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All issues of, and articles published in, *Word Ways, the Journal of Recreational Linguistics*, may be read and downloaded free of charge at the website Digital Commons @ Butler University: digitalcommons.butler.edu/wordways/

COMMEMORATING THE FIRST THANKSGIVING DINNER: A CELEBRATIONOF NATIVE AMERICAN WORDS

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Four centuries ago, the roots of Thanksgiving first took hold in our American soil. We living today commemorate the solemn dinner, back in the fall of 1621, shared by the Pilgrims of Plymouth, Mass., and the Wampanoag ("Dawnlanders") Indians, the local tribe who generously pulled the fragile Pilgrim colony through their first winter and taught them how to plant corn.

Let's talk turkey about our indigenous, Native American heritage. Suppose you had been one of the early explorers or settlers of North America. You would have found many things in your new land unknown to you. The handiest way of filling voids in your vocabulary would have been to ask the locals what words they used. The early colonists began borrowing words from friendly Native Americans almost from the moment of their first contact, and many of those names have remained in our everyday language:

In a letter that British explorer John Smith wrote home in 1608, he described a critter that the Virginia Algonquians (Powhatan) called a *rahaughcum* or an *aroughcan*, "he scratches with his hands." Over the years the word was shortened and simplified to *raccoon*, one of the very first English words coined in America.

Pronouncing many of the Native American words was difficult for the early explorers and settlers. In many instances, they had to shorten and simplify the names. Identify the following animals from their Native American names:

apossoum (Don't play dead now.)
otchig (How much wood?)
segankw (What's black and white and stinks all over?)

The hidden animals are: *opossum* (Powhatan Algonquian), *woodchuck* (from Ojibwa Algonquian for a weasel-like fisher), and *skunk* (Abenaki Algonquian). To this menagerie we may add the likes of *caribou* (Micmac), *chipmunk* (Ojibwa), *moose* (Abenaki), and *muskrat* (Massachusett *musquash*).

You can expand the lexicon with the likes of food — *squash* (Narragansett), *pecan* (Ojibwa), *hominy* (Virginia Algonquian), *pone* (Delaware Algonquian), *pemmican* (Cree), and *succotash* (Narragansett) — and other ingredients of Native American life: *moccasin* (Narragansett), *toboggan* (Micmac Algonquian), *tomahawk* (Virginia Algonquian), *wigwam* (Abenaki), *teepee* (Dakota Siouan), *caucus* (Virginia Algonquian), *powwow* (Narragansett),

wampum (Narragansett), *bayou* (Choctaw Muskogean), *potlatch* (Nootka), *hogan* (Navajo Athabascan), *hickory* (Virginia Algonquian), *kayak* (Inuit), *parka* (Aleut), *totem* (Ojibwa), *sachem* (Narragansett), *squaw* (Massachusett), *papoose* (Narragansett), and *mugwump* (Massachusett).

If you examine a map of the United States, you will realize how freely settlers used words of Indian origin to name the places where we live. Rivers, lakes, ponds, creeks, mountains, valleys, counties, towns, and cities as large as Chicago (from a Fox word that means "place that stinks of wild onions") bear Native American names. Four of our five Great Lakes — Huron, Ontario, Michigan, and Erie — and twenty-five of our states have names borrowed from Native American words:

Alabama: name of a tribe in the Creek Confederacy, meaning "plant cutters"; *Alaska:* "mainland" (Aleut); *Arizona:* "having a little spring" (Pima); *Arkansas:* named for the Siouan Kansa tribe (Dhegiha Siouan); *Connecticut:* "place of the long tidal river" (Southern New England Algonquian);

Idaho: "enemy" (Kiowa-Apache Athabascan); *Illinois:* "he speaks the typical way" (Ottawa from Miami-Illinois); *Iowa:* "sleepy ones" (Santee Siouan); *Kansas:* named for the Siouan Kansa tribe (Dhegiha Siouan); *Kentucky:* "meadowland" (Wyandot Iroquoian);

Massachusetts: "great hillock place" (Massachusett); *Michigan:* "great water (Ojibwa); *Minnesota:* "milky blue river" (Dakota); *Mississippi:* "large river" (Ottawa); *Missouri:* "wood boat, dugout" (Miami-Illinois);

Nebraska: "flat water" (Omaha Siouan); *North Dakota* and *South Dakota:* "friendly"; "allies" (Dakota Siouan); *Ohio:* "great river" (Seneca Iroquoian); *Oklahoma:* "red people" (Choctaw);

Tennessee: "name of a Cherokee village"; *Texas:* "friends, allies" (Caddo); *Utah:* named after the tribe Ute, "high" (Western Apache); *Wisconsin:* "It lies red," referring to the Wisconsin River (Miami-Illinois); *Wyoming:* "at the big river flat" (Munsee).

Some of our loveliest place names began life as Native American words — *Susquehanna* (Algonquian) , *Shenandoah* (Oneida), and *Rappahannock* (Delaware). Such names are the stuff of poetry. To the poet Walt Whitman, *Monongahela* (Unami Delaware) "rolls with venison richness upon the palate." About the Lenape Indians William Penn wrote: "I know not a language spoken in Europe that hath words of more sweetness and greatness." How fortunate we are that the poetry the First Peoples heard in the American landscape lives on in our American language.

COLLOQUY

In this Issue

The packing of word lists into both grids and crossword networks, especially in an ordered fashion, continues to be a topic of interest to several *Interim* contributors, accounting for about half of the articles in this issue and even finding its way into this Colloquy. But there are other topics herein as well. For one, in a part of the world in which recorded history only goes back about 400 years, the 400th anniversary of any celebrated event is well worth taking notice of, and this year's 400th anniversary of the first Thanksgiving in 1621certainly commands our thoughtful reflection. Happily for *Interim*, **Richard Lederer**, inspired by the occasion, has identified the perfect linguistic topic for this issue's leadoff article, giving us an informed and fascinating discussion of the distinctive, often poetic contributions of Native American languages to modern American English, and especially to American place names. A most appropriate contribution.

In a 2015 article in *Word Ways*, **Susan Thorpe** listed in order the alphanumerical equivalents of the letters in the names of all but a half dozen of the first 92 chemical elements and by judiciously inserting arithmetical function signs between these numbers, somehow produced equations yielding the atomic numbers of the elements concerned. Now, in the article that follows Colloquy, **Darryl Francis** does the same thing with the names of the transuranic elements of atomic numbers 93 through 118, and also, by adding a new mathematical function to the mix, completes the roster of the first 92 element names. Is it just me, or do both Susan's and Darryl's perplexing equations seem to savor strongly of black magic?

In the spruce article that follows Darryl's, **Mike Keith** pulls off an equally incredible feat, managing to construct a crossword puzzle that's solvable in two entirely separate ways. Not only are there two sets of clues to the solution of the puzzle, but each set of clues clues a different word path, with one set clueing words in the familiar horizontal and vertical directions and the other set clueing words that follow a complex path (identified by Mike as a Hilbert curve) which passes through every square in the puzzle (there are no black squares). Thus, every letter in the puzzle is simultaneously a part of at least two different words, and most are a part of three. I'm no authority on crossword puzzles, but I've never heard of one like this one ever having been constructed before. Behold the first crisscrossword puzzle!

How many words in English begin and end with the same four letters in the same order? If you eliminate tautonyms, two-word terms (whether hyphenated or not) and coinages, surprisingly few, it appears. In "Matching Initial and Final Tetragrams," **Jeff Grant** and colleagues have attempted to compile a complete listing of such words; can readers think of any they've missed?

After Jeff's article there commences a string of six straight articles dealing with the packing of word lists. The first two articles explore the grid- and/or crossword-style packings of word lists not previously packed in *Interim.* The first one, "Classical Packings," takes as its subjects several short lists of names gleaned from Classical mythology, while the second article examines ordered crossword-style packings of the names of the ordinal numbers — a surprisingly interesting study, as it turned out, thanks largely to a novel word-packing constraint called "reentrance."
The next two articles, "Packing the State Capitals" and "Packing All 118 Elements," both written by Darryl Francis, explain the author's methodology for his successful grid packings of two very

considerable word lists, the names of the 50 states *plus* the names of their capital cities, and the names of all of the 118 chemical elements. The task is greatly simplified, he points out, if one substitutes numbers indicating word lengths for the words during parts of the packing process.

Following these two articles, Mike Keith has, for the second *Interim* issue in a row, contributed a milestone word list-packing article, this one concerned with the *ordered* packing of word lists in grids. In it, Mike presents improvements to existing ordered packings of the four major word lists previously considered in *Interim* — the cardinal numbers, the chemical elements, U.S. presidents and the 50 U.S. states — plus two new ones, the ordinal numbers and the sequence of digits in the number *pi*, in addition to a number of other new results. Of the many improved packings on display in this article, I'm most impressed by Mike's one-name improvements in the ordered packing of the presidents through Bush 41 in a 17x17 square and the ordered packing of the presidents through Biden in a 19x16 rectangle; I've previously published less-successful versions of both of those packings. The baroque ingenuity of his packings attests to the stubborn determination with which he must have attacked the problem of fitting in those additional two ordered names. Like Darryl, Mike offers task-simplifying advice to packers of large word lists.

After Mike's and Darryl's successes, do any heroic grid-packing challenges remain? One, perhaps: an ordered packing of *all* 118 element names in a 71x13 grid may barely be possible.

In "King's-Move Word Packing," the next article, Darryl Francis updates **Ross Eckler's** 1994 packing of U.S. presidential surnames through Clinton, needing to add only six letters to Ross's packing to accommodate the four additional presidents' names that have accrued since then. Next comes Darryl's second installment of Kickshaws for *Interim*, mostly logological esoterica he's discovered himself, including a new transposal of COPYRIGHT and pairs and triplets of element names which react to form new words (GOLD + IRON → DROOLING), as well as a new highest-scoring single-dictionary Scrabble turn which was recently contrived by **Stuart Klimek**.

Stepping closely on kickshaws' heels comes an article sure to knock your socks dead, **Don Hauptman's** droll new collection of mixed metaphors. Some of these were wild-caught in Don's daily reading, others were deliberately crafted, and all of them give us food for reflection.

Lastly, the delayed second part of my article "The Great Brain Robbery" attempts to understand how it came about that three articles on the history and perceived poetics of palindromes, which had been copied directly from a master's thesis written by **Gary Coen**, had been published, without Coen's knowledge and misattributed to **Dmitri Borgmann**, in *Word Ways* in 1979 and 1980. The most likely explanation, improbable as it may at first sound, is, I believe, that there was no premeditation involved in the genesis of this long-undiscovered misrepresentation; rather, it was more a case of arrant egotism, miscalculation, human error and human frailty combining with just the right circumstances to bring about a perfect snafu.

Minimal Pangrammatical Grid Packings

The smallest "interesting" rectangular grid (i.e., one whose sides are all at least three cells in length) that can be packed pangrammatically is one whose cell dimensions are 9x3. An indiscriminate pangrammatical packing of such a grid would not be too difficult, but an ordered one would of course be more so. Let's specify that the order of such a packing should be the order of

the words in a 27-letter pangrammatic sentence; the challenge then is to find or manufacture such a sentence which is also packable in ordered fashion in a 9x3 grid.

Here is one attempt to do so. This 26-letter pangrammatic sentence of unknown authorship once appeared in the *Guinness Book of World Records*:

Veldt jynx grimps waqf zho buck.

(All of those words are listed in Webster's Third; to "grimp" means to climb, and a "zho" or dzo is the offspring of a cow and a yak.) From this sentence can be derived the packable 27-letter pangrammatic sentence

Veldt jynx, a waqf's zho buck grimp!

which can be packed in either (a) an ordered (i.e., boustrophedon) or (b) a more readable fashion:

a.

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

b.

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

Which at least shows that the thing can be done, however strangely.

More difficult of solution is this question that I posed in an article in the August *Interim*: What is the least number of *words* needed to pangrammatically pack any regulation rectangular grid? In my article I opined that it seemed unlikely that three nine-letter English words that had only one repeated letter among them could be found to pack a 9x3 grid, but that it might well be possible to find four seven-letter words having just two repeated letters among them to pack in a 7x4 grid. That was probably too optimistic a guess, as no entirely adequate four-word solutions have been brought to my attention. **Stuart Klimek** did, however, find several pangrammatic solutions of five six-letter words packed into 6x5 rectangles; here is one of them:

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

But if five words is indeed the minimum number of words needed to pangrammatically pack a regulation grid, is five words that include four repeated letters necessarily the best possible solution? In my August article I lacked the space to point out that there are actually several ways in which regulation grids might be packed with groups of four or five words. A four-word solution to the problem could not only be packed as four seven-letter words in a 7x4 grid, but also as two nine-letter words and two shorter words in a 9x3 grid, and a four-word solution consisting of four eight-letter words in an 8x4 grid may be feasible. Five-word solutions could consist of five six-letter words in a 6x5 grid, of three seven-letter words and two shorter words in a 4x7 grid, of two nine-letter words and three shorter words or one nine-letter word and four shorter words in a 9x3 grid, or of seven five-letter words in a 5x7 grid. Note that the different grids have different

numbers of repeated letters, and if two solution grids have an equal number of words but an unequal number of repeated letters, it seems reasonable to say that the grid having the fewer repeated letters is the better solution. For now, the above solution is the only published one.

The Electronics Color Code

Another grid-packing question I asked in my August article was whether or not the electronics industry's ten numbered resistor color names, which can be packed in a 7x7 grid, can be so packed in ordered fashion. Mike Keith informs me that it is mathematically provable that they cannot be so packed.

Crossword-Style Packings of Familiar Planet, Continent, Ocean, Lake and Island Names

I want to correct an oversight in my article "Divers and Sundry Packings" in the August 2021 *Interim*. In it, I presented a 13x4 grid packing of the solar system planets, including Pluto, which I'd supposed was novel, but which wasn't; Ross Eckler, in his May 2004 *Word Ways* article "Planet Packings in Two Dimensions," published essentially the same packing. I apologize for not having remembered Ross's prior 13x4 planets-packing sooner.

In the same article, Ross exhibited a crossword packing of the **nine planets** which could be fitted into a 10x10 square; it's shown at center below (with the "UN" of "SUN" added by me; now it's a solar system packing, not just a planets packing, and Pluto has a place in it). Prior to that, I'd displayed in the "Kickshaws" dept. of the November 1998 *Word Ways* (p. 307) a slightly larger 12x9 crossword packing of the planets, the sun, the moon and the universe, which is reproduced at left below. And subsequently, in my article "Plane Earth Planet Packing" in the February 2005 *Word Ways*, I published two versions of a 7x12 crossword packing of the eight planets plus the sun and Pluto, one of which is shown at right below:

```
  U N I V E R S E
        A
V E N U S   M A R S
    E   A   E   T
J U P I T E R   H   P
    T   U   C       L
    U   R   U R A N U S
S U N   N   R       T
    E       Y   M O O N
```

JP, 12x9, 1998

```
V
E A R T H     S
N             M A R S
U R A N U S   T   U
S     E       U   N
  J U P I T E R
      T       N
  P L U T O
      N
    M E R C U R Y
```

ARE, 10x10, 2004

```
M E R C U R Y
A       R
R       A
S U N   N   S
        U   A
V E N U S   T
    E       U
J U P I T E R
    T       N
P L U T O
    N
    E A R T H
```

JP, 7x12, 2005

I excavate these somewhat elderly planet packings from the depths of the *Word Ways* archives in order to remind everyone that it's been a while since any of them have been improved upon, even though there's one less planet name to deal with now than there used to be.

In contrast, no one that I know of has until now published crossword-style packings of the familiar names of the **seven continents** and **five oceans** of our own planet. Those below may or may not be minimal-area crossword-type packings of those word lists, but even if they are, that would not, in my opinion, be their main point of interest. What *would* be is the fact that both of these

short, topically-related lists of names can be packed in crossword patterns that form three closed rectangles (or "boxes"), consisting in both cases of a larger rectangle enclosing two smaller ones. It's a bit surprising to find that the names of both the continents and the oceans can be so packed, it being unusual to find even one uncontrived list of so few words that can form more than one box when packed in crossword fashion.

```
N O R T H A M E R I C A          A R C T I C
          F   U       U          T       N
          R   R       S          L       D
          I   O       T      P A C I F I C
A         C   P       R          N       A
S O U T H A M E R I C A    S O U T H E R N
I                     L          I
A                     I          C
    A N T A R C T I C A
```

A familiar list of geographical names which can form one, but not two, boxes in a crossword-type packing is that of the names of North America's **five Great Lakes** (below, left):

```
  H       M   E            O   M
S U P E R I O R          H A W A I I
  R       C   I            H   U
  O       H   E        K A U A I
O N T A R I O
          G
          A
          N
```

The names of the **Hawaiian Islands**' four largest islands — Hawaii, Maui, Oahu and Kauai — can form a box by themselves in a crossword packing (above, right). With the names of the four smaller islands in the group — Molokai, Lanai, Niihau and Kahoolawe — left to work with, can a second box be added to that packing?

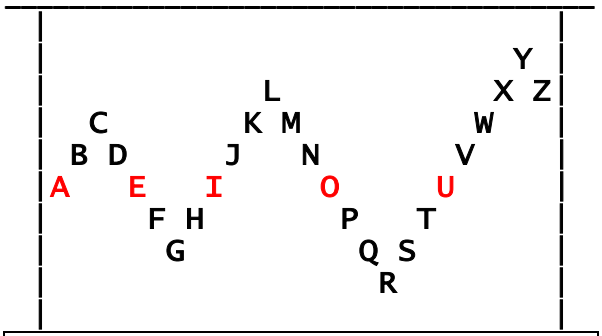
Looking abroad for likely groups of geographical names for such crossword–style packings, we note that the **four main home islands of Japan** — Honshu, Hokkaido, Kyushu and Shikoku — have many letters in common, and sure enough, these names *can* form a stylish one-box crossword packing resembling two crossed framing squares, or perhaps a shipping company's logo.

```
          S
          H
          I
      H O K K A I D O
      O   O
      N   K
K Y U S H U
      H
      U
```

Vowel Play

As the letters-to-the-editor department of a journal that combines serious studies with recreational writing, it is probably not surprising that Colloquy occasionally receives what might be termed "indeterminately serious" correspondence. Take, for instance, this email from a Professor M----, who writes in part:

"…To my utter astonishment, I noticed that when the alphabet is written in a zigzaggedy line such as the one below, in which the first five straight-line segments increase in letter length from left to right one letter at a time — three, four, five, six, seven — the five main vowels line up horizontally! Aha! At last, the hidden logic behind the puzzling distribution of the main vowels in the alphabet becomes apparent — there exists a Periodic Squiggle of the Alphabet, one level of which is reserved for the pure vowels! On the basis of this pattern, we can confidently predict that if and when at least three more letters are added to the alphabet after Z, the third one, the 29th letter, will be the alphabet's sixth pure vowel. However, I predict that it will be unstable, quickly decaying to a Y, four As and several asterisks before it even gets past the uvula…"



The Periodic Squiggle of the Alphabet

The professor's report of his recent epiphany is passed along without comment. For further reading along these lines, Solomon Golomb's article "The Periodic Table of the Alphabet" in the August 1968 issue of *Word Ways* is recommended.

Our Next Issue

We continue to hope that some better-set-up successor wordplay journal can be launched sometime soon, but in any event a fifth issue of *Interim* will definitely be published in February of 2022 on or around Groundhog Day, which is on 2/2/22. (No, that day's not a TUESday, but don't be too disappointed**;** only three weeks later, an even better "Twos Day", 2/22/22, *will* fall on a TUESday.)* The deadline for submissions for February's issue will be 1/22/22 at 1:22:22 p.m., give or take a second. Thanks to anyone who contributed to any of *Interim's* four issues in 2021, and may all of you have a happy holiday season!

*The "Twos Day" which will occur next February is, incidentally, a rare occasion. The next 2/22/22 will not occur until February 22, 2122, and that day is a Sunday. The next *double* "Twos Day" — a "Twos Day" that falls on a Tuesday — after next February's will be Tuesday, February 22, 2422, three centuries hence. Next year's rare "Twos Day"–Tuesday coincidence has so far been noticed and reported, I believe, only here and only just now, in *Interim* — where else?

MORE ELEMENTARY EQUATIONS

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I was thumbing through a 6–year–old issue of *Word Ways* recently – the November 2015 issue (volume 48, number 4) which carried an article by the late Susan Thorpe, Elementary Equations. In her article, Susan showed how to derive the atomic numbers of elements using the alphabetical values of their letters and the mathematical functions of addition, subtraction, division, multiplication and square root (+ – ÷ x √). The first element on her list was **HYDROGEN**, and here's how she derived its atomic number of 1:

(8 + 25 – 4 – 18) ÷ (–15 + 7 + 5 + 14) = 1

Susan offered examples for all the elements except ZINC, TIN, XENON, GOLD, LEAD, and RADON, all of which had obviously proved very difficult to find solutions for. A solution for ZINC was offered in the succeeding issue (February 2016; volume 49, number 1).

Susan's article stopped at element number 92, leaving solutions required for the 26 transuranic elements with atomic numbers 93 to 118. Here are solutions for those elements:

NEPTUNIUM	**14 + 5 + 16 – 20 + 21 + 14 + 9 + 21 + 13 = 93**
PLUTONIUM	**((16 – 12) ÷ √(√(21 – 20 + 15))) + (14 – 9) x 21 – 13 = 94**
AMERICIUM	**–1 + 13 – 5 + 18 + (9 x 3) + 9 + 21 + 13 = 95**
CURIUM	**–3 – 21 + 18 + √9 x (21 + 13) = 96**
BERKELIUM	**2 + (5 x 18) + 11 – 5 – 12 + √9 + 21 – 13 = 97**
CALIFORNIUM	**(3 + 1) x 12 + (9 x 6) – 15 –18 – 14 + 9 + 21 + 13 = 98**
EINSTEINIUM	**5 + √9 + 14 – 19 + (20 x 5) + 9 – 14 + 9 – 21 + 13 = 99**
FERMIUM	**–6 + 5 + 18 + (13 x 9) – 21 – 13 = 100**
MENDELEVIUM	**13 + 5 + 14 + 4 + 5 + 12 – 5 + 22 – √9 + 21 + 13 = 101**
NOBELIUM	**14 + (15 x 2 x 5) – 12 – (√9 x 21) + 13 = 102**
LAWRENCIUM	**12 + 1 + 23 + 18 – 5 + 14 + 3 + √9 + 21 + 13 = 103**
RUTHERFORDIUM	**18 + 21 + 20 + 8 + 5 – 18 + 6 + 15 – 18 + 4 + 9 + 21 + 13 = 104**
DUBNIUM	**(4 x 21) + 2 + 14 – √9 + 21 – 13 = 105**
SEABORGIUM	**19 + 5 + 1 – 2 + 15 + 18 + 7 + 9 + 21 + 13 = 106**
BOHRIUM	**(2 + 15) x 8 – ((18 ÷ 9) x 21) + 13 = 107**

HASSIUM	**8 – 1 – (19 ÷ 19) + √9 x (21 + 13) = 108**
MEITNERIUM	**13 + 5 – 9 + 20 + 14 + 5 + 18 + 9 + 21 + 13 = 109**
DARMSTADTIUM	**((√4 + 1) x 18) + 13 – 19 + 20 + 1 + 4 + 20 + 9 + 21 – 13 = 110**
ROENTGENIUM	**18 – 15 + 5 + 14 + 20 + 7 + 5 + 14 + 9 + 21 + 13 = 111**
COPERNICIUM	**(3 x 15) + √16 x (5 + 18) – 14 – 9 – 3 + 9 – 21 + 13 = 112**
NIHONIUM	**–14 – (9 x 8) + (15 x 14) – √9 – 21 + 13 = 113**
FLEROVIUM	**–6 + 12 + (5 x 18) + 15 – 22 – 9 + 21 + 13 = 114**
MOSCOVIUM	**(13 x 15) + 19 – (3 x 15) + 22 – (√9 x 21) – 13 = 115**
LIVERMORIUM	**(12 x 9) + 22 – 5 + 18 + 13 – 15 + 18 – 9 – 21 – 13 = 116**
TENNESSINE	**(20 x 5) + (14 ÷ 14) + 5 + (19 ÷ 19) – 9 + 14 + 5 = 117**
OGANESSON	**(15 x (7 + 1)) – √(14 – 5) + 19 – 19 + 15 – 14 = 118**

Returning to the problem of finding solutions for TIN (50), XENON (54), GOLD (79), LEAD (82) and RADON (86). I decided to widen the range of mathematical symbols by allowing the use of the decimal point and the factorial sign (**!**). I hoped that 4! and 5! might prove useful, and that a decimal point might be a handy way of division by 10 without actually using the number 10. GOLD then succumbed quite easily using the factorial sign:

GOLD	**7 + (15 – 12) x 4! = 79**

Use of the factorial sign and decimal point didn't help me find solutions for the remaining elements TIN (50), XENON (54), LEAD (82), and RADON (86). I then decided to add a further symbol. In the world of mathematics there's a square brackets symbol indicating 'the integral part of'. For example, writing [13 ÷ 4] means calculate 13 divided by 4, and then take the integral part of the result – thus, [3.25] is 3. This additional symbol allowed me to devise further solutions:

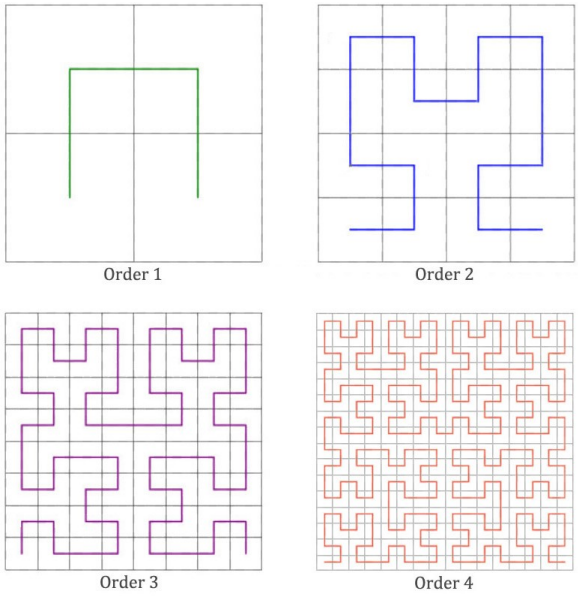
TIN	**[√20] x 9 + 14 = 50**
XENON	**24 + 5 x [√14] + (15! ÷ 14!) = 54**
LEAD	**[12 x (5 – .1 + √4)] = 82**
RADON	**[(18 + 1) x 4 – √15 + 14] = 86**

That's it, all elements conquered! But if you can find better solutions, or solutions without the the factorial sign, the decimal point or the integral–part–of square brackets, please tell the editors.

A HILBERT CURVE CROSSWORD

Mike Keith

The crossword puzzle presented on the next two pages was inspired by the mathematical object known as the Hilbert space-filling curve. As shown at right, it is created by an iterated procedure. Each iteration (or "order") of the curve is created from four half-size copies of the previous order placed in the corners of the new grid, with the bottom two rotated by 90 degrees (one clockwise, the other anticlockwise), then joined with three unit-length connector lines. When iterated an infinite number of times, the resulting one-dimensional curve has the surprising property of visiting every point in the two-dimensional square, so it is "space-filling".



The order-1 curve visits each square in a 2 x 2 grid, the order-2 curve fills a 4 x 4, and so on. The 16 x 16 grid filled by the order-4 curve is nicely similar to the common crossword size of 15 x 15, so we used the order-4 curve as the basis of our puzzle.

In a Hilbert crossword, in addition to Across and Down words there are also "Hilbert words", whose letters are placed in order along the Hilbert curve (which starts in the lower left corner of the square and finishes at lower right). We imposed a requirement that the entire Hilbert curve must be completely filled with a sequence of adjacent clued answers, which all by itself fills in the whole 16 x 16 grid with letters. By liberally adding Across and Down clues we can ensure that there are no, or very few, "unchecked letters" (letters that are only included a single answer) in the puzzle. We could have completely prohibited unchecked letters but we allowed a few here and there in order to make some clues and answers more interesting. On the flip side, there are some *doubly-checked* letters in the puzzle (letters shared by an Across, Down, *and* Hilbert word), a feature which cannot occur in an ordinary crossword.

Notes on the puzzle format. For convenience, each clue number in the grid has markings to indicate whether an Across, Down, or Hilbert answer starts in that square. A dot to the right of the number means Across, a dot below means Down, and a box around the number means Hilbert, and these markings can be combined (for example, 18 is both Across and Hilbert). As an additional aid to the solver, the Hilbert curve's path and direction are shown using a series of gray arrows.

The end of each Across/Down answer is indicated by a black bar after the last letter. The answer length for each Hilbert clue (and its breakdown into multiple words, if relevent) is shown in parentheses at the end of the clue. As is customary in American crosswords these days, Across and Down answers may be multiple words without this being mentioned in the clue.

ACROSS

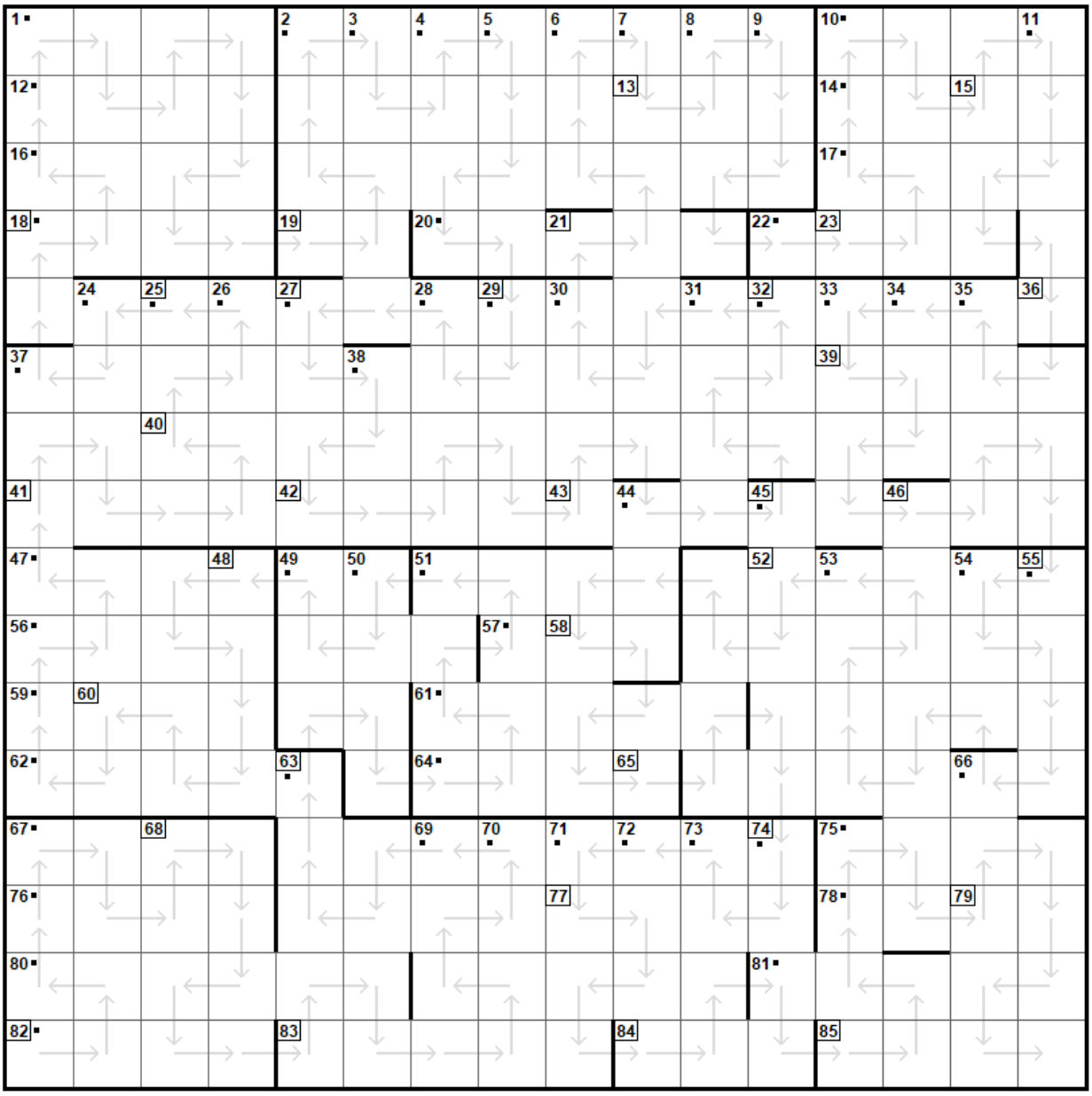
1 Country in the Middle East...or in Romania?
10 Send racy SMS message
12 ___ your way (navigate sloppily)
14 Consumer of hi-tech or drugs
16 ___ Cabell, Houston Astros, ’72 to ’86
17 “Jaws” boat
18 Part of bird or building
20 Follows “general” or “department”
22 Sing jazz nonsense
47 Cervine lodge members
51 Biblical father of giants (Numbers 13)
56 Biblical victim
57 Throwing this is actually a thing nowadays
59 You can do this to anything but a fish
61 ___ Us (multiplayer video game)
62 Sneezy little brats?
64 Key refractor component
67 Green bean capital?
75 Green or black drinks
76 Bird from the internet?
78 Therefore, to Tiberius
80 Popeye, e.g.
81 Sometimes this has an attachment
82 Some wizards’ buttery quaff
83 Rice-Oxley band
84 Offensive event, 1968
85 Eat fancily

DOWN

2 Actor Kapoor
3 Molybdenum, e.g.
4 Murdoch’s eye part?
5 Is unable
6 Bug a horse?
7 Make excessive demands on
8 After-tax trap?
9 Geological period
11 Dis passionately
24 Caffeine result
25 Gin ___
26 On the ___ (accurate)
27 Tittles companions
28 Teller of porkies
29 Discontinue
30 Type of car or machine
31 ___ fail
32 Smells like a church seat
33 On an even ___
34 Queenly const. in the sky
35 Not a door?
37 Neon sign in window of Paleo restaurant?
38 Coder’s whole number
44 He got likes in the ‘50s
45 Soupy of yesteryear
46 CDCDCDCDCD player
49 It often bids welcome
50 “Power ___” (political move)
51 Obsessive, finicky
53 Like eyes, or morning
54 Squid in Suzuka
55 He played Prefontaine
63 Australian actor Sarah
66 Start wrestling
69 Locale of 4 Down
70 After for or love, sadly
71 Point in a network
72 Beware of a bear if you do this in Winter?
73 ZIP word
74 Guitar concern?

HILBERT

13 Highly respects (9)
15 Removes, as a tooth (8)
18 Hedonist’s trifecta (4, 5, 3, 4)
19 Devotee of lands south of the United States (5, 11)
21 Pizza herb (7)
23 Parties hard (8)
25 Norway coast feature (5)
27 This connects two moving parts (5)
29 Baroque Bic (5)
32 Flower girl tossings
36 “Borrow” a plane (6)
39 Bob Ross tool (5)
40 Western U.S. National Park (4)
41 3/4 tunes (7)
42 Gibraltar, e.g. (6)
43 Like some relationships (5)
45 Phone gesture (5)
46 Catches (5)
48 Key Halloween costume? (8)
52 North Pole location? (6)
55 Valley girl’s summary of 2020? (4, 7, 5)
58 Between Iodine and Caesium (5)
60 Like a Jenga tower (8)
63 NEAT LAMBS, e.g. (9, 7)
65 Wise folk (5)
68 More macho (7)
74 Big 2013 musical (6)
77 Rust, e.g., chemically (5)
79 Tesla non-issue (8)
82 Bruter (9)
83 K-pop? (6, 10)
84 2020 palindromic film (5)
85 C ÷ π (8)



Solution on page 236

MATCHING INITIAL AND FINAL TETRAGRAMS

Jeff Grant

Australian wordsmith Anil* has researched ‘overlapping synonyms’, pairs such as arreSTop and chooSElect. He coined the term ‘overlapping selfies’ to describe words which begin and end with the same set of letters, for example:

2 Letters **CH**UR**CH**, **IC**ON**IC**, **KE**EPSA**KE**, **OR**AT**OR**, **TO**MA**TO**
3 Letters **BED**AU**BED**, **HOT**S**HOT**, **MIC**ROCOS**MIC**, **TOR**MEN**TOR**

Here is an A-Z collection of words beginning and ending with the same **four**-letter sets (plus a few fives). Tautonyms like **BERIBERI** and **LAVALAVA** are not permitted, neither are hyphen-ated or two-word terms such as **EVEN**-ST**EVEN**, **NINE**TY-**NINE** and **JEAN** VAL**JEAN** (the pro-tagonist of Victor Hugo’s 1862 novel *Les Miserables*). My thanks to Darryl Francis and Anil for their contributions. Additions and improvements are welcome. [* Anil can’t contribute to *Interim* for now 'for technical reasons’.]

ABRACAD**ABRA** a magic word; gibberish [ChD]
ARCHMON**ARCH** chief or main ruler. **ARCH**PATRI**ARCH** and **ARCH**PHYL**ARCH** are also listed [Web2]

BLESSA**BLES** those that may be blessed, especially in ‘hopeless **blessables**’ [Net]
BETHUM**BETH** archaic or poetic third person singular present indicative of the verb ‘bethumb’, to wear or soil with the thumbs [Web2].

CALLIGRAPHI**CALL** early variant of ‘calligraphical’, of a beautiful literary style [OED, calligraphical, 1630 quot.]

DESTROYE**DEST** archaic for ‘destroyed’. [many Net citations]
‘Power that **destroyedest** Original Sin’ [*Collected Works*, T Carlyle, 1869 (Net)]
DIASCOR**DIAS** variant of ‘diascordium’, an old medicine. [Net]

ESSEN**ESSE** a palindromic nonce-word for ‘essence’ used by James Joyce in *Finnegans Wake* (1939)
ELLEM**ELLE** small town SW of Liege in Belgium [Geo]

FINGERSNIF**FING** sniffing one’s fingers; ’So we’ll leave you with an image of **fingersniffing** ladykilling Funk…’[1947project.blogspot.com, 12 Mar 2006 (Net)]
FREEZE**FREE** frost-free, usually hyphenated [Net]

GALEN**GALE** variant of ‘galingale’, the aromatic root of certain plants of the ginger family, formerly used in medicine and cooking. [ChD]

HISTORIOGRAP**HIST** another name for a historian [Net quots.]
HOODLUM**HOOD** the domain of hoodlums
’The flower and chivalry of American **hoodlumhood** passed before Pat’s eyes.’ [*The Tax Dodgers*, E Irey, W Slocum, 1948, p40]

ICKYLICKYST**ICKY** unpleasantly sticky [OED]
INTERSPL**INTER** between bone splinters, eg '**intersplinter** diastasis' [Net]

JIGGA**JIGG** a song by 'Lone Pigeon' [Net]
JACKA**JACK** a song by Paul Lightfoot [Net]

KINGMA**KING** the act of appointing a king or other person of authority, chiefly by political influence [OED]

LESSON**LESS** without a lesson or lessons
'To one man it [Nature] is **lessonless**, while to another,…full of meaning.' [*Systematic Human Physiology*, *Anatomy & Hygiene*, T S Lambert, 1865, p408]
LITERA**LITE** one who takes everything literally, a literalist
'Nitpicking but IMO [in my opinion] worth it given the number of **literalites** present.' [arstechnica.com, 30 Dec 2008 (Net)]

MUCKY**MUCK** Canadian slang, a person who is or looks very important [CED]
MENTION**MENT** a fancy form of the noun 'mention'
'The miff had its genesis in **mentionment** to you by them of the great black horse.' [*Snow White*, D Barthelme, 2013, p166]

NEUROPRE**NEUR** an entrepreneur in neurotechnology
'We can't all be Zucks, but we can be **neuropreneurs**.' [medium.com, 11 Nov 2015 (Net)]

OVERC**OVER** to cover up; to cover over completely [OED]
OVERH**OVER** and **OVER**L**OVER** are in Web2
OUTSH**OUTS** shouts louder than [Web3]

PIMPERLIM**PIMP** a conjurer's magical powder [Web2]
POLYO**POLY** a market situation where there are no large sellers but many small ones [Monash Marketing Dictionary, www.monash.edu (Net)]

QUADS**QUAD** quad-biking enterprise in Arana, Canary Islands [Net]
QUINA**QUIN** a surname recorded many times on Facebook [Net]
QINGLONG**QING** town in Yunnan province, SE China [Geo]

RESTO**REST** as in 'thou **restorest**', archaic second person singular present form of 'restore' [yourdictionary.com (Net)]
RINGWEA**RING** wearing a ring or rings; 'Roman fashion in **ringwearing** passed through several stages.' [*Catalogue of Engraved Gems*, G Richter, 2006, pXIX]
ROOFIEP**ROOF** (hopefully) safe from roofies, date-rape drugs
'Or bring a **roofieproof** sippy top for your drink.' [imgur.com, 22 Oct 2015 (Net)]

SINGULARI**SING** making singular [ChD]

TRINI**TRIN** nitroglycerine, as a treatment for angina [ChD]
TRICEN**TRIC** based on three centres [Wikt]

URICOS**URIC** promoting the excretion of uric acid in urine [CED]
UNDERGRO**UNDER** a member of an underground group [CED]

VERSELO**VERS** lovers of poetry, compare ‘versemaker’ [OED]
‘Talking of Julie, **verselovers** are strongly advised to invest in her new book of poems.’ [rikfiles.blogspot.com, 3 Jul 2006 (Net)]
VILLER**VILLE** a community in the Normandy region, France [Geo]

WISHTON**WISH** the North American prairie dog [ChD]
WISECRACK**WISE** with reference to wisecracks (gibes, jokes)
'Unamused, [he] …suggested that the commentator hold his fire **wisecrackwise**.’ [Pre-Code Hollywood, epdf.pub (Net)]
WINGBO**WING** displaying a ‘wingbow’, defined in CED as 'a distinctive band of colour marking the wing of a bird.’ ’The **wingbowing** is also characteristic of pomarina (eagle)’ [Net]

XIANG**XIAN** a town in the Guanxi region, southern China [Geo]

YESTERDA**YEST** awkward comparative of ‘yesterday’; old-fashioned, out-of-date
‘Yesterday U at its most **yesterdayest**!’ [www.insidesocial.com, 2 Oct 2015 (Net)]

ZINGANI**ZING** from **Zing**a + galv**anizing**; Zinga is a film galvanizing system.
‘Recent tests show that **zinganizing** the coated steel rebars before assembly… has at least twice the corrosion protection.’ [www.tagroup.com (Net)]

References
CED *Collins English Dictionary* online, 2021
ChD *Chambers Dictionary*, 13th ed., 2014
Geo geonames.org, US Board on Geographic Names
Net Internet, using Google search program
OED *Oxford English Dictionary* online, 2021
Web2 *Webster’s New International Dictionary*, 2nd ed., 1961
Web3 *Webster’s 3rd New International Dictionary*, 1976
Wikt Wiktionary, online dictionary (Net)

*Editor’s Note: I found **OUTSCOUTS** is in Web3, and **GEST**ICULATIN**GEST**, **GEST**URIN**GEST** and **RING**MASTE**RING** might be acceptable inflections of common words.*

CLASSICAL PACKINGS

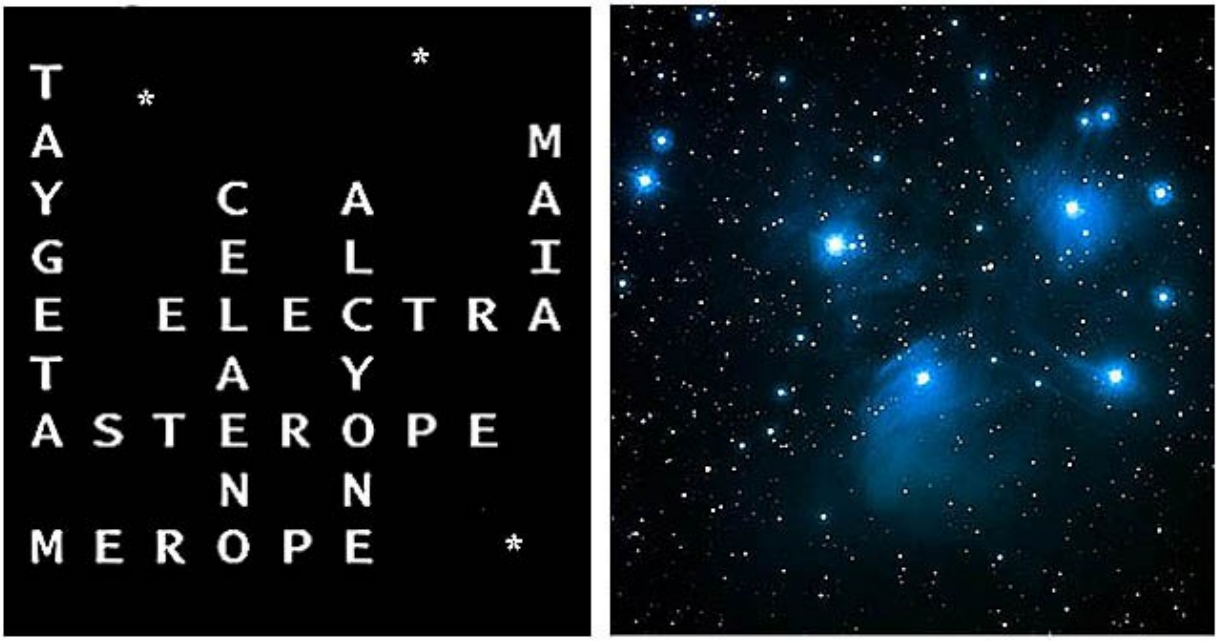
JIM PUDER

This article utilizes in either crossword- or grid-type packing efforts four lists of names that have in common the fact that they are all the products of Greek or Roman mythology. One list names the seven Pleiades, another the nine Hesiodian Muses, the third the twelve constellations of the zodiac and the fourth the twelve Great Gods of the Roman pagan pantheon. The Pleiades and the Muses share the further distinction that they were both, in classical mythology, all-sister groups.

The Seven Sisters

For reasons which are neither agreed upon nor very plausible, the seven daughters of Atlas and Pleïone (a daughter of Oceanus and Tethys) were said by the ancients to have been placed in the sky by Zeus, where they came to be known as the Pleiades (after their mother), or, more commonly, as the Seven Sisters. In his book *Skywatching* David H. Levy describes the astronomical Pleiades as an open star cluster of more than 500 stars about 410 light years from earth. According to Levy, the seven brightest stars in the cluster, in decreasing order of brightness, are **Alcyone, Maia, Asterope** (a double star), **Taygeta, Celaeno, Electra** and **Merope**. (Two frequent spelling variants are "Sterope" for Asterope and "Taygete" for Taygeta.) These are the names of the Seven Sisters stars said to be visible to the naked eye from earth.

The total number of letters in the names of the Seven Sisters is either 45 or 46 (depending upon whether one prefers ASTEROPE or STEROPE), totals which do not permit their packing in an artistic grid. It is nonetheless possible to array them in a pleasing three-box crossword-type packing as shown at left below. (At right, the four brightest stars of the Pleiades' celestial namesakes seem arrayed in accordilng to a simi-



lar orthogonal plan.) Can these seven names be packed in an any more compact crossword array than this 9x9 square?

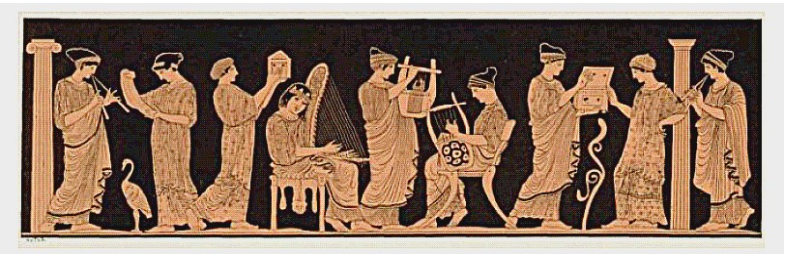
An *ordered* crossword-type word list packing has not previously, to my recollection, been published, but such packings are certainly feasible, given an amenable word list. By "amenable" I mean an ordered word list in which each word in the list has at least one letter in common with the word before it in the list, if there is one, and another letter in common with the word after it in the list, (if there is one). The brightness-ordered list of the names of the seven brightest stars of the Pleiades happens to be such a list, and shown below is an ordered crossword packing of it (recall that their luminosity-based ordering is ALCYONE – MAIA – ASTEROPE – TAYGETA – CELAENO – ELECTRA – MEROPE):



Is this 13x8 crossword packing of the Pleiades is the most compact *ordered* one possible?

The Muses

The nine muses were said to be the daughters of Zeus and Mnemosyne (Memory). Their names and number may have been first set forth by the late eighth century B.C. poet Hesiod, although specific arts were apparently not assigned to them until much later. In listing their names, I follow the spellings given in Edward Tripp's *Dictionary of Classical Mythology*: **Calliope, Cleio, Erato**, **Euterpe**, **Melpomene**, **Polyhymnia**, **Terpsichore**, **Thaleia** and **Urania**. (Common variant spellings include **Clio**, **Polymnia**, **Thalia** and **Ourania**.) The total number of letters in Tripp's list of the names of the Muses is 68, a number which yields only one grid usable for packing purposes, a 17x4 rectangle. I found that this grid is indeed exactly packable with those nine names, and one version of such a packing is shown at the top of the next page.



C	A	L	L	I	O	P	E	M	E	L	P	O	M	E	N	E
C	L	E	I	O	E	R	A	T	O	E	U	T	E	R	P	E
P	O	L	Y	H	Y	M	N	I	A	T	H	A	L	E	I	A
T	E	R	P	S	I	C	H	O	R	E	U	R	A	N	I	A

A crossword-type packing of these names would doubtless also be possible, but given that their list is not an ordered one, it would probably not be especially interesting.

The Constellations of the Zodiac

The 77 letters of the names of the constellations of the zodiac do not engender any fully packable grids, but crossword-type packings, with their greater openness, seem a more fitting way to array constellations in any case. Here's a fairly compact, non-ordered packing of the zodiacal zoo:

```
L E O           C
I   S A G I T T A R I U S
B       E       P
R   T   M   A R I E S   V
A Q U A R I U S   I       I
    U   N       C A N C E R
S C O R P I O     O       G
    U             R       O
  P I S C E S     N
```



The zodiacal constellation Virgo as depicted in Urania's Mirror, *a set of astronomical star chart cards first published in 1824. Holes punched in the cards allowed viewers to note the positions of the brightest stars in each constellation when the cards were held up to a light.*

Alas, an *ordered* crossword-type packing of the constellations of the zodiac is just not in the stars, no matter where in their cycle one chooses to begin the list of them. Indeed, ordered word lists more than half a dozen words long that *are* amenable to a crossword-type ordered packing seem to be rather scarce; can anyone think of any others besides the names of the Pleiades? (Come to think of it, I believe that I *do* know of such a list, and an exploration of its ordered crossword-type packings will be the subject of the article following this one.)

We come, finally, to classical mythology's A-list names. The twelve great gods of the polytheistic pantheon of the ancient Greeks and Romans were actually six gods and six goddesses, an equality of number which led many of the ancients to assume that six couples were involved. The Roman historian Livy, for one, who wrote in the time of Augustus, thought that sufficient evidence existed to justify the supposition of these pairings: Jupiter and Juno, Apollo and Diana, Neptune and Minerva, Mercury and Ceres, Mars and Venus, and Vulcan and Vesta (to use their Latin names).

Having determined that the Latin names, at least, of the great gods of the Greco-Roman pantheon could be successfully packed into a grid of acceptable dimensions, I wondered how to proceed; apart from their acknowledgement of Jupiter (or Zeus) as their leader, the great gods had no hierarchical organization, and so cannot be packed in ordered fashion. The only information that supplied a shred of ordering to their list was Livy's speculation as to their marital or romantic arrangements, and so I based this packing as far as possible on that. In the grid packing below, JUPITER is naturally positioned in the center of the top row, and the color-coded names of members of supposed couples are positioned adjacent to one another, while throughout the grid the names of gods and goddesses alternate both horizontally and vertically.

C	E	R	E	S	J	U	P	I	T	E	R	D	I	A	N	A
M	E	R	C	U	R	Y	J	U	N	O	A	P	O	L	L	O
V	E	N	U	S	N	E	P	T	U	N	E	V	E	S	T	A
M	A	R	S	M	I	N	E	R	V	A	V	U	L	C	A	N



REENTRANT ORDERED CROSSWORD PACKINGS OF THE ORDINAL NUMBERS

JIM PUDER

The concept and practice of packing grids with the words of an ordered word list in an ordered fashion was introduced by A. Ross Eckler in an August, 1999 *Word Ways* article entitled "Packing the Cardinals." Since then, ordered packings have been a common element in *Word Ways* and *Interim* articles featuring grid packing. This article, like the one preceding it in this issue, attempts a novel kind of packing: the crossword-style, rather than the grid-style, ordered packing of an ordered word list on a plane surface. (In a crossword-type ordered packing, words adjacent to one another in an ordered word list must not merely touch, they must intersect at some letter they have in common.) In the preceding article the names of the seven brightest stars of the Pleiades cluster were packed crossword-style in ordered fashion; in this article, the ordered word list selected for such packing is the one of what are commonly called the ordinal numbers. (Other ordered word sequences which could be characterized as being ordinal in function begin with words such as *once, single, primary, simplex, firstly, singly, primarily,* and so forth.)

To be a candidate for an ordered crossword-type packing, an ordered list of words must possess the property that every word in it must have at least one different letter in it in common with each of the adjacent one or two words in its list. Very few ordered word lists of any significant length meet this qualifying standard, and among those that do fewer still can be successfully packed in ordered crossword fashion for more than a handful of words. The list of the ordinal number names beginning with ZEROTH, for example, cannot be packed in ordered crossword fashion beyond FIRST; fortunately for this project, however, the list of the ordinal number names that begins with FIRST can apparently be packed indefinitely.

Oddly enough, the very fact that the list of the ordinal number names that begins with FIRST *can* be packed endlessly presents a problem. A crossword-type ordered packing of an infinite list of names is confronted by the fact that since the list has no end point, the packing has no natural stopping point, no point at which it can logically be considered to be complete. (There does not come, as there does with an ordered grid-type packing, a point at which either the packing is complete or at which no way can be found to extend it further.) And a packing that has no end or completion point in view, no objective to be attained, has no particular reason to be undertaken in the first place.

It was while I was mulling this difficulty that Mike Keith's superlative new article on the ordered packing of grids, which is published elsewhere in this issue, arrived at *Interim*. In it, Keith proposes the recognition of *reentrant* ("inward-directed") packings, which are complete ordered packings in which, in a grid packing, the first and last words in an ordered list end up touching each other. The virtue of such a final configuration is that it is not only more difficult to achieve, it is also more artistically elegant than a non-reentrant ordered packing, and should therefore be considered a more meritorious result. And in a crossword-type ordered packing, I soon realized, such a reentrant finish would not only be more meritorious, it would supply an objective for the packing, lending it a purpose that had theretofore been lacking. That is why all of the ordered crossword-type packings of the ordinals that follow are reentrant ones; without re–entrance as their goal, they would have had no point. Now, thanks to this new constraint, they have one.

Some discussion of the details of the packings is in order. In every crossword-type ordered packing of the ordinals, the first four number names form a box-like structure that I call the "origin box", a structure that

makes it difficult to achieve reentry by intersecting FIRST from below; only a few numbers will now be able to do so (see Figure 6). After the formation of the origin box, there is a forced movement of the packing downward and to the left until TENTH or ELEVENTH is reached, after which the packer can gain a measure of control over the direction of the packing and guide it upward, either to the left or to the right of the origin box, to a position from which it can intersect FIRST from above (assuming that a quick reentry is the objective). In the four ordered crossword-style packings of the ordinals exhibited in this article, reentries of the packings at their FIRSTs occur at their numbers THIRTIETH, TWENTYSIXTH, TWENTIETH and THIRTY-SIXTH (Figures 2, 3, 4, and 6).

Most of the packings in this article begin with FIRST packed horizontally. When FIRST is packed vertically, different packing patterns appear to occur, but these are merely rotations and reflections of packings with FIRST packed horizontally, and need not be considered separately. (See Figure 1.)

The following six figures and their captions complete this article. Readers' improvements, comments and suggestions are welcome and solicited.

Figure 1: FIRST packed horizontally and vertically

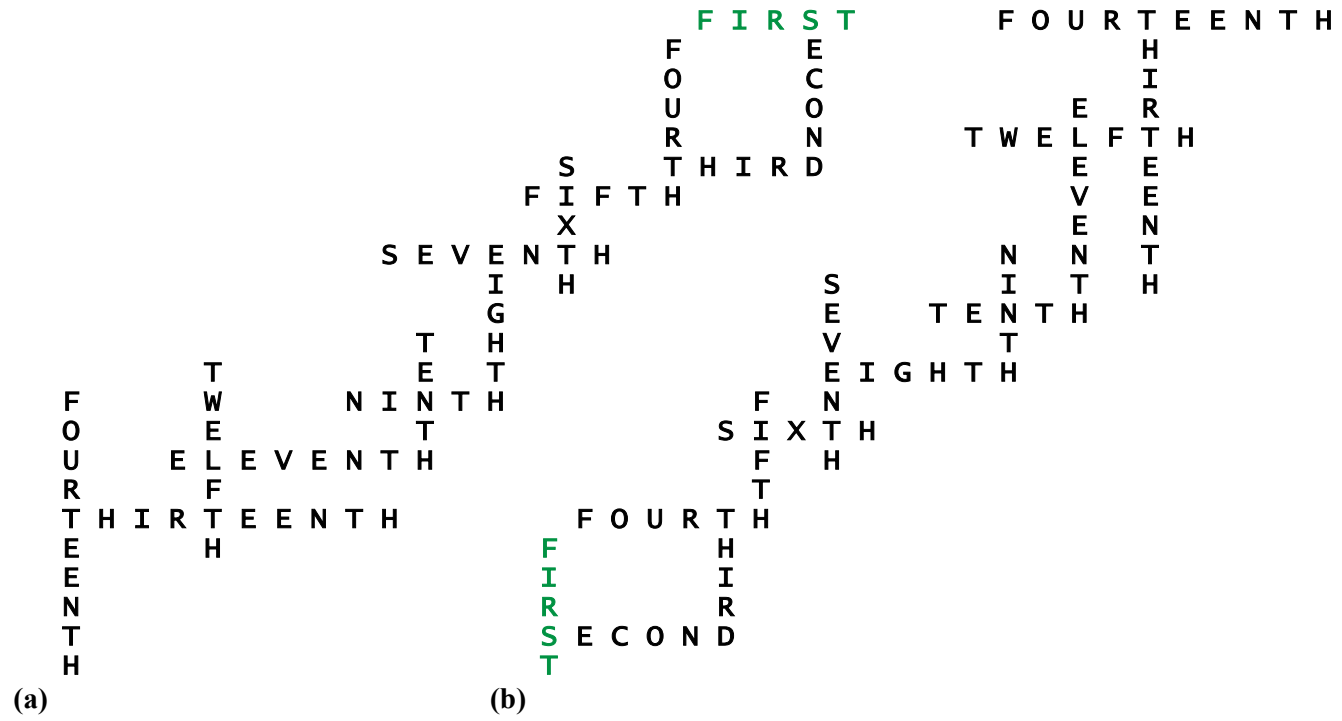


Figure 1: The pattern of every ordered, crossword-type packing of the ordinals is largely forced for the first ten or so words, and two different patterns appear to emerge depending upon whether FIRST is oriented (a) horizontally or (b) vertically. Pattern-wise, however, (a) and (b) are the same; (b) is merely (a) rotated 90 degrees clockwise and reversed right to left — in other words, they are the same packing pattern and need not be investigated separately. (Such orientational transformability is, in fact, a property of every crossword.) In this article, packings with FIRST oriented horizontally are preferred.

Figure 2: An Ordered Packing Reentrant at THIRTIETH

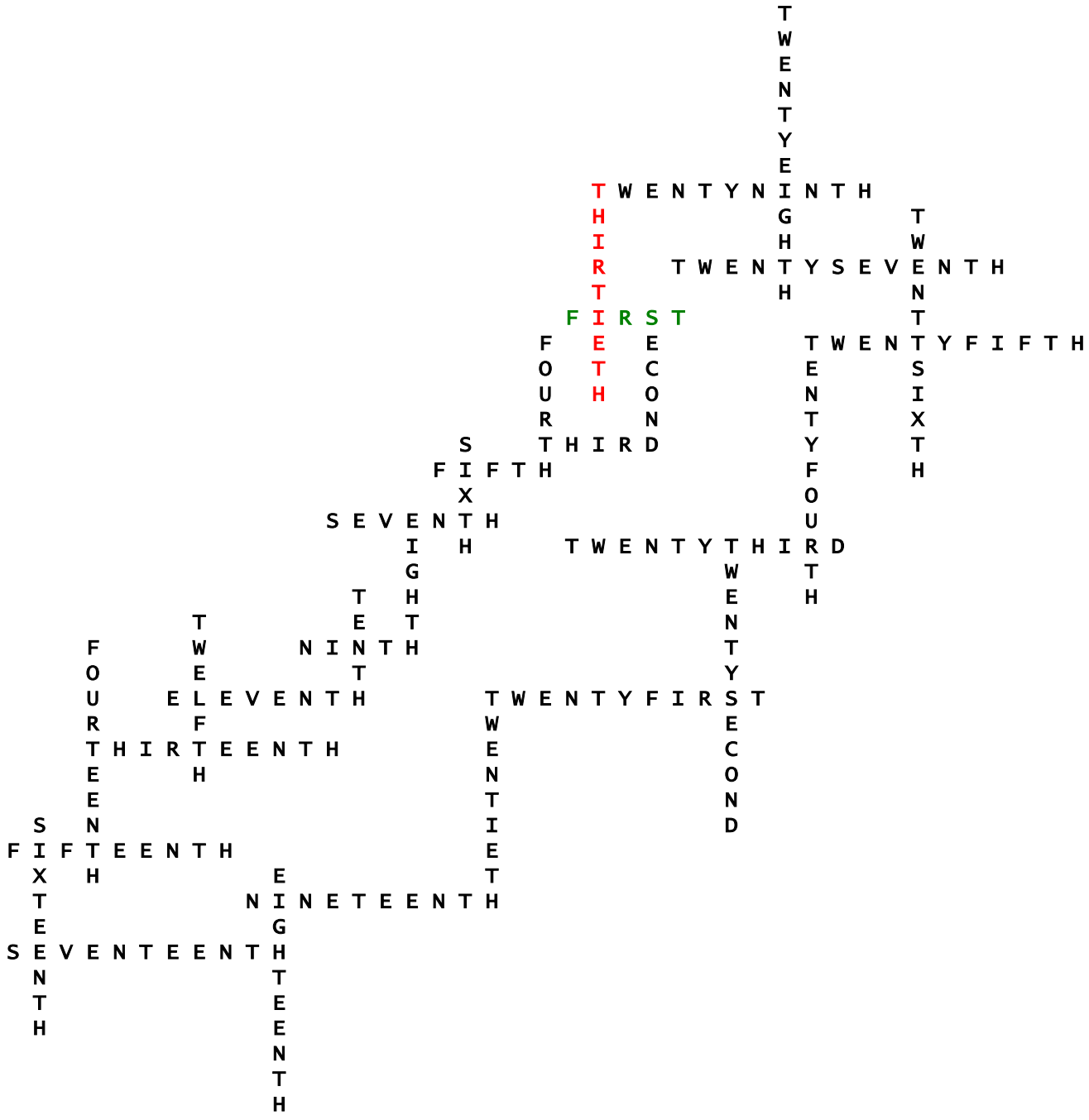


Figure 2: Initially forced to move down and to the left, after SIXTEENTH this packing is finally able to move up on the right side of the origin box to intersect FIRST from above at THIRTIEST. (Alternatively, the packing could have taken an upward route that passed on the left side of the origin box instead.) With this closed circuit's many turnings, crossroads and blind alleys, the thought occurs that this is what a racetrack designed by the Minotaur — a labydrome, if you will — might resemble.

Figure 3: An Ordered Packing Reentrant at TWENTYSIXTH

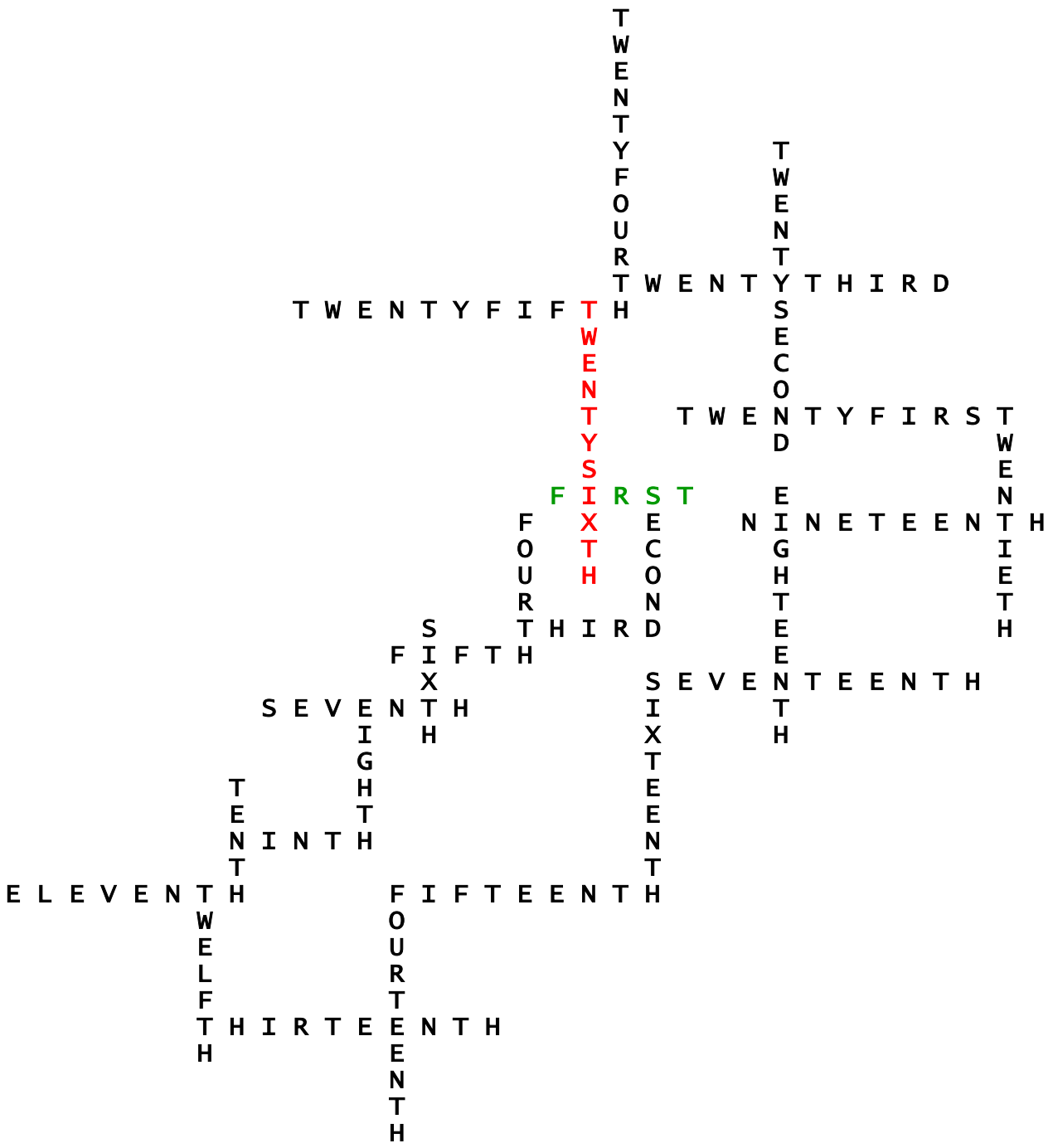


Figure 3: You might call this somewhat ungainly-looking packing, another right-side ascender, the Windmill. Despite its awkward appearance, however, its intersection of FIRST at TWENTYSIXTH shaves a substantial four numbers from the previous packing's reentry total. That's impressive; but might not a **left-side** *climb past the origin box result in an even lower reentry number? Let's see.*

Figure 4: An Ordered Packing Reentrant at TWENTIETH

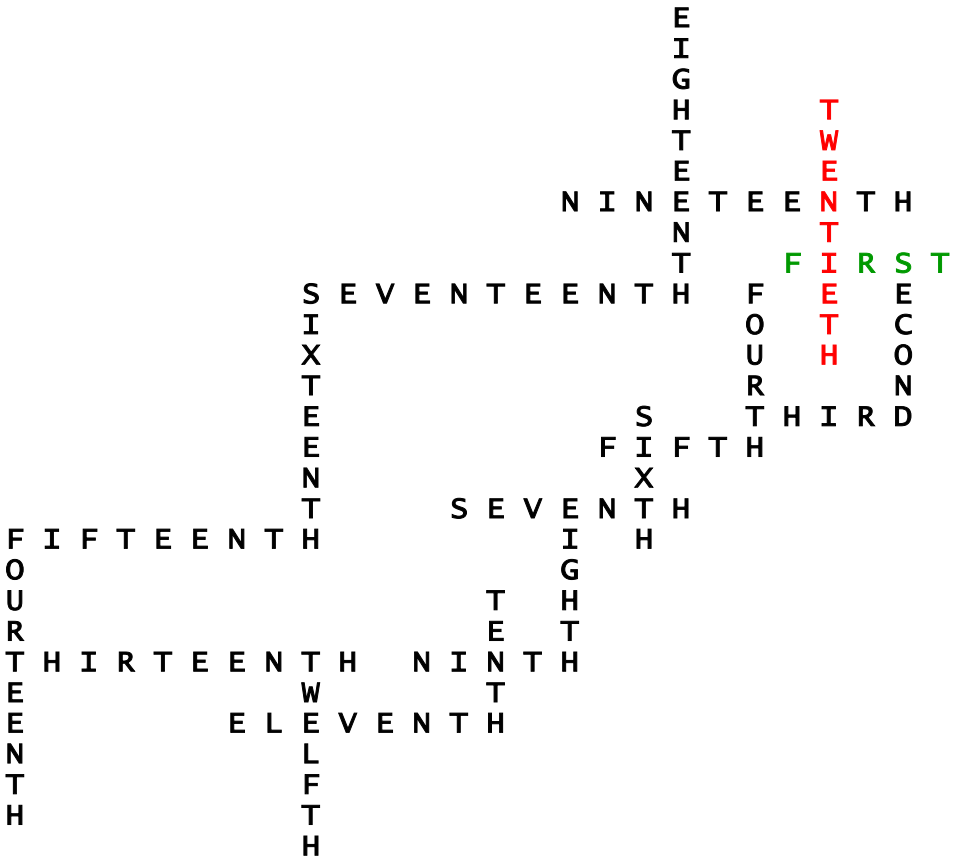


Figure 4: It's no contest — this left-side ascender doesn't dally, it just charges directly off to a rendezvous with its FIRST by its TWENTIETH. Competition over; for reasons having to do with spelling, word lengths and the forced initial packing pattern, there can be no ordinal reentry number lower than TWENTIETH — well, at least not for **this** *variety of ordinal numbers...*

Figure 5: PRIMARY, SECONDARY, TERTIARY, etc.

Figure 5: Another sequence of ordering (i.e., ordinal) numbers begins "primary, secondary, tertiary, quaternary, quinary, senary, septenary, octonary, nonary, denary," skips a number, adds "duodenary" and is done. When packed in ordered crossword fashion, this sequence can, remarkably, achieve reentry in just four words (the fewest permitted by plane geometry) in at least two ways:

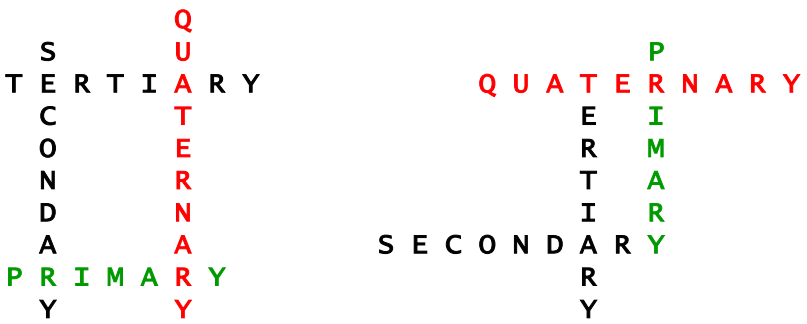


Figure 6: An Ordered Packing Reentrant at THIRTYSIXTH

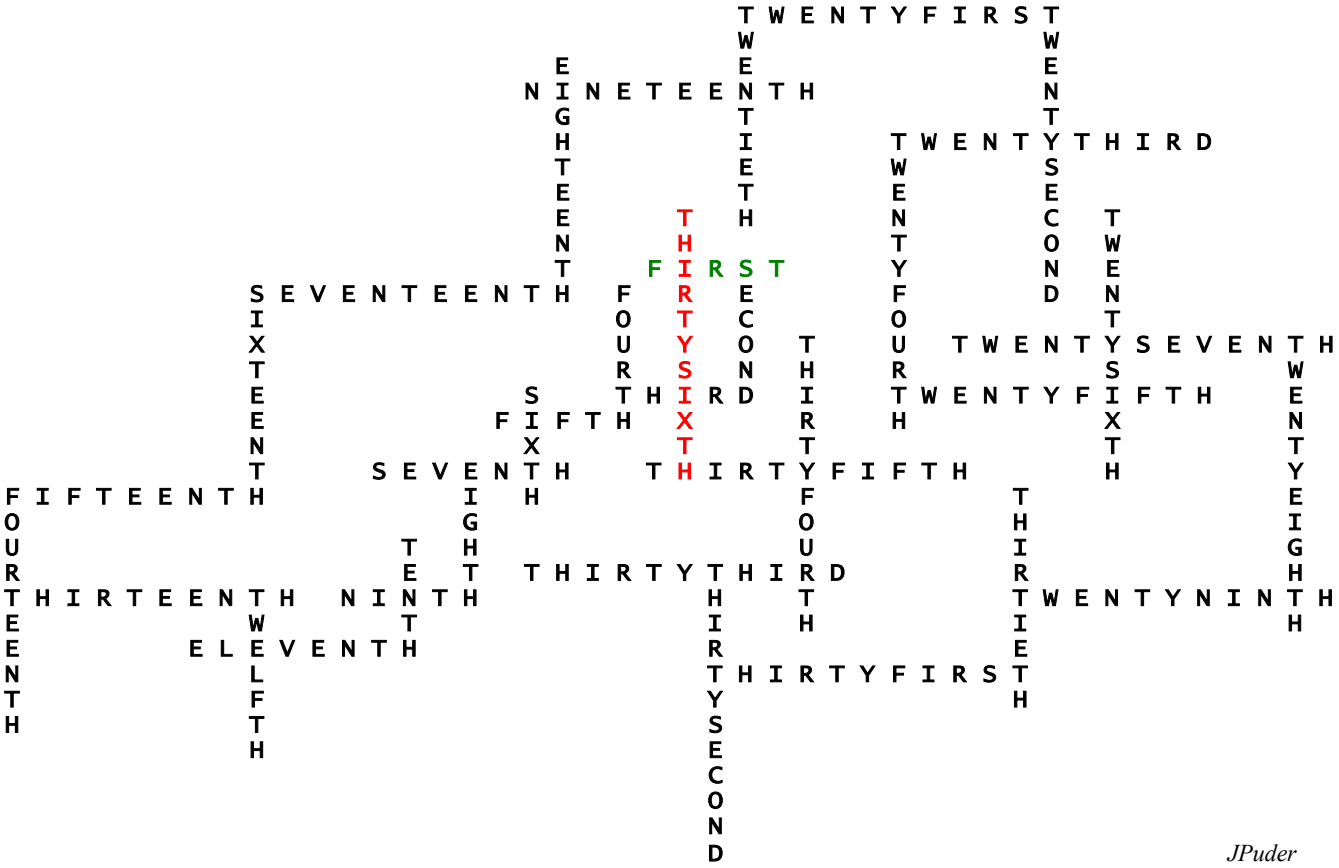
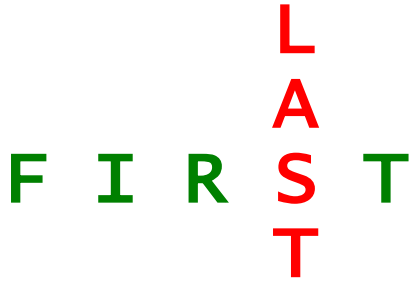


Figure 6: Why attempt a packing that reenters at THIRTYSIXTH? Because THIRTYSIXTH happens to be the lowest number theoretically capable of intersecting FIRST from below, and I was curious to see if this could be accomplished in practice. (The three next-lowest number names having this capability are FIFTYSIXTH, SIXTYSIXTH and NINETYSIXTH.) To use up the requisite number of number names, the packing's path takes the long way around the origin box to position the packing to intersect FIRST from below THIRD. En route, it incidentally traces an impressionistic sketch of a spreading shade tree hung with Spanish moss. Now, if one could only draw this well on purpose!



PACKING THE STATE CAPITALS

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After the recent deluge of squares and rectangles packed with the names of US presidents, US states, chemical elements and so on, I decided to tackle yet another group of names. I wanted to see what could be achieved with the names of the 50 US state capitals. Could these be packed perfectly into a square or rectangle? In total, the names of all the state capitals have 409 letters, but that isn't factorizable, so there is no appropriate square or rectangle. How about if I included the spaces used in 10 of the names (as in **NEW JERSEY**)? It turns out that 419 isn't factorizable, either. How about if I doubled the size of the challenge and used the names of the 50 state capitals partnered with the names of their corresponding states? The names of the 50 states contain 412 letters and 10 spaces. This gave me various options:

state capitals without spaces (409) + states without spaces (412) = 821 letters
state capitals with spaces (419) + states with spaces (422) = 841 characters

But 821 isn't factorable, so there's no square or rectangle into which the names could be perfectly packed. Yet 841 is a perfect square (29 x 29), so could this be the target of the proposed packing? Given that this would retain spaces in the names of both the state capitals and states, I would end up with blocks looking like these:

SANTA FENEW MEXICO
SALT LAKE CITYUTAH

The absence of spaces (or some other separators) between the names of the state capitals and states would make for an unattractive offering. How about adding a space between each state capital and its state? For example:

SANTA FE NEW MEXICO
SALT LAKE CITY UTAH

This would increase the character count from 841 to 891. It turns out that 891 is factorizable in several ways: 3 x 297, 9 x 99, 11 x 81, and 27 x 33. I decided to work with the most square-like of these, and see what could be achieved with a 27 x 33 rectangle. (But I was also attracted to the other rectangles, more of which later on.)

Having decided on the size of my target rectangle, I set about arranging by length all the state capital / state name blocks, with appropriate embedded spaces. For interest, the longest is the 24-character block **CHARLESTON WEST VIRGINIA** and the shortest is the 11-character block **BOISE IDAHO**. Since the average length of the 50 blocks is almost 18 characters, I anticipated that it would be difficult to get anywhere close to a perfectly packed solution. But how close could I get to perfect packing of the 50 blocks?

I started filling my rectangle with the longest blocks, working down through progressively shorter blocks. After several false starts, I finally managed to get 49 of the blocks packed into my rectangle. My first 49-block solution failed to fit in one of the 16-character blocks, **LINCOLN NEBRASKA**, although it could have been either of the other two same-length blocks **CHEYENNE WYOMING** and **LANSING MICHIGAN**. This gave me a fill ratio of 98.20%

(875/891). After further manipulation of the blocks, I managed a solution missing only a 14-character block (**HELENA MONTANA**), for a fill ratio of 98.43% (877/891). This solution is shown below, with the 14 unfilled squares marked '14'.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	C	H	A	R	L	E	S	T	O	N		W	E	S	T		V	I	R	G	I	N	I	A	M	L	R
2	C	O	L	U	M	B	I	A		S	O	U	T	H		C	A	R	O	L	I	N	A	A	A	A	I
3	H	A	R	R	I	S	B	U	R	G		P	E	N	N	S	Y	L	V	A	N	I	A	T	D	N	C
4	J	E	F	F	E	R	S	O	N		C	I	T	Y		M	I	S	S	O	U	R	I	L	I	S	H
5	P	R	O	V	I	D	E	N	C	E		R	H	O	D	E		I	S	L	A	N	D	A	S	I	M
6	O	K	L	A	H	O	M	A		C	I	T	Y		O	K	L	A	H	O	M	A	C	N	O	N	O
7	R	A	L	E	I	G	H		N	O	R	T	H		C	A	R	O	L	I	N	A	O	T	N	G	N
8	B	A	T	O	N		R	O	U	G	E		L	O	U	I	S	I	A	N	A	A	L	A			D
9	B	I	S	M	A	R	C	K		N	O	R	T	H		D	A	K	O	T	A	U	U		W	M	
10	C	O	N	C	O	R	D		N	E	W		H	A	M	P	S	H	I	R	E	S	M	G	I	I	V
11	S	A	C	R	A	M	E	N	T	O		C	A	L	I	F	O	R	N	I	A	T	B	E	S	C	I
12	B	O	S	T	O	N		M	A	S	S	A	C	H	U	S	E	T	T	S	S	I	U	O	C	H	R
13	H	A	R	T	F	O	R	D		C	O	N	N	E	C	T	I	C	U	T	P	N	S	R	O	I	G
14	I	N	D	I	A	N	A	P	O	L	I	S		I	N	D	I	A	N	A	R			G	N	G	I
15	L	I	T	T	L	E		R	O	C	K		A	R	K	A	N	S	A	S	I	T	O	I	S	A	N
16	J	A	C	K	S	O	N		M	I	S	S	I	S	S	I	P	P	I	D	N	E	H	A	I	N	I
17	N	A	S	H	V	I	L	L	E		T	E	N	N	E	S	S	E	E	E	G	X	I	D	N	P	A
18	P	I	E	R	R	E		S	O	U	T	H		D	A	K	O	T	A	S	F	A	O	E	D	H	C
19	S	A	L	T		L	A	K	E		C	I	T	Y		U	T	A	H		I	S	J	N	O	O	H
20	S	A	N	T	A		F	E		N	E	W		M	E	X	I	C	O	M	E	S	U	V	V	E	E
21	T	A	L	L	A	H	A	S	S	E	E		F	L	O	R	I	D	A	O	L	A	N	E	E	N	Y
22	A	N	N	A	P	O	L	I	S		M	A	R	Y	L	A	N	D	14	I	D	L	E	R	R	I	E
23	C	A	R	S	O	N		C	I	T	Y		N	E	V	A	D	A	14	N		E	A			X	N
24	F	R	A	N	K	F	O	R	T		K	E	N	T	U	C	K	Y	14	E	I	M	U	C	D		N
25	M	O	N	T	G	O	M	E	R	Y		A	L	A	B	A	M	A	14	S	L			O	E	A	E
26	M	O	N	T	P	E	L	I	E	R		V	E	R	M	O	N	T	14		L	O	A	L	L	R	
27	O	L	Y	M	P	I	A		W	A	S	H	I	N	G	T	O	N	14	I	I	R	L	O	A	I	W
28	T	R	E	N	T	O	N		N	E	W		J	E	R	S	E	Y	14	O	N	E	A	R	W	Z	Y
29	H	O	N	O	L	U	L	U		H	A	W	A	I	I	14	14	14	14	W	O	G	S	A	A	O	O
30	L	I	N	C	O	L	N		N	E	B	R	A	S	K	A	14	14	14	A	I	O	K	D	R	N	M
31	S	A	I	N	T		P	A	U	L		M	I	N	N	E	S	O	T	A	S	N	A	O	E	A	I
32	A	U	G	U	S	T	A		M	A	I	N	E	T	O	P	E	K	A		K	A	N	S	A	S	N
33	A	L	B	A	N	Y		N	E	W		Y	O	R	K	B	O	I	S	E		I	D	A	H	O	G

For this 27 x 33 rectangle, there are now only four improvements theoretically possible:
improve the packing so that just one 13-character block is omitted (fill ratio = 98.54%)
improve the packing so that just one 12-character block is omitted (fill ratio = 98.65%)
improve the packing so that the only 11-character block is omitted (fill ratio = 98.76%)
improve the packing so that all 50 blocks are packed (fill ratio = 100%)

Can any of these be achieved? Do let the editors know if you can make any of these improvements.

What about the other rectangles? Is a perfect packing possible with any of the 3 x 297, 9 x 99 and 11 x 81 rectangles? It turns out that perfect packing is possible with all three of these other rectangles. Let's begin by demonstrating this for the 3 x 297 rectangle. Rather than constructing a 3 x 297 rectangle and trying to fit in the 50 state capital / state blocks, it is as straightforward as taking all 50 of the different block lengths and arranging them into rows such that each of the three rows totals 297. Like this:

24	**23**	**23**	**20**	**20**	**20**	**19**	**18**	**18**	**18**	**18**	**17**	**16**	**15**	**14**	**14**		**= 297**
23	**23**	**22**	**22**	**21**	**20**	**19**	**19**	**18**	**18**	**17**	**16**	**16**	**15**	**15**	**13**		**= 297**
21	**21**	**21**	**20**	**20**	**19**	**19**	**19**	**18**	**15**	**15**	**15**	**13**	**13**	**13**	**12**	**12**	**11**	**= 297**

Now simply substitute each state capital / state block against a number corresponding to its length. Job done!

Exactly the same approach can be taken with the 9 x 99 rectangle. The 50 block lengths simply need to be arranged into 9 rows such that each row totals 99 – thus:

24	**23**	**19**	**18**	**15**		**= 99**
23	**23**	**22**	**18**	**13**		**= 99**
23	**21**	**19**	**18**	**18**		**= 99**
22	**20**	**20**	**20**	**17**		**= 99**
21	**21**	**19**	**15**	**12**	**11**	**= 99**
21	**20**	**16**	**15**	**14**	**13**	**= 99**
20	**20**	**16**	**15**	**15**	**13**	**= 99**
19	**19**	**18**	**16**	**14**	**13**	**= 99**
19	**18**	**18**	**17**	**15**	**12**	**= 99**

Yet again, the same approach can be taken with the 11 x 81 rectangle. This time, the 50 block lengths need to be arranged into 11 rows such that each row totals 81 – thus:

24	**23**	**19**	**15**		**= 81**
23	**22**	**18**	**18**		**= 81**
23	**21**	**20**	**17**		**= 81**
23	**20**	**19**	**19**		**= 81**
22	**16**	**15**	**15**	**13**	**= 81**
21	**21**	**16**	**12**	**11**	**= 81**
21	**20**	**20**	**20**		**= 81**
20	**19**	**15**	**14**	**13**	**= 81**
19	**19**	**16**	**14**	**13**	**= 81**
18	**18**	**18**	**15**	**12**	**= 81**
18	**18**	**17**	**15**	**13**	**= 81**

The reason this approach works with the 3 x 297, 9 x 99 and 11 x 81 rectangles is because all 50 blocks can be laid in the same direction. The row totals of 297, 99 and 81 are sufficiently larger than the maximum block length of 24 (**CHARLESTON WEST VIRGINIA**) such that there

are combinations of other block lengths which can be created in order to provide the row totals of 297, 99 and 81. This approach won't work for a 27 x 33 rectangle, though. It's not possible to compose a solution with all the blocks placed in the same direction because placement of the 24 length block obviates a row total of 27 and 33, which means that some blocks have to be laid perpendicular to other blocks, as in my 27 x 33 solution above, which was obtained by sheer trial and error.

PACKING ALL 118 ELEMENTS

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We know that there are 118 elements in the periodic table, and we know that their official spellings contain a total of 923 letters. The only factors of 923 are 13 and 71. Can all 118 elements be packed into a 13 x 71 rectangle? Yes, and in a huge number of different ways.

Using the methodology in my article Packing the State Capitals, it's merely necessary to arrange the lengths of the elements into 13 rows such that the total of each of the rows is 71. Here is just one way in which this can be achieved:

13	**9**	**9**	**8**	**8**	**8**	**7**	**5**	**4**		**= 71**
12	**11**	**8**	**8**	**7**	**7**	**7**	**7**	**4**		**= 71**
12	**10**	**8**	**8**	**7**	**7**	**7**	**6**	**6**		**= 71**
12	**9**	**9**	**8**	**7**	**7**	**7**	**6**	**6**		**= 71**
11	**10**	**9**	**9**	**9**	**8**	**7**	**4**	**4**		**= 71**
11	**10**	**9**	**8**	**8**	**7**	**7**	**6**	**5**		**= 71**
11	**10**	**9**	**8**	**8**	**7**	**7**	**6**	**5**		**= 71**
11	**10**	**9**	**8**	**8**	**7**	**6**	**6**	**6**		**= 71**
11	**9**	**9**	**8**	**8**	**7**	**7**	**6**	**6**		**= 71**
10	**10**	**9**	**9**	**8**	**8**	**7**	**7**	**3**		**= 71**
10	**10**	**9**	**9**	**8**	**7**	**7**	**6**	**5**		**= 71**
10	**9**	**9**	**9**	**8**	**7**	**7**	**6**	**6**		**= 71**
9	**9**	**8**	**8**	**8**	**7**	**6**	**6**	**6**	**4**	**= 71**

All that remains is to replace each of the numbers in this table with an element name of that length.

Given that numbers in any row can be swapped with numbers totalling the same from another row (eg swap an 8 and 5 with a 6 and 7), there are many variations possible on the above table, ensuring, of course, that each row still totals 71. Then, when it comes to replacing a number with any of several element names of the required length, there are many further variations. It might be instructive to calculate the total number of different ways in which the 118 elements can be arranged into a 13 x 71 rectangle.

ORDERED WORD LIST PACKING:
SOME NEW SPECIMENS AND CONSTRUCTION TECHNIQUES

Mike Keith

In his 1999 article in *Word Ways* [1], Ross Eckler introduced the concept of an *ordered* packing of the first *n* words from a word list into a rectangular grid. In this recreation the words are placed on straight polyominoes then packed, Tetris-style, into a rectangle. To be an ordered packing, (a) the word list must have a natural ordering, and (b) each pair of adjacent words in the ordered sequence must touch along the edge of at least one cell in the grid. Equivalently, it must be possible to draw a single curve from the first to last word that passes through (part of) each word in order (first word, second word, ..., last word).



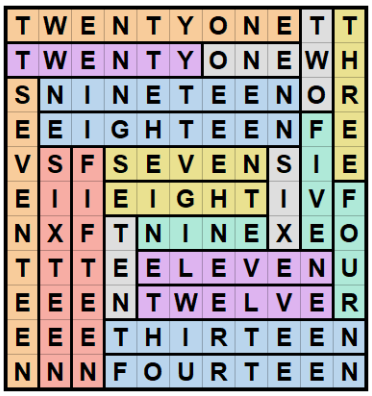
An example of a nice ordered packing (from Eckler's article) is shown at the right: the names of the first 17 cardinal numbers packed into a 10 x 9 rectangle. Observe that ONE abuts TWO, TWO adjoins THREE, THREE touches FOUR, and so on, all the way to the last word in the sequence, SEVENTEEN.

In this article we will present some new ordered packings, including improvements on several previously-published constructions, using the following words lists:

1) The cardinal number names (ONE, TWO, THREE,...), with the obvious ordering.
2) The names of the 118 chemical elements, ordered by atomic number.
3) The surnames of the U.S. presidents in order of service.
4) The names of the 50 U.S. states, in statehood date order.
5) The ordinal number names (FIRST, SECOND, THIRD,...)
6) The sequence of digits in the number π (3,1,4,1,5,9,2,6,5,3...)

We'll also discuss some general techniques for constructing ordered packings, especially large ones with hundreds or thousands of letters.

More cardinal numbers. In [1], Eckler conjectured that the packing of the first 17 cardinals shown above is the largest possible ordered packing with the cardinal numbers. Here are three successively larger examples which disprove that conjecture. At right are the first 21 number names packed in an ordered fashion into an 11 x 11 square. Not too many complete ordered *squares* are known (using any word list) so this is a pleasing find. Also note the interesting juxtaposition of TWENTYONE with TWENTY ONE on the top two lines.

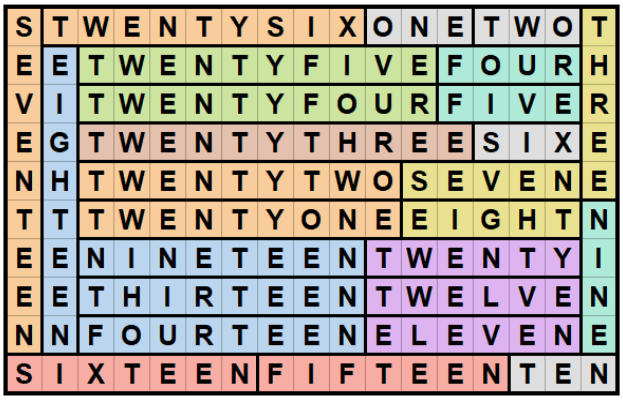


This ordered packing is notable for another reason: the last word (TWENTYONE) is connected to the first (ONE), making this a *reentrant* ordered packing, where the thread connecting the ordered words forms a closed loop. This seems to be a new puzzle not previously considered. For any given word list and

grid shape, besides a "normal" ordered packing having spatially separated start and end cells, we can also attempt the harder task of finding a reentrant ordered packing.

Adding just one more cardinal for a total of 22 provides 130 letters for a 13 x 10 rectangle. The left-hand diagram below shows a successful ordered packing of this rectangle. Note that the first and last word are both located in corners of the grid, which is not often possible.

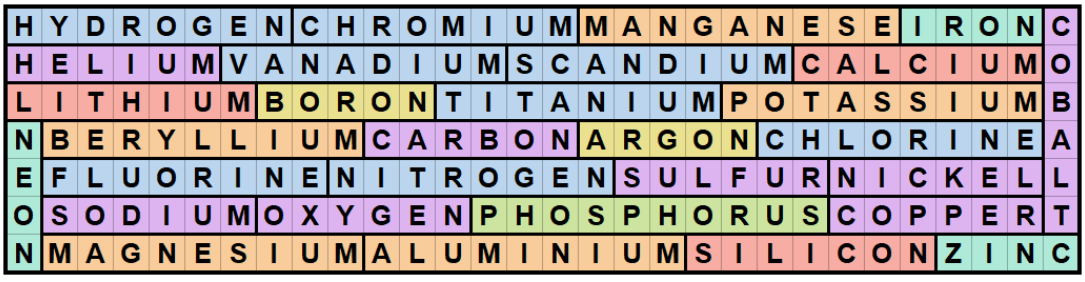




Our next example has the first 26 cardinals in a 17 x 10 rectangle (above right). Remarkably, this packing is also reentrant. It has an interesting layout, with a one-cell wide "picture frame" made from vertical and horizontal words, and an interior consisting of all horizontal words but one (EIGHTEEN).

The elements. The names in the periodic table are rife with packing potential (both ordered and unordered), with many different values of *n* and rectangle sizes available. As we just did with the cardinals, it is usually interesting to find one or more small packings of a word list before moving on to the search for larger ones.

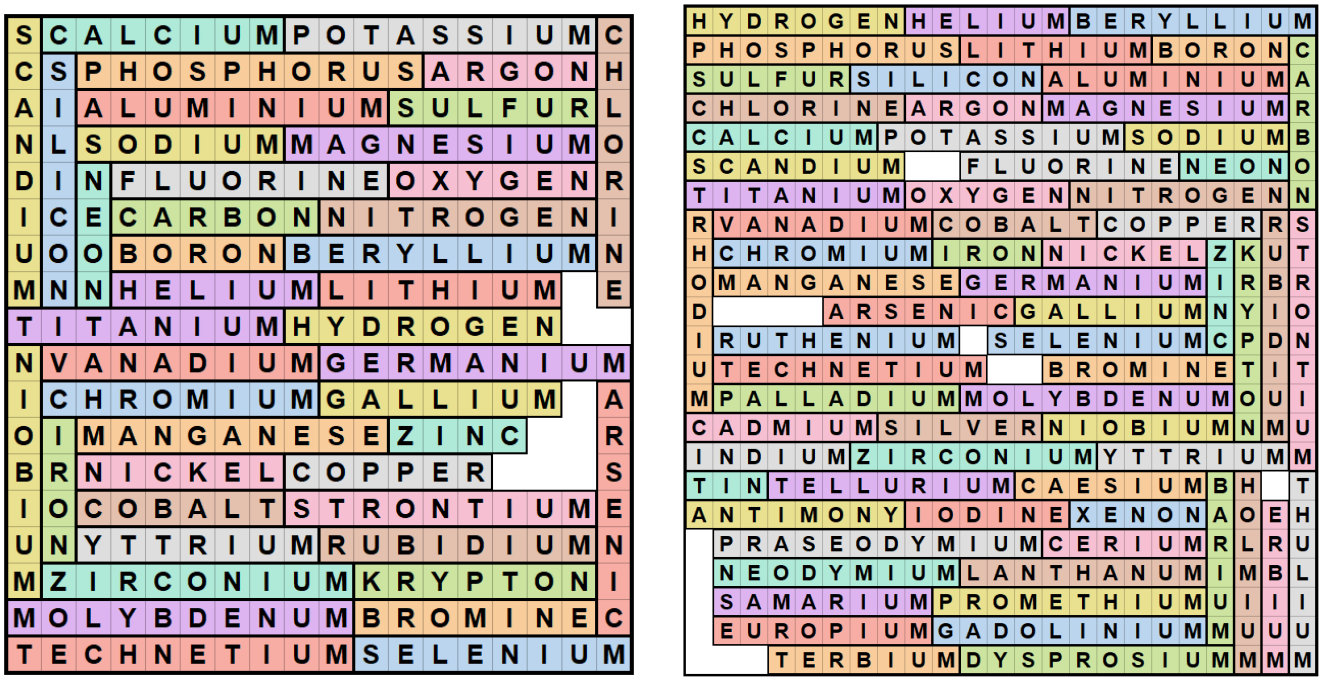
The smallest non-trivial ordered packing of the elements we found, shown below, is for the first 30 elements in a 30 x 7 rectangle



We don't know for sure if one exists with fewer elements (having, say, 4 or more rows). An ordered packing of these same 30 elements in a 15 x 14 seems impossible.

Elements in the 18 x 18 and 23 x 23 squares. Normally, we seek a complete ordered packing of a given rectangle or square, which means that all the words in the sequence that could possibly fit, just based on letter counts, actually *do* fit. But for some especially interesting cases where complete ordered packings have not been found, the best near-complete solutions are of interest.

In [2], Darryl Francis presented near-complete ordered packings of the first *n* elements into the 18 x 18 and 23 x 23 squares, with the 18 x 18 packing missing the last two elements in the sequence (TECHNETIUM and RUTHENIUM) and the 23 x 23 packing missing the last three (THULIUM, YTTERBIUM, and LUTETIUM). We were able to squeeze one more element into each of these, as shown below. On the left is an 18 x 18 that's only missing the last element (RUTHENIUM), while the 23 x 23 on the right is missing the last two (YTTERBIUM and LUTETIUM).



U.S. presidents. An example of a small ordered presidential packing is shown below, the first 21 presidents in a 28 x 5 rectangle. It is also reentrant, with the last name in the list (Arthur) adjacent to the first (Washington). For an even smaller one, the first 17 presidents can be packed in an ordered fashion into a 29 x 4 rectangle; we'll leave this as an exercise for the reader.

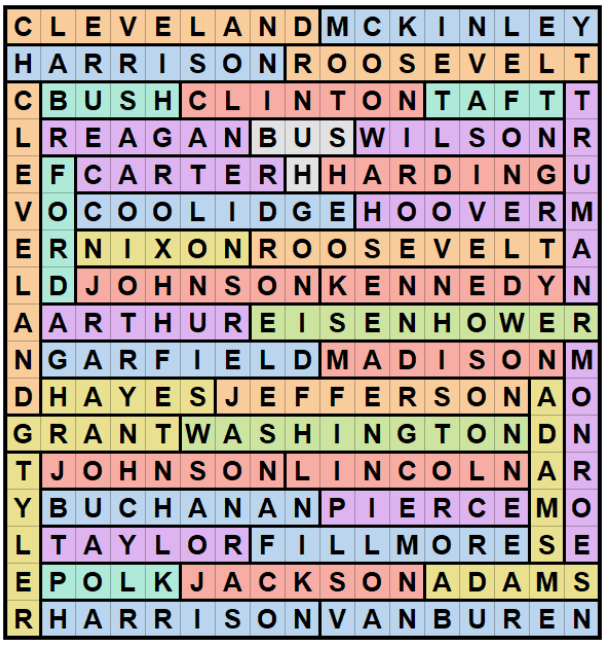


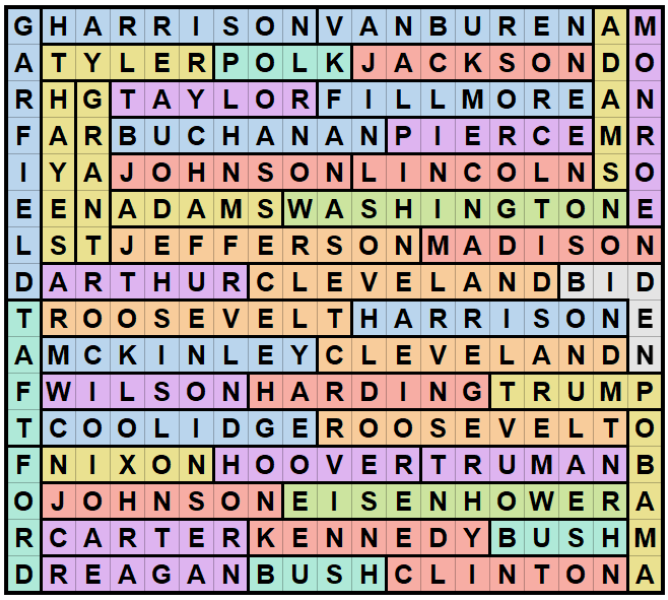
17 x 17 and 19 x 16. Just like with the elements, there are two nearly-complete ordered presidential packings of special interest: the 17 x 17 square (using the first 43 presidents) and the 19 x 16 rectangle (using the entire sequence, as of 2021, of 46 U.S. presidents). The current status on each of these is the same: a near-complete ordered packing has been found that includes all but the last two names in the relevant word list. See [3] and [4] for the best packings of the 17 x 17 and the 19 x 16 grid published so far.

We found improvements for both the 17 x 17 and 19 x 16 in which the first of the two missing names is added into the ordered sequence in the normal fashion *and* the final name is

also present and linked in, but in an unconventional way: by placing the final word on a different polyomino shape rather than the usual straight piece.

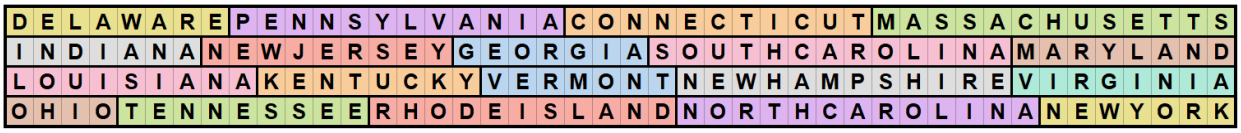
Below left is our ordered packing of the 17 x 17. All 43 names are connected as required, with the final name, BUSH, in gray on a T tetromino. At right is the 19 x 16. Again, all names are connected in order, with BIDEN on an L pentomino.



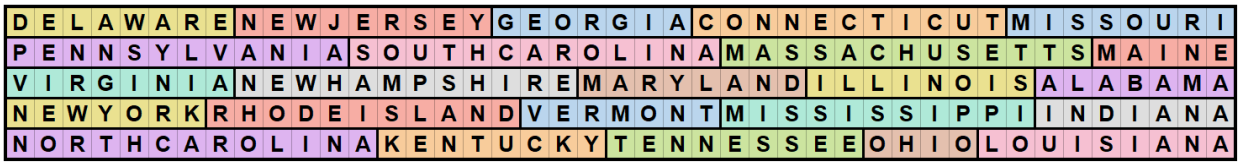


Observe that the 17 x 17 on the left is, in one sense, just a single letter away from being perfect (only the H needs to be relocated to the end of BUS), and by this same measure the 19 x 16 is just two letters off. Is perfection possible for either of these? No one knows.

States of the U.S. Disallowing rectangles with fewer than four rows, the smallest ordered state packing we found has the first 19 states in a 44 x 4 rectangle:



This is reentrant, since INDIANA, the last in the sequence, touches DELAWARE, the first state. Adding the next five states allows for this ordered packing of the first 24 states in a 43 x 5:



For a large ordered packing of the states, the obvious candidate is the 400-letter collection of the first 48 U.S. states (the "lower 48"), which could possibly fit in a 20 x 20, 25 x 16, or 40 x 10 shape. We strongly suspect the 20 x 20 is impossible, and believe that the 25 x 16 is very difficult or impossible, so we decided to try the 40 x 10.

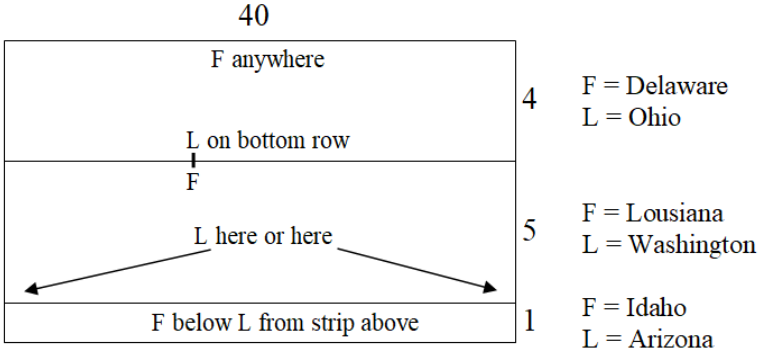
Even though 40 x 10 seems possible, it's still fairly large. To simplify the task we use a common strategy, which is to break a large problem into several smaller problems. Since we're trying to fit everything into a 40 x 10, we examined the values of $s(n)$, the total number of letters in the first n words. If one or more of these are multiples of 40 (the size of one row), then we can subdivide the 40 x 10 into two or more smaller 40 x k rectangles. Packing these smaller rectangles will be easier than packing the 40 x 10 all in one go, and, as long as we follow a few extra rules, when the subrectangles are put together all the words will be fully connected.

For the states word list, here are the values of $s(n)$ closest to the multiples of 40:

36, 81, 121, **160**, 202, 238, 281, 321, **360**, **400**
---------- ---------- ----------
four rows *five rows* *one row*

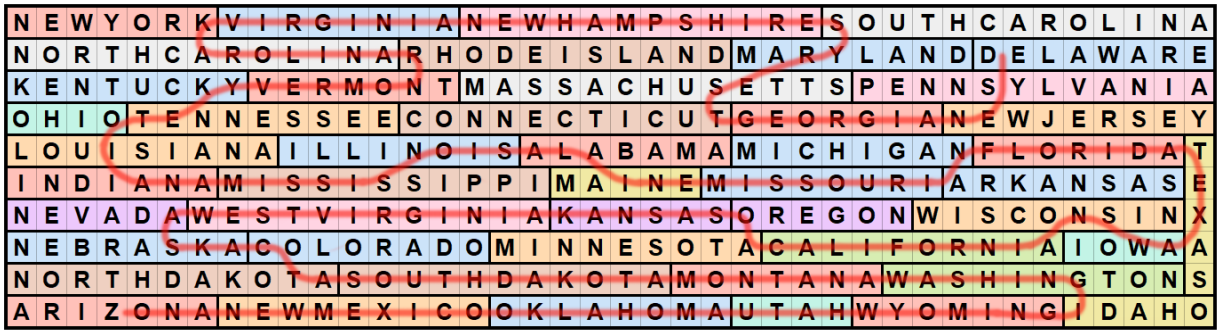
with the **bold** ones being exactly multiples of 40. This means that we can do the top four rows alone, then the next five rows as a unit, and then the bottom row with no effort, by simply stringing the last six state names together. We refer to this technique as *vertical splitting* (since the rectangle is broken apart in the vertical dimension) and the individual pieces as *strips*, and use the notation (x,y,z,w...) to represent the number of rows in each strip, in order from top to bottom. So this subdivision of a 40 x 10 rectangle would be denoted a (4,5,1) split.

We represent a plan like this in a *schematic diagram*, shown below, in which we also depict the extra rules we have to take into account when doing the subrectangle packings.



The numbers on the right side indicate the number of rows in each strip. The first (F) and last (L) word in each strip are listed as a reminder of which words to use when packing each strip (namely, all those from F to L, inclusive). The extra connectivity rules are all variations on this simple principle: the last (L) word of each strip must touch the bottom row of that strip, and the first (F) word of the strip below must be in the top row of that strip, and horizontally positioned to touch the L word from the top strip of the pair.

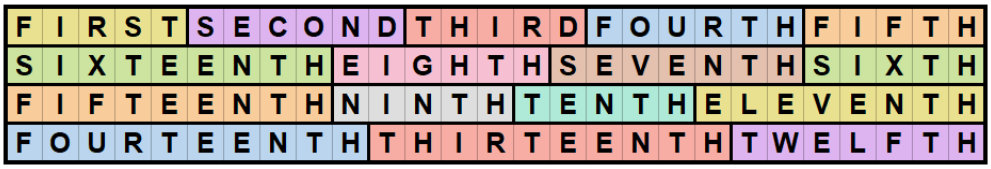
A plan like this may or may not lead to a solution – it all depends on whether we are successful in packing the subrectangles while also taking into account the auxiliary rules. In this case we were able to do so, leading to this final result:



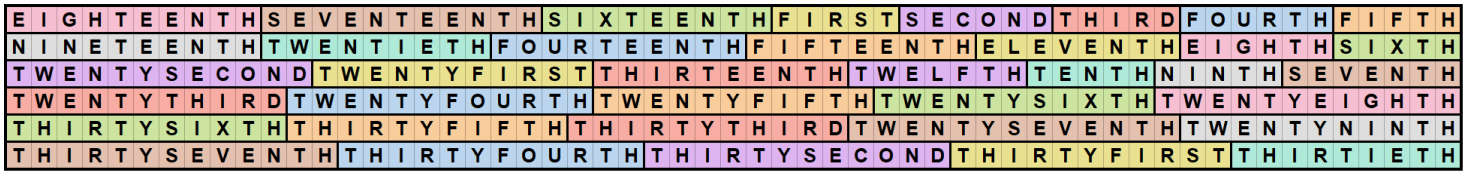
In large packings it is sometimes helpful to overlay a graphic depiction of the "thread" that passes through all the words in order. This thread starts in Delaware near the upper right corner and ends at the bottom left in Arizona.

The ordinal numbers. As pointed out by Jim Puder in [5], the names of the ordinal numbers, cousins of the cardinals, are a natural set for ordered packing, though no published packings of them have appeared.

The smallest possible ordered ordinal packing in a rectangle having at least four rows seems to be the one shown below, with the first 16 ordinals in a 27 x 4 rectangle. Despite its small size it actually has a (1,3) split, which is why the top row is just the ordinals FIRST to FIFTH in order.



The largest one we successfully packed is the first 37 ordinals in a 57 x 6 rectangle. This has a (3,3) split so it was constructed in two separate parts (top and bottom three lines), connected by the 22nd and 23rd ordinals.



We also found packings for four sets between these two: (a) the first 20 ordinals in 37 x 4, (b) the first 25 in 41 x 5, (c) the first 26 in 54 x 4, and (d) the first 29 in 63 x 4. These all make interesting puzzles, especially (b). The other three (a, c, and d) have ordered packings that are *linear* (with no vertical words), but we think that (b) cannot be done linearly, which makes it more difficult. We leave the construction of even larger ordered packings of the ordinals as another challenge for the reader.

The first *n* digits of the number π. Also mentioned by Jim Puder in [5], this natural list of ordered words is just the sequence of digits in the number π: 3.141592653..., or in words THREE, ONE, FOUR, ONE, FIVE, etc. Since there are many possible rectangles available

we'll exclusively limit our investigation to square grids. Here is a table of the first thirteen squares that correspond to the initial *n* digits of π, for some *n*:

n = #Digits = #Words	#Letters	Square	#Letters ÷ #Words
25	100	10 x 10	4
71	289	17 x 17	4.070
89	361	19 x 19	4.056
156	625	25 x 25	4.006
169	676	26 x 26	4
257	1024	32 x 32	3.984
274	1089	33 x 33	3.974
346	1369	37 x 37	3.956
425	1681	41 x 41	3.955
557	2209	47 x 47	3.965
680	2704	52 x 52	3.976
847	3364	58 x 58	3.971
1027	4096	64 x 64	3.988

The last column is especially interesting. For a random collection of decimal digits the number of letters per word (what's shown in the last column) will be *roughly* 4.0, because there are 40 letters in the 10 "digit words" (ZERO, ONE, ... NINE). But this is just average behavior, so, as the table illustrates, the number of letters per word is always approximately 4 but will only be *exactly* 4 once in a while. Note that the very first feasible π square (the 10 x 10) is one of these rare cases with a letters per word value of exactly 4. The next time this occurs is with the 26 x 26 square, also shown in the table. The next one after that is much later, the 340 x 340 square, and there isn't another one in the first million digits of π (equivalent to a 2000 x 2000 square). So clearly the 10 x 10 and 26 x 26 square, which both have this property, are quite notable.

Since the 10 x 10 has exactly 4 letters per word (= letters per digit), this means that the digit words fit in a 10 x 10 grid while at the same time the numerical digits fit exactly into a 5 x 5. This led to the idea of a difficult extra-constrained packing task that we'll call a *clone-path packing*. The idea is this: make a standard ordered packing of the words into a 10 x 10, and draw a rectilinear thread showing a path through the grid that visits each word once, in order – which must be possible, of course, since it's an ordered packing. Note that there are many rectilinear paths that will work, since there is some flexibility in exactly which squares of the grid we choose to pass through. Now draw a 5 x 5 grid with the same overall size as the 10 x 10, and clone (copy exactly) the path from the 10 x 10 to the 5 x 5. The construction is a success if this same path is also a tour of the 5 x 5 grid that visits each of the squares in the 5 x 5 exactly once. If that requirement is satisfied, it means that we can fill in the digits along the path in the 5 x 5 grid to produce a remarkable configuration in which both the digits (in the 5 x 5) and the words corresponding to the digits (in the 10 x 10) can both be toured *using exactly the same path*.

After a fair amount of work on this we were somewhat convinced that it was impossible, but with some more trying we eventually found this solution:





Is a clone-path packing also possible for the 26 x 26, with the digits in a 13 x 13? This seems difficult, but based on success with the 10 x 10 we think there's a fair chance it's possible.

We now return to three word lists already discussed (elements, cardinal numbers, digits of π) for some even larger ordered packings.

All the elements. Now that we have one technique (vertical splitting) to make a large ordered packing somewhat easier, we looked at the complete list of 118 elements, which contain 923 letters. This number has only two prime factors, 13 and 71, which means that just a single shape, a rectangle of size 71 x 13, is available for packing these. Since it seems like this packing could be possible, let's look at the possibilities for splitting into strips. The $s(n)$ values closest to multiples of 71 (exact multiples of 71 in bold) are:

73, 143, 210, 284, 353, 430, 499, 565, **639**, 712, 781, 856, **923**

This doesn't help much as it just provides a (9,4) split. But note the fifth number, 353, which is just 2 less than 355 = 71 x 5. Let's examine the element names in this vicinity, and the cumulative letter sums:

	Element	***s*(*n*)**
T1	SILVER	346
T2	CADMIUM	353
B1	INDIUM-TIN	
B2	ANTIMONY	

The horizontal line indicates where we could place a strip boundary if CADMIUM had $s(n) = 355$. The labels T1 and T2 mean "the last two words of the top strip, in order", while B1 and B2 are the *first* two words in the bottom strip. To be an ordered packing these words must be connected like this: T1 → T2 → B1 → B2. We've put INDIUM and TIN together so we can treat them as a single word, for reasons which will shortly become apparent. Observe that INDIUM-TIN has two more letters than CADMIUM. So, if we could just interchange CADMIUM and INDIUM-TIN we would have

	Element	*s(n)*
T1	SILVER	346
B1	INDIUM-TIN	**355**
T2	CADMIUM	
B2	ANTIMONY	

and all the elements above the strip divider would fit in exactly 5 rows (71 x 5 = 355). We call this the *borrowing* strategy, since we look ahead and borrow the initial word from the next strip in order to make the number of letters in *this* strip an exact multiple of the row length. The key point is that borrowing a single word does not destroy the orderedness of the packing. Here's why. Without borrowing, the words T1, T2, B1, and B2 would be arranged, relative to the strip dividing line, as shown on the left below, with T1 and B2 placed anywhere so that they touch T2 and B1, respectively:

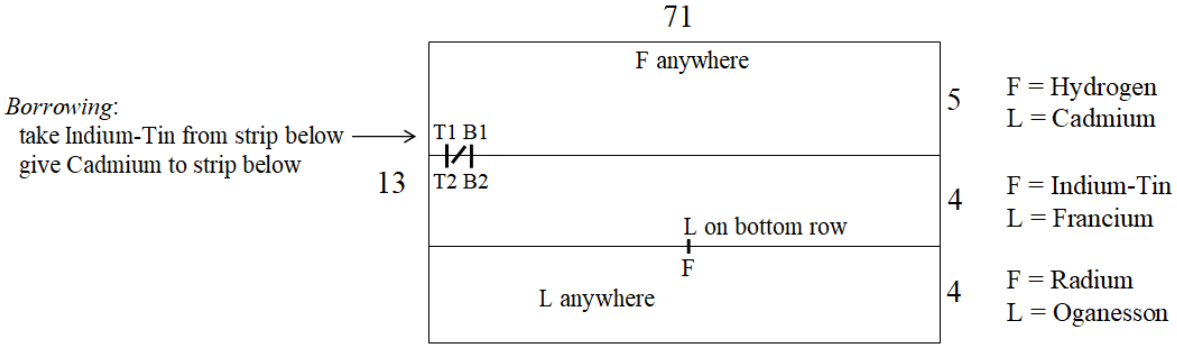


Borrowing changes this to the situation on the right – and observe that the four words are *still* connected in the required sequence, T1 → T2 → B1 → B2. There is a little bit of flexibility in the word positions, too, since T1 B1 can be slid to the left and right by some amount (that depends on the four word lengths), with this sliding constrained by the connecting requirement T1 → T2 → B1 → B2. In this example (remember that we are treating INDIUMTIN as one word), the options are

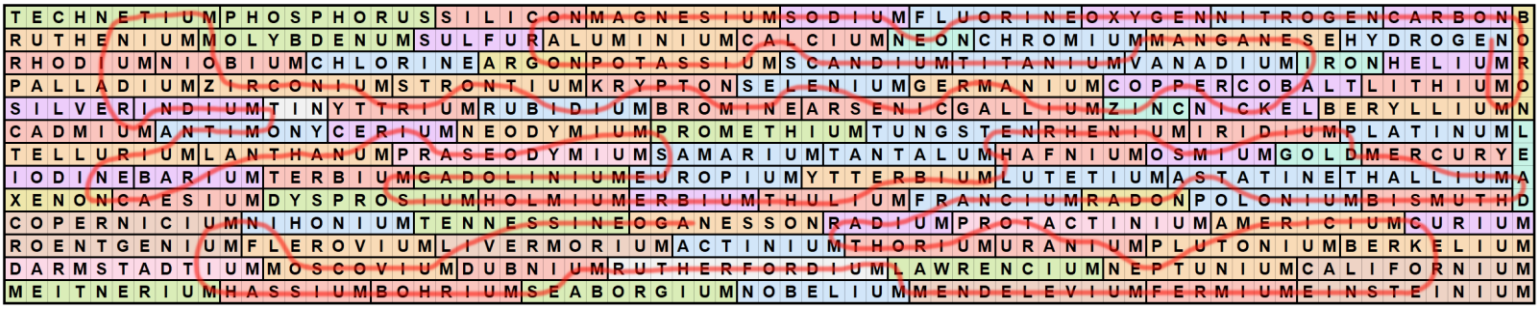
SILVERINDIUMTIN to SILVERINDIUMTIN
CADMIUMANTIMONY CADMIUMANTIMONY

We liked the compact rectangular shape of the last option (the one on the right), so rather than try all these arrangements we chose to tentatively pick that one. Its rectangular shape means that it can be placed up against either edge of the packing rectangle, another nice feature.

Using the borrowing strategy between row 5 and 6 provides a (5,4,4) split of the 71 x 13. Here's a schematic diagram, with the borrowing group on the left edge:



We were able to find ordered packings for all three strips that also obey the extra rules for connectivity of the strips. Here is the final result, a complete ordered packing of all 118 elements:



The ONE to ONEHUNDRED challenge. The cardinal numbers from 1 to 100 make an obvious and interesting ordered packing task. The total number of letters is 864, which leads to a dazzling assortment of rectangles: 32 x 27, 36 x 24, 48 x 18, 54 x 16, 72 x 12, 96 x 9, 108 x 8, 144 x 6, and a few more. We chose 72 x 12 as a compromise between too easy and too hard, and because of its similarity to the 71 x 13 used for the elements.

Examining the $s(n)$ values near multiples of 72 reveals the first simplification: the cardinals 1 to 38 fit exactly into four rows, yielding a subdivision of the 72 x 12 into a 72 x 4 and a 72 x 8. It's very desirable to subdivide the 72 x 8 even further, but in this case there aren't any opportunities for borrowing. However, there's another way that just happens to work in this instance, a new technique that we call a *prefix block*.

First, a preliminary observation. When we create an ordered packing of a subrectangle with a given word list (like, for example, the top four rows of the 40 x 10 states packing), this is made possible primarily by the ability to weave the words between different rows of the rectangle in order to provide an equal number of letters for each row. But we also note that shuffling the words between rows can also be used to achieve, within limits, other letter counts for each row, not just equal ones.

For example, consider a simple task where we just have to fill two lines in an ordered fashion with the cardinals ELEVEN to TWENTYFOUR. These have 112 letters, so they can fill a 56x2 rectangle like so:

```
56  ELEVENTWELVESIXTEENSEVENTEENEIGHTEENTWENTYTWOTWENTYTHREE
56  THIRTEENFOURTEENFIFTEENNINETEENTWENTYTWENTYONETWENTYFOUR
```

In this and the packings below we require that ELEVEN be at the upper left, to connect to a hypothetical strip above having TEN at the left edge, and TWENTYFOUR is required to lie somewhere on the bottom line, for connection to another strip below.

Now consider other line lengths, such at 55/57, or 54/58, and allow the longer line to be either on the top or on the bottom. Many of these configurations can also be filled in an ordered fashion, as shown below.

```
55    ELEVENFOURTEENSIXTEENEIGHTEENTWENTYTWENTYONETWENTYTHREE
57  TWELVETHIRTEENFIFTEENSEVENTEENNINETEENTWENTYTWOTWENTYFOUR

57  ELEVENTWELVEFIFTEENSIXTEENSEVENTEENEIGHTEENNINETEENTWENTY
55    THIRTEENFOURTEENTWENTYFOURTWENTYTHREETWENTYTWOTWENTYONE

58  ELEVENTHIRTEENFIFTEENSEVENTEENNINETEENTWENTYONETWENTYTHREE
54      TWELVEFOURTEENSIXTEENEIGHTEENTWENTYTWENTYTWOTWENTYFOUR

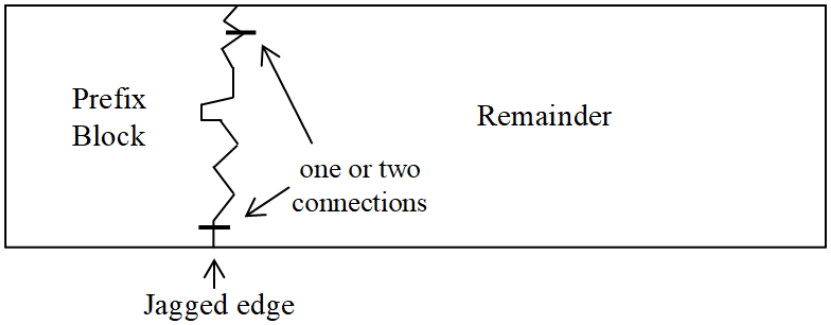
54      ELEVENFIFTEENSIXTEENNINETEENTWENTYTWENTYONETWENTYTHREE
58  TWELVETHIRTEENFOURTEENSEVENTEENEIGHTEENTWENTYTWOTWENTYFOUR

59  ELEVENTWELVETHIRTEENFOURTEENFIFTEENSIXTEENSEVENTEENEIGHTEEN
53        TWENTYFOURTWENTYTHREETWENTYTWOTWENTYONETWENTYNINETEEN
```

In these diagrams the right edge of the packed area is always straight, and we refer to the left side as a "jagged edge".

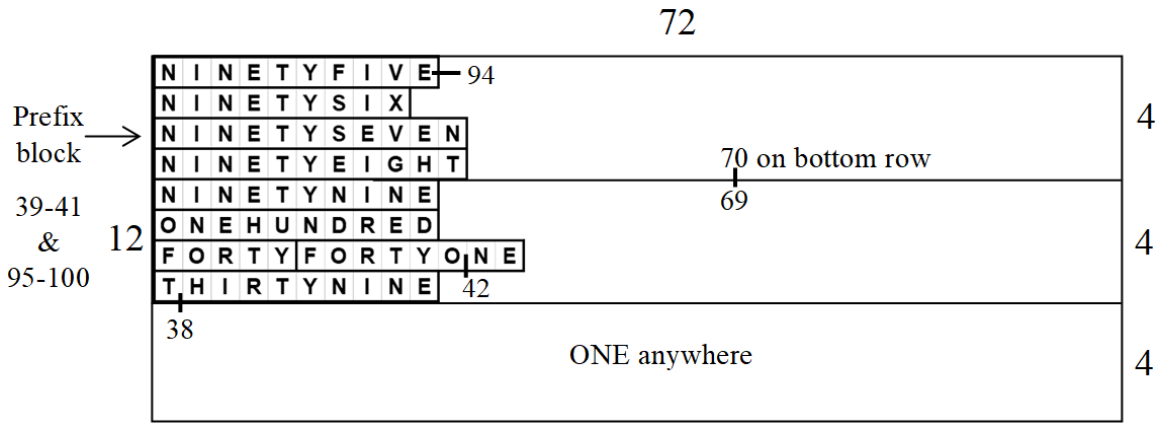
This ability to adjust line lengths also works for groups of three or more lines, and becomes even easier to apply since there are more lines to weave among. As long as the total number of letters in the word set matches the number of cells in an area with a single jagged edge, we can usually fill it, and it's typically no harder to fill than a rectangle with no jagged edges.

This technique allows us to subdivide a rectangle horizontally (as opposed to vertically, as we have done thus far), in a configuration that looks like this:

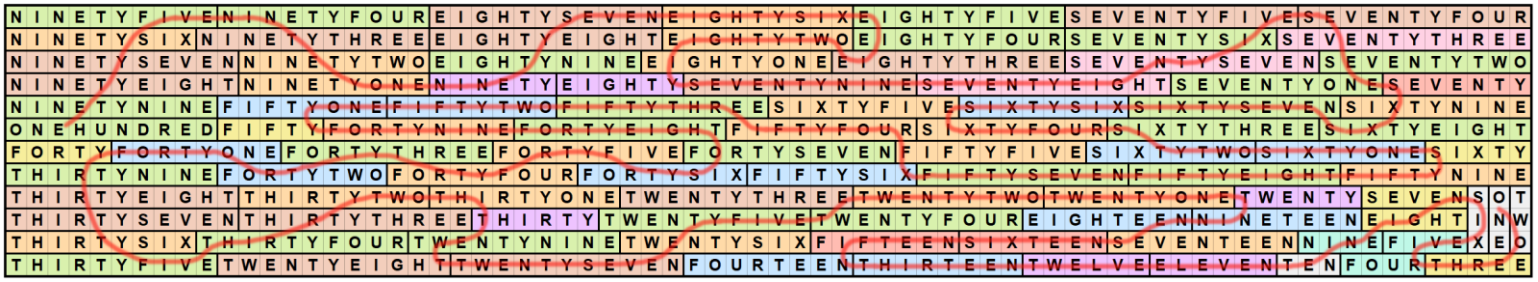


But the real point of a prefix block is this: by playing with the horizontal size of the prefix block, and which subset(s) of the word sequence we choose to put in it, we might be able to find one for which the letter counts of the lines in the remainder *allow that part to be vertically split*. This is usually our ultimate goal when adding a prefix block, although there is a side benefit: the prefix block makes the remainder horizontally smaller than it was before, thus easier to fill.

So, we have a 72 x 8 rectangle that we want to fill with the cardinals 39 to 100. After some experimentation we found a prefix block containing 39-41 and 95-100 that allows the right side to be split into two 4-row strips, leading to this schematic diagram for a perhaps-possible complete ordered packing of 1-100 (including the 72 x 4 at the bottom):



We were able to successfully pack all three strips in this diagram, giving the result shown below. ONE is in the lower right corner, while ONEHUNDRED is inside the prefix block on the left edge. The easy-to-follow thread shows that this is a complete ordered packing of the cardinals 1 to 100.



To wrap up the topic of the cardinal numbers, we offer two more challenges involving them:

1) Can an ordered packing be found for 1 to 100 using any of the taller rectangles? The next one to try is 54 x 16. This might be possible but seems hard.

2) Going even further, a natural next goal would be the cardinals 1 to 1000, but that's impossible because the number of letters, 18451, is a prime number. But 1 to 999 works nicely, with 18440 letters that can fit into a 461 x 40 rectangle (or 922 x 20, etc.). Can one of these, preferably the 461 x 40, be explicitly constructed?

The first 1027 digits of π in a 64 x 64 square. The last line of the table on page 209 is a nice candidate for packing, for at least three reasons. This square is 64 units on a side, which is interesting because 64 is a power of two, making it easy to subdivide the grid into smaller sub-grids. Secondly, 1027 digits is enough to include the remarkable sequence 999999 that occurs from digit #763 to #768 of π. It's also interesting beause we make the following conjecture:

Conjecture P. *Every feasible π square (with the right number of cells to possibly admit an ordered packing) can, in fact, be successfully packed in an ordered fashion.*

The main rationale behind this conjecture is that the "local" difficulty of ordered-packing a random series of digit words is a constant, since the statistics of the word lengths is always

the same. This is unlike, for example, the sequence of cardinal words, where the word lengths continue to grow as we proceed through the sequence.

Thus, our third reason for being interested in the 64 x 64 square is that it is large enough to test this conjecture. If we use some strategy to successfully pack the 64 x 64 involving subdivision of the grid into smaller pieces, said strategy being generalizable to any other size, then the 64 x 64 will provide strong empirical evidence that Conjecture P is true.

Our general strategy for the 64 x 64 packing is as follows:

1) Divide the 64 x 64 into four 16 x 64 columns. We'll proceed down the first column, then up the second, down the third, and up the fourth, ending at the upper right corner.

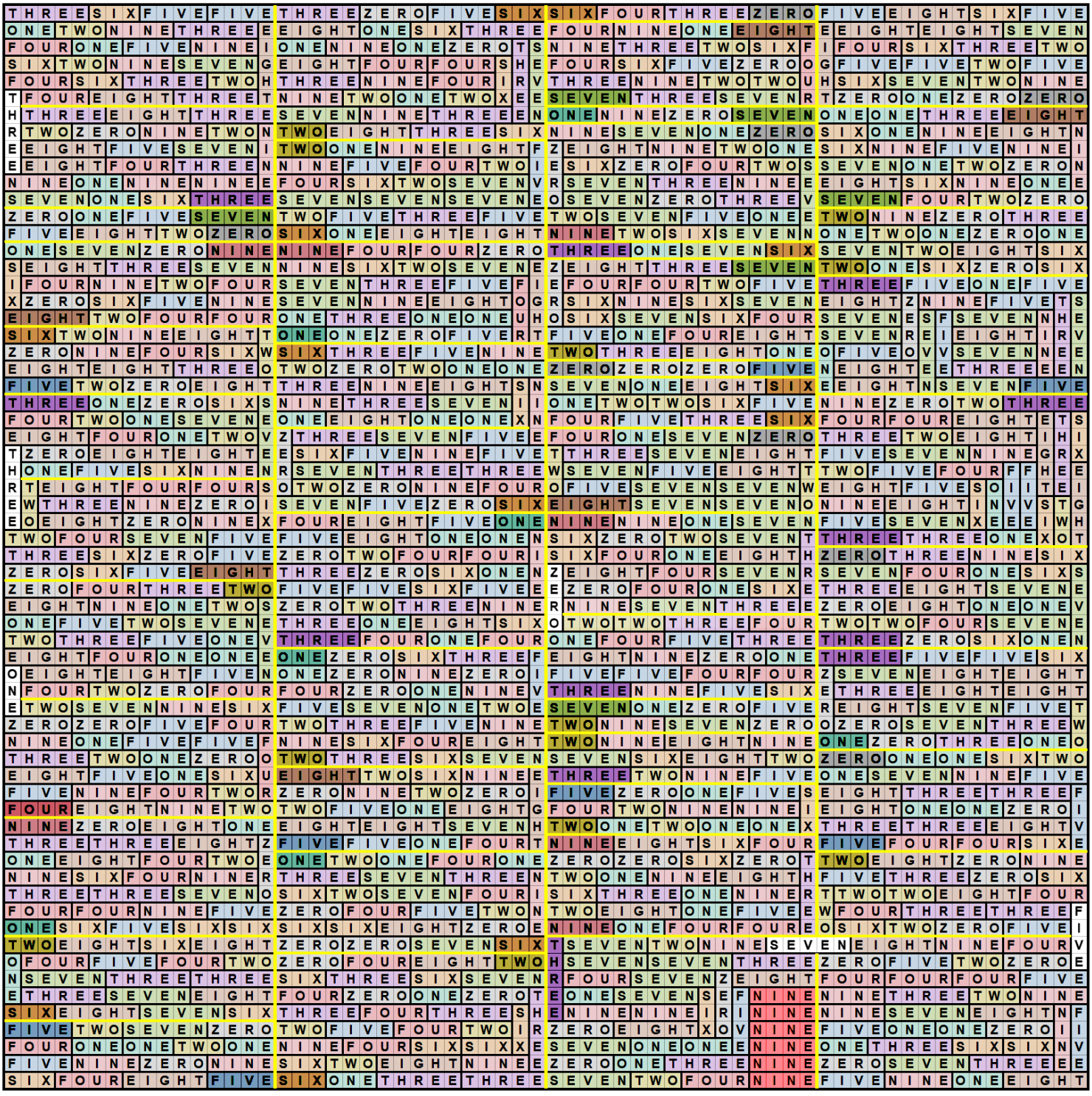
2) Within each column, use vertical splitting at every available opportunity to subdivide the column vertically into strips with a smallish number of rows. Note that the statistics are in our favor here: since the average number of letters in each word is 4, the probability that we'll be able to split on any given row is about 1/4. So the average height of each strip will be ~4 rows, and on average we'll be filling 16 x 4 chunks at a time.

3) If some of the strips are so small we can't fill them, merge adjacent strips to get to a more reasonable size. Indeed, 16 x 4 is a bit small – we tended to prefer 16 x 5 or 16 x 6 as a nice size that's neither too large (hard or just tedious to fill) nor too small (not enough elbow room). 16 x 5 or larger allows any word to be placed vertically, which is handy.

4) If a strip has more rows than we like, we might be able to split it using borrowing, or using another new technique that only works when all the words in the word list are short, which is to use a *vertical connector*. This is basically a degenerate prefix block consisting of a single vertical word placed on the left or right edge, which causes the remainder to be splittable vertically, just like the big prefix block in the 1-100 cardinal packing. A vertical connector almost always works, as long the word list has all short words. In fact, we never had to use borrowing.

In step (1), each column has two cases: (a) the appropriate part of the word list fits all the cells in the column exactly, or (b) the last word only partially fits. If case (b) happens then we use a *horizontal connector*, just like the vertical connector from step 4 but oriented horizontally. For this particular square, there are three boundaries between the four columns. The first two boundaries were, by chance, exact. A horizontal connector only had to be used for the third boundary, between the 3rd and 4th columns.

Here's the final result, a complete ordered packing of the first 1027 digits (words) of π, with 4096 letters, into a 64 x 64 square. The yellow lines show the subdivisions into four columns and, within each column, into strips.



The first digit of π is the THREE at upper left. Recall that we go down, up, down, and up through columns 1, 2, 3, and 4. The last of the 1027 digits, FIVE, is at the upper right.

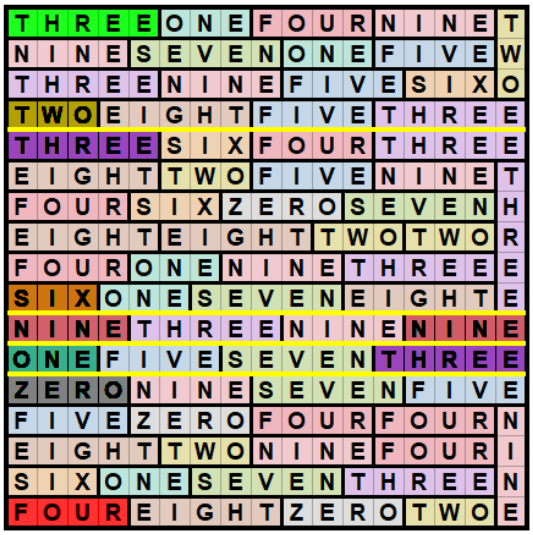
All the darkened words are connectors, in the sense used in the 118-element and 1-100 cardinal packings: horizontal words from two adjacent strips (that are also adjacent in the ordered sequence of words) which are placed next to each other in order to provide connectivity from one strip to the next. The five white words are vertical or horizontal connectors, as described earlier, used to provide further splitting when needed.

By chance, column 2 turned out to be the simplest. All the strip divisions are simple ones where the number of letters in the strip just happens to be a multiple of 16, and none of the resulting blocks were too tall (the tallest is 16 x 8).

Note that every dark connector touches the left or right edge of the strip it's in. This is not necessary – each pair of these can be positioned anywhere horizontally. We did this merely for aesthetic cleanness, and the fact that we could do it indicates how easy this task is: it was not a problem to incorporate this additional constraint.

The famous 999999 occurs at the bottom right corner of the third column, exactly the same place where it would occur in a columnar display of the first 1024 digits of π (since it ends at digit 768, which is 3/4 of 1024). But note that there are 1027 words here, not 1024! We did some special finagling (basically, an extra-circuitous path through that block) to maneuver the 999999 to be where we wanted it, exactly in the bottom right corner of the column.

To pack a π square of a different size we would subdivide it into one or more columns with widths of, say, 12 to 20, then split each column into strips as we did here, using the natural splits as well as additional splits, if necessary, via vertical connectors or borrowing. Then we'd fill the columns in zigzag fashion, as in our 64 x 64. For example, here are the next two squares after the 10 x 10, the 17 x 17 and 19 x 19 squares, created using this procedure:





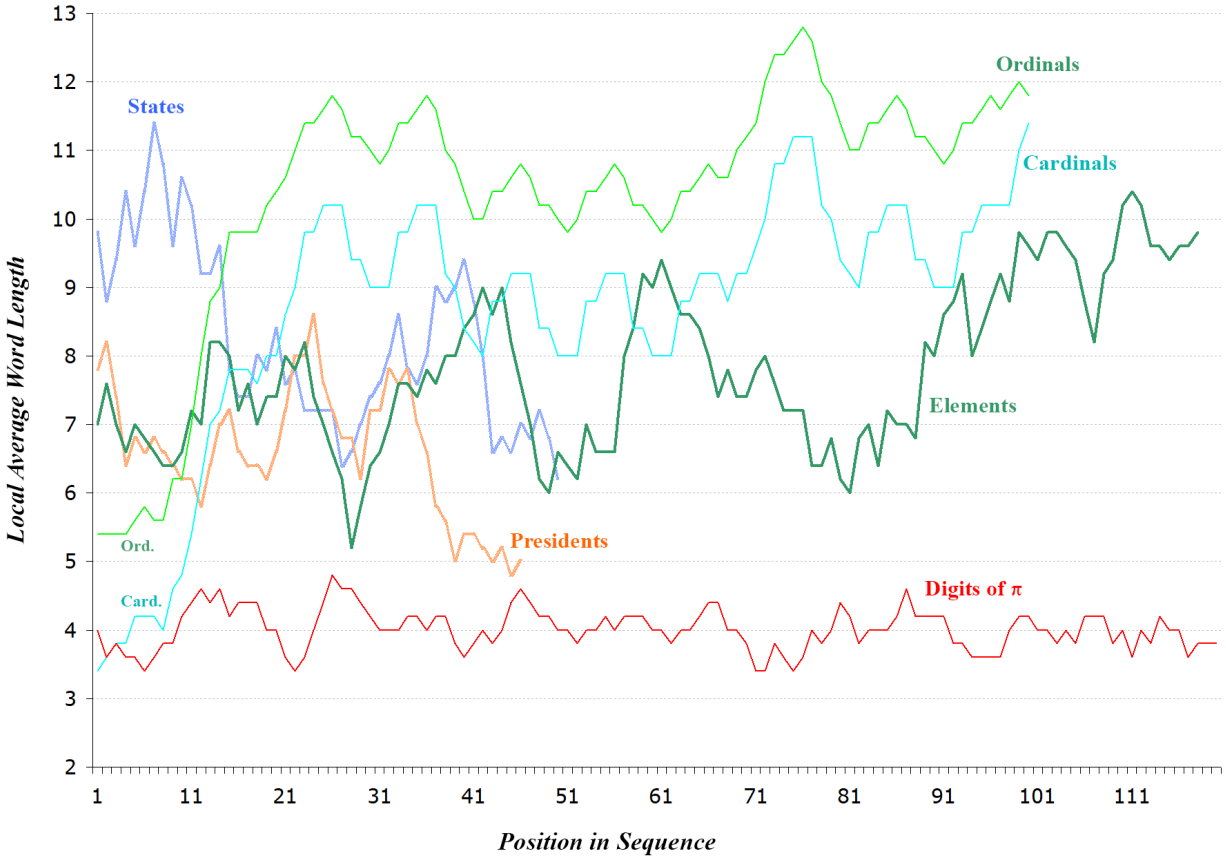
Just by chance, both of these were quite simple and straightforward. Only one column is used (so no zigzagging), and all the splits (again indicated by yellow lines) are natural ones. As before, the dark squares indicate connectors that touch at strip boundaries. In both diagrams, the sequence of π digits starts at the upper left corner (the bright green THREE) and ends at the bright red word on the bottom row. Notice that both packings are nearly linear with only a few vertical words – another indication of how relatively easy this task is.

For the next couple squares (25 x 25 and 26 x 26) we might continue to use one column, or perhaps split into two columns of width 12 or 13. For the next one, 32 x 32, we would surely

split into two columns of width 16 and fill it in a manner similar to the 64 x 64. It seems clear that we have enough empirical evidence to suggest fairly strongly that Conjecture P is is true.

Conjecture P applies to any random sequence of digits, so any ordered packing of the digits of *e* (basis of natural logarithms), or φ (the golden ratio), or the square root of 2, or the digits of any other famous real number into a rectangle or square should be equally straightforward.

Relative difficulty of different word lists. How hard it is to pack word list X versus list Y? The six overlaid graphs below show the local average word length at each position in each of the six word lists used in this article. For the local average we used the average of the five adjacent words in the list centered on a given word. This running average smooths out some of the "noise" in the graph while still allowing variations in word length to be visible.



Local average word length is simple to calculate and seems to provide a good metric of the difficulty of packing a particular portion of a specific word list (ordered or unordered), and based on creating numerous ordered packings we think it's an especially good predictor for ordered packing difficulty.

The chart above predicts that the ordinals are the most difficult to pack, followed by the cardinals. These words start out small but from 21 onward are long enough to be awkward. And, of course, they get even longer again after 100 (and again after 1000, etc.), so it's fairly obvious that they present the hardest packing challenge of these six word lists.

The chart also shows that the U. S. states are generally harder to pack than the U. S. presidents, since the state names are noticeably longer than the president surnames (which

seem to be currently stuck in a short-name rut – good for packing!). The elements are medium in difficulty, getting worse near the end (the last 30-40 elements). Finally, note the curve for the digits of π, which indicates that these words are by far the easiest to pack. These loose predictions are consistent with our impressions from creating the packings in this article.

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KING'S MOVE WORD PACKING – THE PRESIDENTS

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Ross Eckler authored an article called King's Move Word Packing in *Word Ways* back in May 1994 (volume 27, number 2). He explained that in chess, a king can move to any of the eight adjacent squares on the board – up, down, left, right and the four diagonals. He explored the logological challenge of inserting letters on individual squares of a chessboard (extended, if necessary beyond the board's 8-by-8 limits), and spelling out groups of words, moving from letter to letter via king's moves. Ross's article considered the surnames of the US presidents. He offered the letter arrangement below, noting that it contained the surnames of the US presidents from Washington to Clinton. In this arrangement, repeated surnames (such as JOHNSON) are spelled out using the same letters. Also, surnames with paired letters (such as COOLIDGE) are handled by permitting the king to tarry on a square. Ross explained that the criterion of excellence in judging the surname-packing in such an arrangement is the total number of letters required to do the job, the fewer the better. His arrangement below contains a total of 93 letters:

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

Since Ross's article, there have been four further presidents – BUSH (#43), OBAMA, TRUMP and BIDEN. As BUSH (#41) was already in Ross's solution, it was only necessary to add letters to include OBAMA, TRUMP and BIDEN. My arrangement below now contains all of the presidents' surnames in 99 letters. Six new letters (B E M O U R) have been added, and one (A) has been moved. These new and moved letters are shown in red. Is any further reduction of this figure possible?

What other groups of words could this concept be applied to? The names of the chemical elements might be an interesting group to investigate. Even though the elements' names contain over 900 letters, the repeated use of -IUM endings might only require the use of a few Is, Us and Ms in a completed letter arrangement.

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

KICKSHAWS

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For those not familiar with the songs of “Weird Al" Yankovic, check out two of his video performances on YouTube. First off, try his rendition of *Bob*. Composed entirely of palindromes, the video is based on the iconic film segment of Bob Dylan’s *Subterranean Homesick Blues*, where Dylan displays all the lyrics on cards. While the palindromes are not original, it’s fun to see how they have been strung together. The second Yankovic video is entitled *Word Crimes*, which is a parody of the video *Blurred Lines* by Robin Thicke. Yankovic takes a swipe at many of the ways in which the English language is misused.

In July 2021, *NASPA News* (NASPA is the North American Scrabble Players Association) ran an item from its member Dan Stock. He explained: “Back in the 1990s, I found a set of two 15-letter words and five 14-letter words that use all 100 tiles in a Scrabble set. Since then, I've wondered if it is possible to come up with seven 14-letter words that use the 98 non-blank tiles. This past weekend I wrote an SQL query to try to search for them. After a 30-hour run, it found this set below”:

ACKNOWLEDGEDLY DEHUMANIZATION IMPROVISATIONS
JUSTIFIABILITY OVEREXAGGERATE UNCONQUERABLES
WEATHERPROOFED

Note that you can use the two blanks to make **DEHUMANIZATIONS** and either **OVEREXAGGERATED** or **OVEREXAGGERATES** to get another set of seven words that use all 100 of the tiles. In response to Dan Stock's solution, Quebec Scrabbler Daniel Desjardins offered another seven-word 98-tile set:

CINEMATOGRAPHY DIAGONALIZABLE FOREKNOWLEDGES
NONOBJECTIVITY QUADRUMVIRATES UNISEXUALITIES
WEATHERPROOFED

It’s difficult to see how the two blanks can be added easily to this latter solution, but readers are encouraged to attempt it. Or to find completely different solutions.

If you find the name of **Rednaxela Terrace** in Hong Kong slightly peculiar, you’re not the only one. The terrace is actually named after the original owner, a Mr Alexander, but it was transcribed backwards. Anyone care to work that into a palindrome? *Need you even ask? See page 226 – Ed.*





In the August 2013 *Word Ways*, Jeff Grant wrote that a single-turn Scrabble score of over 1900 points using only words from Webster's Second Edition might be achievable, based on the 15-letter word BENZOXYCAMPHORS. Eight years on, *Interim* reader Stuart Klimek has managed to devise a single-turn solution scoring 1922 points. The board layout (top left) shows how words were placed on the board prior to the record-breaking turn. While the layout is obviously contrived, this arrangement of words can actually be achieved by a genuine succession preceding moves. (The blanks in the diagram are the S in OsIER and the H in OOPhYTIC.) The 'lucky' player then found the tiles BZXCPHS on their rack, and spotted the horizontal play of the word BENZOXYCAMPHORS, making seven other vertical words in the process: BOARFISHES (54), ZOOPhYTIC (34), XIS (10), CROQUETING (66), PREVIEWED (18), HOVERING (19) and SJAMBOKING (78) – see the board layout at bottom left. With the 1643 points for BENZOXYCAMPHORS, this gives a total score for the move of 1922 points. A new single-dictionary, single-move record! 11 tiles remained unused – AADDDLTTTUU. Is an even highest score than 1922 points achievable, based only on words from Webster's Second Edition?



I was thumbing through a 6-year-old issue of *Word Ways* recently – the November 2015 issue (volume 48, number 4). In that issue, my article Now My Fifty++ Great New Isograms presented 20 new 2-isograms – words, names and terms using two occurrences of each different letter; for example, TRANSEASTERN. A name which can be added to that list of 2-isograms is PENNY PERRY, a casting director for several episodes of the Netflix tv series *Chesapeake Shores*. Her name can be found in the international film database (www.imdb.com). I wonder if anyone noticed that the title of my *Word Ways* article was itself a 2-isogram.

From the small table below, you can spell out 16 different words by taking either letter from each of the four columns:

M	**A**	**T**	**E**
P	**O**	**S**	**S**

The 16 different words are:
MASE MASS MATE MATS MOSE MOSS MOTE MOTS PASE PASS PATE PATS POSE POSS POTE POTS
Coincidentally, each of the 16 words has at least one transposal:
SAME SAMS TAME MAST SOME SOMS TOME MOST PEAS SAPS TAPE SPAT OPES SOPS TOPE STOP
This prompts some questions:

(1) Can a wider table of 5 columns and 2 rows be populated with letters such that all 32 five-letter combinations are valid words? If 32 words are unachievable, what's the most which are valid?
(2) Can a taller table of 4 columns and 3 rows be populated with letters such that all 81 four-letter combinations are valid words? If 81 is far too big an ask, what's the most valid words achievable?

The **Chinese zodiac is a repeating cycle of 12 years,** with each year represented by an animal and its reputed attributes. In order, the 12 Chinese horoscope animals are: rat, ox, tiger, rabbit, dragon, snake, horse, goat, monkey, rooster, dog, pig. Between them, they have 55 letters. Can the 12 animals be fitted into a 5 x 11 rectangle? My best attempt is here. But this solution is not perfectly packed, as it's not possible to move from one animal to an adjacent animal in the order in which they appear in the Chinese zodiac. Is there a way to fit the animals into a 5 x 11 rectangle so that they are perfectly packed?

R	**O**	**O**	**S**	**T**	**E**	**R**	**R**	**T**	**S**	**H**
G	**O**	**A**	**T**	**D**	**O**	**G**	**A**	**I**	**N**	**O**
R	**A**	**B**	**B**	**I**	**T**	**P**	**T**	**G**	**A**	**R**
D	**R**	**A**	**G**	**O**	**N**	**I**	**O**	**E**	**K**	**S**
M	**O**	**N**	**K**	**E**	**Y**	**G**	**X**	**R**	**E**	**E**

I was visiting the local podiatrist's (chiropodist's) surgery recently and was intrigued by a small display of strange foot-related objects. There were odd-shaped foot bones, antique surgical instruments, old containers of various foot balms and ointments, and so on. But I was particularly interested in one of the weirdly formed toenails, which was labelled GRYPHOTIC TOENAIL. I knew TOENAIL was a transposal of ALNOITE and ELATION, but I was curious about GRYPHOTIC. I saw immediately it was a transposal of COPYRIGHT, but I was certain I had never seen the word GRYPHOTIC before. On returning home, I did some checking. None of the OED, Webster's Third and Webster's Second listed the word. The Merriam-Webster dictionaries both list GRYPOSIS, defining it as abnormal curvature especially of the fingernail. Perhaps medical dictionaries would list the word. My various editions of *Stedman's Medical Dictionary* only show

GRYPOSIS, but my *Dorland's Medical Dictionary* has both GRYPHOSIS and GRYPOSIS. Even my 1892 edition of Foster's *Illustrated Encyclopaedic Medical Dictionary* contains both GRYPHOSIS and GRYPOSIS. My even older *Century Dictionary* (1889) only lists GRYPOSIS. Clearly, neither of these two words, with or without the H, is new to the medical profession. But I still couldn't find a dictionary listing for the obviously adjectival GRYPHOTIC. Returning to the OED, I found it has a main entry for ONYCHOGRYPHOSIS, also showing ONYCHOGRYPOSIS as a variant form. The OED's definition refers to excessive curvature and thickening of toenails and fingernails. Various online dictionaries include GRYPHOSIS. But GRYPHOTIC does appear on various podiatry-related websites – for example, dubaipodiatry.com and bexleyfootclinic.co.uk. And just in case you're in any doubt about how to pronounce GRYPHOTIC, there is a 61-second video on YouTube which pronounces the word multiple times. So, there it is, a newly discovered transposal of COPYRIGHT.

The internet has numerous websites describing themselves as anagram solvers. One of the most inclusive is **anagram-solver.net**, which even goes so far as providing various misspellings. I tested many of these websites by inputting the word COPYRIGHT. None of them offered GRYPHOTIC as a solution. But they did throw up GOSSIPRY as a transposal of GRYPOSIS.

In the world of chemistry, according to Merriam-Webster, a compound is "a chemically distinct substance formed by union of two or more elements in definite proportion by weight and with definite structural arrangement". But in the world of logology, a compound can be formed when the letters of two or more elements can be combined to create a new word. Here are some examples of compound words formed by the union of two elements:

ACTINIUM + LEAD → ADMINICULATE
ARGON + CAESIUM → GRAMINACEOUS
ARGON + TIN → IGNORANT
ARSENIC + LEAD → CALENDARISE
ARSENIC + NEON → NONINCREASE
ARSENIC + TIN → CARNITINES
BORON + LEAD → BANDOLERO
ERBIUM + TIN → TIMBURINE
GOLD + IRON → DROOLING
INDIUM + LEAD → ADLUMIDINE
LEAD + TIN → LANDTIE
NEON + SILVER → NONSERVILE
RADON + TIN → ORDINANT

And here are some compound items formed by the union of three elements:

ARGON + LEAD + TIN → ANDROGENITAL
COBALT + LEAD + TIN → BALLET D'ACTION
IRON + LEAD + TIN → INTERNODIAL
LEAD + NEON + TIN → NONENTAILED

There are almost 7000 potential combinations of two element names. Can readers find further examples of genuine compound words among the 7000? Are there other genuine three-element compound words? Is there even a single four-element-compound word?

The online *Oxford English Dictionary* (www.oed.com) is updated quarterly with new words, sub-entries, and revisions. The most recent regular update was in September this year. A full list of the updated entries, plus various notes, can be found at **public.oed.com**. Here are 20 of the brand new words, none of which appears in the unabridged Merriam-Webster dictionary (**unabridged.merriam-webster.com**):

aegyo : Cuteness or charm, esp. of a sort considered characteristic of Korean popular culture.
bammy : In Jamaican cookery: a round flatbread made from cassava flour.
chimaek : In South Korea and Korean-style restaurants: fried chicken served with beer.
decarceration : The release of a person from prison.
fassy : Sores on the skin; inflammation of the skin.
gho : The national dress for men in Bhutan, consisting of a long robe hitched up to knee-length and fastened at the waist by a cloth belt.
hallyu : The increase in international interest in South Korea and its popular culture, esp. as represented by the global success of South Korean music, film, etc.
japchae : A Korean dish consisting of cellophane noodles made from sweet potato starch, stir-fried with vegetables and other ingredients.
kaiso : A style of Caribbean music of West African origin, associated esp. with carnivals and similar celebrations.
livestreaming : The action or process of broadcasting an event, etc., live over the internet.
mukbang : A video, esp. one that is livestreamed, that features a person eating a large quantity of food and talking to the audience.
noona : In Korean-speaking contexts: a boy's or man's elder sister.
orhni : A length of fabric worn as a scarf, shawl, veil, or shoulder wrap by women of South Asia or of South Asian descent.
phukni : A blowpipe used to direct a current of air into a fire so as to make it burn more effectively.
sheg : To provoke, vex, or annoy (a person).
tabanca : A state or feeling of depression or melancholy, esp. as a result of unrequited love or the end of a romantic relationship; lovesickness.
upful : Inspiring happiness, optimism, or hope.
washikong : A light canvas shoe with a rubber sole, a plimsoll; a trainer or running shoe.
wuk : Esp. of a woman: to dance with rhythmic gyratory movements of the hips and pelvis.
zombocalypse : An imaginary event in which the world is taken over by zombies.

In the May 2021 edition of *Interim*, I commented that the term **long Covid** hadn't at that time made it into the online OED. With the September 2021 update of the OED, that term is now present. Here's the way the OED lists and defines the term:
long Covid : a syndrome characterized by the persistence or development of symptoms attributed to Covid-19 weeks after (esp. more than 12 weeks after) initial infection. Such symptoms may arise in any organ system of the body but often include extreme fatigue, breathlessness, muscle weakness, and various types of neurological dysfunction.

As US readers undoubtedly will be aware, NANCY PELOSI is a politician serving as Speaker of the US House of Representatives; she has served as a representative for California's 12th congressional district since 1987. Why mention her? Well, her name is a transposal of PENNY SOCIAL, a main entry from the *Dictionary of American Regional English*, an

alternative form of which is PENNY SUPPER. A penny social is a fundraising event that combines elements of raffles and silent auctions (and food), with entry typically costing one penny (one cent) or maybe a dime.

From the current Speaker of the House of Representatives to an early US president. I wonder if *Interim*'s contributing editor DON HAUPTMAN is aware that his name can be spelled out from the letters of PRESIDENT JOHN QUINCY ADAMS.

Speaking of Don Hauptman, Don sends the following report:

> On April 10, 2021, the Styles section of the Sunday *New York Times* contained a long cover story that was surprisingly lurid for that usually staid publication.
>
> An S&M mistress has a roster of clients who enjoy being abused and insulted, online or in person, and who give her money, often large sums, in return for such services.
>
> As I often quip: Strange, yet bizarre!
>
> Other such, er, professionals, and their customers, were profiled. The reporter elaborated: "'Financial submissives' . . . send monetary 'tributes' to a financial dominatrix, who could be any gender, in exchange for being humiliated and degraded." Psychologists were quoted, who attempted to explain the motivations behind the fetish: power, ownership, surrendering control.
>
> In the November 2002 issue of *Word Ways*, my spoonerism article included this specimen: ***"Please pay when served. Please say when perved."*** I liked the coinage so much that I briefly repeated it in subsequent articles, in 2017 and 2020.
>
> I had ascertained the pun's probable originality when I first invented it. But when the *Times* article appeared, I searched again. Google responded: *"It looks like there aren't many great matches for your search."* In fact, though, there were. Immediately following that dubious assertion were links to my *Word Ways* articles—and they are indeed great!
>
> If anyone is interested (and why would you be?) in the *Times* article: https://www.nytimes.com/2021/04/10/style/findom-kink.html

And finally, write down the numbers from 1 to 99 using letters. Sort the list into alphabetical order. Only one number doesn't change its position. Which number?

Editor's note: As for using that inadvertent reversal of a Hong Kong stree name pictured on the first page of Kickshaws, "Rednaxela Terrace," in a palindrome, how about this one:

"RED NAXELA TERRACE"*?* LA! . . . STILL, IT'S A LE CARRE TALE, XANDER.

YOU CAN'T TURN ON A DIME LIKE A LIGHT SWITCH
More Mixed Metaphors and Related Amusing Gaffes

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This just in, from George Will's *Washington Post* column, November 21, 2018:

"Never one to use a scalpel when there is a machete at hand, the president denounced the Trans-Pacific Partnership trade agreement, a dunderheaded move but a reason for giving thanks today because it elicited from Sen. Claire McCaskill, D-Mo., 2018's most exquisitely mixed metaphor: 'He shot from the hip with a sledgehammer instead of using a scalpel.'"

The reason for the three-year delay? My previous roundup of mixed metaphors appeared in the August 2018 issue of *Word Ways*. So this one missed the deadline. Mixed metaphors were especially prevalent
in political news during the Trump era:

- "Mueller's witch-hunt investigation is now a runaway train that is clearly careening off the tracks."
- "Even such toothless criticism has dried up under the Trump administration."
- "It's an Achilles' heel that's been built into every single thing they've done."
- On whether or not public officials should behave nicely: "Sometimes you need a bulldog to cut through the baloney and get things done. . . ."

Mixed metaphors seem to appear everywhere. Here are other genuine examples I collected in the course of that long temporal lacuna:

- "I've kicked my crystal ball into a dumpster fire."
- "We'll get all the pieces aligned so it's on cruise control to keep going."
- On Disney movies: "They've been more on the nose recently and it's starting to show some cracks."
- Brexit is "the mother of all mulligans."
- Landlords reacting to proposed regulations: "It's an all-hands-on-deck thing because this came out of left field."
- An interviewee's decision to retire is a "bittersweet fork in the road."

- “I’ve seen no white knight step up to the plate.”

- If you’ve followed my articles on the subject (this is the 11th installment in the series), you know that I enjoy coining mixed metaphors intentionally for amusement purposes. For example, I recently texted a friend who had sought my advice on a professional matter: “Don’t hold your horses while the bandwagon is hot!” But others also relish this puckish practice. Well, I’m charitably making that assumption and giving the benefit of the doubt to these specimens, which struck me as too obviously outrageous to be inadvertent:

- Commercial for home exercise equipment: “This puppy has bells and whistles.”

- A Republican congressman’s prediction of Democratic victories: “We are staring down the barrel of a blue tsunami.”

- On resuming real-life interactions, post-pandemic: “But now the snake-pit moments in the social fishbowl are back with a vengeance. . . .”

- Headline: “Facebook’s Worst Demons Have Come Home to Roost.”

Finally, there’s the variety that doesn’t quite fit the official definitions, so I’ve dubbed such examples “mashed metaphors.” They concatenate familiar expressions, generating a result that’s awkward and clichéd. For instance:

- “If you play the long game, it can once in a blue moon pay off.”

- “It was when I started raising red flags that things started going downhill.”

- “And the only thing you can do is go with the flow and pivot.”

- “The knives come out, the donors flee and the candidate throws embarrassing Hail Marys.”

- “[Woody] Allen’s movie may have pushed the envelope on May-December romance, but it didn’t appear out of a vacuum.”

- “There was somewhat of a level playing field because we were all in the same boat.”

- “You only scratched the surface; the rabbit hole is much deeper, and there are no white hats.”

- “The buck should have stopped on Governor Brown’s desk a long time ago. . . . It smacks of a lame duck walking through the finish line.”

You’ve just encountered more mixed metaphors than you can shake a stick at after the dust has settled. True, I threw in everything but the kitchen sink, but that was just icing on the cake. Will there be another entry in this series? When the gloves are off, wild horses couldn’t stop me!

CREDIT: For spotting the “crystal ball” specimen, thanks to Ralph MacPhail, Jr., Bridgewater, Va.

THE GREAT BRAIN ROBBERY

JIM PUDER

PART TWO: LOGOLOGY NOIR

It has always seemed to me that the Borgmann affair — which seems as good a name for it as any, notwithstanding that there were two other principal actors involved in it — consisted of not just one but two distinct mysteries, or rather sets of mysteries. When, in 2014, questions were raised in *Word Ways* as to whether revered wordplay pioneer Dmitri Borgmann, who had died nearly three decades before, was truly the author of three articles on the subject of palin-drome history which had appeared under his name in *Word Ways* in 1979-80, a number of questions at once presented themselves: *Was* Borgmann indeed not the author of the articles? If not, who was, and where and how had Borgmann obtained the articles? Another question, less immediate but still critical, was whether or not Borgmann had made any significant alterations to the articles before submitting them to *Word Ways*. These were all questions which, while initially baffling, at least had theoretically discoverable answers, and as was reported in Part I of this article, which appeared in the May 2021 issue of *Interim*, all of the first set of mysteries in the Borgmann affair have now been elucidated, thanks in part to sheer good fortune and in part to the alertness of palindrome history researcher Mark Saltveit. To review, the questioned articles have been identified as the work of a still-living author, Gary Coen, who wrote the three "articles" (which were actu-ally chapters of his master's thesis) while a graduate student in the late 1970's. Coen had be-come acquainted with Borgmann in the course of researching his thesis, and upon its com-pletion had presented Borgmann with a copy of the work.

The just-mentioned second set of mysteries has mainly to do with motives and intentions: why did Borgmann sent the three articles to *Word Ways* under the pretense that they came from someone who was definitely *not* their author? Why did *Word Ways* editor A. Ross Eckler, after ascertaining that that person had not really sent the articles, apparently not bother to contact Borgmann to confirm that Borgmann was indeed their author before publishing them under his name? And, given that Borgmann had evidently never had any intention of claiming authorial credit for the articles for himself, why, when he discovered or realized — probably to his considerable consternation — what had happened, did he not come forward to disclaim the false credit? Unlike the first group of mysteries, these are all questions which at this date can no longer be answered with any great certainty.

To begin with the first of those mysteries, what possessed Borgmann to do what he did in the early autumn of 1979 — why did he, without Coen's knowledge or permission, submit three chapters of his erstwhile correspondent's master's thesis to *Word Ways* for publication under the pretense that they originated with a third person whom neither he nor Coen even knew? On the face of it, it seems a daft act. Whatever Borgmann's purpose may have been, it seems safe to assume, for the following reasons among others, that he did *not* do what he did with any intent to claim the authorship of the articles for himself:

- Not only did Borgmann sign the pirated articles with the name of a *Word Ways* reader with whom he had no connection, he apparently did everything conveniently possible to make it appear that this person was also responsible for submitting the articles to *Word Ways*. If Borgmann's real purpose had been pass those works off as his own writings, this was certainly a strange way to go about it.

- As received from Borgmann and published by *Word Ways*, the articles are rife with thought and opinion contrary to that in Borgmann's own published writings on the same topics. They also cite numerous articles in decades-old foreign-language journals that Borgmann would have been unlikely even to have known of, let alone to have known how to access if he had, and some of which he probably would not have been able to read in any case. Moreover, in his own published writings Borgmann had never before exhibited the slightest interest in tracing the development of wordplay even as far back as the 1940's, never mind antiquity. Borgmann was surely aware of the many discrepancies between Coen's writings and his own, and that a good deal of revision and editing would be needed before the former would even begin to resemble the latter; and yet, *Borgmann made not a single change to Coen's commandeered chapters, beyond adding false by-lines, before submitting them to Word Ways*. The conclusion is inescapable that Borgmann simply did not *care* that Coen's writings on palindromes ancient and modern did not greatly resemble his own, and may even have considered, at the time, that this circumstance exactly suited his purposes.

- Other reasons why Borgmann would have been most unlikely to have schemed to steal the authorial credit for Coen's writings include the fact that he had not the slightest need to augment his own very prolific and rapid production of quality wordplay articles, the fact that he probably would not have *wanted* to be thought to have been the author of the works in question, and most of all that it is absurd to suppose that Borgmann, who was clearly proud of his reputation as the father of logology (a word he coined) would have willingly risked the ruination of that reputation for the sake of plagiarizing a treatise on a subject in which he had scant interest. Add to these the fact that Borgmann would have had no reason to suppose in advance that such a plagiarization would be likely to pass undetected. After all, Coen had sent a copy of his thesis to Borgmann; might he not also have sent one to Martin Gardner, whom Borgmann knew Coen knew, or to Howard Bergerson, say, or to Ross Eckler? Or might Coen, whom Borgmann had not spoken to in over a year, perchance by that time have begun to read *Word Ways* himself? Had any of those things transpired — and Borgmann would have had no way of knowing if any of them had — his plagiarism of Coen would almost certainly come to light, and his journalistic career in *Word Ways* possibly come to an end.

If, then, publishing portions of Coen's thesis under his own name had *not* been Borgmann's intention all along, why *did* he do what he did? While we can never know for certain the answer to that question, we can at least make an informed guess based on what we do know of what actually happened, which is based primarily on the recollections of Gary Coen and Ross Eckler. Coen's postal relations with Borgmann in 1978 and 1979 were described earlier. Here Eckler, writing in the February 1987 issue of *Word Ways*, a time when he was still under the impression that Borgmann was the author of the misattributed articles, describes the manner in which Borgmann transmitted them to him:

> His landmark article on the history of palindromes and the SATOR square, appearing in *Word Ways* in 1979-80, was sent to me under the name of David R. Williams, a member of the National Puzzlers' League who had been mentioned in passing in *Word Ways* some time before. It took a letter to Williams to satisfy me that I had been spoofed.

(Note that Eckler does not say that he ever contacted Borgmann to confirm his assumption that he was the sender of the articles, or his further assumptions that Borgmann was their author and wished them to be published in *Word Ways*.) Other reminiscences by Eckler in several issues of *Word Ways* about his experiences with Borgmann dwell, significantly, upon the latter's penchant for adorning his occasionally frequent letters to Eckler with odd embellishments, apparently humorously or ironically intended. Beginning in the mid-1970's, according to Eckler, Borgmann would do such things as write on stationery bearing letterheads having nothing to do with himself and ornament his envelopes and letters with a variety foreign stamps and assorted stickers. As time went on Borgmann seemed to keep trying to top his previous efforts in this practice until by 1978 he was sending the *Word Ways* editor bizarre but clearly joking notices of his own pending or actual death.

It is this game of Borgmann's of ever-increasing postal sportiveness, with Ross Eckler cast in his mind as his appreciative audience, that is, I suggest, the key to understanding why he did what he did. I think that his cavalier misuse of Coen's thesis must have been part and parcel of a series of increasingly outlandish, although humorously intended, stunts connected to his correspondence with Eckler — japes which ended abruptly after his last one misfired and landed him in serious jeopardy of unpleasant consequences. If we rule out any plagiaristic intent on Borgmann's part, as I believe we may, then I submit that there is really no other plausible explanation of his behavior in this matter in view. This has to be why he did it.

Let's see what a reconstruction of events based on this conclusion might look like. First, consider this further recollection by Eckler of Borgmann's history of article contributions in the August 2013 issue of Word Ways:

> "Dmitri's articles were generated in fits and starts. He sent in seven at once, which I was able to use during the first year of my editorship. In November 1972 he sent in a flood of articles, and in July 1973 about 30 more, including a number under pseudonyms . . . so that I could publish more at one time. In 1978 he became enamored of the problem of compiling a set of transpositions for the chemical element names and bombarded me with letters updating his researches for several months. I then heard very little from him until the summer of 1984, when another torrent of articles arrived …"

Borgmann's 1978 correspondence with Eckler on the element-names transpositions topic would have concluded with his submission of his article "Elementary Transpositions" to the August 1978 *Word Ways*. (Borgmann, incidentally, wrote of this article, which was one of the finest that he ever contributed to *Word Ways*, that it was the result "of more than four months of unrelenting search for the best possible transposition of each element name," and the time and effort that he put into it shows. Perhaps Eckler took note of its unusually scholarly cast and as a consequence became readier to believe Borgmann capable of writing the 1979-80 palindrome articles.) Now, in, let's say, September of 1979, Borgmann hasn't had any occasion to correspond with Eckler in over a year. (He hadn't needed to submit any new articles during that time to keep on being published in *Word Ways*, as his "flood" of submissions in November of 1972 and about 30 more in July of 1973 had created a backlog of unpublished articles that Eckler was still gradually reducing, publishing one or two at a time in every issue.) Perhaps Borgmann found that he missed those collegial exchanges with the *Word Ways* editor and would have liked to renew them, and felt that he needed some apt occasion for doing so. But what? He had no new spate of articles or single blockbuster article to submit to *Word Ways* that would have served the purpose.

His mind turned to Coen's *Palindrome* paper. He surmised that neither Coen nor anyone else had sent Eckler a copy of it, for if they had, portions of it would probably have appeared in *Word Ways* by this time. So Eckler had never seen it, and would probably appreciate receiving a copy of it from Borgmann. Yes, that could be a way to create an occasion for reestablishing contact with Eckler, make him a gift of Coen's thesis; he'd also give him his last address for Coen, in case Ross wanted to reach him. Sending Eckler the thesis would also provide a new opportunity for Borgmann to do something creatively amusing with his mailing. In the course of his 1978 correspondence with Eckler on element-name transpositions, for instance, he'd embellished his letters with various dire official-looking pronouncements. But he didn't want to repeat himself, no true original does. He considered the matter, and somehow there gradually coalesced in his mind a plan for his greatest postal prank yet: a fake bogus articles submission to *Word Ways.*

Yes, a *fake* bogus articles submission — one that *pretends* to be a serious attempt to deceive, but which really isn't, being in reality only an attempt to amuse its recipient with its simulation of a serious hoax attempt. For surely Borgmann must have known that the hoax couldn't possibly succeed, inasmuch as the envelope the articles arrived in would inevitably have been prominent-ly postmarked "Dayton, Wash.," and seeing this, Eckler would hardly have been likely to believe that the articles had really been sent by David Williams of Rochester, New York. (In his brief *Word Ways* comment on the incident, Eckler doesn't say what made him suspect that Williams hadn't sent him the articles, but seeing that postmark could certainly have had that effect on him.) So it must have been the case that Borgmann never intended or expected Eckler to be fooled by the imposture, and probably expected that, having deduced the true origin of the articles, Eckler would write to him for an explanation and Borgmann would tell him about Gary Coen and his thesis, and they'd both share a laugh at Borgmann's little joke, and no harm would have been done to anyone. If he thought about Coen at all, he probably thought he was doing the graduate student a favor by putting Eckler in possession of his paper; who knew what might eventually come of that? Well, perhaps he'd been overly harsh with the young man, and maybe this small favor would help to make it up to him.

Let us now momentarily shift our reconstruction of events from Dayton, Washington, to Morristown, New Jersey, where Ross Eckler, having quickly assessed the shipment of the three articles as bearing all the hallmarks of a Borgmann creation, must have been sorely tempted to simply accept the three articles as being Borgmann's work, despite their "David R. Williams" bylines, and let the matter rest there. But he knew that he couldn't in good conscience do this, so off went a letter to David Williams to ask if he knew anything about the articles, and back came Williams' expected reply that he didn't. Now the question was whether or not to follow up that letter with one to Borgmann asking just what knick knack patty-whack, give a dog a bone game he thought he was playing at with this hoax. On the "yes" side of that question was the fact that it might be wise to ascertain just what the provenance of those articles was before publishing them under Borgmann's name, although it hardly seemed likely that he'd be playing this fast and loose with anyone's writings but his own. On the "no" side of the question, Borgmann's postal playfulness was probably beginning to wear a bit thin with Eckler, who wouldn't have appreciated being forced to approach Williams with his odd inquiry. These increasingly eccentric stunts were just so much attention-seeking on Borgmann's part, Eckler may have thought, and perhaps the best way to cure him of that would be to pay them less attention. And who else *but* Borgmann would it even have occurred to send him new articles misattributed to someone else as a joke? Oh, the articles were Borgmann's, all right. *Did* Eckler ever check back with

Borgmann to confirm that he was in fact the author of the palindrome articles before he published them under Borgmann's name? I don't know, but the fact that he ended his *Word Ways* comment on the incident without *saying* that he did suggests that he didn't.

Returning to Dayton, let's assume that by mid-October Borgmann still had heard nothing from Eckler and had correctly concluded that this could only mean one thing — that, as expected, Eckler had checked with Williams and been told that the latter wasn't the author of the articles, but had then, as Borgmann had *not* expected, instead of checking with Borgmann to confirm that the articles were his, had simply decided that the articles could only be Borgmann's submissions and was planning to publish one or more of them under *his* name in the next *Word Ways*. Clearly, what Borgmann needed to do now — and quickly, before The November issue went to the printers — was to let Eckler know of the real provenance of the articles that Borgmann had sent him. Eckler would be vexed, of course, at not being able to publish them, but that was nothing compared to the potential difficulties that lay in store for Borgmann if one or more of those articles got published under his name. And yet, Borgmann did nothing. Why not? Here, my crystal ball fails me; I can't imagine why he didn't act, while he still could, to avoid incurring the considerable risk of someday being subjected to hard-to- refute charges of plagiarism. Could it have been for so simple a reason as an inability to ever admit to anyone having made a mistake or done something foolish?

Whatever his reason, Borgmann kept silent and the first of the three Gary Coen-written palindrome articles was published under his name in the November 1979 *Word Ways*. Now he was faced with a choice similar to the one he had faced before, only the stakes were higher. On the one hand, if before the February *Word Ways* was out he came forward with a more or less true account of how the November palindrome article had come to be misattributed to him, he could still plausibly deny any intent to plagiarize. His embarrassing explanation would have to be a public one, however, and his critics in the wordplay community would surely have a field day with it, doubtless bruiting about such inapt expressions as "hoist with his own petard." On the other hand, if he continued to keep silent, there was a definite chance that no one would recognize the palindrome article as being the work of anyone other that Borgmann, and he'd be able to skate through this scrape without having to make any embarrassing explanations to anyone. The trouble with this plan was that if the misattribution *was* discovered sometime after the February *Word Ways* was published, Borgmann would find it very difficult to explain why he had not come forward in the interval between the November and February issues to set the record straight. But in either case, if someone were going to recognize the article as having been cribbed from Coen's thesis and blow the whistle on him, they would likely do so early on, in November or December, whereas Borgmann had the luxury of waiting until January to come forward with an explanation, if he decided to do that; so he could afford to sit tight for a while and see what transpired. In the event, Borgmann did nothing, the February 1980 *Word Ways* was published, and Borgmann's only remaining tolerable alternative was to keep mum about the articles and hope for the best.

Did Borgmann really play the hand he'd been dealt as coolly and calculatingly as this analysis suggests he might have, or was it more the case that a kind of volitional paralysis gripped him during this episode, preventing him from doing anything at all? I don't know, but we possess one piece of information that may shed a light on his state of mind at that time and for some time afterward. In one of his *Word Ways* commentaries excerpted above, Eckler writes of Borgmann, "He sent in seven [articles] at once, which I was able to use during the first year of my editorship. In November 1972 he sent in a flood of articles, and in

July 1973 about 30 more… In 1978 he became enamored of the problem of compiling a set of transpositions for the chemical element names and bombarded me with letters updating his researches for several months. I then heard very little from him until the summer of 1984, when another torrent of letters arrived…" As I interpret this comment and others by Eckler in *Word Ways*, from 1970 to 1973, depending on how many were in the "flood" that he contributed in late 1972, Borgmann contributed about 60 articles to *Word Ways*, and very few thereafter until mid-1984 when he once again began submitting articles in large quantities. For most of the intervening period Eckler seems to have made it his practice to dole out Borgmann's backlog of 1970-73 contributions one or two articles at a time, thereby stretching his supply of unused Borgmann articles out for several years.

Very well. We know that Borgmann did contribute at least one additional article between 1973 and 1984, the "Elementary Transpositions" article over which he'd labored for four months and about which he'd frequently written to Eckler, which he submitted to *Word Ways* for its August 1978 issue. After this, if I correctly understand what Eckler is implying, he contributed no new articles at all (if you don't count his unintended contribution of the three palindrome articles) until the summer of 1984, a period of six years. What could have caused Borgmann's abrupt loss of interest in participating in *Word Ways* so soon after his enthusiastic research and writing of his August 1978 transpositions article? It would likely be something that happened not long after that. Well, Borgmann's 1979 fake bogus *Word Ways* contributions fiasco occurred not long after that; could there possibly be *any* connection between the two things? In brief, could Borgmann's close brush with journalistic infamy in 1979 have so frightened him that he recoiled from any further writing for *Word Ways* until 1984, when intimations of mortality turned his thoughts to fortifying his legacy as logology's greatest pioneer, and he began once more to deluge *Word Ways* with the fruits of his logological researches, which had probably not altogether ceased during his "lost years." That's one theory, anyway; can anyone suggest an alternative explanation for his half-decade-long withdrawal from *Word Ways*?

To sum up, my answer to the question of why Borgmann did what he did is that it seems to have been for a complex of reasons, most of which involved no willful misconduct but some of which did. It was by accident, not calculation, that Borgmann ended up being credited as the author of someone else's writings, and though he *was* the initiator of the bizarre chain of events that led to the misattribution, he was only partly responsible for it. It's harder to understand his silence after the misattribution occurred; it seems unlikely that it was because he keenly coveted the authorial credit for the palindrome articles, which he was never reported to have claimed to have written (2. In the end, though, the greatest victim of the Borgmann Affair may have been Borgmann himself, who may well have been put off of logological writing for four or five years as a result of it.

Another observation that may be worth making is that the Borgmann Affair was not necessarily uniformly negative in all of its effects. For instance, although Gary Coen, for one, can be justifiably annoyed that for over three decades portions of his master's thesis were publicly billed as the works of another writer, it can't be said that Coen was materially harmed by the misattribution — he lost no income thereby. And thanks to Borgmann's causing parts of his thesis to be published in *Word Ways*, probably a thousand more people have read those writings than would otherwise have been the case. Not only that, but Borgmann's 1979 recycling of Coen's thesis into several faux articles which accidentally got published for real was the eventual cause, many years later, of Coen's decision to expand his 1978 master's thesis into *Running Back Again: Re-flections on the Palindrome,* a marvelous

full-length book that is surely the deepest exploration of the impact of palindromic writings on the human psyche ever written. Had Borgmann not unilaterally decided to lay those faux articles before Ross Eckler, partly as a joke but partly too, I suspect, to give him a look at Coen's thesis, *Running Back Again* would most likely never have been written, which would have been a great loss. The dust jacket of Coen's book, when it comes out, should symbolically feature a silver lining, in recognition of the Borgmann Affair's material contribution to its genesis.

NOTES

(1) Borgmann's indifference to the contents of the misattributed articles Once it had been discovered that Gary Coen's 1978 master's thesis had been the source of the three palindrome articles misattributed to David Wiliams that Dmitri Borgmann had, pretending to be Williams, submitted to *Word Ways* in 1979, it became possible to compare the articles with their source document in order to ascertain whether Borgmann had made any changes to Coen's thesis which would cause it to more closely resemble his own writing. If he had, the theory was, it would be a strong indication that Borgmann had intended all along to arrange somehow for the articles to be published under his own name, as indeed they eventually were. In particular, Borgmann would have been expected to insert stretches of his own writing into the text, and to eliminate such dismissive Coen phrases as "mere wordplay" and "puerile wordplay" (in reference to modern palindromes) in the course of making a host of changes calculated to make Coen's prose seem more Borgmann-like, if the filching of the authorial credit for the articles had been his object.

A letter-by-letter comparison of Coen's original thesis with the text of the articles as they were published in *Word Ways* established that, apart from the insertion of the false bylines (changed from "David R. Williams" to "Dmitri A. Borgmann" in *Word Ways'* version), only a single possibly significant change was to be found in the text of the published articles. This was in close agreement with my expectations, as I'd long since concluded that Borgmann had made no deliberate changes at all, apart from the insertion of the spurious bylines, in the texts of the articles before shipping them off to Morristown. What puzzled me was that single change, which was evidently a deliberate one. In his thesis, referring to present-day palindromists, Coen had written

> "Among these the most important are Leigh Mercer, Dmitri Borgmann, and J. A. Lindon, who together strike a note…"

In place of this language, the *Word Ways* version read

> "Among these the most important British practitioners are Leigh Mercer and J. A. Lindon, who strike a note…"

Somewhere along the line someone had dropped Borgmann from the ranks of the "most important" and inserted the word "British"; why? After a while, the answer dawned on me — this change hadn't been made by Borgmann at all; those fingerrprints all over it could only be Ross Eckler's.

In those computerless days of yore *Word Ways*' editor personally retyped virtually every article contributed to the journal, both to achieve stylistic uniformity and to afford an opportunity

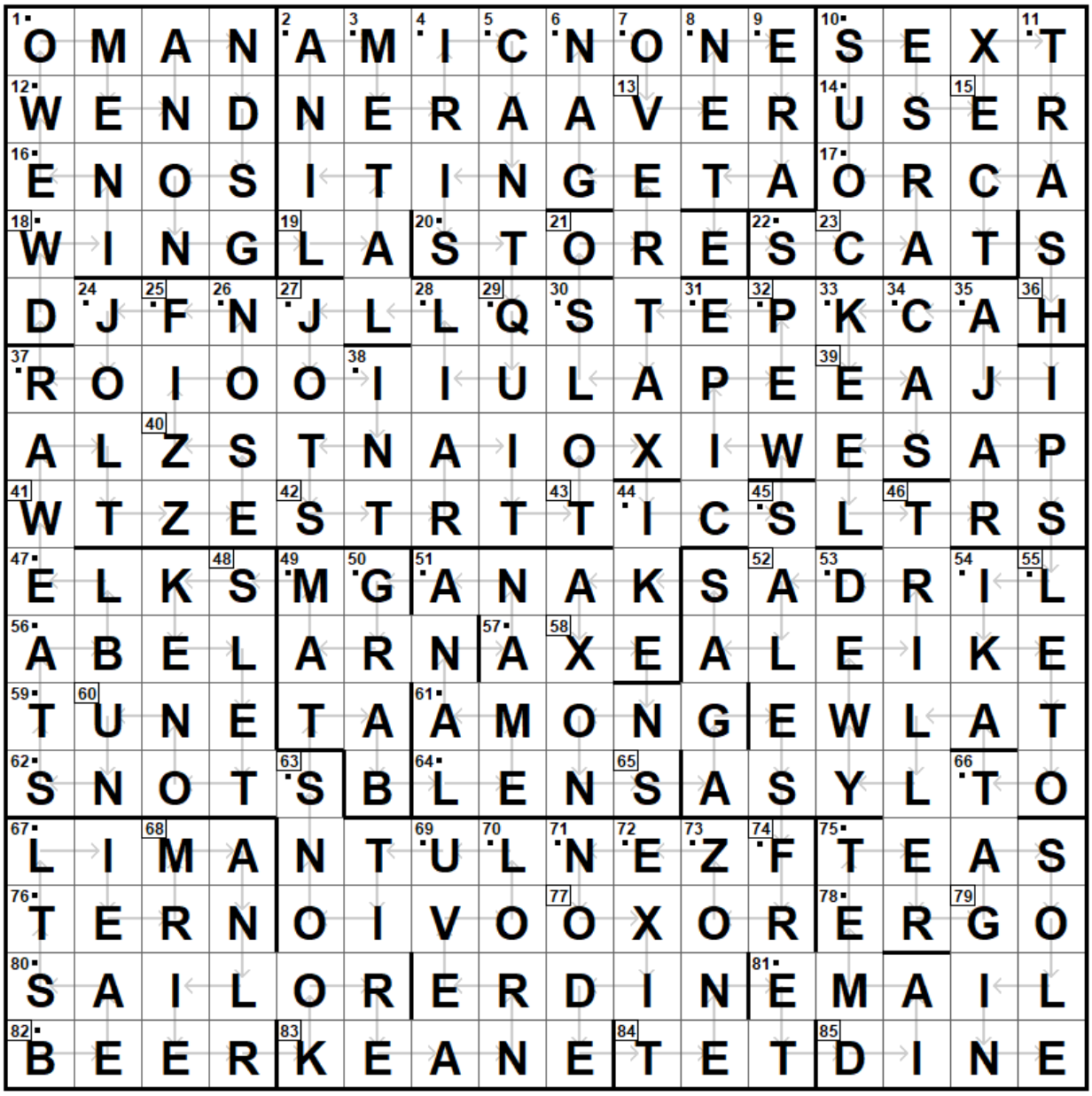
for such editing as might be necessary, and his editing fingers must have twitched anticipatorially when he saw, as he thought, that Borgmann had rated himself as being among the world's top palindromists. That was definitely non-U. Eckler knew that Borgmann strongly objected to any editorial alteration of his prose, but no matter; no such solecism as an author blatantly singing his own praises that way was getting into *Word Ways*. Borgmann's name was off the list. But there was still a problem with calling Mercer and Lindon the "most important" palindromists around; unlike Coen, Eckler was aware that this hadn't been true for quite some time; newer palindromists such as Howard Bergerson and Jeff Grant (who both happened to be *Word Ways* contributors) were at least the equals of the older pair. And while Eckler could justify to himself the dropping of Borgmann's name from the "most important" list, adding Bergerson's and Grant's names in his place would probably be taking too great an editorial liberty. In the end, Eckler finessed the problem by simply inserting the word "British" in the sentence — both Mercer and Lindon were British, and neither Bergerson nor Grant was. Problem solved. And that explained the textual discrepancy.

(2) Borgmann's Opinion of Rotas square studies Here is what Borgmann, writing in his 1965 book *Language on Vacation*, has to say about the Rotas square: "The treatment we have given the 'Sator' square is far from adequate, partly from lack of space, partly because we don't happen to care for it. To us, it is a symbol of imperfection, of failure to achieve a desired goal, and we want to dissociate ourselves from it." As two of the three misattributed articles deal chiefly with the Rotas square, would Borgmann have even *wanted* the authorial credit for them, let alone gambled his reputation to get it?

EPILOG

In the *Word Ways* archive administered by Digital Commons at Butler University, Dmitri Borgmann is still credited with the authorship of the three misaccredited 1979-80 palindromes articles. I don't suggest that his name should be expunged from those articles and replaced with Gary Coen's, as such an alteration of historical records would be contrary to the purpose of an archive. But could any way be found to inform readers of these articles of the name of their real author?

Solution to the Hilbert Curve Crossword Puzzle



INFORMATION FOR CONTRIBUTORS

Please email articles and other correspondence to **wordways2@outlook.com** *Interim* is published in February, May, August and November on or around the first day of the month; submissions intended for a particular month should be received no later than the 22nd day of the preceding month. Articles should be submitted in an MS-word format and emailed as attachments. Do not send a PDF; the entire issue will be converted to a PDF before being distributed. Choices of typeface and font size, as well as all other stylistic conventions, are left to authors; however, *Interim* reserves the right to edit content.

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