2/54	12:00	-7:00	-4.25	/3.50
30.	3/2/54	1:00	-7.25	-4.50	/3.25

SUBJECT A

	Date	Time	#19	#21	#20
1.	3/3/54	8:00	-10.00	≠2.75	-4.75
2.	3/3/54	9:00	-9.25	≠2.50	-6.00
3.	3/3/54	10:00	-9.75	≠2.75	-5.00
4.	3/3/54	11:00	-9.75	≠2.50	-5.50
5.	3/3/54	12:00	-9.50	≠2.50	-6.00
6.	3/3/54	1:00	-9.50	≠2.75	-5.50
7.	3/3/54	2:00	-9.75	≠2.50	-5.50
8.	3/3/54	3:00	-9.75	≠2.75	-5.75
9.	3/3/54	4:00	-9.25	≠2.75	-5.50
10.	3/4/54	8:00	-9.50	≠2.50	-6.00
11.	3/4/54	9:00	-9.50	≠2.75	-5.75
12.	3/4/54	10:00	-9.00	≠2.75	-5.75
13.	3/4/54	11:00	-9.50	≠2.75	-5.50
14.	3/4/54	12:00	-9.25	≠2.50	-5.50
15.	3/4/54	1:00	-9.00	≠3.00	-5.75
16.	3/4/54	2:00	-9.25	≠2.75	-5.50
17.	3/4/54	3:00	-9.50	≠2.75	-5.25
18.	3/4/54	4:00	-9.00	≠2.75	-5.75
19.	3/4/54	5:00	-9.00	≠2.25	-5.00
20.	3/5/54	8:00	-9.50	≠2.25	-5.50
21.	3/5/54	9:00	-9.25	≠2.50	-4.75
22.	3/5/54	10:00	-9.00	≠3.75	-5.00
23.	3/5/54	11:00	-9.25	≠2.75	-5.25
24.	3/5/54	12:00	-9.25	≠2.75	-5.25
25.	3/5/54	1:00	-9.50	≠2.50	-5.00
26.	3/5/54	2:00	-9.25	≠2.75	-5.25
27.	3/5/54	3:00	-9.50	≠2.50	-5.50
28.	3/5/54	4:00	-9.50	≠2.25	-4.75
29.	3/5/54	5:00	-9.25	≠2.50	-4.75
30.	3/5/54	6:00	-9.50	≠2.25	-4.75

SUBJECT B

	Date	Time	#19	#21	#20
1.	3/3/54	8:00	-7.75	≠3.50	-5.50
2.	3/3/54	9:00	-7.75	≠3.50	-5.00
3.	3/3/54	10:00	-8.00	≠3.50	-5.00
4.	3/3/54	11:00	-8.00	≠3.75	-5.00
5.	3/3/54	12:00	-7.50	≠3.50	-5.00
6.	3/3/54	1:00	-7.75	≠3.50	-5.00
7.	3/3/54	2:00	-8.00	≠3.25	-4.75
8.	3/3/54	3:00	-7.50	≠-3.50	-5.00
9.	3/3/54	4:00	-7.75	≠3.50	-5.00
10.	3/3/54	5:00	-7.75	≠3.75	-5.25
11.	3/4/54	9:00	-8.00	≠3.75	-5.00
12.	3/4/54	10:00	-7.75	≠3.50	-5.25
13.	3/4/54	11:00	-8.00	≠3.75	-5.25
14.	3/4/54	12:00	-7.75	≠3.75	-5.00
15.	3/4/54	1:00	-7.50	≠3.50	-5.00
16.	3/4/54	3:00	-8.75	≠3.50	-4.50
17.	3/4/54	4:00	-8.50	≠3.50	-5.00
18.	3/4/54	5:00	-8.25	≠3.25	-5.25
19.	3/4/54	6:00	-7.75	≠3.50	-4.75
20.	3/5/54	8:00	-8.00	≠3.25	-5.00
21.	3/5/54	9:00	-8.25	≠3.50	-5.00
22.	3/5/54	10:00	-7.75	≠3.25	-4.75
23.	3/5/54	11:00	-8.25	≠3.50	-5.00
24.	3/5/54	12:00	-8.00	≠3.25	-5.25
25.	3/5/54	1:00	-7.75	≠3.25	-5.75
26.	3/5/54	2:00	-7.75	≠3.50	-5.25
27.	3/5/54	3:00	-7.50	≠3.50	-5.50
28.	3/5/54	4:00	-7.75	≠3.50	-5.00
29.	3/5/54	5:00	-7.75	≠3.25	-5.25
30.	3/5/54	6:00	-8.25	≠3.25	-5.00

SUBJECT A

	Date	Time	#20	#19	#21
1.	3/10/54	9:00	-6.00	-10.25	≠2.75
2.	3/10/54	10:00	-6.00	-10.25	≠2.50
3.	3/10/54	11:00	-5.25	-10.00	≠2.50
4.	3/10/54	12:00	-5.75	-9.75	≠2.25
5.	3/10/54	1:00	-5.00	-10.25	≠2.50
6.	3/10/54	3:00	-5.50	-10.00	≠2.50
7.	3/10/54	4:00	-5.75	-10.25	≠2.50
8.	3/11/54	9:00	-5.50	-10.00	≠2.25
9.	3/11/54	10:00	-5.25	-9.75	≠2.25
10.	3/11/54	11:00	-5.75	-9.75	≠2.50
11.	3/11/54	12:00	-5.50	-10.00	≠2.25
12.	3/11/54	2:00	-6.00	-10.25	≠2.50
13.	3/11/54	3:00	-5.75	-10.00	≠2.75
14.	3/12/54	9:00	-5.75	-9.75	≠2.50
15.	3/12/54	10:00	-5.50	-9.50	≠2.25
16.	3/12/54	12:00	-5.50	-9.75	≠2.50
17.	3/12/54	1:00	-5.75	-9.50	≠2.50
18.	3/12/54	2:00	-5.25	-9.25	≠2.25
19.	3/12/54	4:00	-5.25	-9.50	≠2.50
20.	3/12/54	5:00	-5.50	-9.75	≠2.50
21.	3/15/54	9:00	-5.50	-9.50	≠2.25
22.	3/15/54	11:00	-5.50	-9.50	≠2.25
23.	3/15/54	12:00	-5.50	-9.75	≠2.50
24.	3/15/54	1:00	-5.25	-9.50	≠2.75
25.	3/15/54	2:00	-5.50	-9.25	≠2.50
26.	3/15/54	4:00	-5.25	-9.50	≠2.75
27.	3/17/54	9:00	-5.25	-9.50	≠2.50
28.	3/17/54	10:00	-5.50	-10.00	≠2.25
29.	3/17/54	2:00	-5.75	-9.75	≠2.50
30.	3/17/54	4:00	-5.50	-9.75	≠3.50

	Date	Time	#20	#19	#21
1.	3/10/54	9:00	-6.25	-9.00	≠3.50
2.	3/10/54	10:00	-6.00	-8.75	≠3.50
3.	3/10/54	11:00	-5.25	-8.25	≠3.75
4.	3/10/54	12:00	-5.50	-8.25	≠3.75
5.	3/10/54	1:00	-5.75	-9.00	≠4.00
6.	3/10/54	3:00	-5.75	-8.75	≠3.25
7.	3/10/54	4:00	-6.00	-9.00	≠3.50
8.	3/11/54	9:00	-5.50	-8.75	≠3.75
9.	3/11/54	10:00	-5.25	-8.25	≠3.75
10.	3/11/54	11:00	-5.75	-8.75	≠3.50
11.	3/11/54	12:00	-5.50	-8.25	≠3.50
12.	3/11/54	2:00	-5.75	-8.75	≠3.50
13.	3/11/54	3:00	-6.00	-9.00	≠3.75
14.	3/12/54	9:00	-6.00	-8.50	≠3.75
15.	3/12/54	10:00	-5.75	-8.50	≠3.50
16.	3/12/54	12:00	-5.50	-8.50	≠3.50
17.	3/12/54	1:00	-5.50	-9.25	≠2.25
18.	3/12/54	2:00	-5.75	-8.25	≠3.75
19.	3/12/54	4:00	-5.25	-3.50	≠3.50
20.	3/12/54	5:00	-5.50	-8.75	≠3.25
21.	3/15/54	9:00	-5.75	-8.50	≠3.25
22.	3/15/54	11:00	-5.25	-9.00	≠3.50
23.	3/15/54	12:00	-5.50	-8.75	≠3.50
24.	3/15/54	1:00	-5.50	-9.00	≠3.25
25.	3/15/54	2:00	-5.25	-8.75	≠3.75
26.	3/15/54	4:00	-5.75	-8.75	≠3.50
27.	3/17/54	9:00	-5.50	-8.50	≠3.75
28.	3/17/54	10:00	-5.75	-8.25	≠3.50
29.	3/17/54	2:00	-5.50	-8.75	≠3.75
30.	3/17/54	3:00	-5.50	-8.75	≠3.50

SUBJECT A

	Date	Time	#20	#21	#19
1.	3/18/54	9:00	-4.75	≠2.50	-8.50
2.	3/18/54	10:00	-5.25	≠2.50	-9.75
3.	3/18/54	11:00	-5.50	≠2.50	-9.50
4.	3/18/54	1:00	-5.50	≠2.50	-9.75
5.	3/18/54	3:00	-5.00	≠2.75	-9.50
6.	3/18/54	4:00	-5.25	≠2.50	-9.50
7.	3/19/54	9:00	-4.75	≠2.75	-9.00
8.	3/19/54	10:00	-5.50	≠2.50	-9.50
9.	3/19/54	11:00	-5.25	≠2.50	-10.00
10.	3/19/54	12:00	-5.75	≠2.25	-9.75
11.	3/19/54	1:00	-4.50	≠2.75	-9.00
12.	3/19/54	3:00	-5.00	≠2.50	-9.25
13.	3/19/54	4:00	-5.25	≠2.50	-9.50
14.	3/20/54	9:00	-5.25	≠2.50	-9.00
15.	3/20/54	10:00	-5.00	≠2.75	-9.25
16.	3/29/54	11:00	-5.25	≠2.25	-9.75
17.	3/20/54	12:00	-4.50	≠2.00	-10.00
18.	3/20/54	1:00	-4.75	≠2.25	-9.75
19.	3/20/54	2:00	-2.25	≠2.25	-9.75
20.	3/20/54	3:00	-5.00	≠2.00	-9.50
21.	3/20/54	4:00	-5.00	≠2.00	-9.75
22.	3/20/54	5:00	-4.50	≠2.50	-9.25
23.	3/23/54	8:00	-4.50	≠2.50	-9.50
24.	3/23/54	9:00	-4.50	≠2.50	-9.50
25.	3/23/54	10:00	-5.00	≠2.25	-9.75
26.	3/23/54	12:00	-4.75	≠2.25	-9.75
27.	3/23/54	1:00	-5.00	≠2.25	-10.00
28.	3/23/54	2:00	-5.25	≠2.00	-9.75
29.	3/23/54	3:00	-4.75	≠2.50	-9.50
30.	3/23/54	4:00	-4.50	≠2.50	-9.50

	Date	Time	#20	#21	#19
1.	3/18/54	9:00	-6.75	/3.50	-8.50
2.	3/18/54	10:00	-5.50	/3.75	-8.00
3.	3/18/54	11:00	-5.75	/4.00	-8.25
4.	3/18/54	1:00	-5.75	/3.50	-8.25
5.	3/18/54	3:00	-5.50	/3.75	-8.00
6.	3/18/54	4:00	-5.75	/4.00	-8.50
7.	3/19/54	9:00	-5.50	/3.50	-8.25
8.	3/19/54	10:00	-6.00	/3.75	-8.50
9.	3/19/54	11:00	-5.50	/3.75	-8.00
10.	3/19/54	12:00	-5.75	/4.00	-8.25
11.	3/19/54	1:00	-5.50	//3.75	-8.50
12.	3/19/54	3:00	-6.50	/4.00	-8.00
13.	3/19/54	4:00	-5.75	/4.00	-8.25
14.	3/20/54	9:00	-6.00	/3.50	-8.50
15.	3/20/54	10:00	-5.50	/3.75	-8.25
16.	3/20/54	11:00	-6.00	/3.25	-8.25
17.	3/20/54	12:00	-5.75	/3.50	-8.00
18.	3/20/54	1:00	-5.75	/3.50	-8.50
19.	3/20/54	2:00	-5.25	/3.75	-8.25
20.	3/20/54	3:00	-5.50	/3.50	-8.00
21.	3/20/54	4:00	-5.75	/3.25	-8.00
22.	3/20/54	5:00	-5.50	/3.50	-8.25
23.	3/23/54	8:00	-6.25	/3.75	-8.25
24.	3/23/54	9:00	-6.00	/3.50	-8.00
25.	3/23/54	10:00	-5.75	/3.75	-8.50
26.	3/23/54	12:00	-5.75	/3.50	-8.25
27.	3/23/54	1:00	-6.00	/3.50	-8.25
28.	3/23/54	2:00	-6.00	/3.75	-8.00
29.	3/23/54	3:00	-5.75	/3.50	-8.00
30.	3/23/54	4:00	-6.25	/3.50	-8.25

SUBJECT A

	Date	Time	#21	#19	#20
1.	3/24/54	8:00	+2.50	-9.75	-6.00
2.	3/24/54	9:00	+2.50	-9.75	-5.25
3.	3/24/54	10:00	+2.25	-9.75	-5.00
4.	3/24/54	11:00	+2.50	-10.50	-5.25
5.	3/24/54	12:00	+2.50	-9.50	-5.25
6.	3/24/54	1:00	+2.50	-9.75	-5.00
7.	3/24/54	3:00	+2.50	-9.75	-5.00
8.	3/24/54	4:00	+2.75	-10.00	-5.25
9.	3/25/54	9:00	+2.50	-9.75	-5.75
10.	3/25/54	10:00	+2.75	-10.00	-5.50
11.	3/25/54	11:00	+2.50	-10.25	-5.50
12.	3/25/54	12:00	+2.50	-9.75	-5.25
13.	3/25/54	1:00	+2.25	-9,75	-5.25
14.	3/25/54	3:00	+2.50	-9.50	-5.25
15.	3/25/54	4:00	+2.50	-9.75	-5.50
16.	3/26/54	9:00	+2.50	-9.75	-5.50
17.	3/26/54	10:00	+2.25	-9.75	-5.25
18.	3/26/54	11:00	+2.50	-9.50	-4.50
19.	3/26/54	12:00	+2.50	-9.75	-5.00
20.	3/26/54	1:00	+2.75	-9.00	-4.75
21.	3/26/54	3:00	+2.50	-9.25	-5.00
22.	3/26/54	4:00	+2.50	-9.50	-5.50
23.	3/26/54	5:00	+2.25	-9.50	-5.00
24.	3/29/54	9:00	+2.50	-9.75	-5.25
25.	3/29/54	10:00	+2.25	-9.50	-5.00
26.	3/29/54	11:00	+2.50	-9.25	-5.00
27.	3/29/54	12:00	+2.50	-9.50	-4.75
28.	3/29/54	1:00	+2.75	-9.50	-4.75
29.	3/29/54	3:00	+2.50	-9.75	-5.00
30.	3/29/54	4:00	+2.50	-9.50	-4.75

	Date	Time	#21	#19	#20
1.	3/24/54	8:00	≠3.50	-7.25	-5.50
2.	3/24/54	9:00	≠3.50	-7.75	-5.50
3.	3/24/54	10:00	≠3.50	-7.50	-6.00
4.	3/24/54	11:00	≠3.50	-7.50	-5.75
5.	3/24/54	12:00	≠3.25	-7.75	-5.50
6.	3/24/54	1:00	≠3.75	-8.00	-5.50
7.	3/24/54	3:00	≠3.50	-7.75	-5.75
8.	3/24/54	4:00	≠3.75	-7.50	-5.50
9.	3/25/54	9:00	≠3.50	-9.00	-5.75
10.	3/25/54	10:00	≠3.75	-8.75	-5.75
11.	3/25/54	11:00	≠3.50	-8.50	-6.00
12.	3/25/54	12:00	≠3.50	-8.25	-5.75
13.	3/25/54	1:00	≠3.75	-8.50	-5.50
14.	3/25/54	3:00	≠3.50	-8.50	-6.00
15.	3/25/54	4:00	≠3.50	-8.25	-5.75
16.	3/26/54	9:00	≠3.50	-8.50	-5.75
17.	3/26/54	10:00	≠3.50	-8.75	-5.50
18.	3/26/54	11:00	≠3.00	-8.00	-6.00
19.	3/26/54	12:00	≠3.25	-8.25	-5.75
20.	3/26/54	1:00	≠3.50	-8.50	-5.75
21.	3/26/54	3:00	≠3.50	-8.50	-5.50
22.	3/26/54	4:00	≠3.50	-8.75	-5.75
23.	3/26/54	5:00	≠3.25	-8.25	-5.50
24.	3/29/54	9:00	≠3.50	-8.00	-5.50
25.	3/29/54	10:00	≠3.75	-8.25	-5.50
26.	3/29/54	11:00	≠3.50	-8.50	-5.75
27.	3/29/54	12:00	≠3.50	-8.00	-5.75
28.	3/29/54	1:00	≠3.50	-8.25	-6.00
29.	3/29/54	3:00	≠3.50	-8.25	-6.25
30.	3/29/54	4:00	≠3.50	-8.25	-6.00

SUBJECT A

	Date	Time	#21	#20	#19
1.	3/30/54	9:00	+2.25	-4.75	-10.25
2.	3/30/54	10:00	+2.50	-5.00	-10.25
3.	3/30/54	11:00	+2.50	-5.00	-10.25
4.	3/30/54	12:00	+2.75	-5.25	-10.50
5.	3/30/54	1:00	+2.50	-5.25	-10.25
6.	3/30/54	2:00	+2.50	-5.25	-10.50
7.	3/30/54	3:00	+2.50	-5.00	-10.00
8.	3/30/54	4:00	+2.25	-5.25	-10.25
9.	3/31/54	8:00	+2.25	-5.50	-10.50
10.	3/31/54	9:00	+2.50	-5.50	-10.50
11.	3/31/54	10:00	+2.50	-5.75	-10.75
12.	3/31/54	11:00	+2.50	-5/50	-10.50
13.	3/31/54	12:00	+2.50	-5.25	-10.50
14.	3/31/54	1:00	+2.75	-5.00	-10.25
15.	3/31/54	3:00	+2.75	-5.00	-10.25
16.	4/1/54	8:00	+2.50	-5.25	-10.50
17.	4/1/54	9:00	+2.50	-5.50	-10.50
18.	4/1/54	10:00	+2.50	-5.25	-10.25
19.	4/1/54	11:00	+2.25	-5.00	-10.25
20.	4/1/54	12:00	+2.50	-5.25	-10.50
21.	4/1/54	1:00	+2.50	-5.50	-10.50
22.	4/1/54	2:00	+2.75	-5.50	-10.75
23.	4/1/54	3:00	+2.50	-5.25	-10.75
24.	4/2/54	9:00	+2.50	-5.25	-10.50
25.	4/2/54	10:00	+2.50	-5.00	-10.25
26.	4/2/54	11:00	+2.75	-5.00	-10.50
27.	4/2/54	12:00	+2.50	-5.25	-10.50
28.	4/2/54	1:00	+2.50	-5.25	-10.50
29.	4/2/54	2:00	+2.50	-5.50	-10.75
30.	4/2/54	3:00	+2.25	-5.50	-10.75

	Date	Time	#21	#20	#19
1.	3/30/54	9:00	/3.50	-5.25	-9.25
2.	3/30/54	10:00	/3.75	-5.50	-9.00
3.	3/30/54	11.00	/3.50	-5.25	-9.00
4.	3/30/54	12:00	/3.50	-5.50	-8.75
5.	3/30/54	1:00	/3.50	-5.50	-9.00
6.	3/30/54	2:00	/3.50	-5.75	-9.25
7.	3/30/54	3:00	/3.75	-5.25	-9.00
8.	3/30/54	4:00	/3.50	-5.50	-9.25
9.	3/31/54	8:00	/3.75	-5.50	-9.00
10.	3/31/54	9:00	/3.50	-5.50	-9.25
11.	3/31/54	10:00	/3.50	-5.50	-9.00
12.	3/31/54	11:00	/3.50	-5.25	-9.00
13.	3/31/54	12:00	/3.75	-5.50	-9.00
14.	3/31/54	1:00	/3.50	-5.25	-8.75
15.	3/31/54	3:00	/3.50	-5.50	-8.75
16.	4/1/54	8:00	/3.50	-5.75	-9.25
17.	4/1/54	9:00	/3.50	-5.50	-9.00
18.	4/1/54	10:00	/3.50	-5.50	-9.00
19.	4/1/54	11:00	/3.50	-5.75	-8.75
20.	4/1/54	12:00	/3.50	-6.00	-8.75
21.	4/1/54	1:00	/3.50	-5.75	-9.25
22.	4/1/54	2:00	/3.50	-5.75	-9.25
23.	4/1/54	3:00	/3.25	-5.75	-9.00
24.	4/2/54	9:00	/3.50	-6.00	-9.25
25.	4/2/54	10:00	/3.75	-5.50	-8.75
26.	4/2/54	11:00	/3.50	-5.50	-9.00
27.	4/2/54	12:00	/3.50	-5.50	-9.25
28.	4/2/54	1:00	/3.50	-5.50	-9.50
29.	4/2/54	2:00	/3.50	-6.25	-9.00
30.	4/2/54	3:00	/3.75	-5.75	-9.25

NORMS FOR SUBJECT A

SEQUENCE A   /   #19   #20   #21

SEQUENCE B   /   #19   #21   #20

SEQUENCE C   /   #20   #19   #21

SEQUENCE D   /   #20   #21   #19

SEQUENCE E   /   #21   #19   #20

SEQUENCE F   /   #21   #20   #19

Sequence	#19 Norms	#20 Norms	#21 Norms
A	−7.80	−4.77	+2.45
B	−9.37	−5.37	+2.61
C	−8.56	−5.16	+2.29
D	−9.49	−4.99	+2.38
E	−9.68	−5.17	+2.49
F	−10.44	−5.28	+2.50

NORMS FOR SUBJECT B

SEQUENCE A - #19   #20   #21

SEQUENCE B - #19   #21   #20

SEQUENCE C - #20   #19   #21

SEQUENCE D - #20   #21   #19

SEQUENCE E - #21   #19   #20

SEQUENCE F - #21   #20   #19

Sequence	#19 Norms	#20 Norms	#21 Norms
A	-7.62	-4.86	+3.28
B	-8.22	-5.08	+3.48
C	-8.67	-5.63	+3.53
D	-8.23	-5.83	+3.48
E	-8.19	-5.73	+3.50
F	-9.00	-5.56	+3.54

SEQUENCE   A

SUBJECT A

Test	Mean	Sigma	High	Low
#19	-7.80	0.50	-9.25	-7.25
#20	-4.77	0.63	-6.00	-4.00
#21	≠2.45	0.25	≠2.75	≠2.00

SEQUENCE   B

SUBJECT A

Test	Mean	Sigma	High	Low
#19	-9.37	0.25	-10.00	-9.00
#20	-5.37	0.46	-6.00	-4.75
#21	≠2.61	0.31	≠3.00	≠2.25

SEQUENCE   C

SUBJECT A

Test	Mean	Sigma	High	Low
#19	-8.56	0.26	-10.25	-9.25
#20	-5.16	0.51	-6.00	-5.00
#21	≠2.29	0.30	≠2.75	≠2.25

SEQUENCE D

SUBJECT A

Test	Mean	Sigma	High	Low
#19	-9.49	0.83	-10.00	-8.50
#20	-4.99	0.47	-5.75	-4.50
#21	≠2.38	0.31	≠2.75	≠2.00.

SEQUENCE E

SUBJECT A

Test	Mean	Sigma	High	Low
#19	-9.68	0.49	-10.50	-9.25
#20	-5.17	0.55	-6.00	-4.50
#21	≠2.49	0.21	≠2.75	≠2.25

SEQUENCE F

SUBJECT A

Test	Mean	Sigma	High	Low
#19	-10.44	0.23	-10.75	-10.25
#20	-5.28	0.38	-5.75	-4.75
#21	≠2.50	0.21	≠2.75	≠2.25

SEQUENCE A

SUBJECT B

TEST	MEAN	SIGMA	HIGH	LOW
#19	-7.02	0.56	-8.50	-7.00
#20	-4.86	0.71	-6.00	-4.00
#21	/3.38	0.33	/3.50	/2.75

SEQUENCE B

SUBJECT B

Test	Mean	Sigma	High	Low
#19	-8.22	0.47	-8.75	-7.50
#20	-5.08	0.47	-5.75	-4.50
#21	/3.48	0.22	/3.75	/3.25

SEQUENCE C

SUBJECT B

Test	Mean	Sigma	High	Low
#19	-8.67	0.40	-9.25	-8.25
#20	-5.63	0.41	-6.25	-5.25
#21	/3.53	0.31	/4.00	/3.25

SEQUENCE   D

SUBJECT B

Test	Mean	Sigma	High	Low
#19	-8.23	0.22	-8.50	-8.00
#20	-5.83	0.57	-6.75	-5.25
#21	/3.48	0.33	/4.00	/3.25

SEQUENCE   E

SUBJECT B

Test	Mean	Sigma	High	Low
#19	-8.19	0.63	-9.00	-7.25
#20	-5.73	0.33	-6.25	-5.50
#21	/3.50	0.31	/3.75	/3.00

SEQUENCE   F

SUBJECT B

Test	Mean	Sigma	High	Low
#19	-9.00	0.44	-9.25	-8.25
#20	-5.56	0.42	-6.25	-5.25
#21	/3.54	0.23	/3.75	/3.25