DUDENEY'S LOST WORD-PUZZLE

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Most readers of **Word Ways** are aware that Henry Ernest Dudeney, England's most distinguished puzzleist, was interested in words as well as numbers. Most of his word puzzles appeared in The World's Best Word Puzzles, published in 1925 by the Daily News of London; a few also appeared in A Puzzle-Mine, issued after his death in 1930. Most of these are now available to the American reader in 300 Best Word Puzzles, a 1968 Scribner's publication edited by Martin Gardner.

For a long time I believed that no other Dudeney word puzzles existed. However, a letter that Leigh Mercer wrote to Howard Bergerson on October 16, 1968 mentions a Dudeney word problem appearing on page 79 of Amusements in Mathematics, published in 1917:

> Form three-letter words from the letters A through O, no two letters appearing together more than once. Thus, if ALE is chosen, A and L must not be found together in any other word, nor A with E, nor L with E. Words like Joe, Alf, Flo are not allowed.

Dudeney's answer to his problem was the 21-word set ale, cab, **hag, fan, jam, aid,** oak, **bed, ice, foe, hen, gem, kin, him, jib, fig, oil, can,** hod, jog and **mob.** Note that if the word **jek** existed, all possible vowel-consonant pairs would be represented. In other words, no more than 22 words are theoretically possible if each word must contain both vowels and consonants.

If we decide to use only words having no repeated letters, Dudeney's problem may be restated as follows: using the letters A through O, form as many three-letter words as possible, no pair of which have more than one letter in common.

There is no reason to exclude the letters P through Z from consideration. The maximum possible number of words, each one of which has at most one letter in common with any other word in the set, is 60. Each word is assumed to have three different letters, either two vowels and a consonant, or two consonants and and a vowel.

Why 60 words? There are six vowels (counting Y) and twenty consonants, making 120 possible pairs; each three-letter word, whether it contains one vowel and two consonants or two vowels and one consonant, must use two of these pairs.

Of course, it is difficult to find an actual set of 60 words satisfying these requirements because of the refractory nature of the letter Q. Such a set must contain at least three words with a Q and two vowels, or six words with a Q, a vowel, and another consonant. In addition, certain other vowel-consonant pairs such as ZU, WU, JY and ZY are difficult to find in three-letter words.

If one restricts the words to a relatively small dictionary such as boldface entries in Webster's Pocket Dictionary, it is possible to assemble a set of 53 words, all having at least one vowel and at least one consonant. It is best to start with words using Y as a vowel since there are fewest of these, and continue through U, O, E, I and A:

gym	jut	ohm	vex	zip	adz
pyx	sum	box	fez	fix	wax
sky	dun	jog	jew	jib	cam
why	fur	vow	elk	kid	van
try	lug	lop	beg	gin	lab
fly	cup	oft	sen	his	fag
jay	hue	sod	per	mil	hap
ivy	auk	nor	met	wit	sat
buy			ice		
coy			air		
dye					

The fourteen vowel-consonant pairs not used are QA, QE, QI, QO, QU, QY, ZO, ZU, ZY, XU, WU, VU, KO and NY.

Are 54 words possible? NY is a common vowel-consonant pair; one might hope that another vowel-consonant pair could be selected and these two juggled with the ones already in the 53 words to form a new list of 54 words. However, this is a vain hope. The only Pocket Webster word containing KO is oak, but this shares a K and A with auk, which is the only word containing KU. There are no Pocket Webster words using the other twelve vowel-consonant pairs.

However, there is a simple way to add a 54th word, the all-consonant nth in Webster's Pocket Dictionary.

A similar list can be generated for four-letter words. If one considers only words having no repeated letters, and containing both vowels and consonants, it is theoretically possible to find 40 of them which use up all the 120 vowel-consonant pairs. Words with either three vowels and one consonant or three consonants and one vowel contain three vowel-consonant pairs apiece; however, words with two vowels and two consonants contain four vowel-consonant pairs and should consequently be avoided. Not every mix of three-vowel and three-consonant words is possible; one cannot include more than five of the former, since only fifteen vowel-vowel pairs are available.

Unfortunately, there exist few Pocket Webster words with three different consonants and the vowel Y: whys, hymn, myth, lynx, cyst, sync, drys, plus the plurals of gym and gyp. Of these, at

most three can simultaneously appear in a single list, for example **lynx, myth** and **gyps**. Despite this severe handicap, it is possible to find 30 Pocket Webster words which satisfy the conditions of the problem:

jamb	whiz	josh	chef	surf	myth
czar	jinx	foxy	jerk	hump	sync
vast	pick	bloc	veld	duct	
gawk	bird	monk	went	July	
flap	gift	prow	pegs	bung	
hand	slim				
quai					

The unused 28 vowel-consonant pairs are BE, BY, DO, DY, GO, GY, KU, KY, ME, PY, QE, QO, QY, RY, TO, VI, VO, VU, VY, WU, WY, XA, XE, XU, ZE, ZO, ZU and ZY.

Can **Word Ways** readers find a 31-word list satisfying the Pocket Webster conditions?

No doubt these lists can be enlarged by using more comprehensive dictionaries. One speculates that a maximum list of three-letter or four-letter words is possible using the resources of the Oxford English Dictionary; even then, Q is likely to be the most difficult letter to incorporate.

There is no reason why similar lists cannot be prepared using five-letter, six-letter, etc., words; however, it is likely that the aid of a computer will be required to keep track of the various letter-combinations already used. Better still, the computer might be programmed to carry out the search for suitable lists automatically. Good hunting!

EXTREMELY LONG PALINDROMES

Elsewhere in this issue, Lawrence Levine details the years of work that went into Dr. Awkward & Olson in Oslo, a palindromic novel of some 104,000 letters. Although he hopes to find a commercial publisher, he is willing to sell a very limited number of mimeographed copies to **Word Ways** *readers at $10 apiece, postpaid. If interested, write him at 115 Dory Road, St. Augustine FL 32086.*

Satire: Veritas, a 59,000-letter palindrome by David Stephens that was advertised on the back cover of the May 1980 **Word Ways**, *is still available from the editor in mimeographed format at $5 per copy.*