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

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Recommended Citation

O'Connor, Charles M.; Freeton, William E.; and Priest, Paul W., "A study of the effect of lenses and prisms on vertical ductions at 16 inches" (1958). *College of Optometry*. 205. https://commons.pacificu.edu/opt/205

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

Abstract

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

Degree Type

Thesis

Degree Name

Master of Science in Vision Science

Committee Chair

Subject Categories

Optometry

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

- C -

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

Charles M. O'Connor William E. Preston and Paul W. Priest

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 # 7A06 BI measured OD then OS.

Through # 7A - 1.00 measured OD then OS.

Through # 7A 0 6 BO measured OD then OS.

Instructions - Vertical Phoris.

"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 ; A.
- 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

	bro	Break for Supraduction				Breek for Infraduction			
	f	đ	fđ	ra ²	f	d	£đ	fd2	
3.90-4.00	2	14	28	392					
3.70-3.80		23	0						
3.50-3.60	1	12	12	144	2	12	24	288	
3.30-3.40		11	0			11	0		
3.10-3.20		10	0			10	0		
2.90-3.00	7	9	63	567	3	9	36	243	
2.70-2.80	2	8 7	8	64	-	8	0		
2.50-2.60	3	7	21	147	3	7	21	147	
2.30-2.40		6	0		3	6	6	36	
2.10-2.20	1	5	5	25		5	0		
1.90-2.00	9	4	0 5 36	144	13	4	52	208	
1.70-1.80	9 3 1	ž	9	27	2	3	6	18	
1.50-1.60	ĺ	2	2	4	4	2	8	16	
1.30-1.40	O	654321	2	•		7 6 5 4 3 2 1	0		
1.10-1.20	2	0	0		2	0	0		
.90-1.00			184	1514			153	956	
.7080	N =	30							
	Re	covery	for Supr	reduction	Recovery for Infraduction				
2.85-3.00									
2.55-2.70					2	7654321	14	98	
2.25-2.40						6	0		
1.95-2.10	7	7	49	343	3 1 4 18	5	15	75 16 36 72	
1.65-1.00	1	6	6	36	1	4	12 36	16	
1.35-1.50	3	5	15	75	4	3	12	36	
1.05-1.20	13	5 4 3 2	52	208	18	2	36	72	
.7590		3	0			1	0		
4560	2	2	4	8	2	0	0		
.1530	2 2		2 0	2					
O	2	0	127	672			81	297	
	# =	30	201	310			97	671	

CALCULATIONS FOR DUCTIONS THROUGH # 7A

Sigma for Supraduction Break

Sigma for Infraduction Break

Sigma =
$$\frac{i}{N}$$
 Wrfd²-(rfd)²

Bigma =
$$\frac{i}{N}$$
 $\sqrt{\pi z t d^2 - (t d)^2}$

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

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

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

Sigma =
$$\frac{\cdot 1}{30}$$
 5271

Sigma =
$$\frac{.10}{30}$$
 x 1025

$$Sigma = \frac{\cdot 10}{30} \times 727$$

Signs for Supraduction Recovery

Sigma for Infraduction Recovery

Sigma =
$$\frac{i}{N}$$
 $\sqrt{\pi rtd^2 - (rtd)^2}$

Signa =
$$\frac{i}{N}$$
 Vista (zra)2

Signa =
$$\frac{.15}{30}$$
 30(672)-(127)²

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

$$Signa = \frac{.15}{30} \sqrt{4031}$$

$$Signe = \frac{.15}{30} \sqrt{2319}$$

Sigma =
$$\frac{.15}{30}$$
 x 48

DUCTIONS THROUGH # 7A C +1.00

SUPRADUCTION INFRADUCTION

B	R	В	R
N. P.	***	-	

Mean =	2,066	1.183	1.89	1.066				
	3	Break fo	or Supred	metion	Bz	esk for	Infraduct	ion
•	ť	đ	fā	fd ²	£	đ.	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	10	20	200
2.70-2.80		9	0			9	0	
2,50-2,60	5	87654321	40	320	2	8765492	16	126
2.30-2.40		7	0			?	o	
2.10-2.20		6	0	***	1	6	6	36
1.90-2.00	13	5	65	325	12	5	60	300
1.70-1.80	_	4	0			4	0	
1.50-1.60	3	3	9	27	6	3	16	54
1.30-1.40	2	2	4	8	_	2	0	
1.10-1.20	3 2 2 2		0 9 4 2 0	2	5	1	5	5
.90-1.00		0	150	982			125	723
	N =							
	R.	Terrange	for Supr	aduction_	Reco	very for	Infraduc	tion
2.85-3.00 2.55-2.70 2.25-2.40								
1.85-2.10	7	5	35	175	4	7	42	294
1.65-1.80	,	ž	20	112	1	6	6	36
1.35-1.50	2	4 3 2 1	6	18	3	4	15	75
1.05-1.20	15	3	30	60	12	1	48	192
.7590	2	ĩ	30 3 0	3	1	3	3	9
.4560	3	ō	ő	-	3	ź	6	12
.1530	-	-	-		6 1 3 12 1 3	76 54 32 1	36	12
	N =	30					-	
0			74	256	2	0	122	600

CALCULATIONS FOR DUCTIONS THROUGH # 7A / 1.00

Sigma for Supraduction Break

Signs for Infraduction Break

Sigma =
$$\frac{1}{N}$$
 $\sqrt{N \Sigma f d^2 - (\Sigma f d)^2}$

Sigma =
$$\frac{.1}{50}$$
 $\sqrt{30(982)-(150)^2}$

Signa =
$$\frac{\cdot 1}{30}$$
 \tag{6960}

Sigma =
$$\frac{.1}{30}$$
 x 83.5

Sigma =
$$\frac{i}{N}$$
 $\sqrt{N \Sigma f d^2 - (\Sigma f d)^2}$

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

Sigme =
$$\frac{.1}{30}$$
 \quad 6065

$$Sigma = \frac{\cdot 1}{30} \times 78$$

Siema for Supraduction Recovery

Sigma = $\frac{i}{N}$ $\sqrt{N \Sigma f d^2 - (\Sigma f d)^2}$

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

Signe =
$$\frac{15}{30}\sqrt{1204}$$

Sigma =
$$\frac{.15}{30}$$
 x 34.5

Sigma for Infraduction Recovery

Signa =
$$\frac{i}{N}$$
 $\sqrt{N \Sigma f d^2 - (\Sigma f d)^2}$

$$61gma = \frac{\cdot 15}{30} \sqrt{30(620) - (122)^2}$$

Signa =
$$\frac{.15}{30}$$
 $\sqrt{3716}$

Sigma =
$$\frac{.15}{30}$$
 x 61

DUCTIONS THROUGH # 7AC6 BI

	SUPRAD	UCTION	INFRAL	UCTION				
	B	R	В	R				
Mean =	2.100	1,300	1.491	0.958				
	B	reak fo	r Supre	due tion	Br	eak for	Infraduct	ion
	f	đ	fđ	fd2	f	đ	£ã	£d2
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	نو	8	0	042			P2	10
2.50-2.60	5	7	35	245	1.	7	7	49
2.30-2.40		9	Ð	0.5		0	0	
2.10-2.20	1	5 4 3 2	5 56 3 6	25	-	5 4 3 2	0	On.
1.90-2.00 1.70-1.80	14	4	20	224 9	?	4	20	36
1.50-1.60	1 3	3	2	12	32	٥	20	90 36 40 2
1.30-1.40	3	ī	0	1.2	70	~	2	40
1.10-1.20	3	ő	o o		5 4 10 2 8	ő	õ	~
.90-1.00	2	U	Ċ,		Q	v	4.7	
70- 80								
• 1m • 000	N =	30	1.32	758			41	217
	Re	covery	for Sup	raduction	Recove	ry for I	nfreducti	on
4 05 5 04								
2,85-3.00								
2.25-2.40								
1,95-2,10	7	7	49	343	3	2	21	147
1.65-1.80	3	4	18	108	,	7	O	24 6
1.35-1.50	4	6	20	100	**			75
1.05-1.20	10	7	40	160	9	7	15 36	144
.7590	1	2	2	9	1	**	2	4
.4560	3	2	6	12	Ġ	ž	18	26
15- 30	20	654321	3 6 0	4-4-	3 9 1 9 2 3	543210	18 2 0	9 36 2
0	2	ō	ŏ		3	ô	ñ	dup
•	P+v	•	126	722	-		OK	172

N = 30

CALCULATIONS FOR DUCTIONS THROUGH # 74 -6 BI

Signa for Supraduction Break

Signa for Infraduction Break

Signa =
$$\frac{1}{N}$$
 $\sqrt{N \Sigma \text{ fd}^2 - (\Sigma \text{ fd})^2}$

Signa =
$$\frac{i}{N}$$
 VErd²-(Erd)² Signa = $\frac{i}{N}$ VErd²-(Erd)²

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

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

$$\mathbf{Signa} = \frac{\cdot 10}{30} \mathbf{5316}$$

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

Signa =
$$\frac{.10}{30}$$
 × 73

Signa =
$$\frac{.10}{30}$$
 x 52.5

Signa for Supraduction Recovery

Signa for Infraduction Recovery

Sigma =
$$\frac{1}{N}$$
 $N \sum td^2 - (\sum td)^2$

Signe =
$$\frac{1}{N}$$
 $\sqrt{\frac{1}{12}} (\Sigma fd)^2$

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

Signa =
$$\frac{.15}{30}$$
 $\sqrt{30(4.13)-(95)^2}$

$$Sigma = \frac{.15}{30} \sqrt{364}$$

Signs =
$$\frac{.15}{30}$$
 x 59

Signa =
$$\frac{.15}{30}$$
 x 58

SUPFRADUCTION	INFRADUCTION
---------------	--------------

В	R	В	R

Meen =	1.975	1.08	3 1.791	0.783				
	B	resk f	or Supred	uction	Br	eak for	Infreduct	ton
	£	đ	fd	fd2	£	đ	fd	fd ²
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		18	162	3	9	27	243
2,70-2,80	~	987654321	0		_	98765438	0	
2.50-2.60	2	7	14	96	1	7	7	49
2.30-2.40	X	6	Ó	•		6	0	• •
2.10-2.20		5	0		2	5	10	50
1.90-2.00	16	Ã	64	256	9	Ā	36	744
1.70-1.80	3	3	9	27	2	á	6	18
1.50-1.60	3	2	6	12	8	ĕ	16	512
1,30-1.40	-	ī	0		9 2 8 1	1	1	1
1.10-1.20	3	0	Ō		4	0	0	_
90-1.00		_	_					
.7080								
0,00	N =	30	121	655			103	1017
	Reco	very fo	or Suprad	etion	Reser	ery for	Intraduc	tion
2.85-3.00					2	8	16	128
2.55-2.70	2	9	18	162				
2.25-2.40		8	O					
1,95-2,10	2	7	14	98	2	7	14	98
1.65-1.80	2 3 7 6	6	18	108	2 1 6	6	6	36
1.35-1.50	7	5	35	175		5	30	150
1.05-1.20	6	4	24	64	1.2	4	48	192
.7590		3	0			3	0	
.4560	4	3	8	16	3	5 4 3 2 1	6	12
.1530	2	1	2	2			0	
0	4	0	119	625	4	0	120	616

N = 30

CALCULATIONS FOR DUCTIONS THROUGH # 7AC- 1.00

Sigma for Supraduction Break

Signs for Infraduction Break

Signa =
$$\frac{i}{N}$$
 $\sqrt{N \epsilon f d^2 - (\epsilon f d)^2}$

Signa =
$$\frac{i}{N}$$
 $\sqrt{N \epsilon t d^2 - (\epsilon t d)^2}$

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

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

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

Signa =
$$\frac{.1}{30}$$
 19901

Sigma =
$$\frac{\cdot 1}{30}$$
 x 71

Sigma =
$$\frac{\cdot 1}{30}$$
 x 141

Signa for Supraduction Recovery

Signa for Infraduction Recovery

Signa =
$$\frac{1}{N}$$
 $\forall \Sigma Id^2 - (\Sigma Id)^2$

Signe =
$$\frac{i}{N}$$
 $\sqrt{N \epsilon rd^2 (\epsilon rd)^2}$

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

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

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

Sigma =
$$\frac{.15}{30}$$
 x 67.5

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

	SUPRA	DUCTION	INFRA	duction				
	В	R	B	R				
Mea	$n=\overline{2,108}$	1,175	1,966	9.575				
	B	reak for	r Suprad	ve tion	Br	eak for	Infreduct	ion
	f	d	fd	fd ²	f	d	fd	fd ²
3.90-4.0								
3.70-3.8			4.7					
3.50-3.6		30	10	100				
3.30-3.4		9	0					
3.10-3.2	0 1	8	8	64 98				
2.90-3.0	0 2	76543210	14	98				
2.70-2.8		6	O					
2,50-2,6	0 2	5	10	50	1	7	7	49
2.30-2.4	0	4	6			6	0	
2,10-2,2	0 2	3	6	18	2	5	10	50
1,90-2,0		2	32	64	4	4	16	64
1.70-1.8		1	0		2 4 5 6	3	15	45
1.50-1.6		0	0		6	2	12	50 64 45 24
1,30-1,4						7654321	0	•
1.10-1.2					12	0	0	
90-110								
.708		30						
1,0		,,,,,	80	394			60	232
	Rec	overy i	or Supre	duction	Recov	ery for	Infraduct	ion
2.85-3.0	0							
2.55-2.7		8	8	64				
2.25-2.4		7	0					
1.95-2.1		7 6	36	216				
1.65-1.8		5	ō					
1.35-1.5			_	80	2	-	12	25
1.05-1.2	0 5 0 10 0 1 0 5	4 3 2 1 0	20 30 2 5 0	gn	372828	543210	/5 28 6 16 2	75 112 18 32 2
75	0 7	9	ور	90 4 5	2	2	6	78
.759 .456 .153	0 #	1	E	A+	Q	2	76	30
74 0	2 3	0	0	9	0	3	70	26
~ +4.5™ • 5	0 2	U	U		2	7	~	4
0			101	459	Ö	U	67	239
	N =	20	46V 46	477			44	W. 37

CALCULATIONS FOR DUCTIONS TAKEN THROUGH # 7A 0 6 BO

Signa for Supraduction Break

Sime for Infraduction Break

Sigme =
$$\frac{i}{N} \sqrt{8 \Sigma Rd^2 - (\Sigma Rd)^2}$$

Sigms =
$$\frac{.1}{50}$$
 $\sqrt{30(394)-(80)^2}$

Sigma =
$$\frac{1}{30}$$
 \(\square{54.20}

Sigma =
$$\frac{\cdot 1}{30}$$
 x 74

Sigma = $\frac{i}{N}$ $\sqrt{N \Sigma t d^2 - (\Sigma t d)^2}$

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

Singma =
$$\frac{\cdot 1}{30}$$
 $\sqrt{3360}$

$$Sigma = \frac{\cdot 1}{30} \times 58$$

Sieme for Supraduction Recovery

Sigma =
$$\frac{1}{N} \sqrt{N \epsilon r a^2 - (\epsilon r a)^2}$$

Sigma =
$$\frac{.15}{30}$$
 $\sqrt{30(459)-(201)^2}$

Signa =
$$\frac{.15}{30}$$
 3569

Signa =
$$\frac{.15}{30}$$
 x 59.5

Sigma for Infreduction Recovery

Sigma =
$$\frac{i}{N}$$
 $\sqrt{N \Sigma t d^2 - (\Sigma t d)^2}$

Sigma =
$$\frac{.15}{30}$$
 $\sqrt{20(239)+(67)^2}$

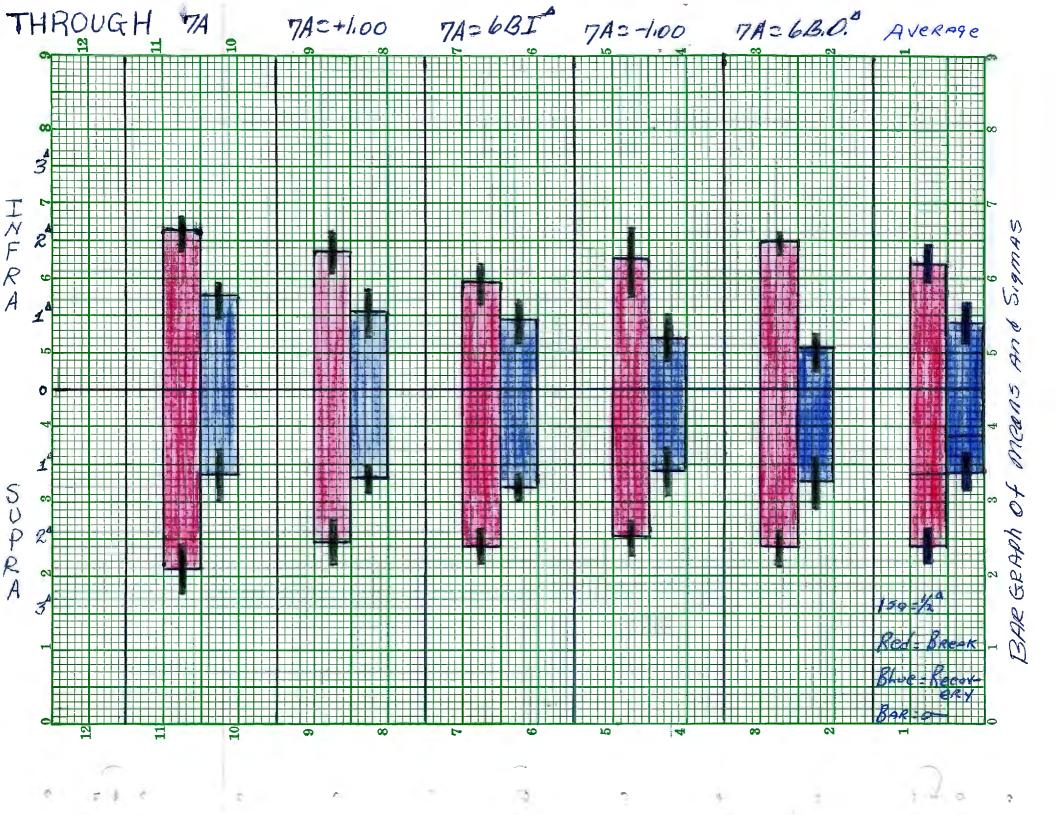
Signa =
$$\frac{.15}{30}$$
 \ 2681

Signa =
$$\frac{.15}{30}$$
 x 51.8

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.



(Supraduction) Frequency Distribution of Broaks 15 13 3 ° 225 - 250 ° 275 6 * 3.25° 3.50 ° 3.75 -Prism Diopters

