

# LET YOUR FINGERS DO THE WORDPLAY

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## INTRODUCTION

Dmitri Borgmann's *Language on Vacation* includes the following tidbit concerning wordplay and the telephone dial: "It appears that the longest word which can be dialed using only letters that appear with odd numerals is WELL-EXPRESSED, and that...with even numerals NONCOMMUNICATING." It seems to us that the first example is an adjectival phrase; the longest single words appear to be PERPLEXEDLY or SLEEPLESSLY. (If you want a longer adjectival phrase, consider the sentence "SELFLESSLY-DEFERRED pleasures are often the best kind.") We can't quibble with the second example except to point out that NONCONTAMINATING ties it for length.

In this article we consider various curiosities of the telephone dial, such as the word KEYPUNCH, which arises if you punch each lettered key exactly once! All words cited, most of which are reasonably common, can be found in the Merriam-Webster Collegiate Dictionary, 10th edition.

## GENERAL DEFINITIONS

**Telephone Alphabet:** the regular alphabet minus Q and Z (recently, Sony added these letters to the telephone dial, in a break with the glorious 24-letter tradition that has flourished for most of this century)

**Telephone Word:** in general, a word whose letters have special significance to the alphabetic arrangement on the telephone

**Rotary Telephone Word:** a word requiring a rotary phone for its effect

**Touchtone Telephone Word:** a word requiring a touchtone keypad for its effect

**Trigram:** three letters assigned to a single digit on the telephone--  
ABC to 2, DEF to 3, ... WXY to 9

**Key:** a single location used to dial a number on a rotary telephone dial or a touchtone telephone pad. The individual keys are identified by digits--the 2-key, for example, is the one labeled 2/ABC

**Numeric Representation:** the digits on the telephone keys that represent the letters of a word--for example, WORD = 9673

## SINGLE-KEY WORDS

Let's start with the most basic telephone words of all, those that use all three letters once each on a single key--perfect single-key words. Webster's Collegiate lists CAB, FED, GHI, MON, NOM. FED reverses the 3-key letters, GHI reads off the 4-key letters, and MON and NOM are a reversal pair.

Imperfect single-key words lack the three letters or use letters more than once. For various keys, here are the longest examples: ABACA 2, DEEDED or FEEDED 3, HIGH 4, MOON or NOON 6, TUTU 8.

## PAIRED-KEY WORDS

In these words only two of the keys can be used, but both keys must be used at least once. There are 28 possible combinations, with the longest examples listed below:

- 2-3 FACADE, ACCEEDED, DEFACED, EFFACED (43 words)
- 2-4 ACACIA (25 words)
- 2-5 JACKAL, BLACKBALL, BLACKJACK (23 words)
- 2-6 BAOBAB, CANNON and many more 6-letter words (59 words)
- 2-7 CARCASS, SCARABS (67 words)
- 2-8 VACUA (plural of vacuum) (20 words)
- 2-9 ABBACY (16 words)
- 3-4 DEIFIED (36 words)
- 3-5 JELLED, KEELED (21 words)
- 3-6 DEFENDED, OFFENDED (83 words)
- 3-7 PREFERRED, REPRESSED (118 words)
- 3-8 VEDETTE (27 words)
- 3-9 WEDDED (23 words)
- 4-5 GILL, HILL, KILL (5 words)
- 4-6 HOGGING, ONGOING (40 words)
- 4-7 PRIGGISH (47 words)
- 4-8 THIGH, TIGHT (18 words)
- 4-9 WHY, WIG (4 words)
- 5-6 KNOLL (10 words)
- 5-7
- 5-8 LULL (2 words)
- 5-9
- 6-7 MONSOONS, SPONSORS (51 words)
- 6-8 UNMOUNT (27 words)
- 6-9 MOMMY, MOONY (15 words)
- 7-8 SUSURRUS (35 words)
- 7-9 SPRY (5 words)
- 8-9 TUTTY (1 word)

Combination 3-7 gives the most words by a large margin, but it ties with 2-5 for the longest words. Combinations 5-7 and 5-9 yield no common words, due to 5-7 having no vowels and 5-9 having only Y.



The 2-3 combination is similar to a well-known recreation among computer programmers: form words out of the letters that occur in the hexadecimal number sequence 0123456789ABCDEF. Such words are sometimes deliberately embedded in computer code so that they can be used to help find certain data fields when the code or data is viewed in hexadecimal.

Some two-key words with additional properties include HOMING, which uses all six letters on the two keys, DEMON 33666 and BABOON 222666 which stay on one key then switch to the other, DEFENDED 33336333 which has the greatest bias toward one key, and DEPRESSED 337737733 and REPRESSES 737737737 which are telepalindromes.

### KEYPUNCH WORDS

These are words that use each key on the dial no more than once, as exemplified by the word KEYPUNCH (numeric isograms). The most elegant keypunch words have eight letters and therefore use every key once:

ADROITLY	ENTHALPY	GUNWALES	KNITWARE	SODALITY	UNEASILY
CRYOLITE	EPICOTYL	IDOLATRY	LYNCHETS	STEAMILY	UNFAIRLY
DILATORY	FOXTAILS	KEYPUNCH	PLAYTIME	TWANGLES	

If the missing letters Q and Z appeared on an additional key, BLOWZIEST is perhaps the only 9-letter numeric isogram.

The word KEYS itself is a numeric isogram that uses just the odd-numbered keys. Additional words of this type are LYRE, RELY, SKEW and YELP. Even-numbered keys yield BOTH, CHUM, GNAT, GOAT, IOTA, MATH, MUCH, OATH, OUCH, TANG, THAN, TOGA and VAIN. The phrase MATH KEYS consists of an even isogram followed by an odd isogram.

### REPEATED KEYPUNCH WORDS

In these words, each key can be used at most once but during its one period of use it can be used as many times in a row as desired. Many words have eleven letters:

BALLYHOOERS	IRREMOVABLY	MOONLIGHTER
DEMONOLATRY	IRREVOCABLY	PIGGYBACKED
HIGHLANDERS	MONOMORPHIC	UNABASHEDLY
IRREFUTABLY		

but the champion is DESPOTICALLY 337768422559, with twelve.

## ONCE-MANY WORDS

In these, seven keys are used once each and the eighth key is used two or more times. Here are the longest words we have found for each of the eight possibilities for the "many" key:

- 2 UNREACHABLY
- 3 ADHERENTLY
- 4 INDIVISIBLY
- 5 LIBELOUSLY
- 6 COMMODIOUSLY
- 7 EARTHWORKS, PLAYHOUSES, SPECIOUSLY
- 8 NEUTRALITY, OPTATIVELY
- 9

## DOUBLE- AND TRIPLE-PLAY WORDS

These words use each key twice in a row before moving to a different key. There are two types of double-play words: (1) no key may be used after its first occurrence, (2) a key may be reused as long as one or more different keys interpose. There are many 6-letter examples of the first type using three keys, including CALLED, DEBARS, PREFAB and SPACED, but only one 8-letter example using four keys: DECATURS (towns named DECATUR, as in Georgia and Illinois). For the second type, the limit is also 8 letters but only three keys, such as DEBARRED, MODELLED, PREFACED and SPOOFERS.

Triple-play Words use each key three times in a row; ACCEDE and BABOON use two keys and six letters. Apparently there are no nine-letter examples of either type.

## QUICK-CHANGE WORDS

These are words in which each letter is on a different keypad from the previous one. This is only slightly more restrictive than prohibiting double letters, so it is not surprising to find very long words with this property. One example is ELECTROENCEPHALOGRAPHY; surely there are longer ones.

## SPECIAL NUMERICAL PROPERTIES

We can require the sequence of numbers to be Non-Decreasing, as in the 9-letter BEDFELLOW 233335568, the longest word of this type we found. For an All-Increasing sequence, in which each number is higher than its predecessor, we know of the 5-letter examples BELOW, FILMS and GLORY, and the more esoteric 6-letter BIJOUX (plural of BIJOU).



For Non-Increasing sequences, there are (among others) UNHEEDED 86433333 and UNNEEDED 86633333, but for words with All-Decreasing sequences, the longest appears to be the 5-letter SOLID. Note that All-Increasing and All-Decreasing Words are also Keypunch Words.

Prime Telephone Words are those which use only the prime-number keys 2,3,5,7. Long ones include the 12-letter BACKSLAPPERS, BLACKBALLERS and HARDSCRABBLE, and the 13-letter IRREPLACEABLE.

Telepalindromes are words whose numeric representation is a palindrome. All alphabetic palindromes (unless they contain Q or Z) are numeric palindromes; we consider only telepalindromes which are not alphabetic. Here are all the ones we found with eight letters or more:

DOCKLAND	OMISSION	SPEEDERS	SUNSPOTS
EDUCATED	RINGINGS	SPELLERS	
DEPRESSED	EVAPORATE	PIRIPIRIS	REDIVIDES
DISCHARGE	IMITATING	POSSESSOR	REPRESSES

#### UNCONSONANT

Telereversals are pairs like ACE/DAB or OUR/PUN in which the numbers are reversals of each other but the words are not. One particularly lovely pair is FILMS/SOLID, numeric isograms using consecutive digits.

#### REPEATED KEY-PATTERN WORDS

Some words have their key numbers in a repeating sequence of the form abab.. or abcabc.. and so on. The sequence doesn't have to be fully repeated at the end of a word. These examples include the elegant triple-three MURMUROUS 687687687.

2 keys: COCOA, RUSTS, TRUSTS

3 keys: COWBOY, ALFALFA, APHASIA, MURMUROUS

4 keys: BUREAUS, IMPUGNS, MARINAS, BERIBERI, COUSCOUS, LIMPKINS

#### TRIGRAM-POSITIONED WORDS

We can require that the letters in a word appear in the same position in the telephone trigrams--first, middle, or last letters. For instance, MAD is composed of the first letters and BEN of the middle letters in the telephone trigrams ABC, DEF, MNO. The longest first-letter word appears to be MAGMATA, and the longest middle-letter words, REBUKE and BUNKER. The last letters yield the most and longest words, including the 9-letter SCOLIOSIS and ISOCYCLIC.

By coincidence, four forms of the verb "to be" are trigram-positioned words: AM (first), BE (middle), BEEN (middle), and IS (last letter).

## ROTARY DIAL WORDPLAY: SLOW AND FAST WORDS

The rotary dial phone offers special possibilities for wordplay not present on the more commonly used touchtone phone. The amount of time needed to dial a given word on a rotary phone is proportional to the sum of its digits, since a 1 is quicker than a 2, a 2 quicker than a 3, and so on. The average time (the total time divided by the number of letters) ranges from 2 to 9. We define a fast word as one with average time between 2 and 5.5, and a slow word as one between 5.5 and 9. What are the fastest and slowest words of  $n$  letters? In the table below, each word (fast or slow) is followed by its numerical sum and average:

5	TUTTY 41, 8.2	ABACA 10, 2.0
6	SYRUPY 47, 7.8	ACACIA 14, 2.3
7	OUTPUTS 52, 7.4	CABBAGE 17, 2.4
8	OUTPOSTS 57, 7.1	BACKACHE 22, 2.75
9	MURMUROUS 63, 7.0	BEACHHEAD 25, 2.77
10	TORTUOUSLY 72, 7.2	DEFACEABLE 28, 2.8
11	TRUSTWORTHY 81, 7.4	ABRACADABRA 33, 3.0
12	TUMULTUOUSLY 86, 7.2	INEFFACEABLE 38, 3.2
13	UNTRUSTWORTHY 95, 7.3	DECAFFEINATED 45, 3.5
14	UNPRESUMPTUOUS 96, 6.9	CHECKERBOARDED 52, 3.71
15	UNTRUSTWORTHILY 104, 6.9	DECALCIFICATION 56, 3.73
16		NONBIODEGRADABLE 64, 4.0

## TOUCHTONE DIAL WORDPLAY: SLOW AND FAST WORDS

We can apply the same concept to the touchtone dial, but in this case the time is measured as the sum of the distances between successive keys. If we assume unit spacing, then the largest distance we can travel is twice the square root of two (from one corner of the keypad to the other--key 3 to key 7). In the following list the average is normalized by this number so that a maximally-slow word has value 1.0.

5	SERFS 11.3, 1.0	ABACA 0, 0
6	CREPES 13.6, 0.96	DEEDED 0, 0
7	PAPERER 15.8, 0.93	ACCEDED 1, 0.06
8	WHEREVER 17.4, 0.88	DEFENDED 2, 0.1
9	PERFIDIES 20.3, 0.9	BALLOONED 3, 0.13
10	EPEXEGESES 22.6, 0.89	CANNONBALL 3.8, 0.15
11	OVERDRESSES 23.4, 0.83	MONOMORPHIC 4.6, 0.16
12	REVERBERATES 25.5, 0.82	ACCOMMODATED 7.6, 0.25
13	REVERBERATORY 26.1, 0.77	MONOTONICALLY 8.6, 0.26
14	SUPEREROGATORY 26.6, 0.72	VULCANOLOGICAL 9.8, 0.27
15	REVERBERATORIES 30.1, 0.76	TRIGONOMETRICAL 11.6, 0.29

Clearly, the strategy to creating a slow word is to alternate as many times as possible between the 3 and 7 keys. SERFS does this on every letter, thus being as slow to dial as a five-letter word can possibly be.



On the other hand, ABACA and DEEDED are one-key words which achieve maximal speed.

This way of measuring speed on the touchtone phone assumes that we are using one finger, but there is no reason why this needs to be the case. If we use two fingers, we suddenly find that SERFS becomes very fast to dial because we rest our fingers on the two keys and press them alternately. (Arguably, this can be done even faster than repeatedly pressing a one-key word.)

#### TOUCHTONE WORDPLAY: ROW/COLUMN/DIAGONAL WORDS

In this case we seek words that use all the keys (one or more letters on each key) in a row, column, or diagonal of the touchtone phone. There are eight cases, but three of them (top row 2-3, left column 4-7, 5-9 diagonal) have already been considered as two-key words. Telephone word SPELLERS will find that word on the 3-5-7 diagonal. For all triple-key lines, here are the longest words we found:

middle row 4-5-6: NONILLION

bottom row 7-8-9: SYRUPY, TRUSTY, TRYSTS

middle column 2-5-8: CUTBACK, TACTUAL

right column 3-6-9: ENDOWED, MONEYED, WOODMEN

minor diagonal 3-5-7: SLEEPLESS

There are many other ways to dial W for Wordplay. Many forms that involve letter manipulation become infused with new challenges when applied to the telephone and its particular way of organizing the 24 letters of the alphabet into trigrams.