WORDS ON TRIANGULAR PAVEMENTS

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In an earlier Word Ways article, I constructed a variety of 'hex-word' patterns by inscribing letters in individual hexagonal tiles to form three-letter words for each group of tiles meeting at a common point. This article considers the analogous problem for pavements of equilateral triangles. Six adjacent triangular tiles form a hexagon with rays meeting at a central point; thus, letters inscribed on these tiles can be combined to form six-letter words arranged around this point.

There is, however, an important difference. On the hexagonal pavement, it is always possible to read off each three-letter word by proceeding either clockwise or counterclockwise around the point; in the triangular pavement, this is no longer guaranteed (in fact, only 12 of the 6! = 720 distinct arrangements of six different letters can be read off serially). Unfortunately, the need to transpose the six letters to form a word diminishes one's visual appreciation of the patterns given below.

Triangular tiles can be assembled into larger hexagonal shapes using 6, 24, 54, 96, ... individual triangles. Of these, the first is trivial since any six-letter word can be inscribed in it. The second is of more interest, for it can be filled with 24 different letters of the alphabet (Q and X omitted) to form seven six-letter words in boldface type from the Merriam-Webster Pocket Dictionary, as illustrated at the right (one word is an inferred plural). Can anyone find another set of Pocket Webster words satisfying this pattern? For larger hexagon's, letter-repetition is, of course, necessary; I leave their construction as an exercise for the reader.

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        C     F
   T    N     D
   I    U     E
K   S    R    P
H   W    A    V
   Y    L     M
   Z    O     J
      B     G
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tunics   logjam
refund   blowzy
revamp   whisky
walrus

The following restrictions preserve some degree of symmetry in the solution: (1) use m letters each k times, so that mk = 54, 96, ... , (2) use six different letters in each word, and (3) do not use a word more than once. (For mk = 54, the choices are 18 letters three times apiece, or 9 letters six times apiece.)

I turn now to the problem of forming words on triangular pave-

ments of infinite extent; on these, each letter is used exactly as often as each other, and the same holds true for the words formed from them. In the simplest such pattern, only six different letters are needed and only three different hexagonal patterns are formed. It is easy to see how the pattern of capital letters at the right can be infinitely extended by annexing one or another of the three basic hexagonal patterns; for example, the FAD seen at the

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        D     F
     E     C     A
     F     B     D
  c     A     E
  b     D     F
     e     C
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lower left can be combined with an additional cbe to form a hexagonal pattern identical to the one at the upper right.

Note that all three hexagonal patterns use the same letters; if transposition is allowed, only one word is represented in the pavement. It is of more interest to create three distinct words by insisting that each one be read off clockwise on its own hexagonal pattern. This is equivalent to finding three transposals which can be read off from the letter rings AFEDCB, ADEBCF and ABEFCD. I have been unable to find three such words in Webster's Second or Third Unabridged Dictionary, the closest ones being AMINES, ASIMEN and MANISE (an obsolete Scots spelling of the verb 'menace' in the OED) or NERITA, RETINA and TENIRA (an Algerian populated place in the Times Index-Gazetteer). Can readers improve on these?

The next larger triangular pavement of infinite extent uses 24 different letters to form 12 hexagonal patterns. It appears impossible to fill such a pattern with Websterian words; a little reflection shows that at least six must have only one vowel (counting AEIOUY as vowels) and nine must contain the rare letters X, J or Z (it is wise to eliminate V and Q at the outset, as they are heavy vowel-users). Words such as MUZJIK give a fine start, but there are too few oddities such as these to continue very far into the pattern; most six-letter words with one vowel use up common consonants too rapidly.

Falling back, one can ask if it is possible to use 12 letters, each repeated twice, with the added restriction that each word be different and that it contain no repeated letters. The answer to this is yes, as shown in the pattern at the right containing boldface words from Webster's Second; note that the 24 letters below the line are in certain cases repeated above the line to show the twelve complete hexagonal patterns. (As before, it is easy to see how this pattern extends; for example, ULY can be added to RAT at the lower right to duplicate the TAURYL hexagonal pattern at the upper left.)

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        N     S     T
     I     A     U     Y
     R /   D     N   \ S
  A  / U     Y     O  \ E
  T /  L     R     D   \ N
   / Y     O     E     I \
    S     O     E     I  R
        E     I     A
        N     S     T
        A     U
```

Diurna	noised
Sunday	tylose
snouty	loiter
tauryl	railed
dourly	tisane
yonder	situal

This pattern has a number of intriguing symmetries built into it. Six letters are vowels and six are consonants; the vowels all appear on point-up equilateral triangles and the consonants on point-down equilateral triangles. Each word contains three vowels and three consonants taken from one of the following sets:

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aie    ieo    eoy    oyu    yua    uai
drl    rlt    lts    tsn    snd    ndr
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(These can be summarized by the trigram rings AIEOYU and DRL-TSN.) Each set of vowels appears in exactly two words, the consonants of which are disjoint; for example, AIE is contained in TISANE (with TSN) and RAILED (with DRL).

Although this word group superficially resembles the ones discussed in the May 1977 Word Ways, it does not possess the symmetries of letter-overlap or letter-pairing characteristic of those groups. For example, any one of the 12 words has four letters in common with two other words, three in common with six other words, two in common with two other words, and none in common with the word directly above or below it (for example, SUNDAY and LOITER, or TAURYL and NOISED). Similarly, letter-pairs are unevenly scattered through the group: vowel-consonant pairs appear three times each, but vowel-vowel or consonant-consonant pairs appear four (dr, rl, lt, ts, sn, nd; ai, ie, eo, oy, yu, ua), two (dl, ls, sd, nr, rt, tn; ae, ey, ya, io, ou, ui) or no times (dt, ln, rs; ao, eu, iy) in the same word.

Only one other Websterian-word triangular pavement of this type is known, based on the trigram rings AEIOUY and LDNSTR; can the reader construct it? (The words are given in Answers and Solutions.) Other choices of letters remain unexplored.

NATIVE TONGUES

This is the title of a new (1982) book by Charles Berlitz, published by Grosset & Dunlap for $14.95. I imagine the IQ of the average Word Ways reader is above 125. Now, imagine a Word Ways written for readers with an IQ of about 110. The Kickshaws column of such a magazine would probably resemble this book. (Don't get me wrong; I am not patronizing the book. It is interesting, but it is light reading. I like a book to last me a week, and I went through this one in an afternoon.)

The multi-lingual Berlitz covers a wide range of topics: the origin of alphabets, the development of English, insults and slurs, numbers, strange word origins, and many other common logological subjects (M. Brooke).