Letter association and sequence norms¹

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Abstract

Single letter responses to each letter of the alphabet were collected from 1611 Ss. Subsamples were instructed either to respond with associations or to attempt to reproduce letter sequences of the English language. The results differed in several ways from previous norms.

Problem

Research on verbal processes, in recent years, has encompassed units of analysis previously neglected. Sentences, words, morphemes, and letters increasingly have been subjected to experimental scrutiny in psychological inquiry. Letters of the alphabet are currently utilized both as the object of investigation (Underwood & Keppel, 1963) and as an experimental tool (Battig, Brown, & Schild, 1964). Letter sequence frequencies typically are obtained from Pratt (1942) and normative data on letter associations from Underwood & Schulz (1960). The latter was collected from a sample of 373 Ss who simultaneously were associating to every two-letter combination. Subsequent research (Underwood & Keppel, 1963) yielded alphabetical sequence intrusion errors that the norms were not designed to predict. It, therefore, seemed desirable to amass normative data, limited to single letter stimuli, from a much larger sample.

Method

The Ss were 1611 introductory psychology students. Sets of 27 IBM cards were distributed to each S. A different letter of the alphabet and a dash (i. e., A____) was printed at the left center on each of 26 cards. The S's name, etc., was recorded on the top card. A different random order of letters had previously been generated for each S by IBM 1620 computer. Two sets of instructions were administered to subsamples: association (N=812) and letter sequence (N=799). The association group was instructed to respond to each stimulus letter with "the first letter it makes you think of . . ." Instructions to the sequence group requested that they respond with a letter "that you think would most often come next in everyday words . . ." All Ss were directed to write a single letter in the blank space of every card. The entire alphabet and mark-sense spaces were printed on the right side of each card, i. e., A() B(), etc. After the Ss completed all cards, they were told again to go through the deck and to mark-sense their responses. The data were compiled by an IBM 519 and 7044.

Results and Discussion

The number of Ss responding with a given letter to each stimulus letter is presented in Table 1 for

TABLE 1
RESPONSE FREQUENCIES TO LETTER STIMULI WITH ASSOCIATION INSTRUCTIONS

STIMULUS LETTER	RESPONSE LETTER																									
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	84	484	26	15	6	4	6	4	2	2	4	15	18	22	2	9	2	15	17	25	6	10	1	4	2	27
B	113	96	257	59	65	11	9	4	9	3	7	12	4	2	59	14	1	21	16	11	16	2	5	3	4	8
C	88	51	80	327	31	10	13	18	6	1	20	9	10	3	52	12	7	15	12	13	15	4	5	3	2	5
D	37	36	37	88	280	23	8	3	26	5	6	12	11	5	125	16	3	25	18	14	15	5	2	4	3	5
E	28	26	4	44	80	373	33	5	13	7	6	32	22	18	8	10	0	21	14	28	2	10	3	4	2	10
F	62	12	6	13	62	75	234	22	31	7	14	19	24	7	31	23	11	53	7	35	47	1	1	5	4	6
G	29	16	25	27	32	28	91	274	32	6	14	15	11	2	103	7	5	39	12	20	8	1	7	2	2	4
H	36	8	2	6	40	6	15	85	412	25	13	27	15	8	48	7	6	6	2	18	13	6	1	0	5	2
I	14	20	12	11	9	13	4	16	80	248	30	83	67	42	29	13	8	8	18	63	8	4	1	0	7	4
J	72	15	9	10	8	5	10	13	33	84	341	40	22	4	47	18	4	17	9	11	25	5	2	2	3	3
K	53	14	11	8	21	6	11	11	40	27	85	50	33	9	19	23	2	28	11	20	3	6	4	8	6	3
L	38	10	6	11	17	8	4	5	52	10	13	80	404	15	61	10	7	8	16	14	4	4	1	1	3	6
M	40	3	8	9	33	2	5	4	7	2	2	27	77	439	80	8	3	10	6	11	6	2	16	4	4	5
N	23	7	1	5	9	5	4	3	12	2	4	12	196	81	357	33	4	3	10	16	3	4	0	4	5	0
O	6	15	12	10	2	7	3	10	6	5	11	18	45	49	80	385	35	27	11	33	10	8	6	6	2	10
P	33	24	5	14	26	3	4	7	8	4	2	24	27	14	111	76	278	63	29	21	21	3	1	5	2	7
Q	5	4	1	1	2	1	2	0	9	3	4	10	9	5	49	70	70	303	26	58	142	6	2	8	0	22
R	41	15	4	8	24	9	5	2	14	1	9	14	16	18	47	36	14	85	358	41	21	12	2	7	3	6
S	20	14	11	4	21	5	2	22	15	1	2	8	23	6	45	24	5	46	89	394	10	13	7	4	3	0
T	13	15	8	5	27	10	6	23	30	2	2	24	8	10	88	14	17	48	129	91	159	46	4	10	4	17
U	6	20	12	5	2	5	2	1	5	3	4	13	16	20	17	47	8	45	24	65	75	156	26	0	10	12
V	35	11	3	26	48	1	7	1	33	1	5	7	8	13	45	10	10	11	8	38	94	79	259	31	7	21
W	33	7	4	3	41	5	2	12	24	2	6	4	42	10	53	5	2	12	17	20	38	80	201	26	44	
X	10	7	2	3	17	3	2	0	8	2	6	17	11	2	6	6	13	1	5	6	0	14	20	421	75	
Y	34	8	2	3	40	2	4	3	9	1	6	12	10	9	88	4	4	9	16	22	38	25	30	57	85	201
Z	148	33	4	8	60	7	3	0	6	1	11	16	10	16	83	8	23	16	7	33	8	8	32	93	79	22

TABLE 2
RESPONSE FREQUENCIES TO LETTER STIMULI WITH LANGUAGE INSTRUCTIONS

STIMULUS	RESPONSE LETTER																									
LETTER	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	2	109	45	35	30	8	3	1	11	0	0	74	38	160	4	26	0	79	64	107	1	0	1	0	1	0
B	291	6	6	0	209	0	0	0	28	1	0	27	2	0	122	0	0	73	2	0	27	0	0	1	4	0
C	433	0	3	11	64	0	0	78	5	0	6	22	0	0	113	0	0	52	0	2	9	0	0	0	1	0
D	146	1	0	5	248	0	1	0	83	0	0	3	0	0	255	0	0	45	2	2	5	0	0	0	3	0
E	231	5	5	40	13	47	12	1	38	1	1	31	25	127	0	2	0	87	38	30	6	29	0	29	1	0
F	257	0	0	2	102	2	7	0	97	0	0	25	1	0	111	0	0	154	0	3	37	0	0	0	1	0
G	130	0	0	1	137	0	2	47	43	0	0	13	1	1	247	0	0	160	2	2	12	0	0	0	1	0
H	213	0	1	0	244	0	0	3	198	0	0	0	0	1	115	0	0	0	1	5	13	0	0	0	5	0
I	14	2	11	34	66	6	6	1	5	7	3	64	41	326	18	1	0	30	72	89	0	2	1	0	0	0
J	299	0	0	0	110	0	0	1	44	5	12	0	0	1	167	0	0	0	1	154	2	1	1	0	0	0
K	128	1	0	2	218	0	0	1	279	3	7	59	0	53	16	1	0	21	4	0	5	0	0	0	1	0
L	212	0	0	3	149	0	2	1	173	0	1	6	12	0	205	2	1	0	1	3	18	0	0	0	10	0
M	301	0	0	1	170	0	0	0	68	0	0	0	11	17	208	2	0	0	2	1	11	0	0	0	6	1
N	135	0	2	5	174	0	8	0	39	0	0	0	3	5	408	0	0	0	1	10	8	0	0	0	1	0
O	20	37	18	16	4	22	0	7	5	0	1	27	27	136	15	210	0	95	19	71	46	14	3	1	2	0
P	163	1	0	2	133	0	0	37	48	0	0	64	0	0	179	11	9	115	3	3	29	0	0	0	2	0
Q	5	0	0	0	1	0	0	0	4	0	0	0	0	0	2	1	3	9	2	2	764	2	0	0	2	1
R	226	1	1	2	286	0	0	4	91	0	0	0	0	2	136	1	0	2	16	9	19	0	0	0	3	0
S	148	1	8	0	134	0	0	64	61	0	2	10	6	1	87	11	0	2	3	243	12	0	2	0	3	1
T	133	0	0	1	137	0	0	155	52	0	0	4	1	0	209	0	1	79	7	4	12	2	1	0	1	0
U	15	8	3	1	12	0	9	0	24	0	1	22	25	360	7	47	0	75	105	66	1	15	1	2	0	0
V	160	0	0	1	315	0	0	0	169	0	0	1	1	1	116	1	1	3	1	2	11	2	11	0	3	0
W	208	0	0	0	163	1	0	146	90	0	0	0	0	1	148	0	0	22	1	1	1	0	5	9	3	0
X	72	0	16	0	211	0	0	0	34	0	2	3	7	3	24	5	0	41	1	10	2	0	0	6	356	6
Y	83	0	1	0	304	0	1	1	16	0	0	3	0	2	343	2	0	1	9	1	9	1	0	0	8	14
Z	35	0	0	0	379	0	0	0	42	0	0	1	0	1	257	0	0	1	1	0	11	0	1	4	59	7

association instructions and Table 2 for sequence instructions. Enormous differences between the two tables are apparent. As expected, the most pronounced difference between Table 1 and the Underwood & Schulz norms is along the alphabetical sequence diagonal. It should be noted that alphabetical sequence habits are far from uniform; the frequency varies from 159 U responses for T to 491 Y responses to X. Some sizable differences occur between Table 1 and previous norms for occasional letter pairs.

References

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Note

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