

TRAVELING AROUND THE OUIJA BOARD

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Supposedly guided by spirits from another world, the planchette glides from letter to letter on a Ouija board, spelling out words. One can characterize the difficulty of a word by the distance the planchette must travel to spell the words (visiting the letters in the order of their appearance in the word). The table below gives the shortest-travel and the longest-travel words of various lengths, in pixels using the Ouija board at <http://www.brainjar.com/dhtml.ouija/graphics/board.jpg>. The ratio of the longest to the shortest travel is given in the final column.

4 68 feed	1155 mama	17
5 112 deers	1446 Malay	13
6 126 booboo	1809 malaya	14
7 180 feeders	2034 layaway	11
8 228 deferred	2247 chalazal	9.9
9 266 deferrers	2892 Malayalam	11
10 323 feedstuffs	2522 amalgamate	7.8
11 441 prestressed	2804 emblazoning	6.4
12 447 dessertspoon	3020 amalgamating	6.8
13 672 preregistered	3042 emblazonments	4.5
14 854 oppressiveness, stubbornnesses	3081 unmaintainable	3.6
15 826 dessertspoonful	3155 uncomplainingly	3.8
16 995 suggestivenesses	3286 circumambulating	3.3
17 1090 nonpossessiveness	3362 symptomatological	3.1
18 1310 lightheartednesses	3205 compartmentalizing	2.4
19 1655 antivivisectionists	3422 symptomatologically	2.1
20 1839 representativenesses	3336 microminiaturization	1.8
21 1862 hyperaggressivenesses	3505 microminiaturizations	1.9
22 2495 counterrevolutionaries	3172 electroencephalography	1.9
23 3254 electroencephalographic	3361 disestablishmentarianism	1.0

One can similarly measure the distance traveled on a QWERTY typewriter keyboard to spell out various words, using <http://ww.btinternet.com/~bill.furnell/QWERTY.jpg> as a guide.

4 52 loll	846 papa	16
5 90 deeds	1101 papal	12
6 105 weewee	1234 jalaps	12
7 134 weeweed	1344 halalah	10
8 149 assessee	1520 palatals	10
9 216 addressee	1750 Malayalam	8.1
10 254 addressees	1776 soapflakes	7.0
11 345 readdressed	1848 Panamanians	5.4
12 454 underdressed	1995 spermatozoan	4.4
13 510 underassessed	2042 legislatorial	4.0
14 682 addressability	2155 paleographical	3.2
15 810 assertivenesses	2217 kaleidoscopic	2.7

16 836 schoolmistresses	2281 parliamentarians	2.7
17 1054 wrongheadednesses	2495 triskaidekaphobia	2.4
18 1028 lightheartednesses	2340 psychoanalytically	2.3
19 1399 disinterestednesses	2552 antiparliamentarian	1.8
20 1450 counterrevolutionary	2697 antiparliamentarians	1.9
21 1526 hyperaggressivenesses	2669 electroencephalograph	1.7
22 1712 counterrevolutionaries	2797 electroencephalographs	1.6
23 2860 disestablishmentarianism	2890 electroencephalographic	1.0

The long palindrome Malayalam appears on both lists, as does counterrevolutionaries, despite the completely different arrangement of the alphabet.

Logologists may well prefer a distance metric based on position in the alphabet. Replace the letters of a word with their alphabet values (A=1, B=2, etc.) and take the sum of the absolute differences between successive values (for example, FIB's travel is based on 6 9 2 which becomes $3+7 = 10$). Here again are the longest-travel and shortest-travel words sorted by length.

4 2 deed, feed, noon, poon, poop	68 away
5 4 ababa	83 braza, rayas
6 4 deeded	101 brazas
7 7 acceded	127 layaway
8 13 cabbaged, pronposs, rollmops	133 layaways
9 19 mollified, nonporous	141 graveyard
10 20 nonsupport	156 graveyards
11 21 nonsupports	159 sauerbraten
12 32 opportunists	173 taramasalata
13 43 diffeomorphic	177 bureaucratize
14 51 nonnitrogenous	191 bureaucratizes
15 58 nonproportional	185 bureaucratizing
16 66 monopolistically	200 parameterization
17 71 nonproportionally	218 bureaucratization
18 93 hemorrhoidectomies	197 pseudoaristocratic
19 96 anthropomorphically	192 hydrotherapeutician
20 112 antiinsurrectionists	221 representativenesses
21 122 antiinstitutionalists	211 hyperaggressivenesses
22 178 counterclassifications	186 electroencephalography
23 176 electroencephalographic	203 disestablishmentarianism

If you allow for a circular alphabet (for example, A to Z is 1 step, not 25) you get dramatically different results for the longest-travel words, since the longest distance between letters in a circular alphabet gets cut in half. Improved shortest-travel words are asterisked.

4 2 deed, feed, noon, poon, poop	39 nana
5 4 ababa	51 frere, serer
6 4 deeded	64 manana
7 7 acceded	72 mananas, paperer
8 13 cabbaged, pronposs, rollmops	82 frescoer
9 15 succeeded*	91 lapboards
10 20 nonsupport	102 paperboard
11 21 nonsupports	113 paperboards
12 32 opportunists	121 repetitively

13 43 diffeomorphic	123 grandmaternal, prerequisites
14 47 monopolization*	131 repetitiveness
15 52 monopolizations*	137 hyperactivities, representatives
16 66 monopolistically	155 repetitivenesses
17 71 nonproportionally	148 overargumentative
18 83 hemorrhoidectomies*	165 hypersensitivities
19 96 anthropomorphically	155 antiparlamentarian, hyperaggressiveness
20 103 microminiaturization*	179 representativenesses
21 108 microminiaturizations*	179 hyperaggressivenesses
22 148 counterclassifications*	162 counterrevolutionaries
23 191 electroencephalographic*	167 disestablishmentarianism

Can one improve the letter layouts on a Ouija board to minimize the average travel distance for a typical word? For the Ouija board, place the letters of the alphabet on a hexagonal grid, adding a position to signal the space between successive words. Calculate the total travel distance for a corpus of common words for this arrangement, and then recalculate the travel distance with a pair of letters interchanged. By successive trial-and-error repetitions of this nature, one can approach that arrangement which minimizes the total travel distance. The pattern below gives the best arrangement found after numerous computer runs; not unexpectedly, the etaoinshrdlu common letters cluster around the space. The total travel distance was 522059582.

What if one uses a checkerboard grid instead? The best arrangement, found by similar trial and error, is given below; it is nearly 3 per cent more efficient than the hexagonal one, yielding a total travel distance of 508196981.

If one merely rearranges the letters to lie on two straight lines, mimicking the two arcs on the Ouija board, the travel distance corresponding to the arrangement ZXVGINAROFUPQ over JKWCHTESDLMYB is increased to 724085201, still much better than the standard arrangement of ABCDEFGHIJKLM over NOPQRSTUVWXYZ with total travel distance of 1082666795. The spacebar is placed under the A in the first arrangement, and the T in the second.

Thinking beyond the Ouija board, one can generalize to any communication task involving a stylus, say on a PDA or on an interface for a disabled person. The total travel distance for similarly-sized squares laid out on a typewriter keyboard is 964564575. After rearranging the letters to QBULCINGVZ on the top row, JPMOATHWK on the second, and XYFRSED on the third, the total travel distance is reduced to 615591269, 36 per cent better than the qwerty keyboard.



				Z
V	W	H	C	K
Y	A	T	I	G
L	E		N	D
B	R	S	O	F
X	P	M	U	J
				Q