

The New Merology of Beastly Numbers

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Let him that hath understanding count the number of the beast; for it is the number of a man; and his number is Six hundred threescore and six. Revelation of St. John 13:18.

The flames of hellfire flickered amid towering pillars of smoke, scorching the leaden sky. In the distance the iron walls of Dis glowed a fiery red. A green demon in a sweatshirt was lounging beside a lake of boiling oil, idly tossing a brown oval object from claw to claw. The shirt bore the number 666 on the front, and when he swivelled round for a practice throw the name THE BEAST became visible on the back.

The second demon, which was a rather attractive shade of pastel blue, tapped him on the shoulder. "Uh --- excuse me, Mr. Beast sir."

"Who are you?" The Beast looked at the blue demon's sweatshirt. "What pansy kind of a number is *minus 847i*?"

"It's what they gave me when I took the job you advertised, sir. It was the only shirt that fitted."

"Job? *What* --- oh, I remember. Turn round." The back of the blue demon's shirt bore the words JUNIOR SOULS ASSISTANT. "OK, Junior, let's see how good you are. Make a run for touch and I'll throw you a pass." The Junior Souls Assistant set off at a gallop along the shoreline. The Beast drew back a bony arm and speared one of the oval objects at Junior's head. Junior made a grab for it, missed, and watched it bounce past him into the lake. The oval object screamed as it hit, then mercifully sank from view.

"Sorry, I got some sulphur in my eye," said Junior. He looked at the ripples spreading across the burning lake. "Was it a good one?" Then he caught himself. "Sorry, silly question. We don't get the *good* ones down here."

"It wasn't even a *bad* one," said the Beast. "A cheap rubber soul, not even leather. Don't worry about losing it, there are always plenty of condemned souls to kick around." He picked up another one from a huge pile at his feet, scrutinized it. "Oh, her," said the Beast dismissively. "Yes, she was bound to end up here all right. But at least," he added, pointing to the name stamped on the soul in uneven gothic lettering, "she knows who the Heaven she is. Unlike me." Tears suddenly rolled down its cheeks.

Junior went a paler shade of blue. Everybody knew that the Beast was going through a mid-death identity crisis. Without warning the huge green demon leaped to its

feet and began kicking things. "WHO AM I?" it roared. "Thousands of years, and nobody ever tells me *who I am!*" Then it burst into tears.

"I heard that in Aramaic --- the original language of the *Book of Revelation* --- the symbols for 666 spell 'Nero'. Do you think you might be Nero?"

" 'Nero fiddled while Rome burned...' I don't mind the burning bit, but I'm not a very good fiddler, you know."

"Well, the Jesuit Father Bongus decoded your number as 'Martin Luther'," the Junior Souls Assistant ventured, patting the Beast sympathetically between its horns. He used the system known as 'gematria' in which A = 1, B = 2, ..., up to Z = 26."

"I know all about that. But, on the other claw, Michael Stifel --- a German mathematician --- 'proved' I was Pope Leo X," snivelled the Beast. "He started with LEO DECIMUS, threw away everything except LDCIMU."

"Why?"

"Those are the letters that correspond to Roman numerals. They add up to 1656, so he added another X because it was Leo X, and deducted M because it was the initial letter of 'mystery'." The Beast grimaced. "Did you ever hear of such a silly argument?"

"Never," said Junior. "Obviously contrived to get the desired result."

"Precisely. Everybody's got an axe to grind. And what makes it worse," said the Beast, "is that they all have different systems for assigning numerical values to letters. Nobody asks themselves if there's some sensible method that doesn't depend upon alphabetical order or other arbitrary choices."

"Funny you should mention that. I've just been reading the February 1990 issue of *Word Ways*."

"What the angel is *that?*"

"It's a journal of recreational linguistics."

"We're in trouble then," said the Beast. "This is a *mathematical* recreations column."

"Ah, but that particular issue had an article that combined both mathematical and linguistic recreations. It was by Lee Sallows, an expert in numerical word-play, and it was called *The New Merology*. He noted that "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."

"I don't follow you," said the Beast.

"Well, take for instance the English word ONE. With the usual alphabetic ordering in that language, its numerical value --- or gematric constant --- is $15+14+5 = 34$. But if numerology has any intrinsic meaning, then the gematric constant clearly ought to be the number that the word denotes, namely 1. But it's not."

"Do any number-words have totals that equal their gematric constant?"

"According to Dave Morice, no --- not in English, at least. Unless you count phrases like 'This is a Beastly text: numerological constant of six-six-six.' "

"So what does this Sallows person propose to do about it?"

"Assign numbers for each letter that aren't given by the position in the alphabet. Say that a number word is *perfect* if, using those assignments, its gematric constant equals its numerical value. Then try to make as many as possible of the number words ONE, TWO, and so on be perfect. He restricts attention to whole number values, and imposes the rule that different letters must be given different values."

The Beast blew its nose loudly. "To what effect?" it sniffed.

"Well, you get a whole pile of equations like

$$O+N+E = 1$$

$$T+W+O = 2$$

$$T+H+R+E+E = 3$$

in algebraic unknowns O, N, E, T, W, H, R You see how many of those equations can be solved, and then adjust your answers so that they satisfy any other criteria you want to impose. For instance, you can see from the equation $O+N+E = 1$ that some of the numbers have to be negative. Then, since N and E both occur in NINE and TEN, it makes sense to assume that N and E have been assigned values and see what happens. So O, for instance, must satisfy $O = 1-N-E$. From NINE and TEN you get $I = 9-2N-E$, $T = 10-N-E$. Then, since we want $T+W+O = 2$, we find that $W = 2-O-T = 2-(1-N-E)-(10-N-E) = -9+2N+2E$.

"You have to watch out, though. Suppose you decide to start with $E = 4$, $N = 2$. Then T works out as 4 too --- the same as E. Since that's not allowed, you have to choose different values for E and N."

The Beast perked up. "I get it! Suppose you try $E = 1$, $N = 2$. Then you have to have $I = 4$, $T = 7$, $O = -2$, and $W = -3$. What if we want THREE to be perfect too? Well, that's two new letters, H and R. If I guess that $H = 3$, and use the fact that $T+H+R+E+E = 3$, then R has to be -9. And then FOUR gives two more new letters F

and U. If I choose $F=5$ then $F+O+U+R = 4$ leads to $U = 10$. Making good progress, Junior."

"Right. Then $F+I+V+E = 5$ leads to $V = -5$. Since SIX contains two new letters, let's try SEVEN first and fix the value of S. If $S+E+V+E+N = 7$ then $S = 8$. And then we can fill in X from $S+I+X = 6$, getting $X = -6$. Then looking at the equation for EIGHT we get $G = -7$."

"So now all the number names from ONE through TEN are perfect. Can we go further?"

"Maybe. The only extra letter in ELEVEN and TWELVE is L. It would be quite a coincidence if it could be chosen to make them both perfect."

"Yes, but in fact $L = 11$ *does* make them both perfect."

"Amazing. Now $T+H+I+R+T+E+E+N = 7+3+4+(-9)+7+1+1+2$, which is 16. Oh, salvation take it!"

"I suppose we might get further by making different choices earlier," said Junior. "Several of the values were just arbitrary guesses."

"I'm not sure it helps," said the Beast. "Look, if you take the equation

$$\text{THREE}+\text{TEN} = \text{THIRTEEN}$$

and cancel a letter if it occurs on each side, then you end up with $E = I$. And that violates the rule that different letters get different values."

Junior Souls Assistant nodded. "I remember now, Sallows discovered that argument. He says it's a new merological proof that thirteen is unlucky."

"We could still go backwards. Let's see, if $Z+E+R+O = 0$ then $Z = 10$."

"That's the same as U. Bother."

"Yes, but we made a lot of assumptions about the values of letters. Maybe we can fix things up by changing them." And they discovered they could: see BOX 1.

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BOX 1 PERFECT NUMBER WORDS IN ENGLISH

Assign the values

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

Then

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

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"Sallows describes several magic tricks based on similar ideas," said Junior. For instance, if you use a different assignment

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

then ZERO through TWELVE are perfect, and so are FOURTEEN, SIXTEEN, SEVENTEEN and NINETEEN. The idea is to make a set of cards, each having a letter and the corresponding number written on it. Make three cards with E/0, two with N/4, and one each for the rest, a total of nineteen cards. Ask someone in the audience to spell out a number word. Add up the numbers on the cards, and lo and behold it is the same value. Except for sign --- it could be positive or negative."

"What if some smartass spells out THIRTEEN or FIFTEEN?" asked the Beast.

"They can't. There's only one T and only one F in the pack."

"Devilishly clever. That Sallows guy would fit in well down here."

"True. He invented a similar trick that involves a 4x4 chessboard (**Fig.1**).

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

Lee Sallows's numerical spell. Select any number on the board. Spell it out, letter by letter. Add together the corresponding numbers (subtracting those on black squares, adding those on white squares). The result will always be plus or minus the number you chose.

Choose any number on the board. Spell out its name, and add up the numbers associated with its letters, counting them as positive on white squares but negative on black. Again, the result is the number selected."

The Beast laughed, a horrible sound. Joyously, it booted a dozen condemned souls out of sight over the horizon, and bounced a thirteenth up and down to the accompaniment of muted howls whenever it hit the ground. Then the demon's face fell.

"What's the matter, Mr. Beast?"

"It's all very well using English names. *Mais en Français, par exemple --- ?*"

"Ah, yes. Well, that opens up an entire new range of questions. In French the number words are UN, DEUX, TROIS, QUATRE, CINQ, SIX, SEPT, HUIT, NEUF, DIX, ONZE, DOUZE, TREIZE, QUATORZE, and so on. Now you can get as far as thirteen, but not fourteen. Because cancelling common letters on both sides of QUATRE+ONZE = UN+QUATORZE leads to E = U, which is forbidden since different letters must get different numbers. The whole game is remarkably rigid in French. If you tackle the number words in the right order from ZERO to TREIZE, you will find that

eleven letters are all determined by the value of N, and that the only other free choice is

A. That is, you are forced to have

$$\begin{array}{ll} A = * & P = 2 \\ C = A-5N-4 & Q = 2N+5-A \\ D = 2N & R = N-11 \\ E = 3N-5 & S = 2N-4 \\ F = 13-3N & T = 14-5N \\ H = 4N-11 & U = 1-N \\ I = 2N+4 & X = 6-4N \\ N = * & Z = 16-4N \\ O = 0 & \end{array}$$

You get different (and small) values for all the letters if you take $A = 20$, $N = 7$. Then you end up with the assignments

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

Every number name from ZERO to TREIZE is then perfect."

"Und auf Deutsch?"

"Oops. Sallows didn't mention German in his article. I guess we'd better work that out for ourselves."

"Me first. Omitting zero --- because I have a hunch it will be better that way --- the number words go EINS, ZWEI, DREI, VIER, FU(uumlaut)NF, SECHS, SIEBEN, ACHT, NEUN, ZEHN, ELF, ZWOLF, DREIZEHN, VIERZEHN, FU(uumlaut)NFZEHN, SECHSZEHN, SIEBZEHN, ACHTZEHN, NEUNZEHN, ZWANZIG. I suppose we'd better consider the umlaut U(uumlaut) to be the same as ordinary U."

"If you say so, Mr. Beast. Hey, I think we're onto something here. Look, because of the way German deals with the teens, if you get the number names up to ZEHN working then DREIZEHN up to NEUNZEHN are automatic."

"Except from SIEBZEHN, which isn't SIEBENZEHN."

"Right. But that tells us that since $SIEBEN+ZEHN = SIEBZEHN$ then, cancelling, we must have $E+N = 0$. Then $E+I+N+S = 1$ tells us that $I+S = 1$. Suppose we let E and I have any values we like. Then we must have

$$E = *$$

$$I = *$$

$$N = -E$$

$$S = 1-I.$$

Continuing with ZWEI we can make Z arbitrary, and deduce that

$$Z = *$$

$$W = 2-E-I-Z.$$

And so on. It gets complicated, but I think if we work through it systematically we can --
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"Yes. And I've just had a thought. German for 'twenty-one' is 'EINUNDZWANZIG' and so on. If we make UND have total 0 then we ought to get the numbers from twenty-one to twenty-nine for free too."

For several hours Junior and the Beast scribbled in the sulphur sands of Hades with their pointed tails. Eventually they came up with this:

A	B	C	D	E	F	G	H	I	L	N	O	R
-10	7	-18	-9	-1	-2	33	17	-3	14	1	-6	16
S	T	U	V	W	Z							
4	19	8	-8	13	-7							

Now all number names from EINS to NEUNUNDZWANZIG (29) are perfect.

"Good work, Mr. Beast," said Junior. "I wonder if we can get DREIZIG (30) working as well? If so, we'd get 31-39 for free. And what about Italian, Spanish, Russian, Greek, Japanese, Pidgin... ?"

"Best left for the torment of Earthly souls, I would judge," said the Beast.

FURTHER READING

Dave Morice, Kickshaws, *Word Ways* **22**, November 1989, 50-58.

Lee Sallows, The New Merology, *Word Ways* **23**, February 1990, 12-19.

[*Word Ways* is available from Faith W.Eckler, Spring Valley Road, Morristown NJ 07960. A year's subscription is currently \$17.]

Vera Sanford, *A Short History of Mathematics*, Riverside Press, Cambridge Mass. 1930.-