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4. TITLE AND SUBTITLE (DEPSCOR 92) Computational Modelling of Equiluminant Vision			5. FUNDING NUMBERS G. F49620-93-1-0546	
6. AUTHOR(S) G. L. Zimmerman			61103D 3484/BS	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Tulane University, Office of Research 327 Gibson Hall 6823 St. Charles New Orleans LA 70118-5698			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NL 110 Duncan Ave., Suite B115 Bolling AFB DC 20332-0001			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION AVAILABILITY STATEMENT Approved for public release; distribution unlimited			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) The goal of this grant, AFOSR-93-94 was to obtain equipment for studying psychophysical and computational aspects of chromatic motion perception. The equipment consisted of color measurement, data capture, data storage and color presentation devices. Our main result include the influence of luminant motion information on equiluminant motion direction, the impact of equilumance on both page and RSVP reading, the development of computational method to eliminate motion blur, and adaptive computational model of motion perception at equilumance.				
14. SUBJECT TERMS Equiluminant motion perception.			15. NUMBER OF PAGES	
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(DEPSCOR 92) COMPUTATIONAL MODELLING OF EQUILUMINANT VISION

Final Report for AFOSR93-94 Equipment grant

The goal of this grant, AFOSR-93-94 was to obtain equipment for studying psychophysical and computational aspects of chromatic motion perception. Most of the first year of the grant was spent purchasing and installing the equipment. The equipment consisted of color measurement, data capture, data storage and color presentation devices.

The equipment has been used in two completed Ph.D. Dissertations, one published manuscript, and several conference papers. Results from the work is summarized below:

- 1) Combining luminant and equiluminant motion streams - the work resulted in two studies presented at ARVO and a manuscript published in Perception [1,2,3]. The main result from this work is that the perceived direction of motion of equiluminant moving dots is not effected by the motion of luminant dots until the difference in their direction of motion is sufficiently close (i.e. <30 degrees).
- 2) Page and RSVP reading speed under luminant and equiluminant conditions for normal and disabled readers -- This work has resulted in a presentation at ARVO and a Ph.D. dissertation [4,5]. The main result is that for normal readers, equiluminant text dramatically slows reading speeds for page reading while having significantly less impact on RSVP reading speed rates. A secondary result is that RSVP presentation to disabled readers improved their reading speed but not as dramatically as that experienced by normal readers.
- 3) Eliminating motion blur through modulo switching circuits -- This work resulted in a Ph.D. dissertation [6]. Any device which senses light by integrating energy at a point, such as a video camera or our own eyes, will exhibit motion blur. Our main result is to demonstrate through computer simulation the elimination of motion blur using several layers of locally controlled switching networks.
- 4) Computational model of chromatic motion perception -- This work was presented at the conference on Mathematical Psychology [7]. The main result is that the perceived slowing of motion at equiluminance can be modeled by an adaptive computational structure where there are differences in the adaptive learning rates between informational channels. This suggests that the perceptual phenomena surrounding equiluminant stimuli may be the result of learning differences between neuronal pathways.

The availability of this equipment in 1994 was crucial to our being awarded an LEQSF grant (LEQSF-RCS-95-98) which supported the graduate and undergraduate students who maintained the laboratory and performed much of the work.

References

- [1] S. Heidenreich and G. L. Zimmerman (1993), Evidence for directionally selective mechanism that integrates luminant and equiluminant motion , Investigative

Ophthalmology and Visual Science Supplement , 34, 1032.

[2] S. Heidenreich and G. L. Zimmerman (1994), Speed and contrast of luminant motion affect directional information of equiluminant motion , Investigative Ophthalmology and Visual Science Supplement , 35, 1270.

[3] S. Heidenreich and G. L. Zimmerman (1995) Evidence that Luminant and Equiluminant Motion Information are Integrated by Directionally Selective Mechanisms, Perception, 879-890.

[4] Beth O'Brien (1996) Luminance and Chromatic Contrast Effects on Skilled and Disabled Reading Performed with and without Required Eye Movements, dissertation advisor G. L. Zimmerman, Tulane University.

[5] Beth O'Brien and G. L. Zimmerman (1996) Reading under luminant and equiluminant conditions, Investigative Ophthalmology and Visual Science Supplement , 37,

[6] James Norton (1996) , A Vision Based Approach to Motion Deblurring, dissertation advisor G. L. Zimmerman, Tulane University.

[7] G. L. Zimmerman and M. Canaday (1996), Computational model of equiluminant motion perception, 29th Conference on Mathematical Psychology, Chapel Hill, NC.

*** FD4 ***

DATE RUN 09/09/94
 TIME RUN 10:25:52
 FBM091

TULANE UNIVERSITY - F.Y. 95-96 FIFTH CLOSE
 FINANCIAL RECORDS SYSTEM
 REPORT OF TRANSACTIONS FOR 06/30/94

DEPCOR92 COMPUTATIONAL MODELLING OF EQUILIBRIANT VISION

ACCT: 5-33996
 DEPT: 45400

TO: GEORGE ZIMMERMAN
 ENGINEERING

OBJ CODE	DESCRIPTION	DATE	EC	REF.	2ND REF.	J.E. OFFSET ACCOUNT	BUDGET ENTRIES	CURRENT REV/EXP	COMMITMENTS	BATCH REF. DATE
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3020	** TOTAL PH CRGS-LD-TELECOMM							8.05		
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3110	UPS SHIPMENTS 000001	06/21	061	101884	0629009	2-21049-8063CR		10.92		MLR001 940623
3110	** TOTAL POSTAGE							14.79		
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3310	FIRST LIGHT	06/03	048	P114344	5065728			203.50		APC436 940603
3310	FIRST LIGHT	04/07	050	P114344				314.92		ENC188 940407
3310	THORLABS INC	06/23	050	P350423				355.20		ENC243 940623
3310	THORLABS INC	06/23	051	P350423				355.20		ENC244 940624
3310	** TOTAL LABORATORY SUPPLIES							314.92		
3440	SAFE HARBOR COMPUTER	04/14	048	P345302	5058946			679.10		APC381 940414
3440	FIRST SOURCE INTERNA	05/09	048	P347307	5060322			2,946.00		APC419 940509
3440	SAFE HARBOR COMPUTER	02/22	050	P345302				751.00		ENC157 940222
3440	FIRST SOURCE INTERNA	04/06	050	P347307				2,930.00		ENC187 940406
3440	SAFE HARBOR COMPUTER	02/22	051	P345302				87.10		ENC183 940330
3440	** TOTAL DP SOFTWARE							3,625.10		
4895	B & H PHOTO AND ELEC	06/27	048	P347793	5073843			223.60		APC484 940627
4895	B & H PHOTO AND ELEC	04/19	050	P347793				187.80		ENC196 940419
4895	MCCANN ELECTRONICS	06/24	050	P350500				271.50		ENC244 940624
4895	** TOTAL OTHER							223.60		
5520	DIGITAL MICRONICS IN	01/26	048	P28347	5020589			2,640.00		APC272 940126
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5520	TROXELL COMMUNICATIO	04/04	048	P345132	5051327			35,740.00		APC359 940404
5520	COLUMBIA AUDIO VISIA	04/05	048	P345131	5023943			2,378.00		APC371 940405
5520	TROXELL COMMUNICATIO	04/07	048	P345132	5053063			1,813.67		APC373 940407
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5520	COLUMBIA AUDIO VISIA	04/15	048	P345131	5055167			2,593.50		APC383 940415
5520	MINOTA CORPORATION	04/26	048	P345134	5060323			2,138.00		APC400 940426
5520	MINOTA CORPORATION	04/29	048	P345134	5071682			5,954.26		APC400 940429
5520	TROXELL COMMUNICATIO	05/23	048	P345132	5061935			2,757.89		APC432 940523
5520	MINOTA CORPORATION	04/26	048	P345134	5060323			2,138.00		APD437 940526
5520	MINOTA CORPORATION	04/26	048	P345134	5060323			2,138.00		APC456 940603
5520	SPECTRUM SYSTEMS	06/03	048	P345134	5069244			2,640.00		ENC123 940603
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5520	COLUMBIA AUDIO VISIA	02/16	050	P345131	BD36866			6,500.00		ENC123 940216
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5520	MINOTA CORPORATION	03/24	050	P346884	P344489			6,500.00		ENC180 940325

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To: *Dalley*

From: *Blaug* 3

Co: *GNC*

Phone #: *6581*

Fax #: *8907*

DATE RUN 09/09/94
TIME RUN 10:25:52
PROGRAM ID FBM091

TULANE UNIVERSITY - F.Y. 95-94 FIFTH CLOSE
FINANCIAL RECORDS SYSTEM
REPORT OF TRANSACTIONS FOR 06/30/94

REPORT PAGE 32130
PROGRAM ID FBM091
ACCOUNT PAGE 2

ACCT: 5-33996 5520
DEPT: 45400

DEPCOR92 COMPUTATIONAL MODELLING OF EQUIPMENT VISION

TO: GEORGE ZIMMERMAN
ENGINEERING

OBJ CODE	DESCRIPTION	DATE	EC	REF.	ZND REF.	J.E. OFFSET ACCOUNT	BUDGET ENTRIES	CURRENT REV/EXP	COMMITMENTS	BATCH REF.	DATE
	MINOLTA CORPORATION	03/24	051	P346834	P344489				545.74	ENC186	9409405
	COLUMBIA AUDIO VISUA	02/16	051	P345131	B036866			750.00	750.00	ENC196	9409419
	COLUMBIA AUDIO VISUA	06/30	060	P345131	B001786	0-12200-2110CR		750.00	750.00	RJE198	9409419
5520	** TOTAL EDUCATIONAL EQUIP							58,527.52	8,623.00	RJE803	9406630
5225	ORIGINAL BUDGET	10/12	020		1042304		74,900.00			RJE318	9310330
5225	** TOTAL SCIENTIFIC EQUIPMENT						74,900.00				
9810	COST SHARE	10/12	020		1042304		5,300.00			RJE318	9310330
9810	** TOTAL COST SHARE-DIRECT						5,300.00				
*** ACCOUNT TOTAL ***							69,600.00	62,715.78	8,894.90		

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DATE RUN 05/20/96
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TULANE UNIVERSITY - F.Y. 94-95 FINAL CLOSE
 FINANCIAL RECORDS SYSTEM
 REPORT OF TRANSACTIONS FOR 05/30/95

REPORT PAGE 32807
 PROGRAM ID FBM091
 ACCOUNT PAGE 1

ACCT: 5-33996
 DEPT: 45400

DESCR92 COMPUTATIONAL MODELLING OF EQUILIBRIANT VISION

TO: GEORGE ZIMMERMAN
 ENGINEERING

OBJ CODE	DESCRIPTION	DATE	EC REF.	2ND REF.	C.E. OFFSET ACCOUNT	BUDGET ENTRIES	CURRENT REV/EXP	COMMITMENTS	BRTCH REF. DATE
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3025	PURCHASING DEPT	09/28	069	1800269	0010164	-	.60		CJBT90 940930
3025	** TOTAL FH CRGS-LD-ACAC						.60		
4850	STAGE LIGHTS INC	10/07	048	P354531	6018283		232.00	232.00-	APC622 941007
	CAMARK INTERNATIONAL	12/06	048	P354517	6032945		319.99	319.99-	APC693 941206
	CAMARK INTERNATIONAL	09/13	050	P354517				319.99	ENC051 940913
	STAGE LIGHTS INC	09/13	050	P354531				232.00	ENC051 940913
4850	** TOTAL MINOR EQUIPMENT						551.99		
4895	TAPE DISTRIBUTORS OF	09/30	048	P350500	6018301		257.75	257.75-	APC613 940930
	TAPE DISTRIBUTORS OF	06/24	051	P350500				12.40-	ENC051 940913
	TAPE DISTRIBUTORS OF	06/24	051	P350500				1.75-	ENC063 940929
4895	** TOTAL OTHER						257.75	271.90-	
5515	APPLIED MAGIC INC	03/31	048	P354582	6057801		1,700.00	1,700.00-	APC335 950331
5515	APPLIED MAGIC INC	09/14	050	P354582				1,700.00	ENC052 940914
5515	** TOTAL COMPUTER EQUIPMENT						1,700.00		
5520	COLOMBIA AUDIO VISUA	08/01	048	P345131	6000786		750.00	234.00-	APC526 940801
	COLOMBIA AUDIO VISUA	08/01	048	P345131	6000941		516.00	516.00-	APC526 940931
	MINGOLTA CORPORATION	08/31	048	P344489	5048010		8,506.82	8,506.82	APC568 940831
	MINGOLTA CORPORATION	08/31	048	P344489	6005665			8,506.82-	APC568 940831
	PYRAMID AUDIO PRODC	05/26	048	P345134	6068830		61.50	61.50	APC534 950526
	PYRAMID AUDIO PRODC	05/29	048	P345134	5070854		123.00	123.00-	APC336 950529
	COLOMBIA AUDIO VISUA	02/16	051	P345131	8036866		516.00	516.00-	ENC035 940708
	MINGOLTA CORPORATION	02/01	051	P344489				3,500.00-	ENC023 940803
	SPECTRUM SYSTEMS	02/16	051	P345134	8036866		61.50	61.50-	ENC138 950123
	COLOMBIA AUDIO VISUA	07/08	052	P345131	6000786		750.00	750.00	ENCY1 940718
	COLOMBIA AUDIO VISUA	06/30	052	P345131	0603501			516.00-	ENC031 950630
	REV VCH ACCR-0600103	07/18	060	6003786	0700293	0-12233-21102R	750.00-		RJEA03 940718
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388.08-

2,080.88

*** ACCOUNT TOTAL ***
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