THE NEW MEROLOGY

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Old merology, or that branch of anatomy which deals with the elementary tissues and fluids of the body, we know about. What of the new?

In the November 1989 Kickshaws, Dave Morice points to the absence of self-descriptive English number words whose gematric value is equal to the number indicated (A = 1, B = 2, etc.). "However," he goes on, "perfect number names can be found in neo-alphabets whose letters have been rearranged to accommodate the letter values."

Neo-alphabets? Alphabets using the 26 letters in non-alphabetical order? I call this logological heresy. If I may paraphrase Kronecker: God constructed The Alphabet, everything else is the work of Man. Depart from this principle and logology is lost. And, besides, what on earth would St. Alphabet think?

Like Morice and others he mentions, the failure of perfect number names to exist bothered me, too. In the search for agreement between numbers and letters the best I could manage was a gematric hat trick:

The gematric constant of this sentence is six hundred fifty-three
(33+76+106+21+56+85+28+52+74+122=653)
This is a Beastly text: numerological constant of Six-Six-Six!
(56+28+1+84+69+145+106+21+156=666)
Double check: E=5, O=15, so the Number of the Boast is six hundred seventy six
(59+30+5+15+34+33+73+21+33+57+28+52+74+110+52=676)

This was challenging to complete, but the result is tedious to verify and thus anything but crisp in impact. Furthermore, it is simply not the animal sought. At length, though, a new approach to perfect number names suggested itself, and the rewards it brings are quite worthwhile.

Observe that in Morice's rearrangement scheme every letter retains a value in the range 1 to 26, but differently ordered. However, I suggest now is the time to stop thinking in terms of positions and to see this as simply a reallocation of numbers to letters. This view not only dispenses with neo-alphabets, but it reminds us that we are free to assign values to letters at will. Any values. Not merely those between 1 and 26, or, indeed, whole numbers only. The time-honoured practice of linking each letter to its position number is an expendable -- because profitless -- convention. New merology takes this as its starting point.

Suppose ONE is a perfect number name. Then O+N+E = 1, by definition. Clearly, either O, N, and E are not whole numbers or at least one of them must be negative. Leaving non-integral numbers for future consideration, we allow negative integers and explore further. Now N and E also occur in both NINE and TEN, and perhaps these are perfect number names, too. Let us assume so, and suppose further that the values of E and N are already known. Then by elementary algebra, O = 1-N-E, I = 9-2N-E, and T =10-N-E. Three new values have now been established, but we can do more. Perhaps TWO is a perfect number name as well. If so, W = 2-T-O, and T and O are already identified.

At this stage a question arises. Suppose E=4 and N=2. Then T, which is 10-N-E, equals 4, the same value as E. Are different letters to share identical values? The notion offends a basic principle of gematria. Accordingly, we make it an axiom that the identity of each letter must be reflected in a unique numerical value. For the sake of discussion let us assume E=1 and N=2. This entails I=4, T=7, O=-2 and W=-3. All distinct. ONE, TWO, NINE and TEN are now perfect. Can we go further?

Suppose THREE is perfect. Then H = 3-T-R-2E, but R is unknown. Trial and error will have to suffice. Choosing the first positive integer not yet used, let H=3. This makes R = 3-T-H-2E = -9, a new integer. Then FOUR may be perfect as well. This would mean F = 4-O-U-R, with U still unknown. As before, 1, 2, 3, and 4 having been allocated, we set F=5 and see what happens. It works: U = 4-F-O-R = 10, another new addition. This brings us to FIVE, which implies V = 5-I-F-E = -5. Different again. The numbers employed so far are: -9,-5,-3,-2,1,2,3,4,5,7,10. ONE, TWO, THREE, FOUR, FIVE, NINE and TEN are now perfect.

SIX is our next candidate, but it contains two unknowns, S and X. Better to try SEVEN first, whence S = 7-V-2E-N = 8. Another fresh face. And now that we know S, X = 6-S-I = -6. Yet a new number. We arrive thus at EIGHT, from which G = 8-E-I-H-T = -7. Again original. NINE and TEN have already been dealt with. Dare we try further? Fifteen letters appear in the English number names from ONE through NINETEEN: E,F,G,H,I,L,N,O,R,S,T,U,V,W,X. Fourteen have been accounted for. The only remaining one, L, appears in both ELEVEN and TWELVE. Is it conceivable that L = 11-3E-V-N = 12-T-W-V-2E is a number hitherto unused? It is. The number is 11. QED.

We pause for assessment. Combining algebra with serendipity, the values of 15 letters have been established:

E	F	G	H	I	L	N	O	R	S	T	U	V	W	X
1	5	-7	3	4	11	2	-2	-9	8	7	10	-5	-3	-6

Ignoring sign (and a few consequent repetitions), these numbers make up the consecutive series 1,2,3,4,5,6,7,8,9,10,11. Under these assignments, the gematric constant of ONE through TWELVE is 1 through 12, respectively. The next question is obvious. Will THIRTEEN turn out to be unlucky, as numerologists have ever insisted? Neomerology now supplants superstition with rigorous proof.

From arithmetic we know that 13 = 3+10. Hence, assuming that THREE, TEN, and THIRTEEN are all perfect, we have T+H+I+R+T+E+E+N = T+H+R+E+E + T+E+N. But cancelling common letters on both sides yields I = E, which is to say I and E must share the same value, contrary to axiom. Thus, irrespective of letter values selected, if it includes THREE and TEN, no unbroken run of perfect numbers can exceed TWELVE. Which is to say, for perfectionists THIRTEEN is unlucky.

Having failed at the higher end, can we extend to ZERO at the lower? But in that case Z = O-E-R-O = 10, the same value as U. As yet, though, we have considered only one set of assignments. Using different numbers the goal is achievable. Consider the following allocations:

E	F	G	H	I	L	N	O	R	S	T	U	V	W	X	Z
3	9	6	1	-4	0	5	-7	-6	-1	2	8	-3	7	11	10

Not only is Z now included, but the 16 unsigned integers again comprise a consecutive series, 0,1,2,3,4,5,6,7,8,9,10,11 to yield:

Z + E + R + O	= 10+3-6-7	= 0
O + N + E	= -7+5+3	= 1
T + W + O	= 2+7-7	= 2
T + H + R + E + E	= 2+1-6+3+3	= 3
F + O + U + R	= 9-7+8-6	= 4
F + I + V + E	= 9-4-3+3	= 5
S + I + X	= -1-4+11	= 6
S + E + V + E + N	= -1+3-3+3+5	= 7
E + I + G + H + T	= 3-4+6+1+2	= 8
N + I + N + E	= 5-4+5+3	= 9
T + E + N	= 2+3+5	=10
E + L + E + V + E + N	= 3+0+3-3+3+5	=11
T + W + E + L + V + E	= 2+7+3+0-3+3	=12

The letter values selected here are far from forming a unique solution. So weak are the interdependencies imposed by English orthography that the number of different solution sets using integers below a given ceiling is surprisingly large. No less than 153 exist using integers between -15 and 15, for instance. Moreover, since there is no upper limit on allowable integers, new solutions can be found without bound.

But is the above a minimal solution, in the sense of using the lowest possible values (when ZERO is included)? The answer to this and related questions has been given by a simple Pascal computer program. The algorithm works similarly to the approach explained, with nested DO loops trying out all possible values in systematically incremented steps (details available from Buurmansweg 30, 6525 RW Nijmegen, The Netherlands). In fact, the above solution is one of two sets coming in second place to the minimal solution. Alas, the latter lacks an 8 or -8 needed to form a complete consecutive series:

E	F	G	H	I	L	N	O	R	S	T	U	V	W	X	Z
-2	-6	0	-7	7	9	2	1	4	3	10	5	6	-9	-4	-3

Ideal Maps

So far, we have looked at three solution sets, each of them using integers less than 12. As a result, they share an interesting reflexive property: the values assigned to letters are themselves numbers occurring within the range of perfect number names they produce. (I refer here to the absolute or unsigned letter values used; henceforth, unsigned values can be assumed whenever numbers, integers or values are mentioned.) Now, since there are 16 different letters and only 13 possible number names (ZERO through TWELVE), some of those values must occur twice. The minimal set shows six such repeats: E,N (both 2), S,Z (both 3), R,X (both 4), F,V (both 6), H,I (both 7), and L,W (both 9). But suppose we relax the demand for a serial sequence of perfect numbers and take in all possibilities. Could there exist a set of entirely distinct letter values giving rise to an **identical** set of perfect number names? Or, more realistically, giving rise to a set that **includes** all of its letter values? I propose calling such a set of assignments an **ideal map.** A near miss discovered is one containing 15 rather than 16 different integers:

E	F	G	H	I	L	N	O	R	S	T	U	V	W	X	Z
0	-10	9	-8	1	-7	4	-3	5	-11	6	12	14	-1	16	-2

The numbers employed here are 0 through 12, plus 14 and 16, almost the very lowest sixteen integers. As previously, we find ZERO through TWELVE are perfect, but now E=0 so that T+E+E+N is equal to T+E+N, whereby FOURTEEN and SIXTEEN (as well as SEVENTEEN and NINETEEN) are also self-descriptive. It is a pity that this almost flawless gem is spoiled by the 1 and -1.

Even so, it creates a basis for an impressive display of number magic. To perform this, make up a set of cards, each showing one of the above letters together with its associated number on the same side of the card. You'll need three cards bearing E/0 and two with N/4, for a total of 19 cards. Lay them out from left to right with the numbers in serial order. Point out to your audience that every letter has its own number and that, ignoring sign, these run from 0 through 16, excluding 13 and 15. Get someone to choose a number. The (unsigned) integer named is now spelled out by assembling the appropriate letters in order, whereupon their associated numbers are added up aloud by the demonstrator to reveal the magical identity. The surprise this produces is gratifying. Aside from the small integers it uses, another nice feature is that naughty attempts to spell out THIRTEEN and FIFTEEN are nicely foiled through lack of a second T or F.

At the price of larger integers, however, unblemished specimens can yet be found. We note that extension beyond NINETEEN will bring in Y, while if ZERO drops out, Z may disappear. Here follow two examples:

E	F	G	H	I	L	N	O	R	S	T	U	V	W	X	Y
8	-24	-11	-20	25	3	-12	5	1	7	6	22	-4	-9	-26	21
7	20	-6	24	-8	-1	5	-11	-26	2	-9	21	-14	22	12	4

Observe in each case that besides the 16 numbers appearing, TWENTY through TWENTY-NINE are all perfect, as are ONE through NINE, ELEVEN, TWELVE, FOURTEEN, SIXTEEN, SEVENTEEN and NINETEEN. In the first, setting Z=-14 will make ZERO perfect also, resulting in an ideal map of 17 letters. These examples represent the lowest integer solutions so far unearthed. Probably they can be improved upon. However, the task of generating ideal maps, even with a "powerful" computer, should not be underestimated. A powerful programmer is preferable.

E 4	I 17	N 2	S 16
L 24	F 9	T 20	R 6
W 25	U 12	G 22	O 7
V 1	X 27	Y 11	H 3

One further example is worth presenting. Sixteen numbers occur in the following, eight positive, eight negative. This lends itself to display on a 4x4 checkerboard. Choose any number on the board. Call out the letters that spell its name, adding up their associated numbers when on white squares, subtracting when on black. Their sum is the number you selected.

Related to the above is the question of seeking letter values that maximize the perfect number names produced. Again, this is trickier than first sight suggests. In my best solution to date, as before, ZERO through NINE, ELEVEN, TWELVE, FOURTEEN, SIXTEEN, SEVENTEEN, and NINETEEN are perfect. But now, so also are TWENTY through FORTY-NINE, making a total of 46 self-descriptive number words under ONE HUNDRED.

E	F	G	H	I	L	N	O	R	S	T	U	V	W	X	Y	Z
-11	21	10	-1	-8	27	14	-2	8	12	18	-23	3	-14	2	-5	5

Staying below ONE HUNDRED, can anyone improve on this?

Ross Eckler points out that the list of 46 can be doubled to 92 by proper choice of the D's in (ONE) HUNDRED, 92 doubled again through proper choice of the A in THOUSAND, and so on with M in MILLION, B in BILLION, Q in QUADRILLION, P in SEPTILLION, and C in OCTILLION. This leads to a grand total of 128x46 = 5888 perfect number names! I might add that in this system the much-vaunted ZILLION turns out to be a mere 55, whereas the mysterious UMPTEEN is revealed as 999,999,999,999,999,990,999,866. Question: what value would K have to take if BAKER'S DOZEN is to be set equal to 13?

Perfect Number Names in French

The behaviour of French perfect number names is so different from English, they merit a glance. Seventeen letters are employed: A,C,D,E,F,H,I,N,O,P,Q,R,S,T,U,X,Z. Working out correlations among the admissible values as dictated by UN, DEUX, TROIS, etc., holds such a surprise that I urge readers who enjoy (logo)logical deduction to stop reading now and try it for themselves. The following paragraph gives a good idea of the kind of reasoning involved.

In the first place, in French it is not TREIZE (13) but QUATORZE

(14) that is unlucky. The proof is neat. Subtracting QUATRE (4) from QUATORZE shows that O+Z = 14-4 = 10. Now, O and Z occur in ONZE (11). Hence, ONZE -(O+Z) = N+E = 11-10 = 1. But 1 is UN. Thus, U+N = N+E, from which U=E. A perfect number run including QUATRE and ONZE therefore cannot exceed TREIZE. C'est tout.

In a similar series of deductions, the relations among ZERO, UN, DEUX, TROIS, QUATRE, CINQ, SIX, SEPT, HUIT, NEUF, DIX, ONZE, DOUZE, and TREIZE can also be uncovered. What fascinates me is the rigidity of the interlocking pattern thus gradually disclosed. Amazingly, of the 17 letters involved, nearly three-quarters are expressible as simple arithmetic functions of just one letter, N. That is to say, in assigning a value to N, the values of eleven other letters are simultaneously decided! The completed analysis looks like this:

A = *	F = 13-3N	O = 0	S = 2N-4	Z = 16-4N
C = A-5N-4	H = 4N-11	P = 2	T = 14-5N	
D = 2N	I = 2N+4	Q = 2N+5-A	U = 1-N	
E = 3N-5	N = *	R = N-11	X = 6-4N	

Notice that besides the 11 values determined with N, although A can be assigned any number (provided it is different from the others), C and Q are then defined, while O and P are the fixed constants 0 and 2! Such a tight pattern of correlations means the existence of a solution set cannot be taken for granted. Nevertheless, trying in turn N=1,3,4,..., the first solution occurs when N=7. It is not difficult to see that this is made minimal by setting A=20:

A	C	D	E	F	H	I	N	O	P	Q	R	S	T	U	X	Z
20	-19	14	16	-8	17	18	7	0	2	-1	-4	10	-21	-6	-22	-12

The perfect French number names are then as follows:

Z + E + R + O	= -12+16-4=0	= 0
U + N	= -6+7	= 1
D + E + U + X	= 14+16-6-22	= 2
T + R + O + I + S	= -21-4+0+18+10	= 3
Q + U + A + T + R + E	= -1-6+20-21-4+16	= 4
C + I + N + Q	= -19+18+7-1	= 5
S + I + X	= 10+18-22	= 6
S + E + P + T	= 10+16+2-21	= 7
H + U + I + T	= 17-6+18-21	= 8
N + E + U + F	= 7+16-6-8	= 9
D + I + X	= 14+18-22	=10
O + N + Z + E	= 0+7-12+16	=11
D + O + U + Z + E	= 14+0-6-12+16	=12
T + R + E + I + Z + E	= -21-4+16+18-12+16	=13

Again, the absence of any upper bound on assignable values means that although more thinly spread than English counterparts, the number of different solutions is unlimited.

Final Remarks

It ought to be clear by now that the foregoing is merely an initial step in a field that may well yield more to the spade. Less clear is whether we are dealing here with recreational linguistics or mathematics! Personally, I find great attraction in the no-man's-land between the two. What more might computational isopsephy have to offer?

In the first place, there are the perfect number names in the remaining alphabetic languages, as yet to be examined. Beyond these, stranger structures may await. For instance, notice that we are not bound to assign numbers so as to produce only perfect numbers. Consider the following assignments:

	E	F	G	H	I	L	N	O	R	S	T	U	V	W	X	Z
(a)	7	−4	−5	2	−2	6	−7	−1	−9	−8	−10	10	−6	9	4	3
(b)	2	13	12	−10	−1	3	11	−11	−5	5	16	10	−3	−2	9	14
(c)	2	−7	10	−6	6	−5	1	−1	9	−2	−3	4	5	7	3	−9
(d)	$-4\frac{1}{2}$	$-8\frac{1}{2}$	$1\frac{1}{2}$	$-6\frac{1}{2}$	$6\frac{1}{2}$	$9\frac{1}{2}$	$3\frac{1}{2}$	2	$7\frac{1}{2}$	1	11	3	$11\frac{1}{2}$	−11	$-1\frac{1}{2}$	−5

and the gematric sums:

		(a)	(b)	(c)	(d)
Z + E + R + O	=	0	0	1	0
O + N + E	=	−1	2	2	1
T + W + O	=	−2	3	3	2
T + H + R + E + E	=	−3	5	4	3
F + O + U + R	=	−4	7	5	4
F + I + V + E	=	−5	11	6	5
S + I + X	=	−6	13	7	6
S + E + V + E + N	=	−7	17	8	7
E + I + G + H + T	=	−8	19	9	8
N + I + N + E	=	−9	23	10	9
T + E + N	=	−10	29	0	10

(a) yields the negative integers, (b) the first ten prime numbers, while (c) maps each number word onto its successor (modulo 10). That is, starting with any number (say, EIGHT) and moving in steps as follows: EIGHT to 9, NINE to 10, TEN to 0, ZERO to 1, etc., ten steps will always return us to our starting point. Variations on these themes will occur to readers. (d) reminds us that fractional assignments may also be exploited, as indicated at the outset. Of course the above are just curiosities, merely suggestive of the potential.

A final item of interest in the present context is to see what happens when a reflexicon or self-descriptive word list is encoded by replacing its letters with perfect number producing integers. Reflexicons occur in different formats. Low totals and absence of plural S are convenient in this case:

TWELVE E,	FIVE R,
SIX F,	FIVE S,
THREE H,	SIX T,
SEVEN I,	THREE U,
TWO L,	SIX V,
TWO N,	FOUR W,
FIVE O,	FOUR X

Any of our previous examples will provide integers to substitute for the letters. In doing so, it is useful to reverse items and add brackets so that, for instance, TWELVE E becomes E(TWELVE). The result of this is a single mathematical expression consisting of a sum of products:

1(7-3+1+11-5+1) +	-9((5+4-5+1) +
5(8+4-6) +	8(5+4-5+1) +
3(7+3-9+1+1) +	7(8+4-6) +
4(8+1-5+1+2) +	10(7+3-9+1+1) +
11((7-3-2) +	-5(8+4-6) +
2(7-3-2) +	-3((5-2+10-9) +
-2(5+4-5+1) +	-6(5-2+10-9)

Predictably, this is no longer an ordinary sum such as might be set in a test on Erasmus. Thanks to perfect numbers, the self-descriptive property is retained. Here the sums of the terms in parentheses tell how many times the associated multiplier occurs in the entire expression. Integer 1 occurs (7-3+1+11-5+1) = 12 times, -2 occurs (5+4-5+1) = 5 times, for instance. But curiously, since the above set of numbers is just one among many that might be used, the reflexicon is revealed as a template defining an infinite family of self-descriptive sums. A strange fusion of algebra, cryptanalysis and logology!

ACRONYMS, INITIALISMS & ABBREVIATIONS DICTIONARY

The 3-volume 14th edition (1990) of this landmark work, containing more than 480,000 entries, is now available for $208 from Gale Research, Detroit MI. Although the acronym corpus is still growing, it appears to be slowing down: 14 per cent per year from 1960 to 1983, 11 per cent per year from 1983 to 1988, and only 7 per cent per year from 1988 to 1990.

Logologists have a largely-untapped source at hand; few ***Word Ways*** *articles specifically look at acronyms (however, see Chris Cole's article in this issue). Records are there for the taking: this edition contains the 26-letter initialism COMSUBCOMNELMCOMHEDSUPPACT, eight letters longer than the one reported in the August 1978 Kickshaws. A survey of acronyms beginning with C and R which spell out words or names yielded the following statistics:*

letters	*7*	*8*	*9*	*10*
C	*30*	*11*	*3*	*1*
R	*6*	*1*		

suggesting the existence of an 11-letter specimen (who will find it?). The 10-letter example is CONSCIENCE, the Committee On National Student Citizenship In Every National Case of Emergency.

For curiosa collectors, how about XYZ (eXamine Your Zipper), PP (Petticoat Peeping), AWOL (After Women Or Liquor, A Wolf On the Loose), or CRAP (Constructive Republican Alternative Programs, Committee to Resist Acronym Proliferation)?