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Abstract

DB and Van Orden star phorias calculated as a function of various distances

Degree Type

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Degree Name

Master of Science in Vision Science

Committee Chair

Subject Categories

Optometry

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DB AND VAN ORDEN STAR PHORIAS CALCULATED AS A FUNCTION OF VARIOUS DISTANCES

A Thesis
Presented to
The Faculty of the College of Optometry
Pacific University

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Optometry

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by
Dean Donnelly
and
Robert Breidenstein
January 1955

INTRODUCTION

Since the original introduction of the VanOrden star, considerable emphasis has been placed upon its use. It has been used in the area of suppression and phoric responses, and in the demonstration of abnormal performances to the patient.

PROBLEM

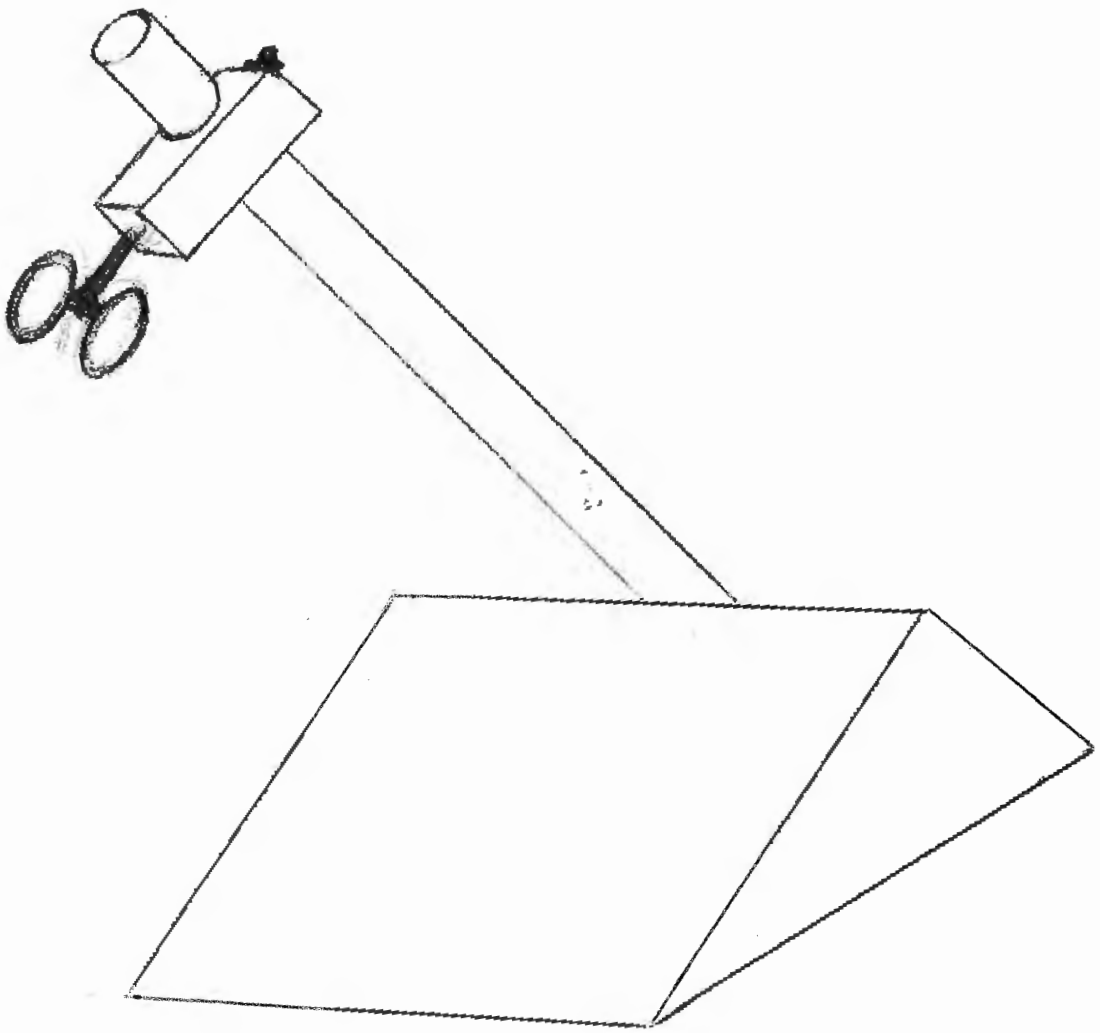
The problem was to compare the phoric responses with and without the drawing activity, as a function of varying distance, to determine whether this variation was a constant, and what individual variations which might be involved in the two phoric situations.

APPARATUS

The apparatus consisted of a working surface, stand, trial frame, wooden clamp and septum constructed as follows: A large plywood base giving an adequate and comfortable working area, with dimensions of twelve by eighteen inches, The working surface was constructed such that it formed a twenty degree angle with the horizontal. To the base of the instrument was attached an upright, aluminum, supporting shaft for varying the distance of the lenses from the working surface. A dissasociating septum was suspended from a wooden clamp to which was also attached an adjustable trial frame for varying the individual interpupillary distances of the observers. The lenses which were placed in the trial frame consisted both of prisms and spheres. The amount of prism in all cases was divided equally before each eye to dissasociate the patient. The spheres which were used allowed the observers to work at optical infinity. Mimeographed white drawing papers, similar to the VO#2 papers, were clamped upon the drawing surface.

PROCEDURE

The subjects were given two pencils of equal color and of approximately equal length and were instructed to place the right pencil on the upper



APPARATUS

right dot and the left pencil on the lower left dot. When the pencils were in place, the patient was instructed to draw the pencils together until their points appeared to touch. Following this, the right pencil was placed on the next dot down and the left on the next dot up. This procedure was followed until a line emerged from each dot forming a Van Orden star.

Teh observers were used, each of whom drew ten stars, at distances of eight, thirteen, sixteen and twenty inches, resulting in a total of four hundred stars.

RESULTS

The results of the obtained data are shown in tables I thru IV and are represented in graphs I thru V inclusively.

Graph I is a representation of the data from table I. Here the mean convergence response, as measured under the two phoric conditions for the group of ten observers, is represented with the absolute convergence in prism diopters plotted as a function of distance. Upon the same graph is a representation of the standard deviation for both responses at the distances of eight, thirteen, sixteen and twenty inches. It can be observed that when the group as a whole was considered, there was a gradual decrease of convergende associated with an increase of distance in the drawing situation. This represents a smooth gradual decrease which shows a more rapid decrease of convergence as the distance form the observer increases. The phoric representation in which the hands were not involved showed an increase of convergence associated with a change from the eight to the thirteen inch distance. Beyond the thirteen inch distance, however, there was seen to be a gradual decrease of convergence from the thirteen to the twenty inch distance, which closely parallels that of the previously mentioned curve.

From the data of table I , a "T" score was calculated resulting in a .1 probablilty that the change of convergence from the eight to thirteen, sixteen and twenty inch distance was a chance variation.

Graphs I and II represent the individual responses by each of the ten observers. These graphs have been plotted showing the absolute convergence in prism diopters as a functiong of distance, and represent both the phoric response of the observer as calculated from the DB-9 lateral phoria card, as well as that calculated from the star point separation. These ten graphs indicate an increase in absolute convergence was associated with the involvement of the hands. From the graphs it would appear that for each individual there was a characteristic response for that individual with respect to the phoric position. The graphs fail to show overall patterns associated with the phoric response involved when a change is made from the eight inch to the thirteen inch distance, or for a change from the thirteen to the sixteen inch distance. There does, however, indicate a rather consistent pattern associated with the change from the sixteen to the twenty inch distance, which in all cases but one, showed a decrease in the convergence. Observing the graphical representation of the two phoric responses, it was seen that they tend to parallel one another. In other words, an increase or decrease from one distance to the next distance, in absolute convergence shown under the phoric response in which the drawing was not involved, shows a like response to that in which this was involved.

Graph IV is a plotting of convergence as a function of distance, for each of the ten individuals involved in the drawing situation. The graph indicates a possible bimodal distribution of the individuals. It can be seen, by observing each individual curve, that from the eight to the thirteen and from the thirteen to the sixteen inch distance, there was, depending upon the observer in question, either an increase or a decrease of convergence, with the increase being slightly the more prevalent. Beyond

the sixteen inch distance, on the other hand, it can be observed, that in all cases but one, there was found a decrease of convergence associated with an increase of distance. In addition, these curves from the sixteen inch to the twenty inch distance represent approximately the same slope in each case.

Graph V represents the same data as represented in graph IV, the only change being their origination from a common point and are plotted to indicate a change of convergence as a function of the distance. The ten curves show the same individual variations between the eight and thirteen, and the thirteen and sixteen inch distances, there being in some cases an increase and in others a decrease associated with the change of distance. Beyond the twenty inch distance can be observed the approximately parallel graphical characteristics.

"T" scores were calculated between the phoric response and that response involving the manual component. Table I indicates that the probability is less than one in one hundred that the increase of convergence in the star drawing over that of the phoria taken in the other manner, is a chance variation.

CONCLUSION

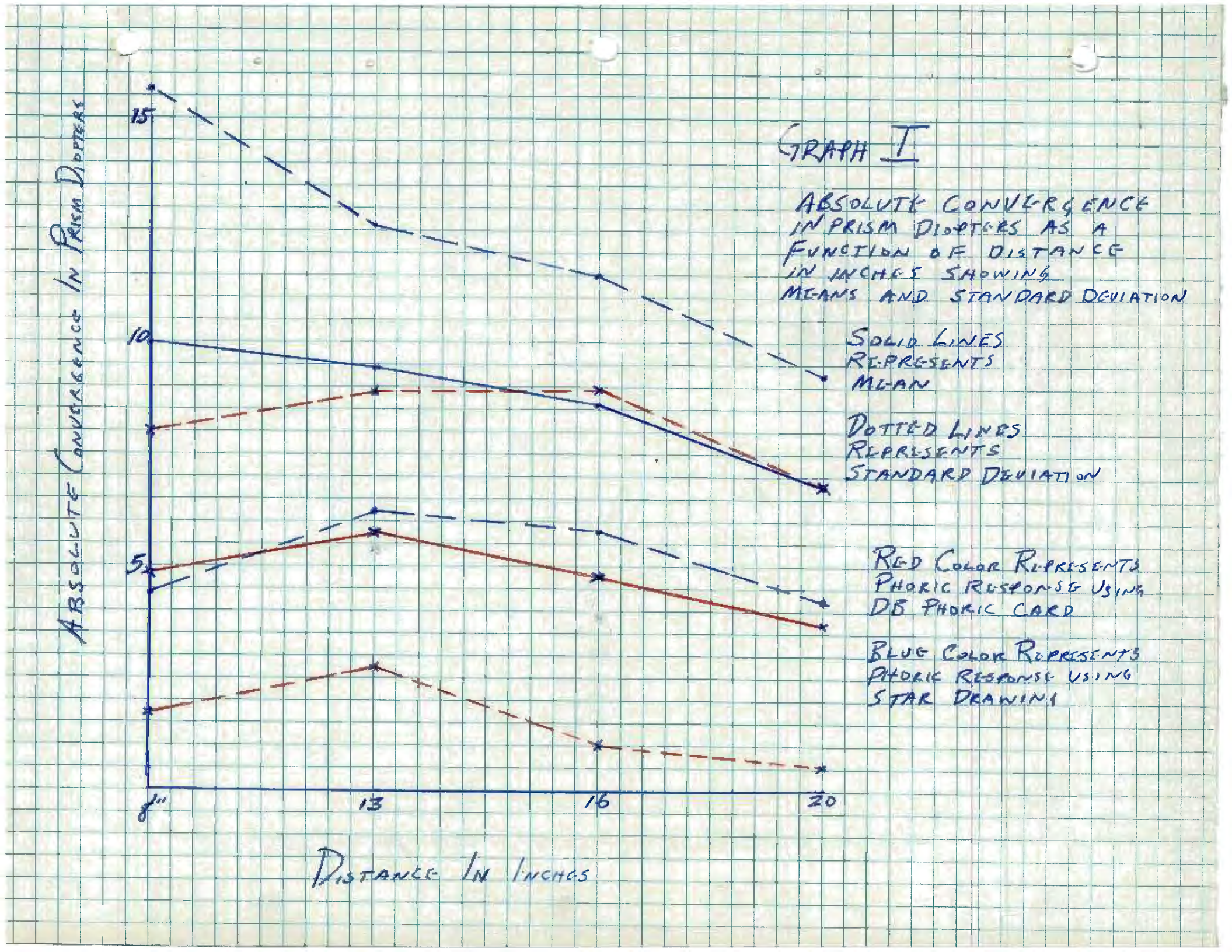
1. When the individuals are considered as a unit, the decline of convergence associated with the increased distance shows a progressively more rapid decline as we proceed from the eight to the twenty inch distance.

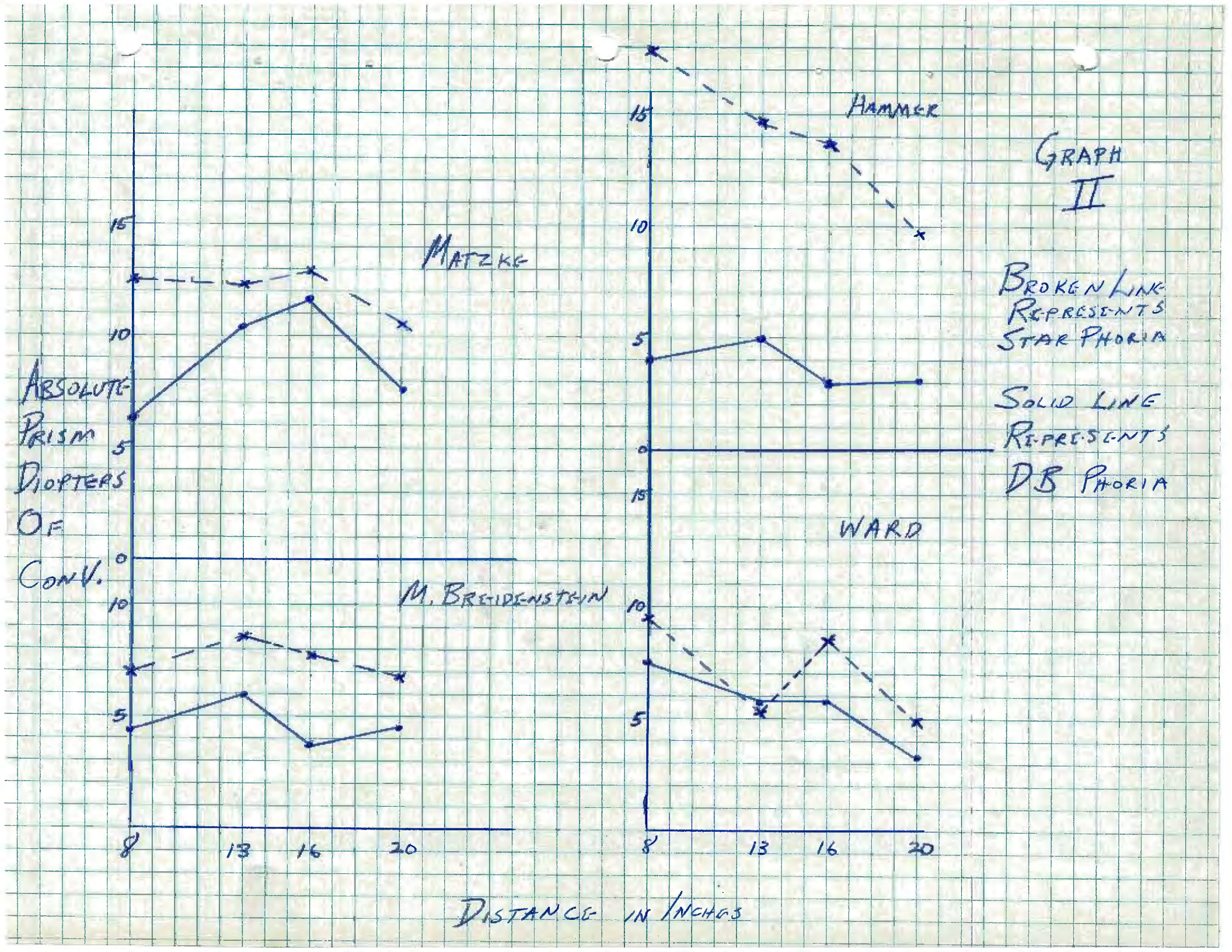
2. The pattern of convergence between eight and thirteen inches and thirteen and sixteen inches appears, when we consider each individual separately, to be a characteristic response of that individual. Between sixteen and twenty inches, however, the characteristic response as to convergence represents a decrease associated with an increase in distance.

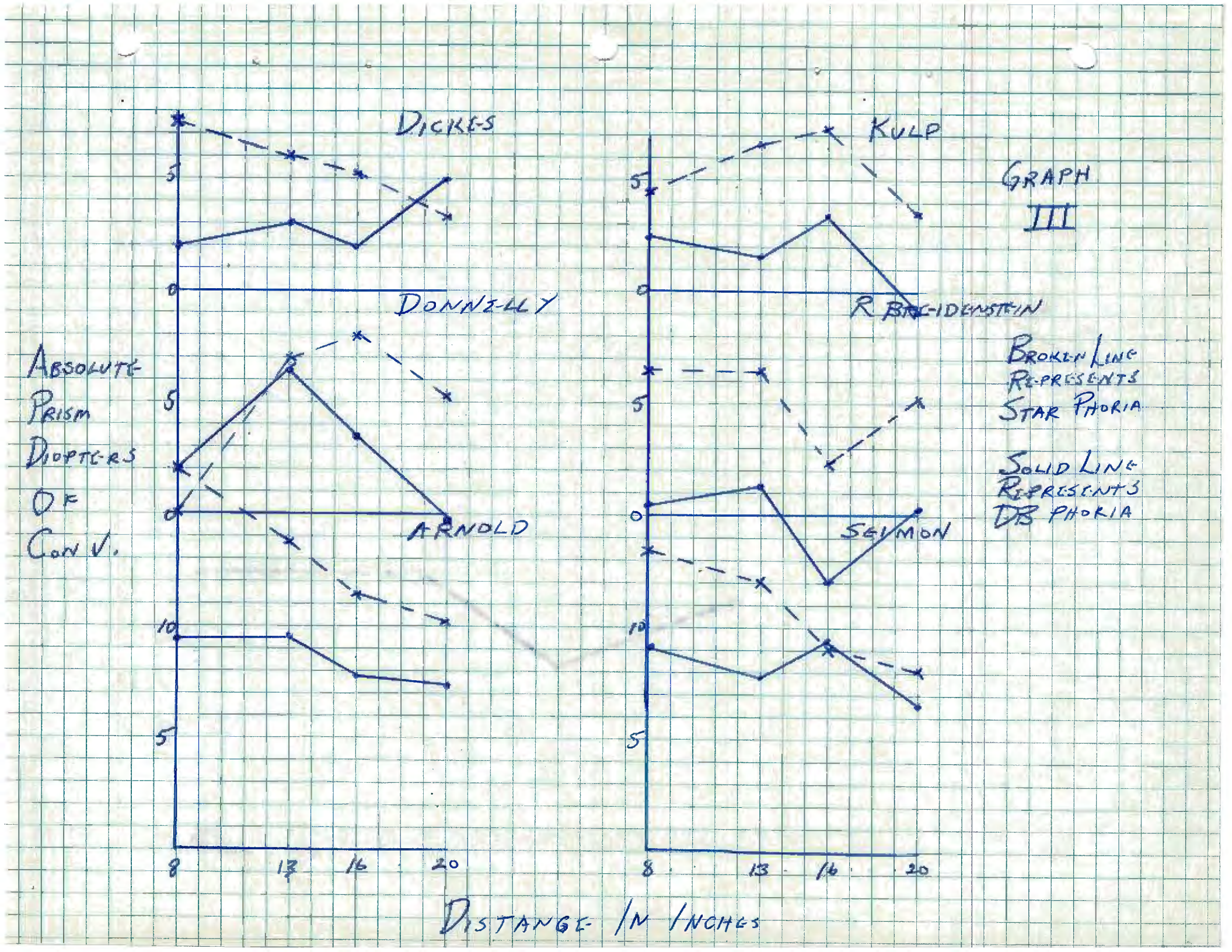
3. From the sixteen inch distance to the twenty inch distance, the decrease of convergence with the increase of distance, in general, is very consistent for all individuals and represents essentially the same slope.

4. There was present, with the hands in the situation, a greater convergence than that found in the cases not involving the manual componen t. Table IV indicates that there was a greater magnitude of difference between the phoric response and that involving the manual domponent between the eight and thirteen inch distance than beyond the thirteen inch distance.

5. There was present a over-all decrease in absolute convergence from the eight; to the thirteen, sixteen and twenty inch distances. That this change was a chance varriation showed a probability of .1 .

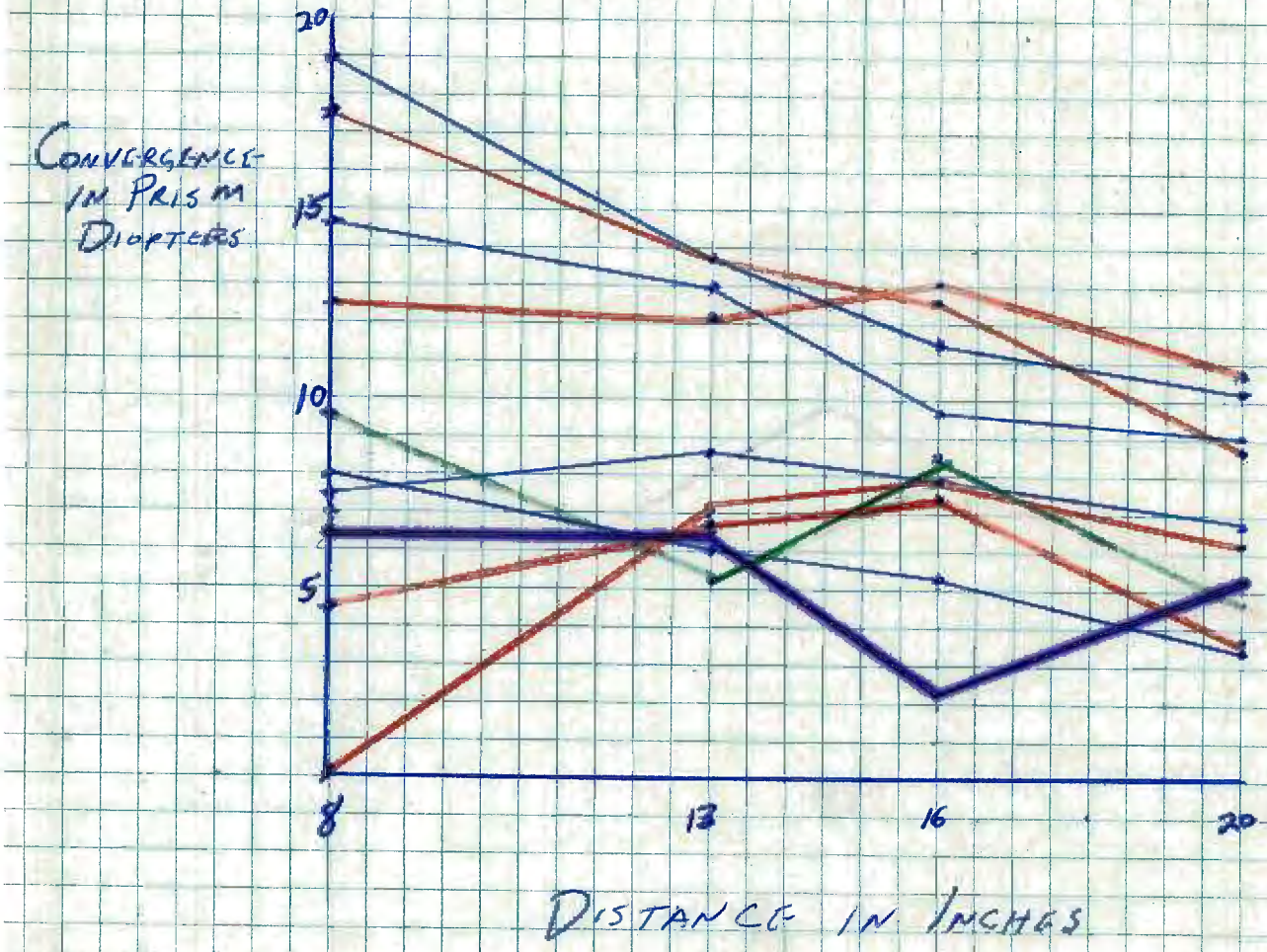

GRAPH I
ABSOLUTE CONVERGENCE IN PRISM DIOPTERS AS A FUNCTION OF DISTANCE IN INCHES SHOWING MEANS AND STANDARD DEVIATION
SOLID LINES REPRESENTS MEAN
DOTTED LINES REPRESENTS STANDARD DEVIATION
RED COLOR REPRESENTS PHORIC RESPONSE USING DB PHORIC CARD
BLUE COLOR REPRESENTS PHORIC RESPONSE USING STAR DRAWING
ABSOLUTE CONVERGENCE IN PRISM DIOPTERS
15
10
5
0
13
16
20
DISTANCE IN INCHES


GRAPH II
HAMMER
MATZKE
WARD
M. BREIDENSTEIN
BROKEN LINE REPRESENTS STAR PHORIA
SOLID LINE REPRESENTS DB PHORIA
ABSOLUTE PRISM DIOPTERS OF CONV.
DISTANCE IN INCHES
15
10
5
0
8
13
16
20


DICKES
KULP
GRAPH III
DONNELLY
R BIELSCHOWSKY
ABSOLUTE PRISM DIOPTERS OF CONV.
BROKEN LINE REPRESENTS STAR PHORIA
SOLID LINE REPRESENTS DB PHORIA
ARNOLD
SEYMON
5
0
5
10
5
8
13
16
20
DISTANCE IN INCHES

Graph IV

Individual Responses For Absolute Convergence As A Function Of Distance As Calculated From The Star Phoria



GRAPH V

CONVERGENCE IN PRISM DIOPTERS AS A FUNCTION OF DISTANCE IN INCHES WHERE ALL CURVES HAVE BEEN DISPLACED SO AS TO ORIGINATE FROM A COMMON POINT OF ORIGIN AT THE EIGHT INCH DISTANCE

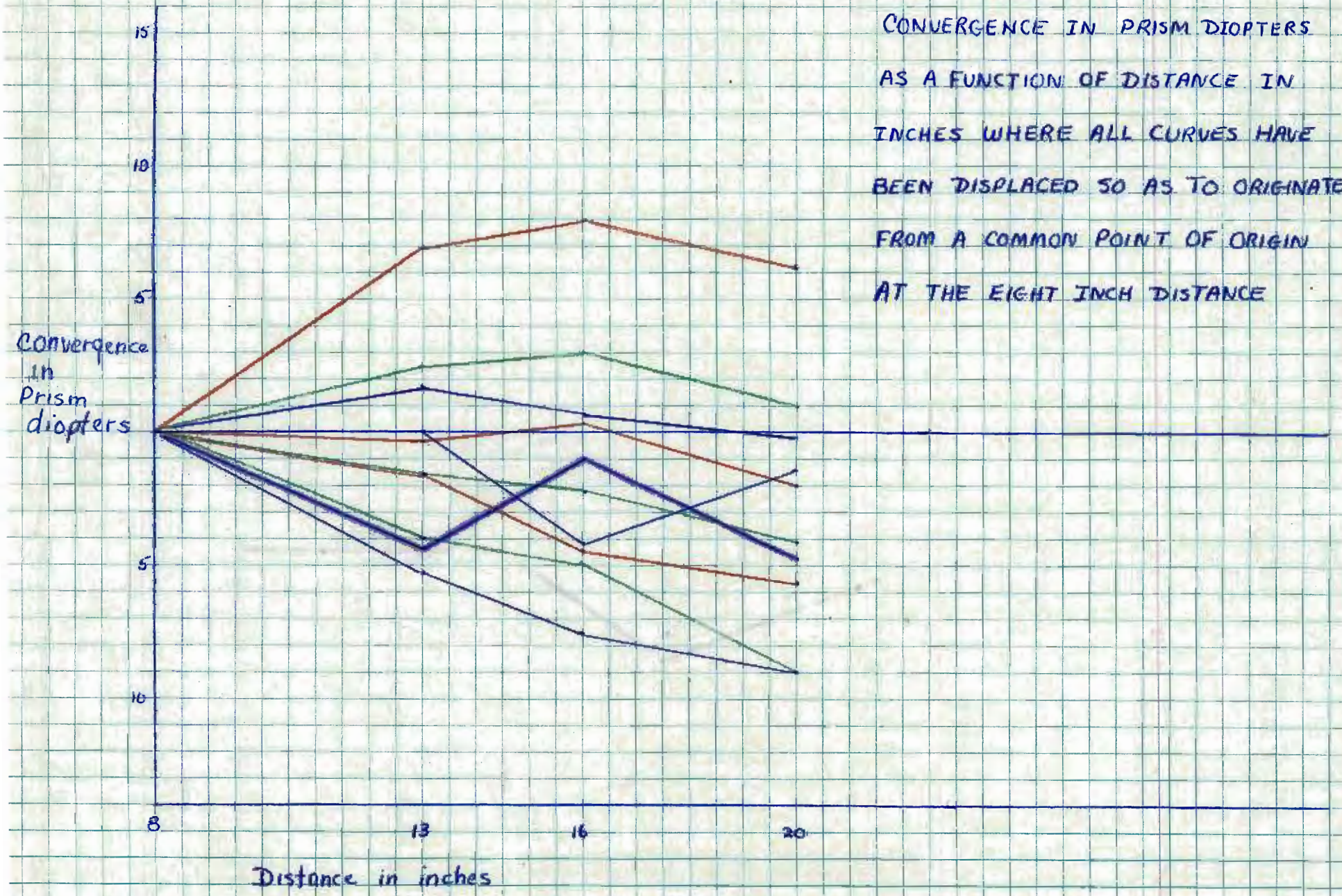


TABLE I

GENERAL STATISTICAL TABLE

DISTANCE		MEAN	T	PROBABILITY
8"	Phoria	4.9	3.1	.01
	Star	9.8	5.6	
.1	Phoria	5.8	3.0	.001
	Star	9.3	3.3	
.1	Phoria	4.8	4.0	.001
	Star	8.6	2.8	
.1	Phoria	3.7	3.2	.001
	Star	6.8	2.4	

DISTANCE PROBABILITY INDICATED IN RED

TABLE IV

DIFFERENCE IN PRISM DIOPTERS BETWEEN STAR AND PHORIA

DISTANCE	DIFFERENCE
8"	5.0
13"	3.5
16"	3.8
20"	3.1

TABLE II

ABSOLUTE CONVERGENCE IN PRISM DIOPTERS FOR THE VAN ORDEN STAR

EIGHT INCH DISTANCE	THIRTEEN INCH DISTANCE	SIXTEEN INCH DISTANCE	TWENTY INCH DISTANCE
7.0	8.7	7.75'	6.6
17.6	13.8	12.6	8.7
9.5'	5.2	8.5'	4.8
7.5'	6.0	5.25'	3.4
4.5'	6.9	7.5'	3.6
0.0	7.0	8.0	6.2
6.5'	6.5'	2.25'	5.2
12.5'	12.2	13.0	10.4
14.5'	13.0	9.75'	9.0
19.0	13.7	11.5'	10.2

TABLE III

ABSOLUTE CONVERGENCE IN PRISM DIOPTERS AS DETERMINED FROM THE DB-9 PHORIA CARD

EIGHT INCH DISTANCE	THIATEEN INCH DISTANCE	SIXTEEN INCH DISTANCE	TWENTY INCH DISTANCE
4.5'	6.0	3.75'	4.4
4.0	5.0	2.75'	3.0
7.5'	5.7	5.75'	3.2
2.0	3.0	2.0	4.9
2.5'	1.5'	3.5'	-1.2
.2	6.6	3.5'	- .2
.5'	1.3	-3.0	.2
6.5'	10.5'	11.75'	7.6
10.0	8.8	10.25'	7.6
9.5'	9.3	7.75'	7.4