1-15-1958

A study of the effect of lenses and prisms on vertical ductions at 16 inches

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Abstract

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Degree Type

Thesis

Degree Name

Master of Science in Vision Science

Committee Chair

Subject Categories

Optometry

A STUDY OF THE EFFECT OF LENSES AND PRISMS ON VERTICAL DUCTIONS AT 16 INCHES

- 0 -

Original Research presented to the faculty of the College of Optometry, Pacific University, in partial fulfillment of the requirements for the degree Doctor of Optometry

By

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January 15, 1958

A STUDY ON THE EFFECT OF PLUS AND MINUS LENSES BI BO PRISM ON VERTICAL DUCTIONS AT 16 INCHES

INTRODUCTION

This study was organized to observe the effect of medial dioptic and binocular vergence stimuli variability on vertical ductions at 16 inches.

APPARATUS

The equipment used in this experiment was an A.O. 590 Phoropter and an A.O. Rotochart target consisting of a single 20/20 horizontal line of letters. The rotary prisms used were 2.75 inches from the eye and 13.25 inches from the target.

PROCEDURE

Instructions - Verticle Ductions.

"Tell me when the line doubles and tell me when it is single."

Testing Vertical Ductions - Base down to B/R then Base up to B/R.

Through # 7A measured OD then OS.

Through # 7A ⌿ 1.00 measured OD then OS.

Through # 7A ○ 6 BI measured OD then OS.

Through # 7A - 1.00 measured OD then OS.

Through # 7A ○ 6 BO measured OD then OS.

Instructions - Vertical Phoria.

"While reading the stationary single line of letters tell me when one line of letters is even with the other line of letters."

Testing Vertical Phoria -

Measuring Prism OD Base up to Base down direction. Disasociating Prism OS Base in direction. Then same procedure with OD disasociating and OS measuring Prism.

Controls for Usable Findings -

1. Vertical Phoria not showing more than $\frac{1}{2}^{\Delta}$.
2. Supra & Infra Ductions as measured on OD in agreement with Supra & Infra Ductions as measured on OS.

DUCTIONS THROUGH # 7A

	SUPRADUCTION		INFRADUCTION	
	B	R	B	R
Mean =	2.416	1.150	2.100	1.250

Break for Supraduction

	f	d	fd	fd^2
3.90-4.00	2	14	28	392
3.70-3.80		13	0	
3.50-3.60	1	12	12	144
3.30-3.40		11	0	
3.10-3.20		10	0	
2.90-3.00	7	9	63	567
2.70-2.80	1	8	8	64
2.50-2.60	3	7	21	147
2.30-2.40		6	0	
2.10-2.20	1	5	5	25
1.90-2.00	9	4	36	144
1.70-1.80	3	3	9	27
1.50-1.60	1	2	2	4
1.30-1.40	0	1	0	
1.10-1.20	2	0	0	
.90-1.00			184	1514
.70- .80	N = 30			

Break for Infraduction

f	d	fd	fd^2
2	12	24	288
	11	0	
	10	0	
3	9	36	243
	8	0	
3	7	21	147
1	6	6	36
	5	0	
13	4	52	208
2	3	6	18
4	2	8	16
	1	0	
2	0	0	
		153	956

Recovery for Supreduction

2.85-3.00				
2.55-2.70				
2.25-2.40				
1.95-2.10	7	7	49	343
1.65-1.00	1	6	6	36
1.35-1.50	3	5	15	75
1.05-1.20	13	4	52	208
.75- .90		3	0	
..45- .60	2	2	4	8
.15- .30	2	1	2	2
0	2	0	0	
			127	672
	N = 30			

Recovery for Infraduction

2	7	14	98
	6	0	
3	5	15	75
1	4	4	16
4	3	12	36
18	2	36	72
	1	0	
2	0	0	
		81	297

CALCULATIONS FOR DUCTIONS THROUGH # 7A

Sigma for Supraduction Break

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{30(1514)-(184)^2}$$

$$\text{Sigma} = \frac{.10}{30}\sqrt{11564}$$

$$\text{Sigma} = \frac{.10}{30} \times 1025$$

$$\text{Sigma} = 0.35^{\Delta}$$

Sigma for Infraduction Break

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{30(956)-(153)}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{5271}$$

$$\text{Sigma} = \frac{.10}{30} \times 727$$

$$\text{Sigma} = 0.23^{\Delta}$$

Sigma for Supraduction Recovery

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{30(672)-(127)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{4031}$$

$$\text{Sigma} = \frac{.15}{30} \times 64$$

$$\text{Sigma} = 0.32^{\Delta}$$

Sigma for Infraduction Recovery

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{30(297)-(81)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{2349}$$

$$\text{Sigma} = \frac{.15}{30} \times 48$$

$$\text{Sigma} = 0.24^{\Delta}$$

DUCTIONS THROUGH # 7A ☉ +1.00

	SUPRADUCTION		INFRADUCTION	
	B	R	B	R
Mean =	2.066	1.183	1.891	1.066

Break for Supraduction

	f	d	fd	fd^2
3.90-4.00				
3.70-3.80				
3.50-3.60				
3.30-3.40				
3.10-3.20				
2.90-3.00	3	10	30	300
2.70-2.80		9	0	
2.50-2.60	5	8	40	320
2.30-2.40		7	0	
2.10-2.20		6	0	
1.90-2.00	13	5	65	325
1.70-1.80		4	0	
1.50-1.60	3	3	9	27
1.30-1.40	2	2	4	8
1.10-1.20	2	1	2	2
.90-1.00	2	0	0	
			159	982

N = 30

Break for Infraduction

	f	d	fd	fd^2
	2	10	20	200
		9	0	
	2	8	16	128
		7	0	
	1	6	6	36
	12	5	60	300
		4	0	
	6	3	16	54
		2	0	
	5	1	5	5
			125	723

Recovery for Supraduction

	f	d	fd	fd^2
2.85-3.00				
2.55-2.70				
2.25-2.40				
1.85-2.10	7	5	35	175
1.65-1.80		4	0	
1.35-1.50	2	3	6	18
1.05-1.20	15	2	30	60
.75- .90	3	1	3	3
.45- .60	3	0	0	
.15- .30				
	N = 30			
0			74	256

Recovery for Infraduction

	f	d	fd	fd^2
	6	7	42	294
	1	6	6	36
	3	5	15	75
	12	4	48	192
	1	3	3	9
	3	2	6	12
	2	1	2	2
	2	0	0	
			122	620

CALCULATIONS FOR DUCTIONS THROUGH # 7A ∠ 1.00

Sigma for Supraduction Break

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{30(982)-(150)^2}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{6960}$$

$$\text{Sigma} = \frac{.1}{30} \times 83.5$$

$$\text{Sigma} = 0.27^{\circ}$$

Sigma for Infraduction Break

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{30(723)-(125)^2}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{6065}$$

$$\text{Sigma} = \frac{.1}{30} \times 78$$

$$\text{Sigma} = 0.24^{\circ}$$

Sigma for Supraduction Recovery

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{30(256)-(74)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{1204}$$

$$\text{Sigma} = \frac{.15}{30} \times 34.5$$

$$\text{Sigma} = 0.17^{\circ}$$

Sigma for Infraduction Recovery

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{30(620)-(122)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{3716}$$

$$\text{Sigma} = \frac{.15}{30} \times 61$$

$$\text{Sigma} = 0.30^{\circ}$$

DUCTIONS THROUGH # 7A36 BI

	SUPRADUCTION		INFRADUCTION	
	B	R	B	R
Mean =	2.100	1.300	1.491	0.958

Break for Supraduction

	f	d	fd	fd^2
3.90-4.00				
3.70-3.80				
3.50-3.60				
3.30-3.40				
3.10-3.20				
2.90-3.00	3	9	27	243
2.70-2.80		8	0	
2.50-2.60	5	7	35	245
2.30-2.40		6	0	
2.10-2.20	1	5	5	25
1.90-2.00	14	4	56	224
1.70-1.80	1	3	3	9
1.50-1.60	3	2	6	12
1.30-1.40		1	0	
1.10-1.20	3	0	0	
.90-1.00				
.70- .80				
	N = 30		132	758

Break for Infraduction

	f	d	fd	fd^2
	1	7	7	49
		6	0	
		5	0	
	5	4	20	90
	4	3	12	36
	10	2	20	40
	2	1	2	2
	8	0	0	
			41	217

Recovery for Supraduction

2.85-3.00				
2.55-2.70				
2.25-2.40				
1.95-2.10	7	7	49	343
1.65-1.80	3	6	18	108
1.35-1.50	4	5	20	100
1.05-1.20	10	4	40	160
.75- .90	1	3	3	9
.45- .60	3	2	6	12
.15- .30		1	0	
0	2	0	0	
			136	732

Recovery for Infraduction

3	7	21	147
	6	0	
3	5	15	75
9	4	36	144
1	3	3	9
9	2	18	36
2	1	2	2
3	0	0	
		95	413

N = 30

CALCULATIONS FOR DUCTIONS THROUGH # 7A & 6 BI

Sigma for Supraduction Break

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{30(758)-(132)^2}$$

$$\text{Sigma} = \frac{.10}{30}\sqrt{5316}$$

$$\text{Sigma} = \frac{.10}{30} \times 73$$

$$\text{Sigma} = 0.24^{\Delta}$$

Sigma for Infraduction Break

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{30(217)-(61)^2}$$

$$\text{Sigma} = \frac{.10}{30}\sqrt{2789}$$

$$\text{Sigma} = \frac{.10}{30} \times 52.5$$

$$\text{Sigma} = 0.17^{\Delta}$$

Sigma for Supraduction Recovery

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{30(732)-(136)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{3564}$$

$$\text{Sigma} = \frac{.15}{30} \times 59$$

$$\text{Sigma} = 0.29^{\Delta}$$

Sigma for Infraduction Recovery

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{30(413)-(95)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{3565}$$

$$\text{Sigma} = \frac{.15}{30} \times 58$$

$$\text{Sigma} = 0.29^{\Delta}$$

DUCTIONS THROUGH 7A ○ - 1.00

	SUPFRADUCTION		INFRADUCTION	
	B	R	B	R
Mean =	1.975	1.083	1.791	0.783

Break for Supreduction

	f	d	fd	fd2
3.90-4.00				
3.70-3.80				
3.50-3.60				
3.30-3.40				
3.10-3.20	1	10	10	100
2.90-3.00	2	9	18	162
2.70-2.80		8	0	
2.50-2.60	2	7	14	98
2.30-2.40		6	0	
2.10-2.20		5	0	
1.90-2.00	16	4	64	256
1.70-1.80	3	3	9	27
1.50-1.60	3	2	6	12
1.30-1.40		1	0	
1.10-1.20	3	0	0	
.90-1.00				
.70- .80				
	N = 30		121	655

Break for Infraduction

f	d	fd	fd^2
3	9	27	243
	8	0	
1	7	7	49
	6	0	
2	5	10	50
9	4	36	144
2	3	6	18
8	8	16	512
1	1	1	1
4	0	0	
		103	1017

Recovery for Supraduction

2.85-3.00				
2.55-2.70	2	9	18	162
2.25-2.40		8	0	
1.95-2.10	2	7	14	98
1.65-1.80	3	6	18	108
1.35-1.50	7	5	35	175
1.05-1.20	6	4	24	64
.75- .90		3	0	
.45- .60	4	2	8	16
.15- .30	2	1	2	2
0	4	0	0	
			119	625

Recovery for Infraduction

2	8	16	128
2	7	14	98
1	6	6	36
6	5	30	150
12	4	48	192
	3	0	
3	2	6	12
	1	0	
4	0	0	
		120	616

N = 30

CALCULATIONS FOR DUCTIONS THROUGH # 7A ♀ - 1.00

Sigma for Supraduction Break

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{30(655)-(121)^2}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{5009}$$

$$\text{Sigma} = \frac{.1}{30} \times 71$$

$$\text{Sigma} = 0.23^{\Delta}$$

Sigma for Infraduction Break

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{30(1017)-(103)^2}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{19901}$$

$$\text{Sigma} = \frac{.1}{30} \times 141$$

$$\text{Sigma} = 0.46^{\Delta}$$

Sigma for Supraduction Recovery

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{30(625)-(119)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{4589}$$

$$\text{Sigma} = \frac{.15}{30} \times 67.5$$

$$\text{Sigma} = 0.33^{\Delta}$$

Sigma for Infraduction Recovery

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{30(616)-120)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{4080}$$

$$\text{Sigma} = \frac{.15}{30} \times 64$$

$$\text{Sigma} = 0.32^{\Delta}$$

DUCTIONS THROUGH # 7A ⊂ 6 BO

	SUPRADUCTION		INFRADUCTION	
	B	R	B	R
Mean =	2.108	1.175	1.966	0.575

Break for Supraduction

	f	d	fd	fd^2
3.90-4.00				
3.70-3.80				
3.50-3.60	1	10	10	100
3.30-3.40		9	0	
3.10-3.20	1	8	8	64
2.90-3.00	2	7	14	98
2.70-2.80		6	0	
2.50-2.60	2	5	10	50
2.30-2.40		4	0	
2.10-2.20	2	3	6	18
1.90-2.00	16	2	32	64
1.70-1.80		1	0	
1.50-1.60	6	0	0	
1.30-1.40				
1.10-1.20				
.90-1100				
.70- .80	N = 30			
			80	394

Break for Infreduction

f	d	fd	fd^2
1	7	7	49
	6	0	
2	5	10	50
4	4	16	64
5	3	15	45
6	2	12	24
	1	0	
12	0	0	
		60	232

Recovery for Supraduction

2.85-3.00				
2.55-2.70	1	8	8	64
2.25-2.40		7	0	
1.95-2.10	6	6	36	216
1.65-1.80		5	0	
1.35-1.50	5	4	20	80
1.05-1.20	10	3	30	90
.75- .90	1	2	2	4
.45- .60	5	1	5	5
.15- .30	2	0	0	
0				
			101	459
	N = 30			

Recovery for Infraduction

3	5	15	75
7	4	28	112
2	3	6	18
8	2	16	32
2	1	2	2
8	0	0	
		67	239

CALCULATIONS FOR DUCTIONS TAKEN THROUGH # 7A ○ 6 BO

Sigma for Supraduction Break

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{30(394)-(80)^2}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{5420}$$

$$\text{Sigma} = \frac{.1}{30} \times 74$$

$$\text{Sigma} = 0.24^{\Delta}$$

Sigma for Infraduction Break

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.1}{30}\sqrt{30(232)-(60)^2}$$

$$\text{Sbgma} = \frac{.1}{30}\sqrt{3360}$$

$$\text{Sigma} = \frac{.1}{30} \times 58$$

$$\text{Sigma} = 0.19^{\Delta}$$

Sigma for Supraduction Recovery

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{30(459)-(101)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{3569}$$

$$\text{Sigma} = \frac{.15}{30} \times 59.5$$

$$\text{Sigma} = 0.29^{\Delta}$$

Sigma for Infraduction Recovery

$$\text{Sigma} = \frac{i}{N}\sqrt{N\Sigma fd^2-(\Sigma fd)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{30(239)-(67)^2}$$

$$\text{Sigma} = \frac{.15}{30}\sqrt{2681}$$

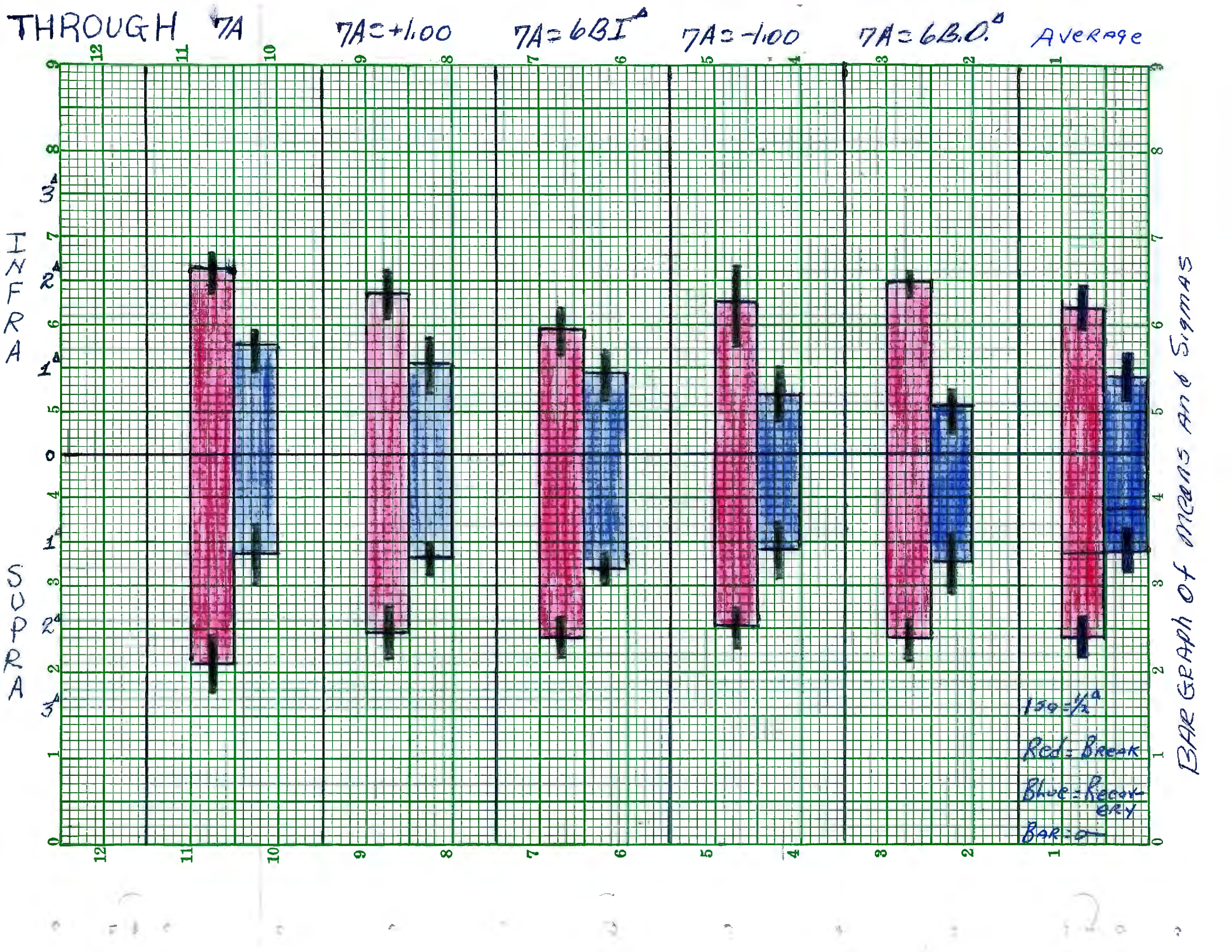
$$\text{Sigma} = \frac{.15}{30} \times 51.8$$

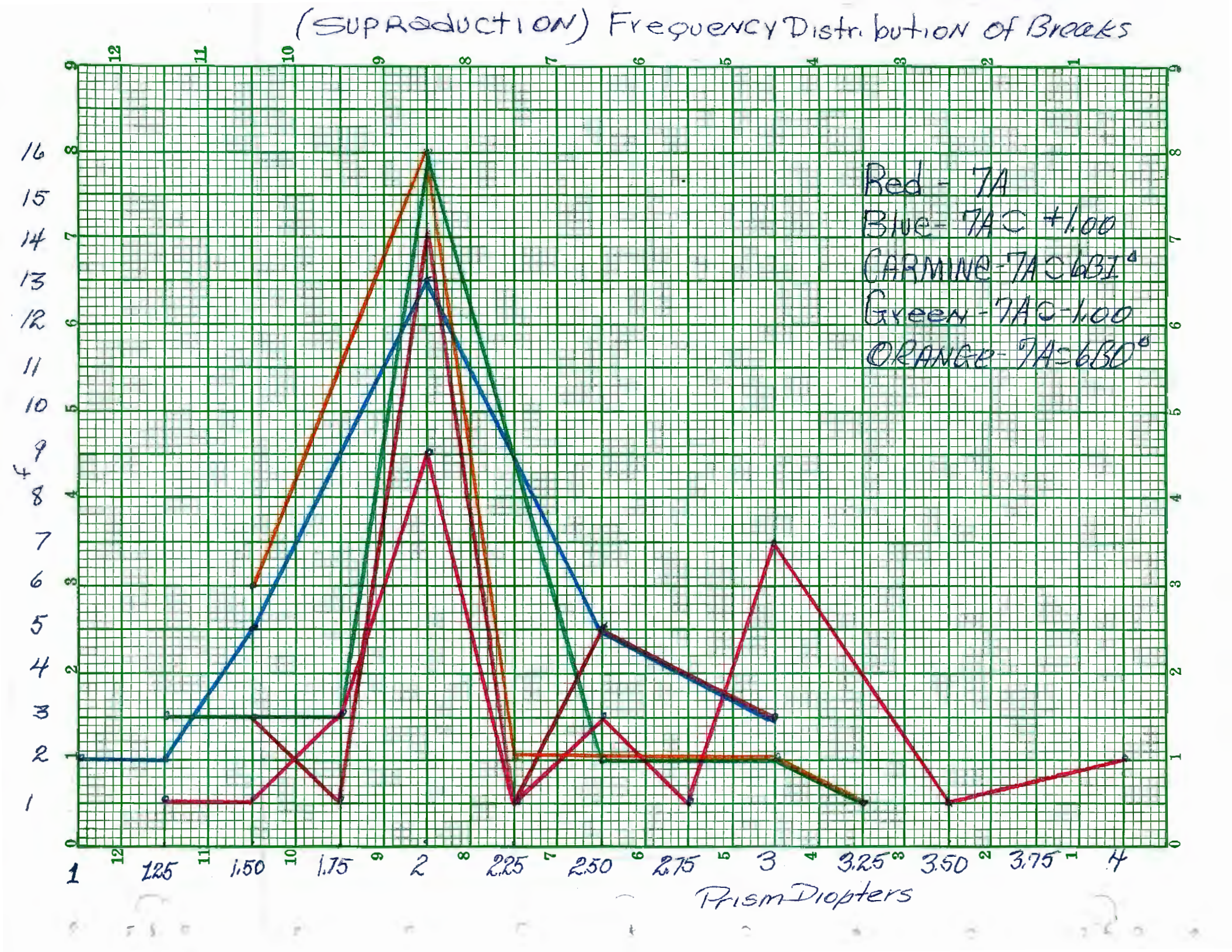
$$\text{Sigma} = 0.25^{\Delta}$$

SUMMARY

This study indicated that the medial dioptic and binocular vergence stimuli variability had no effect on vertical ductions at 16 inches.

The variability shown in the data can be attributed to the gross calibration of the rotary prisms.


THROUGH 7A
7A=+1.00
7A=6BI^Δ
7A=-1.00
7A=6B.O.^Δ
Average
INFRA
SUPRA
BAR GRAPH OF MEANS AND SIGMAS
1σ=½^σ
Red: Break
Blue: Recovery
Bar: σ


(SUPREDUCTION) Frequency Distribution of Breaks
Red - 7A
Blue - 7A ○ +1.00
CARMINE - 7A ○ 6BI°
Green - 7A ○ -1.00
ORANGE - 7A ○ 6BO°
f
1
1.25
1.50
1.75
2
2.25
2.50
2.75
3
3.25
3.50
3.75
4
Prism Diopters

(SUPRADUCTION) Frequency Distribution of Recoveries