Bulletin of the Psychonomic Society
1978, Vol. 11 (4), 212-214

Variability in word-recognition performance

CHRISTINE BROWNING-CRINION, ROBERT DOLMETSCH, and M. S. MAYZNER
Loyola University, Chicago, Illinois 60626

The present study, employing a backward visual masking paradigm and a computer-based CRT display system, examines the word-recognition performance for 220 four-, five-, and six-letter words, with a sample of 50 subjects. Results, as found previously, continue to demonstrate very large individual variabilities in such information processing tasks.

For about the past 10 years we have been concerned with developing a better understanding of pattern recognition in general, and letter and word recognition in particular (Mayzner, 1972, 1975a, 1975b; Mayzner & Greenberg, 1971; Mayzner, Tresselt, & Helfer, 1967). A persistent and puzzling result in almost all of the above-mentioned letter- and word-recognition studies has been the very significant variability found between subjects in letter- and word-recognition performance. Typically, we have found, for groups of college subjects selected at random, that, almost independently of stimulus parameters, individual differences between subjects for the identical stimulus items can and do vary from a few percent correct recognitions to almost 100% correct recognitions, in a variety of backward visual masking paradigms (Mayzner, 1972, 1975a, 1975b; Mayzner & Greenberg, 1971).

As a result of these large individual differences, it seemed reasonable to ask: "If we employed a large number of words [e.g., 220] and a large number of subjects [e.g., N = 50], to what extent should we continue to find such differences?" The present study directly confronted this question.

METHOD

Subjects

Fifty volunteer subjects were employed, 29 females and 21 males, ranging in age from 17 to 56 years.

Procedure

A total of 220 words, four, five, or six letters in length and selected with respect to three frequency groupings from the Kučera and Francis (1967) word list, were employed as stimuli, as shown in Table 1. A computer-based cathode-ray tube (CRT) display system, described previously (Mayzner, 1975a), was used to present the 220 word stimuli and involved a PDP-8/E digital computer driving a VR-14 CRT display coated with a P24 phospher. Each subject was seated 2 ft in front of the CRT display, with the head positioned firmly in a head-and-chin rest. Each letter of the four-, five-, or six-letter words was approximately 1-in. high and ¾-in. wide. Each of the 220 words, displayed in a different random order to each subject, was presented for a fixed duration of 40 msec, followed immediately by a 500-msec noise field or mask, as described earlier (Mayzner, 1972, 1975a, 1975b). After each presentation or display (i.e., a word followed immediately by a noise field or mask), the subject was requested to write all the letters that had been perceived or the entire word, if the entire word had been recognized correctly in its entirety by each subject.

This research was supported in part by NSF Grant BNS 75-09800 A02 to M. S. Mayzner.

RESULTS AND DISCUSSION

Table 1 gives all the words employed in the study, broken down by word length and word frequency, and also presents the percent correct recognitions for each of the 220 words examined, based on the 50 subjects studied. As may be easily seen in Table 1, there are

Table 1
All Words Employed in the Study, Shown by Word Length and Frequency Count and Giving Percent Correct Word Recognitions

Four Letters	Percent Correct	Five Letters	Percent Correct	Six Letters	Percent Correct
Kučera and Francis Word Frequency: 1 Per Million					
bred	30	amity	6	asylum	42
clod	34	avert	16	bigots	16
faze	6	basil	28	cavort	16
hash	46	chaps	32	creamy	36
luca	18	crust	44	embryo	34
jade	40	exalt	42	fiesta	18
keno	16	flirt	48	kneels	36
lurk	50	graze	12	lewdly	10
moth	44	jerks	42	ouster	10
oops	50	joked	40	parcel	40
prim	16	kiosk	4	purses	30
puff	38	liars	24	quirks	18
quam	2	mince	14	reaped	10
rims	30	omega	24	ribald	10
runt	40	plasm	14	stigma	26
teas	22	query	16	suntan	46
whoa	16	rogue	28	topple	46
yolk	36	spoof	38	tycoon	52
		tidal	22	uplift	22
		twigs	18	vocals	4
		usurp	16	wilted	24
		volts	10	yelped	34
		zoned	22	zombie	4
Kučera and Francis Word Frequency: 15 to 25 Per Million					
bees	44	alien	22	beaten	42
burn	56	alter	28	buffer	38
clue	44	blast	48	devote	36
damp	26	boost	4	ethics	50
drag	20	cubic	44	fabric	38
earn	52	deals	34	gotten	24

Table 1 Continued

Four Letters	Percent Correct	Five Letters	Percent Correct	Six Letters	Percent Correct
flag	28	dutch	54	helium	42
grab	22	elder	38	ideals	40
hers	44	fancy	48	judged	46
jeep	32	farms	18	kissed	54
kick	54	gates	20	lyrics	42
lawn	28	ivory	40	madame	16
monk	30	knock	56	needle	54
nest	60	loses	38	occupy	4
oils	38	lover	10	oppose	36
pill	48	marry	12	picnic	42
quit	26	nurse	60	potato	42
rope	42	onion	50	rental	46
spun	46	pains	20	rubber	58
swim	20	razor	28	tennis	60
ties	54	sheer	50	vessel	10
unto	20	stove	50	wasted	30
zero	26	votes	28	whites	28
		waved	14	yankee	52
Kučera and Francis Word Frequency: 100 to 400 Per Million					
able	32	among	18	across	14
area	36	areas	10	behind	52
arms	18	black	50	center	60
book	60	board	28	charge	2
case	36	books	52	common	40
cost	38	child	56	effect	42
find	60	class	50	either	48
full	56	clear	58	figure	58
girl	42	death	56	future	64
hard	56	early	50	having	10
keep	58	field	26	itself	36
knew	10	force	54	looked	48
land	64	front	54	moment	46
love	24	going	34	mother	48
miss	30	group	56	office	50
name	54	hands	40	others	60
plan	40	hardy	52	period	66
play	58	later	50	policy	50
pool	70	level	50	reason	36
rate	46	music	40	result	50
says	46	north	64	second	56
seem	34	quite	42	seemed	38
town	38	short	62	social	42
true	66	sound	58	street	68
type	62	stood	52	toward	28
west	42	total	50	wanted	42
wife	34	voice	44	within	34
york	46	women	32		
		wrong	42		
		young	58		

considerable individual differences in word-recognition scores. More importantly, Table 2 presents the individual recognition scores, ordered from smallest to largest, for each of the 50 subjects in the study. As has been found before (Mayzner, 1972, 1975a, 1975b; Mayzner & Greenberg, 1971), the variability in word-recognition performance between subjects is very large and appears to be a very stable and reproduceable finding. For example, Table 2 shows that for this study, in which 220 different words were shown to 50 different subjects, 10 subjects failed to recognize any words whatsoever, while the recognition scores for the remaining 40 subjects ranged from a low of 12 correct recognitions to a high of 185 correct recognitions, out of a total maximum correct recognition score of 220. While, clearly, no attempt will be made here to provide an explanation for these very large individual differences, their empirical reality must ultimately be accounted for in any comprehensive visual information processing model of word-recognition processes.

While not a major objective of this study, word length and word frequency also varied and the percent correct recognitions for these variations are presented in Table 3.

As shown in Table 3, increases in word frequency led to significant increases in word-recognition scores, that is, from 26.47% correct recognitions ($p < .001$) to 44.37% correct recognitions, as expected, while increases in word length surprisingly led to very small and completely insignificant decreases in word-recognition scores, that is, from 37.31% correct recognitions to 36.05% correct recog-

Table 2
A Listing of All 50 Subjects and Their Associated Recognition Scores (Maximum = 220)

Subjects	N Correct	Subjects	N Correct
1	0	26	81
2	0	27	86
3	0	28	86
4	0	29	95
5	0	30	104
6	0	31	108
7	0	32	120
8	0	33	127
9	0	34	128
10	0	35	130
11	12	36	130
12	14	37	141
13	19	38	142
14	22	39	143
15	23	40	143
16	28	41	145
17	37	42	147
18	41	43	156
19	56	44	156
20	58	45	159
21	58	46	163
22	66	47	168
23	66	48	179
24	74	49	183
25	78	50	185

Table 3
Percent Correct Word Recognitions by Word Length and Word Frequency

	Word Length (N of Letters)			
Word Frequency*	Four	Five	Six	Mean
1 Per Million	29.66	24.34	25.40	26.47
15 to 25 Per Million	37.40	33.92	38.76	36.69
100 to 400 Per Million	44.86	44.26	44.00	44.37
Mean	37.31	34.17	36.05	35.84

**Kučera and Francis, 1967*

nitions ($p > .40$). The failure to find decreases in correct recognitions with increasing word length is unusual, and study of this anomolous finding is being pursued further.

REFERENCES

KUČERA, H., & FRANCIS, W. N. *Computational analysis of present-day American English*. Providence, R.I: Brown University Press, 1967.

MAYZNER, M. S. Visual information processing of alphabetic inputs. *Psychonomic Monograph Supplements*, 1972, **4**(13, Whole No. 6), 239-243.

MAYZNER, M. S. Studies of visual information processing in man. In R. L. Solso (Ed.), *Information processing and cognition: The Loyola symposium*. Hillsdale, N.J: Erlbaum, 1975. Pp. 31-54. (a)

MAYZNER, M. S. Visual information processing of letters and nonletters. *Bulletin of the Psychonomic Society*, 1975, **6**, 421. (b)

MAYZNER, M. S., & GREENBERG, J. Studies in the processing of sequentially presented inputs with overprinting paradigms. *Psychonomic Monograph Supplements*, 1971, **4**(4, Whole No. 52), 73-84.

MAYZNER, M. S., TRESSELT, M. E., & HELFER, M. S. A research strategy for studying certain effects of very fast sequential input rates on the visual system. *Psychonomic Monograph Supplements*, 1967, **2**(5, Whole No. 21), 73-81.

(Received for publication December 7, 1977.)