WORD GIRDERS

CHRIS COLE
Milton, Massachusetts

On p 160 of *Language on Vacation* (1965), Dmitri Borgmann issued the challenge "For the logophile who feels the urge to explore virgin territory, word girders are just the thing." A word girder is constructed by exchanging letters between a pair of words to form another pair of words. Borgmann lists three 5-letter examples:

```
TAPIR : TOPER     MONAD : MINED     CRONE : CLOSE
MOVES : MAVIS     PILER : POLAR     BLAST : BRANT
```

Borgmann proposes several other conditions: the exchanged letters occur in every other position; the words in each pair share no letters; the words in each pair can be transposed to form a word (PALINDROME in the second example); the exchanged letters are consonants (true in the third example). These conditions will be discussed further below.

In the nearly four decades since this challenge was laid down, few people have picked it up. The longest response in Word Ways was by Tom Pulliam, in the August 1976 issue (p 150). He listed 6-letter girders that satisfy Borgmann's first two conditions:

```
CUTLAS : COTMAN     SUCLAT : SOCMAN     CURPIN : CARBID
BOGMEN : BUGLES     BOGMEN : BUGLET     LAMBED : LUMPEN

BADGER : BUDLET     COLIES : CULMEN     METHOD : MATRON
SUNLIT : SANGIR     TUBMAN : TOBIAS     CAPRIN : CUPRID
```

Pulliam concludes "Dmitri knew well what he was doing when he issued this challenge!".

If we had to guess why this logological form has received so little attention, it is probably because it is so difficult to find any examples. The problem seems to require a search nested within a search, which for a 100,000 word list blows up to 10,000,000,000 pairs. This blow-up in difficulty plagues any search for sets of words that together exhibit some property. Such problems are easy to state but potentially very hard to solve. Word girders are minimal examples of this type of problem, since two is the smallest set of words larger than a single word.

Any form of wordplay has extremal properties that are natural to it. Elucidating these properties is an esthetic issue, so tastes will vary. In the case of word girders, we are looking at extremal forms of letter exchange. One natural extreme is to mix the letters between words as thoroughly as possible. This leads to the condition:

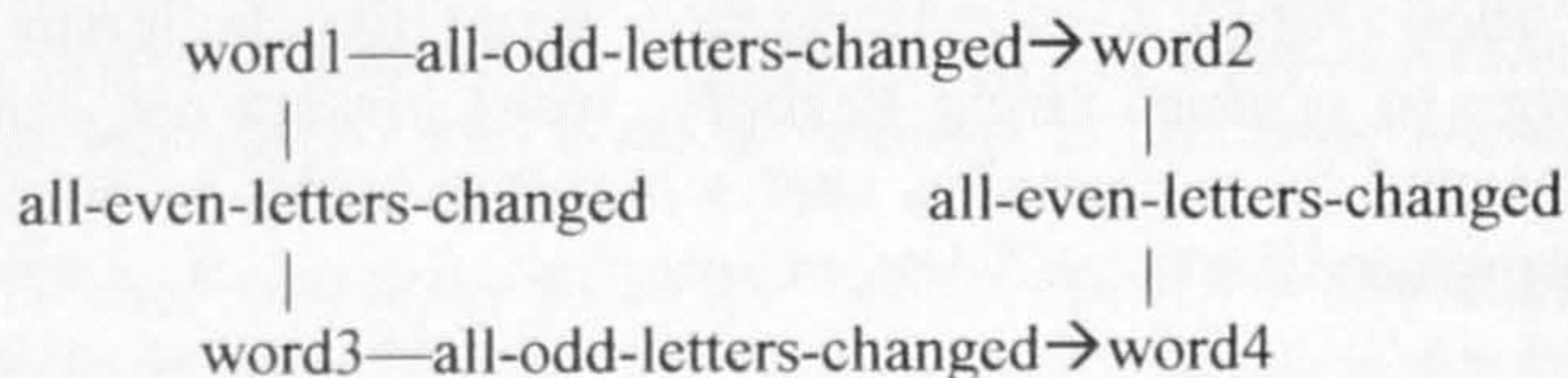**1. The exchanges occur in every other position.**

Since there are two exchanges, a second extremal condition is:

2. In the two exchanges, every letter is changed.

With these two natural extremal conditions, the word girder

        word1 : word2
        word4 : word3

leads to the diagram:

            word1—all-odd-letters-changed→word2
              | |
    all-even-letters-changed   all-even-letters-changed
              | |
            word3—all-odd-letters-changed→word4

If we use a capital letter to represent any letter, and a lower case letter to represent any letter that is not equal to the letter represented by the corresponding capital letter, then we can write down a pattern for each of the words in a word girder formed with 5-letter words:

        ABCDE → AbCdE   ABCDE : AbCdE
          | | abcde : aBcDe
        aBcDe → abcde

The resulting word girder is given above to the right. Thus we see that the words in each pair differ in every position; in other words, they do not crash. This condition was noted by David Morice in the February 1990 Word Ways (p 50).

We can form a 9/8-letter word girder satisfying these two conditions:

        CAVATINAS : CIVETONES
        TIDERODE   : TADARIDA

Unless otherwise noted, all words in this and subsequent girders will be found as closed compounds in Webster's Third. TIDE-RODE is hyphenated.

In his seminal article Borgmann added a third property:

3. The words in each pair have no letters in common.

If we impose all three of these conditions, we can form 7-letter or 7/6-letter word girders:

FINBACK : FUNPARK   BURLAPS : BYROADS   LANTUMS : LONGUES
LUMPERS : LIMBECS   CYTOID : CUTLIP   PORGIE : PARTIM

CYTOID is in the OED. FUN PARK, PORGIE, and PARTIM are found in Chambers.

Borgmann considered two alternative fourth conditions, which in addition to the previous three are satisfied by the following 6-letter word girders:

4a. The letters in each pair can be transposed to form a word.

CAPRID : COPTIS (POMACENTRIDS)   MILDER : MOLGES (PEAR MOLDINGS)
MONTES : MANRED   PONGAS : PINDAR

MANRED is found in Chambers.

4b. The exchanged letters are consonants.

```
GLACIS : GRAVID
PROVED : PLOCES
```

If we drop the first two conditions and keep the third, but require there to be more than a single letter exchanged or the front and back halves switched, we can form the related 9/8-letter girders:

```
LAMPERING : LACKERING      RAMPINGLY : RACKINGLY
DUCKSHOT  : DUMPSHOT       DUCKSHOT  : DUMPSHOT
```

DUCK SHOT and DUMP SHOT are open compounds.

If we require even more mixing, we can form several 8- and 7/9-letter girders:

```
BACKUPED : BOCKINGS   BROCHING : BLACKEYS   BLOCKED   : BLACKINGS
WORMINGS : WARMUPED   FLATKEYS : FROTHING   TRAMPINGS : TROMPED

FLASHING : FLUSHBOX   FLESHING : FLUSHBOX   MILKWORTS : MULCHED
TRUCKBOX : TRACKING   TRUCKBOX : TRECKING   PUNCHED   : PINKWORTS

SHACKLED : SHOCKING   SHACKLED : SHUCKING
TROMPING : TRAMPLED   TRUMPING : TRAMPLED
```

BACK UPED, WARM UPED, FLAT KEYS, FLUSH BOX and TRUCK BOX are open compounds.

If we drop all the conditions but the first, and loosen the first to allow some letters to be left alone, we can form quite a few word girders. If we require that every word is unrelated to every other word, we can form several 9-letter girders:

```
BILLIKENS : BULKINESS    CARMANIAN : CERTATION
DUSKINESS : DISLIKENS    TESTATION : TASMANIAN

GUNRUNNER : GUNBURNER    HEMATOSIS : HAMITESES
OUTBARKED : OUTRANKED    MALINESES : MELANOSIS

MOSTLINGS : MISPLANTS
PIEPLANTS : POETLINGS
```

OUTBARKED is in Funk & Wagnalls. HEMATOSIS is in Random House. MALINESES is in Chambers. MISPLANTS is in the OED. GUNBURNER is an open compound.

If we drop the restriction on related words, we can form a 10-letter girder that still exchanges every other letter:

```
SMELTERMAN : SWEETBRIAR
SWEETBRIER : SMELTERMEN
```