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Shahla J. Pisheh

Pacific University

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Abstract

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Karl Citek

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DESIGNING A FARSI LOGMAR CHART

By

SHAHLA J. PISHEH

A thesis submitted to the faculty of the
College of Optometry
Pacific University
Forest Grove, Oregon
for the degree of
Doctor of Optometry
17th May, 1998

Adviser:

Karl Citek, OD, PhD

Biography

Shahla Pisheh was born and raised in Isfahan, Iran. She received a Bachelor of Medical engineering from University of Tehran, Iran in 1990. She then moved to the united states in 1991 and started to learn English as a second language. In 1994, she received a Bachelor of Art and Science from Pacific University. Shahla will graduate from Pacific University College of Optometry in 1998. She plans to practice optometry in Portland, OR.

Signatures

Shahla J. Pisheh Shahla J. Pisheh

Karl Citek, OD, PhD Karl Citek

Abstract

Currently, most eye care practitioners in Iran use a Tumbling E chart to assess their patient's visual acuity. This project introduces new principles for the design and use of a Farsi letter chart for the measurement of visual acuity at four meters. A chart employing seven selected Farsi letters, based on a logMAR design was made. The chart was tested against the Bailey-Lovie logMAR and the Tumbling E charts. The subjects of the study were fluent in both English and Farsi.

Introduction

There is currently no letter recognition acuity chart for people who read only the Farsi language. Eye care practitioners in Iran, therefore, use the Tumbling E acuity chart. The Tumbling E chart measures minimum recognizable visual acuity and is less demanding than the logMAR visual acuity chart, which is a true minimum legible visual acuity task. The purpose of this project was to design a new LogMAR Acuity chart in the Farsi language and to test its validity against an English logMAR and the Tumbling E charts using bilingual subjects.

We constructed a logMAR distance acuity chart, using seven Farsi letters, realizing that some will be more difficult than others to recognize based on their design. The sizes of letters were chosen to allow measurements of acuities ranging from 20/200 to 20/10 at a four meter test distance.

Methods

The seven upper case letters used in the chart are found in the first two lines, and are repeated randomly throughout the chart. The Farsi alphabet uses several major elements. These elements may have as many as three additional dots to signify a letter with a different name and sound. For example, letter ع (che) has three dots while letter ج (je) has only one dot, and letter ح (hê) has none. While the dots are an important component of many of the letters, acuity demand of the dots themselves is much greater than the entire letter. For example, resolution of the dots on the letter of the 4/40 line requires approximately 4/8 visual acuity.

To eliminate any confusion, only one major element/dot combination was chosen for each letter. However, if the subject named a letter incorrectly only due to "dot confusion", he/she would get credit for the letter. Table I shows letters used and letters with which they could be confused.

chosen letters	"confusion letters"
ع	غ
ش	س ض ص
ن	ب ت
م	ک
ز	ر
م	ا
ج	ح ج خ

Table I.

Comparison of the letters chosen for the acuity chart and the letters with which they can be confused.

Letter sizes were chosen to allow the measurement of acuities ranging from 20/200 (logMAR=1.0) to 20/10 (logMAR=-0.2).

Subjects

The study consisted of 12 native Persians (6 male, 6 female), ages from 25 to 57 years old. The screening criteria for entry into the study included the following:

1. The subject must be able to read both Farsi and English.
2. The subject must have had a visual examination within past the two years, and should be wearing a current Rx.
3. The subject must sign an informed consent form in agreement with the Institutional Review Board.

Visual acuities were measured using the different charts in the order listed in Table II. To prevent any errors based on a subject's becoming fatigued during testing, the order of the charts was rotated. For example, a chart that was used last on subjects #1 and #7, was used first on subjects #5 and #11.

subjects->	1 & 7	2 & 8	3 & 9	4 & 10	5 & 11	6 & 12
1st test	log MAR	log MAR	Farsi	Farsi	E chart	E chart
2nd test	Farsi	E chart	log MAR	E chart	log MAR	Farsi
3rd test	E chart	Farsi	E chart	log MAR	Farsi	log MAR

Table II.

Order of tests used for each subject.

All measurements were done at a distance of 4 meters. The room illumination was kept equal for all of the measurements. Using a photometer, luminance of each chart was measured, and kept constant.

Number: ____

Gender: M/F

Date of Birth:

Age:

- 1) Which of the charts seems to be the easiest for you to understand? why?

- 2) Which of the charts seems to be the hardest for you to understand? why?

- 3) Is there anything about any of the charts that you did or did not like?

- 4) Do you have any additional comments?

Confidentiality

Records of this project will be maintained in a confidential manner, and no name-identifiable information will be released without permission of the participants.

The experimenter will be happy to answer any questions that you might have at any time during the course of this study. If you are not satisfied with the answers you receive, please call Dr. James Peterson at 357-0442. During your participation in this project you are not a Pacific University Clinic patient or client for purposes of the research, and all questions should be directed to the researchers and/or the faculty advisor who will be solely responsible for any treatment (except in an emergency). You will not be receiving complete eye, vision, or health care as a result of your participation in this project; therefore, you need to maintain your regular program of eye, vision, and health care.

Freedom to Withdraw

You are free to withdraw your consent and discontinue participation in this project or activity at any time without prejudice to you.

I have read and understood the above. I am 18 years of age or over, and this form is signed by me.

Printed Subject Name_____

Subject Signature_____

Thank You for your Participation

Results

	Log MAR			Farsi Log			Tumbling E		
	OD	OS	OU	OD	OS	OU	OD	OS	OU
subj.#1	4	5	4	4	5	4	20/30	20/30	20/20
subj.#2	4 ⁺¹	3 ⁺²	2.5	4	4	3	20/20 ⁺¹	20/20	20/20
subj.#3	5 ⁺²	5	4 ⁺¹	4	5	4	20/20 ⁻¹	20/30-1	20/30
subj.#4	3 ⁻¹	4	3	3 ⁻¹	3 ⁻¹	2.5 ⁻¹	20/15	20/15-3	20/15
subj.#5	4	4 ⁺¹	3	5 ⁺¹	5	4 ⁻¹	20/20-2	20/20	20/20
subj.#6	4	4	2.5	3	4	3	20/15	20/15	20/15
subj.#7	4	3	2.5	4 ⁻¹	4	3	20/20 ⁺¹	20/20	20/15
subj.#8	4 ⁻¹	4 ⁻¹	4 ⁻²	5	5	4	20/20-2	20/30	20/20-3
subj.#9	5 ⁻²	5	4	5 ⁻²	5	4	20/20-1	20/20	20/20+2
subj.#10	5 ⁻¹	5 ⁻¹	5 ⁺²	5 ⁻¹	5 ⁻¹	4 ⁻¹	20/30	20/30	20/20-1
subj.#11	4	3 ⁻¹	3	4	3	3 ⁻¹	20/15-2	20/15	20/20
subj.#12	4	4	4 ⁺¹	4	3	3	20/15	20/15	20/15

Table III.
Visual acuities of right eye (OD), left eye (OS) and both eyes (OU).

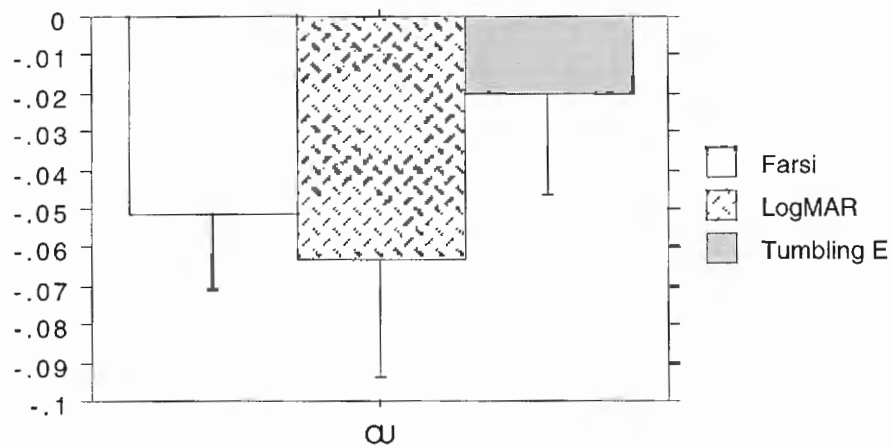


Figure 1.
Comparison of visual acuities of both eyes.

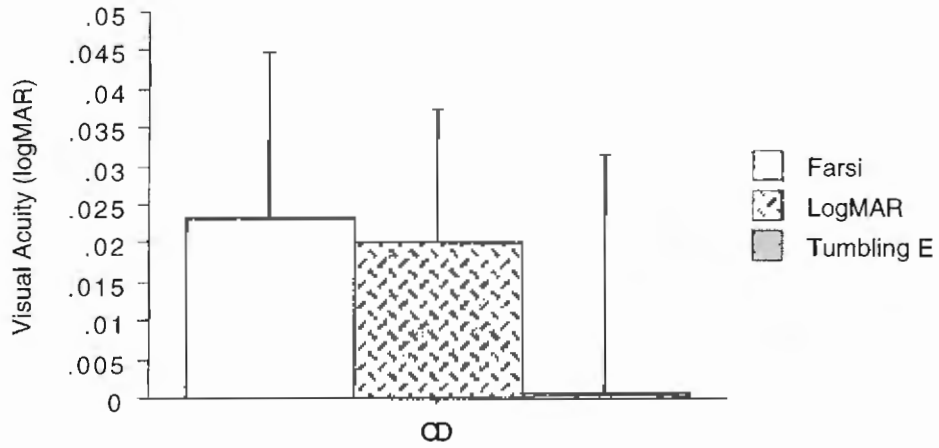


Figure 2.
Comparison of visual acuities of right eyes only.

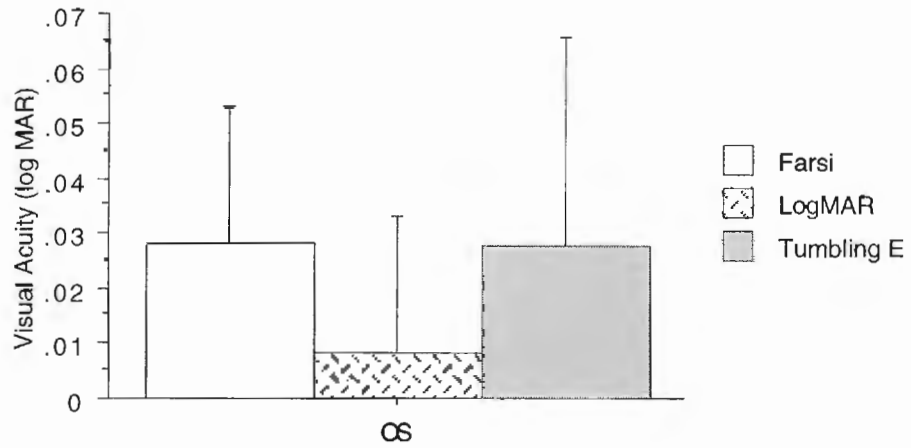


Figure 3.
Comparison of visual acuities of left eyes only.

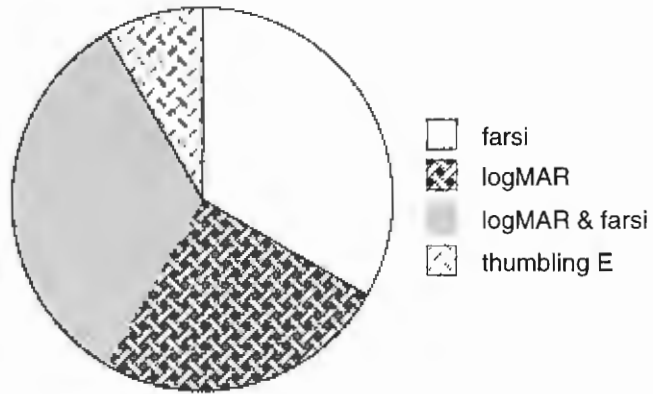


Figure 4.
Subjective responses to which chart subjects liked best.

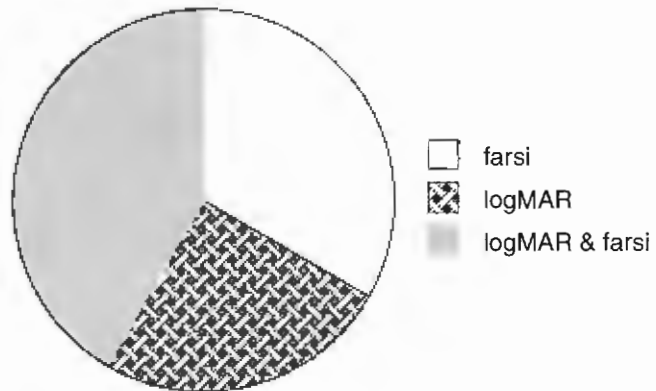


Figure 5.
Subjective responses to which chart was easiest for subjects to use.

	Charts	OD	OS	OJ	Input Column
▶ Type:	String	Real	Real	Real	Real
▶ Source:	User Entered	User Entered	User Entered	User Entered	User Entered
▶ Class:	Nominal	Continuous	Continuous	Continuous	Continuous
▶ Format:	•	Free Format Fi...	Free Format Fi...	Free Format Fi...	Free Format Fixed
▶ Dec. Places:	•	3	3	3	3
Mean:	•	.015	.021	-.045	•
Std. Deviation:	•	.081	.101	.089	•
Std. Error:	•	.013	.017	.015	•
Variance:	•	.007	.010	.008	•
Coeff. of Variation:	•	5.493	4.710	-1.982	•
Minimum:		-.120	-.140	-.200	•
Maximum:		.180	.230	.180	•
Range:	•	.300	.370	.380	•
Count:	36	36	36	36	•
Missing Cells:	0	0	0	0	•
Sum:	•	.530	.770	-1.620	•
Sum of Squares:	•	.237	.372	.351	•

	Charts	OD	OS	OJ	Input Column
1	LogMAR	0.000	.100	0.000	
2	LogMAR	-.020	-.140	-.200	
3	LogMAR	.060	.100	-.020	
4	LogMAR	-.080	0.000	-.100	
5	LogMAR	0.000	-.020	-.100	
6	LogMAR	0.000	0.000	-.200	
7	LogMAR	0.000	-.100	-.200	
8	LogMAR	.020	.020	.040	
9	LogMAR	.140	.100	0.000	
10	LogMAR	.120	.120	.140	
11	LogMAR	0.000	-.080	-.100	
12	LogMAR	0.000	0.000	-.020	
13	Farsi	0.000	.100	0.000	
14	Farsi	0.000	0.000	-.100	
15	Farsi	0.000	.100	0.000	
16	Farsi	-.080	-.080	-.180	
17	Farsi	.080	.100	.020	
18	Farsi	-.100	0.000	-.100	
19	Farsi	.020	0.000	-.100	
20	Farsi	.100	.100	0.000	
21	Farsi	.140	.100	0.000	
22	Farsi	.120	.120	.020	
23	Farsi	0.000	-.100	-.080	
24	Farsi	0.000	-.100	-.100	
25	Tumbling E	.180	.180	0.000	
26	Tumbling E	-.030	0.000	0.000	
27	Tumbling E	.030	.230	.180	
28	Tumbling E	-.120	-.080	-.120	
29	Tumbling E	.050	0.000	0.000	
30	Tumbling E	-.120	-.120	-.120	
31	Tumbling E	-.030	0.000	-.120	
32	Tumbling E	.050	.180	.080	
33	Tumbling E	.030	0.000	-.050	
34	Tumbling E	.180	.180	.030	
35	Tumbling E	-.090	-.120	0.000	
36	Tumbling E	-.120	-.120	-.120	

	Subjects	Log Mar OD	Log MAR OS	Farsi Log OD	Farsi log OS	Tumbling E OD	Tumbling E OS	Input Column
1	subj. #1	0.000	.100	0.000	.100	.180	.180	
2	subj. #2	-.020	-.140	0.000	0.000	-.030	0.000	
3	subj. #3	.060	.100	0.000	.100	.030	.230	
4	subj. #4	-.080	0.000	-.080	-.080	-.120	-.080	
5	subj. #5	0.000	-.020	.080	.100	.050	0.000	
6	subj. #6	0.000	0.000	-.100	0.000	-.120	-.120	
7	subj. #7	0.000	-.100	.020	0.000	-.030	0.000	
8	subj. #8	.020	.020	.100	.100	.050	.180	
9	subj. #9	.140	.100	.140	.100	.030	0.000	
10	subj. #10	.120	.120	.120	.120	.180	.180	
11	subj. #11	0.000	-.080	0.000	-.100	-.090	-.120	
12	subj. #12	0.000	0.000	0.000	-.100	-.120	-.120	

	Subjects	Log Mar OD	Log MAR OS	Farsi Log OD	Farsi log OS	Tumbling E OD	Tumbling E OS	Input Column
Type:	String	Real	Real	Real	Real	Real	Real	Real
Source:	User Entered	User Entered	User Entered	User Entered	User Entered	User Entered	User Entered	User Entered
Class:	Informative	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous
Format:	•	Free Format F...	Free Format F...	Free Format Fi...	Free Format Fi...	Free Format Fixed	Free Format Fixed	Free Format Fixed
Dec. Places:	•	3	3	3	3	3	3	3
Mean:	•	.020	.008	.023	.028	.001	.028	•
Std. Deviation:	•	.060	.085	.074	.086	.106	.132	•
Std. Error:	•	.017	.025	.021	.025	.031	.038	•
Variance:	•	.004	.007	.006	.007	.011	.017	•
Coeff. of Variation:	•	3.015	10.257	3.183	3.032	127.763	4.787	•
Minimum:	•	-.080	-.140	-.100	-.100	-.120	-.120	•
Maximum:	•	.140	.120	.140	.120	.180	.230	•
Range:	•	.220	.260	.240	.220	.300	.350	•
Count:	•	12	12	12	12	12	12	•
Missing Cells:	•	0	0	0	0	0	0	•
Sum:	•	.240	.100	.280	.340	.010	.330	•
Sum of Squares:	•	.045	.081	.067	.091	.125	.200	•

Discussion

Measuring visual acuity is one of the most useful tests of visual function. If the acuity charts are appropriately designed and fine scoring systems are used, visual acuity may be more sensitive for both detecting and quantifying oculo-visual changes¹.

According to Bailey, to standardize the visual acuity chart, it is necessary that the demand be the same at each size level on the chart¹. Therefore, the test task requires the use of letters of equal legibility, the same number of letters on each row, and uniform between-letter and between-row spacing. The acuity chart should also have a geometric progression of letters, meaning uniform steps of letter size change in logarithmic scale. This principle has been accepted by the International Council of Ophthalmology Committee on optotypes and by Germany in its German Standard for the measurement of visual acuity. Both committees use the original recommendation of Green, that multiplier or ratio of the geometric progression should be 10X square root of 10, which is equal to 1.2589 or 0.1 log unit¹. Since the ratio of standard error/mean was found to be nearly a constant, the logMAR method of acuity has been recommended for adoption as a standard for visual acuity, while this was not the case with other scaling methods. Based on these consideration the Farsi logMAR visual acuity chart was designed.

REFERENCES

1. Bailey, I., New Design Principles for Visual Acuity Letter Chart, Am. J. Optom.,53: 740-745, 1976.
2. Sloan, L., Measurement of Visual Acuity, Arch. Ophth., 45: 704-725, 1956.

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