I'm Counting on You![1]

As I wrote in my 2020 essay "Numbers Just Keep Getting Bigger (and Smaller)":

> Remember learning to count? I remember being somewhat confused with eleven. For me at first, one to ten was pretty much of a snap. But after that . . .? I still get a little confused about what comes after ten when I am thinking in Spanish, or modern Greek. (Spanish has separate words for "eleven" to "fifteen" before it switches to "ten- and-six", "ten-and-seven", etc. while modern Greek switches at "ten-and-three".)

And when you were growing up, did your mother ever yell: "Murray! [or whatever your name is] You get down here immediately! I'm going to count to ten. Ten . . . nine . . . eight . . . seven . . . six . . ." by which time you would have slid down the banister to receive a scolding for whatever numbskull thing you had done now? Of course, Mom wasn't counting *to* ten, she was counting *down from* ten.

And the countdown was a part of my life as I was growing up, watching on our B&W TV as NASA undertook JFK's famous 1962 promise ". . . . . to go to the Moon in this decade and do the other things, not because they are easy, but because they are hard." We would hold our breath as a man (it was always a man) would intone that "Ten . . . nine . . . eight . . . seven . . . six . . ." before the engines would ignite and we'd have blastoff.

I remember, back in July of 1969, when, after having spent a month and a half at an intensive Spanish program in northern Mexico, my friend Paul and I took a bus down to Mexico City and on our way to our hotel we passed a bar where there was a crowd of people staring at a television that was showing what looked to be a moonscape. "That's odd," I thought, "that must be some sort of science-fiction movie"—being so completely out of touch with the news that I did not realize what was being broadcast on that TV was Neil Armstrong's historic moon walk.

But I digress. The question of the moment is when did we humans first begin to count?

In 1972, the journalist and amateur paleontologist Alexander Marshack published his *The Roots of Civilization*, in which, using his microscopic studies of inscribed artifacts, he posited that the notches and lines carved on certain Upper Paleolithic bone plaques were in

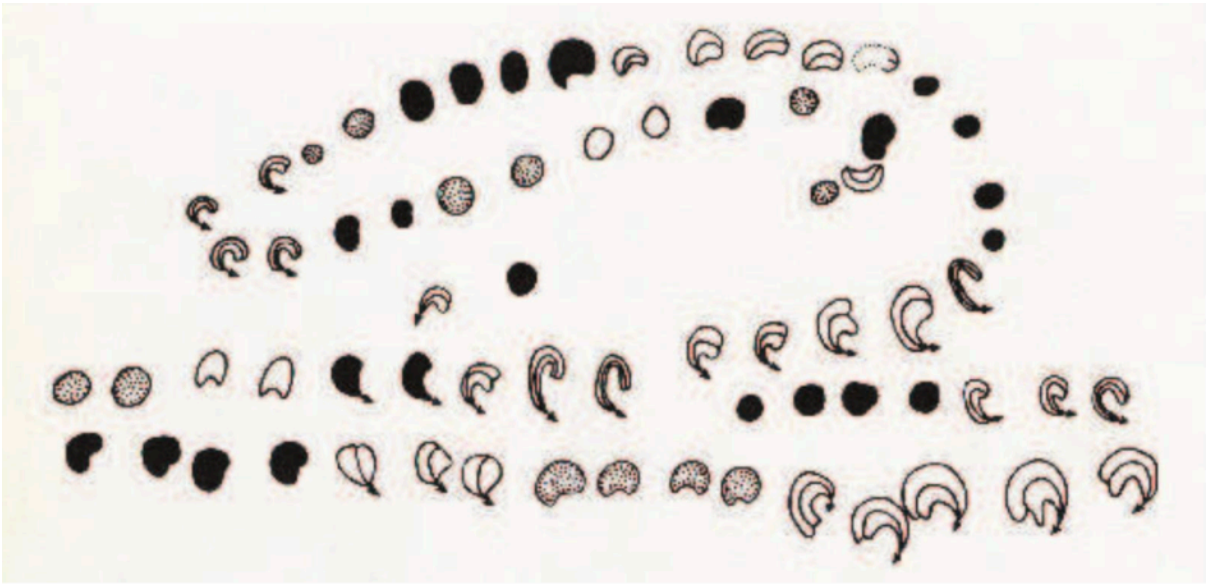
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[1] As I was halfway through writing this essay, I became aware of Benjamin Wardhaugh, *Counting: Humans, History and the Infinite Lives of Numbers*, Harper Collins, 2025. I have only read online excerpts of Wardhaugh's book, but I am sure that the work of a former fellow of Oxford's All Souls College with degrees in mathematics, music, and history would be the place to start for anyone seriously interested in this topic. Nevertheless, I was not deterred from continuing to write this, my own idiosyncratic essay.

fact notation systems, specifically lunar calendars notating the passage of time. While still controversial, many scholars now accept Marshack's interpretation of the lunar calendar on the Blanchard bone, which had been found at the Abri Blanchard rock shelter in the French Dordogne and which dates to the Aurignacian period of the Upper Paleolithic, roughly 32,000 to 30,000 BCE.



Blanchard bone, L. 11 cm. Museé d'Archéologie Nationale, Saint-Germain-en-Laye, France.



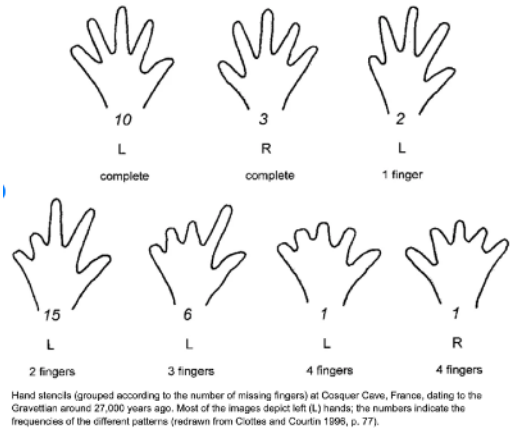
Lunar cycles on the Blanchard bone, from Alexander Marshac, *The Roots of Civilization*.

Okay, so it seems that as early as when H*omo sapiens* first entered Europe, we were already counting. One might, in fact, call our species *Homo numerans*.

And now, the question of the moment is when did we first start using numbers?

Given that most of the numbering systems in the world are based on units of five, ten, or twenty, it is generally believed that we humans first started to count using our fingers.[2]





Hand stencils from Cosquer Cave, France; Gravettian, ca. 27,000 BP. Left, from Wardhaugh, 2025; right, from Ian Gilligan, "The Prehistoric Development of Clothing: Archaeological Implications of a Thermal Model," *Journal of Archaeological Method and Theory*, vol. 17 (2010), pp. 15–80.

The idea that human counting started with fingers is reinforced by the missing digits on many of the numerous hand stencils in Paleolithic caves in northern Spain and southern France. It was once thought that the missing digits on these cave markings, which were made by blowing pigment against a hand held against a cave wall, represented accidents the hunter-gatherers had suffered, or even perhaps ritual mutilation. One suggestion is that the missing digits were produced by bending down one or more fingers of the hand pressed against the wall.

And what did these hand stencils mean? Benjamin Wardhaugh (2025) suggested:

> As with other prehistoric signs and proto-signs, the more general question of the meaning of Palaeolithic hand stencils has been a vexed one for over a century; one scholar aptly says that here modern observers are "uninvited guests in a system of communication designed for others" . . . . . And it is almost impossible to avoid the speculation that the hand positions recorded had something to do with counting. They form a sequence consisting of extending the digits one after another; they are one of the easiest ways you can count to five on your fingers. They are a good candidate for the earliest counting vocabulary recorded: a vocabulary not of spoken words but of gestures; a sign language.

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[2] The *locus classicus* for this topic is Levi Leonard Conant, *The Number Concept: Its Origin and Development*, 1896, which presents an exhausting list of numbering systems from around the world. This work by Conant, a Dartmouth College grad and longtime professor at Worcester Poly Tech, is replete with disturbing racist comments, which I present in the Appendix attached below.

Okay, our Paleolithic ancestors may have counted numbers on their fingers, but we have to wait until the mid-to-late-fourth millennium BCE before we have evidence of numbers *per se*. The numbers on Sumerian proto-cuneiform numerical clay tablets, which were an outgrowth of earlier clay bullae with numerical impressions, were formed by using a round stylus held at different angles to produce the various shapes used for numerical signs. The early Sumerians apparently used a number of counting systems depending on what was being counted—with one system being used for discrete units (such as animals, people, or tools), and different systems being used for counting cheese, volumes of grain, land, or time. By the end of the third millennium BCE, with the development of true cuneiform writing, the Sumerians had begun to adopt a sexagesimal (base 60) counting system; in the following centuries they adopted the so-called Assyro-Babylonian Common; we still use this sexagesimal system to count time (seconds, minutes) and angles (degrees).

[Georges Ifrah (*The Universal History of Numbers: From prehistory to the invention of the computer*, 2000 (1981)) has suggested that this Sumerian sexagesimal counting system began with a duodecimal finger-counting method where each of the three phalanges of the four fingers of one hand (i.e. 12 units) are counted, with one digit of the other hand held up when a count of 12 was reached, reaching a total of 60 when all five of the digits of the other hand were reached. While Ifrah's suggestion is intriguing, there is no evidence that this was how ancient Sumerians counted, and a duodecimal counting system is more readily explained by the twelve months of the lunar year that the Sumerians used.]

We have already seen that keeping track of lunar cycles may go back as early the Paleolithic, and it would seem that we humans first started using numbers to count in order to reconcile a lunar calendar with the solar year. And, historically, many civilizations have used a lunar duodecimal system for keeping track of time.[3]

Of particular interest is the Chinese calendar, which Wikipedia says:

> A Chinese calendar consists of twelve months, each aligned with the phases of the moon, along with an extra intercalary month inserted as needed to keep the calendar in sync with the seasons. It also features twenty-four solar terms, which track the position of the sun and are closely related to climate patterns. Among these, the winter solstice is the most significant reference point and must occur in the eleventh month of the year. Each month contains either

[3] For the history of keeping track of time, a good start is G. J. Whitrow, *Time in History: Views of Time from Prehistory to the Present Day*, Oxford University Press, 1988; Whitrow's book also contains racist comments, such as the absence of words for time in the cultures of "primitive peoples" such as the Hopi of Arizona or the Azande of southern Sudan.

> twenty-nine or thirty days. The sexagenary cycle for each day runs continuously over thousands of years and serves as a determining factor to pinpoint a specific day amidst the many variations in the calendar.

Before we go on to look more at calendars, we should comment on the absurdity of the current resurgence in a belief in astrology and horoscopes based on zodiac constellations. It is understandable that, in a pre-scientific age, people might have thought that the stars—identified with supernatural entities (and the word "zodiac" comes from the ancient Greek *zōdiakos kyklos*, "circle of animals," or *ta zōdia*, "the little animals")—might have had some mysterious power over us on earth. But there is no credible physical mechanism by which the positions of distant stars determine personality or individual fate. It is thus a disturbing comment on our times that, as the online Britannica notes,

> . . . . . the belief that one's personality is determined by the zodiac sign that the Sun was in at one's birth is widespread, and astrology has enjoyed a resurgence in the 2020s, especially among millennials and Generation Z. In a 2022 poll 27 percent of Americans said they believed in astrology, and the percentage was even higher—37 percent—among those under age 30.

And speaking of intercalary months—the insertion of an extra month to a lunar calendar to align it with the solar calendar—they seem originally to have been inserted on an *ad hoc* basis. The regularization of the insertion of seven intercalary months in every nineteen lunar years—the so-called Metonic cycle—has been attributed to the Athenian astronomer Meton (fl. 432 BCE), although we now know that the Babylonians had been using this nineteen-year cycle at least a half century before Meton. [This is an example of the, not uncommon, European usurpation of a discovery originally made in western Asia.]

In the late Roman Republic, the Julian calendar, proposed in 46 BCE by Julius Caesar after his sojourn in Egypt, replaced an earlier 12-month lunar calendrical system that had an intercalary month of 22 or 23 days inserted as needed. The Julian reform assumed that the solar year—the earth's revolution around the sun—was exactly 365.25 days and thus inserted a leap day every fourth year.

An interesting example of an early calendar is the Coligny Calendar, a bronze artifact discovered in 1897 in the Ain department of eastern France. Written in a Gaulish language using Latin letters and Roman numerals, the Coligny Calendar has twelve months, each divided into two parts, the first half with fifteen days and the second half with alternating fifteen or fourteen days. It also has two intercalary months every five years. There are holes running down the middle of the plaque to be used for a peg marking the current day.

Although it used Roman technology and Roman letters, the Coligny Calendar is actually a document that embodies a Gallic conception of the sacred rhythm of the cosmos. Each turn of the moon marked times for sowing and harvest, for ritual observance and renewal; it alternates between auspicious (*matti*) and inauspicious (*anmatti*) days, expressing a belief that not all time was equal—some moments were inherently sacred, filled with divine favor, while others required stillness and restraint. (And today, some New Age fanatics have adopted variations of the Coligny Calendar for their own personal religious or ritual calendar.)



Detail of the Coligny Calendar, Late 2nd century CE. Bronze, 78 x 134.8 cm. Gallo-Roman Museum of Lyon-Fourvière, Lyon, France.

And this brings us to the Gregorian calendar that most of us use today. Introduced by a papal bull issued by Pope Gregory XIII in 1582, the Gregorian calendar corrects a flaw in the Julian calendar. The solar year is actually slightly shorter than the 365.25 days assumed by the Julian calendar, being 365.2422 days (the current value, which varies), which means that, by inserting a leap day every fourth year, the Julian calendar gains one day over the solar calendar every 128 years. By 1582, the Julian calendar was out of line with the solar calendar by ten days. The Gregorian reform skipped ahead ten days and omitted the leap year once a century. When the British government adopted the Gregorian calendar in 1752, skipping eleven days, popular legend claimed angry mobs shouted "Give us our eleven days back!" Of the English Calendar Riots Myth (1752), Google AI notes: "Modern historians consider large-scale physical riots a myth, though minor grumbling, confusion over taxes, and suspicion of "popish" timekeeping did cause widespread public bewilderment."

And speaking of leap years, I remember when my friends and I were twelve years old we made fun of a doofus neighbor who had been born on February 29 (1952): "Haha," we'd taunt, "You're only three years old!" "Oh yeah?" he would reply, "When you are ancient 60-year-olds, I'll only be 15!"



Philibert-Louis Debucourt, "French Republican Calendar of An III (1794 to 1795)," 1794. Drawing. Bibliothèque nationale de France.

During the French Revolution, the new government devised a new French Republican calendar, which was adopted in 1793 and abolished in 1805. This calendar, designed in part to remove religious and royalist influences of the ancien régime, consisted of twelve 30-day months, each divided into three 10-day cycles similar to weeks, plus five or six intercalary days at the end to fill out the balance of a solar year. The French Republican calendar was part of a larger process of decimalization in France (which also included the decimal time of day, the decimalization of currency, and metrication).

By the time that Napoleon abolished it in 1805, the French Republican calendar was already unpopular and many French people had already reverted to seven-day weeks. One unfortunate victim of using the French Republican calendar was Jérôme Lalande, an astronomer who, together with his staff at the Paris Observatory, published in 1801 the *Histoire céleste française,* a catalog of the locations and apparent magnitudes of some 47,390 stars. Because, however, Lalande's data was recorded using the French Republican calendar and its experimental system of decimal time (which divided days into 10 hours, hours into 100 minutes, and minutes into 100 seconds), the *Histoire céleste française* proved incredibly frustrating and impractical for other astronomers around the world to use. Its value wasn't fully realized until 1847, when the English astronomer Francis Baily heavily revised the catalog, re-calculated the data into a standard format, and published a readable version, which is still available today.



Copy of the first meter standard, sealed in the foundation of a building, 36 rue de Vaugirard, Paris.

While the French Republican calendar has gone into the dustbin of history, some of the revolutionary decimalization has remained with us, most notably the use of the meter as a measure of distance. Originally the *mètre* was defined as one ten-millionth of the shortest distance from the North Pole to the equator passing through Paris, assuming an Earth flattening of 1/334 and was standardized with the *Mètre des Archives*, a platinum bar held in

Paris. Today the meter is defined as the distance that light travels in a vacuum in exactly 1/299,792,458 of a second. The metric system has become the international standard of measurement, although customary units remain in common use in the UK and, especially, the US. And while most of its former colonies have adopted metrification, the UK (as well as the US) still uses inches, feet, yards, and miles. In the UK, distances can also be measured in meters and kilometers, and Brits have generally abandoned such archaic units as the rod, furlong, or league. Still, the UK and the US continue to use acres instead of hectares, and in the US we have sixteen fluid ounces to a pint while the Brits have twenty ounces to their imperial pint, and we both have two pints to a quart and four quarts to a gallon, although most people have abandoned the two-gallon peck, the eight-gallon bushel, and sixty-four-gallon quarter. The UK has also abandoned the twelve-pence shilling, twenty of which made up a pound; Brits still, however, measure their body weights in terms of stones!

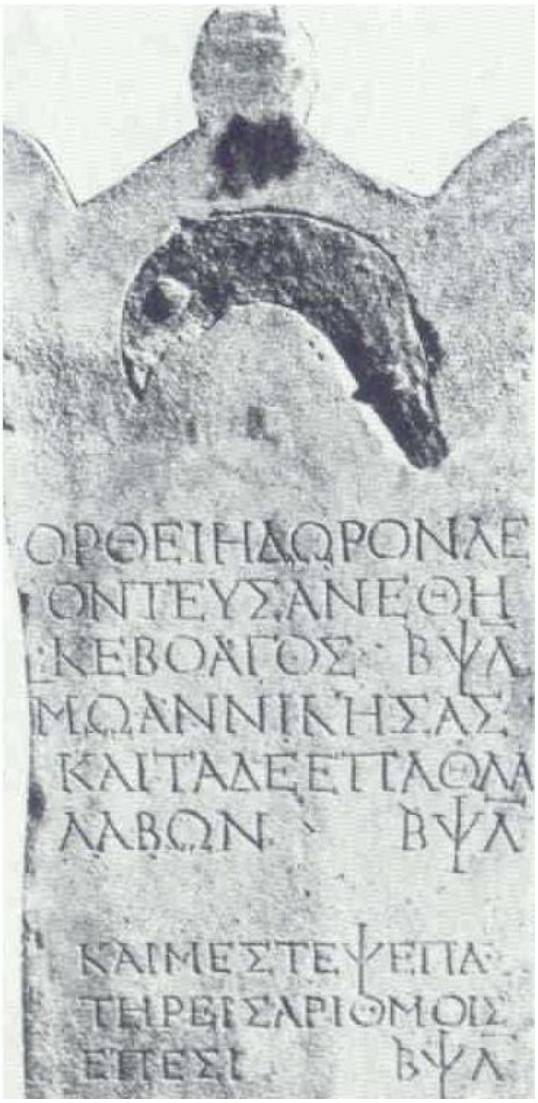
And, for most of us who grew up in countries that have not adopted metrificated units of measurement, it is only a slight headache to convert miles-per-gallon into liters-per-100 kilometers, or Fahrenheit to Celsius. But then there was the 1999 Mars Climate Orbiter Mishap. Launched in 1998 by NASA, the Mars Climate Orbiter was a robotic probe sent to Mars to measure its atmosphere and to serve as a communication relay. But as it approached the Red Planet, instead of skimming the surface of the atmosphere and settling down into a stable orbit, the Mars Climate Orbiter took a nosedive into the planet, presumably burning up in the atmosphere. And the culprit for this disaster turned out to be that, while NASA was measuring the force of the thrusters in terms of newton-seconds, one set of instructions supplied by Lockheed Martin used pound-force-seconds.

One more topic in this I'm-counting-on-you essay that we need to address before concluding is numerology, which Wikipedia defines as:

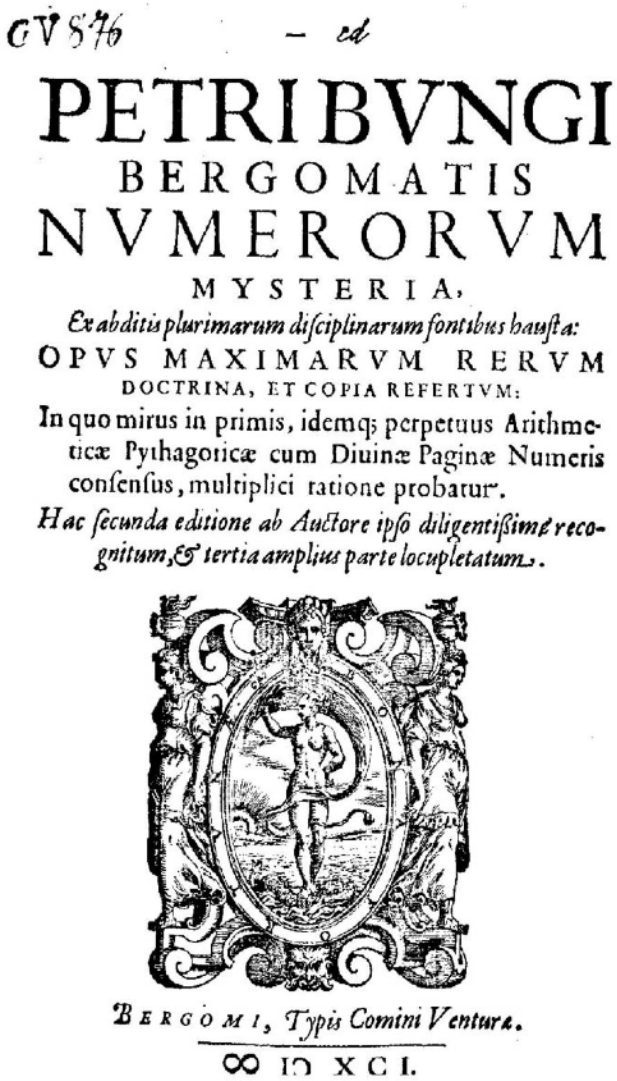
> Numerology (known before the 20th century as arithmancy) is the belief in an occult, divine, or mystical relationship between a number and metaphysical phenomena or ideas. It is also the study of the numerical value, via an alphanumeric system, of the letters in words and names (e.g. gematria). When numerology is applied to a person's name, it is a form of onomancy [the prediction of a person's destiny by analyzing the letters of their name]. It is often associated with astrology and other divinatory arts.

The assigning of numerical values to words and names and imputing those values with religious meaning seems to have begun in western Asia. An Assyrian inscription from the 8th century BCE, commissioned by Sargon II declares "the king built the wall of Khorsabad 16,283 cubits long to correspond with the numerical value of his name". Aristotle

reports that, in the 6th century BCE, Pythagoras practiced isopsephy, the practice of adding up the number values of the letters in a word to form a single number. A notable ancient example of isopsephy is on a votive stele to a boy who had won a singing contest. Found at the Temple of Artemis in Sparta, this stele bears the inscription ΟΡΘΕΙΗ ΔΩΡΟΝ ΛΕΟΝΤΕΥΣ ΑΝΕΘΗΚΕ ΒΟΑΓΟΣ ΒΨΛ ΜΩΑΝ ΝΙΚΗΣΑΣ ΚΑΙ ΤΑΔΕ ΕΠΑΘΛΑ ΛΑΒΩΝ ΒΨΛ ΚΑΙ Μ ΕΣΤΕΨΕ ΠΑΤΗΡ ΕΙΣΑΡΙΘΜΟΙΣ ΕΠΕΣΙ ΒΨΛ (Orthei Doron Leonteus was crowned champion ‘βψλ, and Moan Nikisas received the following prizes: ‘βψλ, and M, and Father Eisarithmos were also crowned 'βψλ); each line of this elegiac verse ends with a ‘βψλ, indicating that the letters in each verse added up to 2,730.



Votive stele to Orthei Doron Leonteus, Temple of Artemis Orthia, Sparta, 2nd century CE.


GV 876 – ed

PETRI BVNGI
BERGOMATIS
NVMERORVM
MYSTERIA,

Ex abditis plurimarum disciplinarum fontibus hausta:

OPVS MAXIMARVM RERVM
DOCTRINA, ET COPIA REFERTVM:

In quo mirus in primis, idemq; perpetuus Arithmeticæ Pythagoricæ cum Diuinæ Paginæ Numeris consensus, multiplici ratione probatur.

Hac secunda editione ab Auctore ipso diligentißimè recognitum, & tertia amplius parte locupletatum.

Bergomi, Typis Comini Venturæ.

∞ IↃ XCI.

Pietro Bongo, *Numerorum mysteria*, Comino Ventura, 1591. Biblioteca Europea di Informazione e Cultura, Milan, Italy.

Medieval Christian numerology taught that God created a well-ordered universe and that deciphering the universe’s numerical patterns would reveal the Creator’s grand plan for

humanity, including individual fates. Pietro Bongo's *Numerorum mysteria*, first published in 1591 and reprinted least four times, brought together Classical texts, Mediaeval Church writings, and recent scholarship to provide an extended commentary of nearly a thousand pages in Latin on the mystical significance of numbers; it was highly influential at the time and became an important compendium of numerical mysticism..

And, of course, New Age quacks have bought into this unscientific worldview. An Australian MP credibly altered the spelling of her own name according to numerological advice, believing it would bring excitement to her life, and many people, like the celebrity Gwyneth Paltrow, have followed a "9-year" numerological cycle signifying transformation and closure, with symbolic gestures such as posting rain-imagery associated with personal renewal.

Now to get back to counting. In the examples I have presented in this essay we can see that counting began as a means of keeping track of things we could see and touch, but has become a means we use to organize and interpret reality; now we count almost everything, whether or not it needs counting. In 1988, G. J. Whitrow said "We have never before been so obsessed with time as we are now." And now, almost four decades later, we are even more obsessed with keeping track of time. With our digital clocks and iPhones, every second and every minute of every day blinks out at us wherever we turn.[4] The sports we watch are stop-watched down to the second; F1 car racing is measured in 1/1000 of a second! And we count and count. In 1845, Elizabeth Barrett Browning (Sonnet 43) said that she would count the ways she loves thee. And we are still taking everything into account.

Whew! I guess that is enough for now, and you should count me out.

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[4] And I might add the hassle of trying to find every clock in the house and change it when daylight savings time comes. But I hope that Europe doesn't end daylight savings time as it looks like the US is going to do; for me, it is a perfect time to reflect on one's life. When things are going well, I'm sad to lose an hour in the spring and happy to gain that hour back in the fall. When my life isn't going well, I'm glad to lose that hour in the spring and resentful of having to spend another hour in the fall.

Appendix: Racism in Levi Leonard Conant, *The Number Concept: Its Origin and Development*, New York: Macmillan and Co., 1896.

The following excerpts from *The Number Concept* have been selected to demonstrate the disturbing racism expressed in Conant's 1896 book. While this racism may be chalked up to the dubious excuse of "a product of its time", *The Number Concept* remained in circulation and was reprinted in 1936. It is interesting to note that Conant regarded Leibniz's binary system of numeration as cumbersome and treated it as a mathematical curiosity; he repeatedly treats indigenous binary counting as evidence of intellectual inferiority, even though later binary counting would play a key role in the development of digital computing.

(Chapt. I. Counting) Such are the devices which have been, and still are, to be found in the daily habit of great numbers of Indian, negro, Mongolian, and Malay tribes; while, to pass at a single step to the other extremity of intellectual development, the German student keeps his beer score by chalk marks on the table or on the wall.

(Chapt. II. Number Systems Limits) With respect to the limits to which the number systems of the various uncivilized races of the earth extend, recent anthropological research has developed many interesting facts. In the case of the Chiquitos and a few other native races of Bolivia we found no distinct number sense at all, as far as could be judged from the absence, in their language, of numerals in the proper sense of the word. . . . . Among the rudest tribes, those whose mode of living approaches most nearly to utter savagery, we find a certain uniformity of method. The entire number system may consist of but two words, *one* and *many*; or of three words, *one*, *two*, *many*. Or, the count may proceed to 3, 4, 5, 10, 20, or 100; passing always, or almost always, from the distinct numeral limit to the indefinite *many* or several, which serves for the expression of any number not readily grasped by the mind.

(Chapter IV. The Origin of Number Words, Continued) By the slow, and often painful, process incident to the extension and development of any mental conception in a mind wholly unused to abstractions, the savage gropes his way onward in his counting from 1, or more probably from 2, to the various higher numbers required to form his scale. The perception of unity offers no difficulty to his mind, though he is conscious at first of the object itself rather than of any idea of number associated with it. The concept of duality, also, is grasped with perfect readiness. This concept is, in its simplest form, presented to the mind as soon as the individual distinguishes himself from another person, though the idea is still essentially concrete. Perhaps the first glimmering of any real number thought in connection with 2 comes when the savage contrasts one single object with another—or, in other words, when he first recognizes the *pair*. At first the individuals composing the pair are simply "this one," and "that one," or "this and that"; and his number system now halts for a time at the stage when he can, rudely enough it may be, count 1, 2, many. There are certain cases where the forms of 1 and 2 are so similar that one may readily imagine that these numbers really were "this" and "that" in the savage's original conception of them; and the same likeness also occurs in the words for 3 and 4, which may readily enough have been a second "this" and a second "that." . . . . .

The first real difficulty which the savage experiences in counting, the difficulty which comes when he attempts to pass beyond 2, and to count 3, 4, and 5, is of course but slight; and these numbers are commonly used and readily understood by almost all tribes, no matter how deeply sunk in barbarism we find them.

(Chapter V. Miscellaneous Number Bases) Two centuries ago the distinguished philosopher and mathematician, Leibnitz [Leibniz], proposed a binary system of numeration. The only symbols needed in such a system would be 0 and 1. The number which is now symbolized by the figure 2 would be represented by 10; while 3, 4, 5, 6, 7, 8, etc., would appear in the binary notation as 11, 100, 101, 110, 111, 1000, etc. The difficulty with such a system is that it rapidly grows cumbersome, requiring the use of so many figures for indicating any number. But Leibnitz found in the representation of all numbers by means of the two digits 0 and 1 a fitting symbolization of the creation out of chaos, or nothing, of the entire universe by the power of the Deity. In commemoration of this invention a medal was struck bearing on the obverse the words

Numero Deus impari gaudet,
[God rejoices in an odd number"]

and on the reverse,

Omnibus ex nihilo ducendis sufficit Unum.
["To produce everything out of nothing, one is sufficient"]

This curious system seems to have been regarded with the greatest affection by its inventor, who used every endeavour in his power to bring it to the notice of scholars and to urge its claims. But it appears to have been received with entire indifference, and to have been regarded merely as a mathematical curiosity.

Unknown to Leibnitz, however, a binary method of counting actually existed during that age; and it is only at the present time that it is becoming extinct. In Australia, the continent that is unique in its flora, its fauna, and its general topography, we find also this anomaly among methods of counting. The natives, who are to be classed among the lowest and the least intelligent of the aboriginal races of the world, have number systems of the most rudimentary nature, and evince a decided tendency to count by twos. This peculiarity, which was to some extent shared by the Tasmanians, the island tribes of the Torres Straits, and other aboriginal races of that region, has by some writers been regarded as peculiar to their part of the world; as though a binary number system were not to be found elsewhere. This attempt to make out of the rude and unusual method of counting which obtained among the Australians a racial characteristic is hardly justified by fuller investigation. Binary number systems, which are given in full on another page, are found in South America. Some of the Dravidian scales are binary; and the marked preference, not infrequently observed among savage races, for counting by pairs, is in itself a sufficient refutation of this theory. Still it is an unquestionable fact that this binary tendency is more pronounced among the Australians than among any other extensive number of kindred races. They seldom count in words above 4, and almost never as high as 7. One of the most careful observers among them expresses his doubt as to a native's ability to discover the loss of two pins, if he were first shown seven pins in a row, and then two were removed without his knowledge. But he believes that if a single pin were removed from the seven, the Blackfellow would become conscious of its loss. This is due to his habit of counting by pairs, which enables him to discover whether any number within reasonable limit is odd or even. Some of the negro tribes of Africa, and of the Indian tribes of America, have the same habit. Progression by pairs may seem to some tribes as

natural as progression by single units. It certainly is not at all rare; and in Australia its influence on spoken number systems is most apparent.

Any number system which passes the limit 10 is reasonably sure to have either a quinary, a decimal, or a vigesimal structure. A binary scale could, as it is developed in primitive languages, hardly extend to 20, or even to 10, without becoming exceedingly cumbersome. A binary scale inevitably suggests a wretchedly low degree of mental development, which stands in the way of the formation of any number scale worthy to be dignified by the name of system. Take, for example, one of the dialects found among the western tribes of the Torres Straits, where, in general, but two numerals are found to exist. In this dialect the method of counting is: . . . . .
Anything above 6 they call *ras*, a lot.

For the sake of uniformity we may speak of this as a "system." But in so doing, we give to the legitimate meaning of the word a severe strain. The customs and modes of life of these people are not such as to require the use of any save the scanty list of numbers given above; and their mental poverty prompts them to call 3, the first number above a single pair, 2-1. In the same way, 4 and 6 are respectively 2 pairs and 3 pairs, while 5 is 1 more than 2 pairs. Five objects, however, they sometimes denote by *urapuni-getal*, 1 hand. A precisely similar condition is found to prevail respecting the arithmetic of all the Australian tribes. In some cases only two numerals are found, and in others three. But in a very great number of the native languages of that continent the count proceeds by pairs, if indeed it proceeds at all. Hence we at once reject the theory that Australian arithmetic, or Australian counting, is essentially peculiar. It is simply a legitimate result, such as might be looked for in any part of the world, of the barbarism in which the races of that quarter of the world were sunk, and in which they were content to live.