Zero, One, Two, Many

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It's been said that programming has only three nice numbers: zero, one, and however many you please.
TOM CHRISTIANSEN AND NATHAN TORKINGTON [1]

In the context of computer programming [1], there are only three numbers worth being concerned about: zero, one, and many. And if you are into the arcana of "regular expressions" and "pattern matching"—which is something done implicitly every time you do a Google search, or look for a book at an online bookstore—that is very sage advice. But how serviceable is this dictum in everyday life?

A real-life scenario

Let us assume that you are living alone, but have decided to invite friends for a Halloween party. You had at first assumed that the full cohort of fifty or so friends to whom you sent invitations were all going to turn up, but had later revised that estimate to half that number. You shop and eagerly prepare sufficient food and drink for the festive occasion. Exhausted but elated with anticipation, you finally finish the chores, sit back, heave a sigh of relief, and wait for your friends.

As the clock ticks inexorably toward the appointed hour, you watch the door but there are no early birds. You stay patient and console yourself that perhaps they will turn up just on time. The awaited hour comes and goes and still no one has shown up.

Meanwhile, you get a series of emails, text messages, and phone calls from your friends, who all mysteriously claim, that at the last minute some unforeseen circumstance prevented their presence. They convey their apologies for not turning up. A full hour after the scheduled time for dinner, you reluctantly conclude that nobody is going to turn up after all, and decide to assuage your sorrow by tucking in.

Zero

And there you have it: the number zero. It precisely equals the number of your expected guests who turned up. It is catastrophic, as on this on occasion, or when you have scored zero marks in the examination, or zero goals in the soccer match. A zero bank balance can drive you up the wall, or worse. Having zero cavities when you visit the dentist, however, is cause for celebration. But is zero really a number?

Face value and place value

The *face value* of a digit is its single-digit value taken in isolation. In this scheme of things, the digit 5 is greater in value than the digit 0.

But the decimal system of numbers also brought with it the notion of *place value* in which the position of a digit in a number determines its value. For example, in the number 45, the digit 4 represents forty and the digit 5 represents five, giving us an implicit sum of forty plus five, which we call forty five. In this case, the digit 4 has a face value less than 5 but a place value greater than 5.

Likewise, in the number 105, we have one hundred, zero tens and five units. The digits 1 and 0 both have a place value greater than the digit 5. Ponder on this: would we ever be able to denote the number one hundred and five without the digit 0? People struggled with this problem for ages before the subtle idea of zero gave them a way out.

Without zero as a place holder, we would not be able to perform arithmetic unambiguously and efficiently. We could never write numbers solely using digits if we had not taken recourse to zero and its beguiling fullness in the midst of emptiness. So, zero, although it is nothing, is paradoxically, something to be reckoned with. And something very powerful at that. It has been called *The Nothing That Is* [2].

One

Think of yourself: the one and only lonely consumer of food at your festive banquet. Left to sup alone and without the cheer of convivial company, *you* nevertheless count. You—the subject—are always there, and therefore, the number one has a subjective significance that rivals only that of zero. This is why *I* is called the *first person pronoun*. Without the first person, everything else is vacuous.

Each of has only *one* body. And even if we had a dozen houses spread across five continents, we can occupy only *one* at any one time. The number one imposes some fundamental constraints on our lives.

The magic of successor numbers

But one has another magical, mathematical property. If you add one to one, you get two, which is the *successor* to one. If you add one to two, you get three—the successor to two—and so on. So, any number that you care to name can be generated by adding one to itself that many times, but one! For example, to get *four*, you need to add one to itself *three* times.

If that sounds too complicated for you, you can equally say that any number can be generated by adding one to zero that number of times. For instance, *four* is one added to zero *four* times. Note, however, that the bedrock for this magic is the number one. Adding zero to itself does us no good in creating new numbers. One needs to add one to zero before the brewing begins.

So, both zero and one are powerful numbers. They hold within themselves the whole menagerie of numbers. Indeed, our modern civilization, built as it is on computers and the binary number system, has the numbers zero and one at its technological foundations. But are there any other powerful and important numbers besides these two?

Two

I nominate the number two. The saying, "It takes two to tango" takes on a new meaning in the world of chemistry, physics, and biology.

Two in Chemistry

In chemistry, elements react with each other to try to attain configurations in which there are *eight* electrons or completed octets. And eight is two cubed. This quest to make eight, either by sharing or tearing electrons is what gives elements their reactivity. It is what drives poisonous chlorine and combustible sodium to form physiologically benign sodium chloride or common salt. And even the lightest of the rare gases, helium, has *two* electrons in its solitary atomic state. Evidence again of the power of two.

Two in Physics

Physics relies on repeatable measurements. And all measurements rely on comparisons. When you weigh one kilogram of beans, you are really comparing the weight of the beans with a weight that is known to be one kilogram. If you are using a commercial scale, which relies on spring tension, you are really comparing the tension or compression on the spring produced by the beans with the tension or compression from the known one kilogram weight. And this is as true with time, distance, and anything else you care to measure, as it is with weight. *All measurements are comparisons, and for that we need two*.

Two in Biology

In biology, there is the famous double helix—DNA or the molecule of life is known to be like a spiral staircase or twisted ladder. But why two? Why not one? Or zero? Or three? Very likely because Mother Nature knew, before us, that all comparisons need two. And if you want to make a copy of something, you need to compare the copy with the original. Since life is really a process of copying, with elegant and random variations thrown in (assuming that you are not totally allergic to the Theory of Evolution) then, two rules again.

Another possible reason for life's affinity with two is the insurance provided by redundancy. We have two kidneys, two ears, two eyes, etc., primarily because of aesthetics, balance, and design elegance, but secondarily because of redundancy. Someone who has lost hearing in one ear or sight in one eye can still hear or see. They might have lost the ability to localize sound or perceive depth, but the sensory channels are still functional.

The number two—and its powers like 4, 8, 16 etc.— are also at the heart of cellular division. During conception two cells—sperm and ovum—become one embryo or zygote. But in all subsequent cellular proliferation, or mitosis, they divide in two.

To sum up

Zero and one are mathematically profound. The number two comes into its own with matter, measurement, and life. But what about the other numbers? What about three, or thirty-seven, or three hundred and thirty million? They might each be interesting in their own right and have some endearing virtue or peculiarity, but these other numbers are not lynchpins. The appellation "many" will do for them.

Moreover, not giving these other numbers special distinction is something we have done many times already. In the grammars for most languages, only two numbers are recognized: singular and plural, one and many. The automatic matching of singular nouns with singular verbs, and plural nouns with plural verbs, is a chore to automate with reports generated by computing languages. And that is because the number one is special. Beyond it, we only think of many. But bear in mind that ancient languages like Greek and Sanskrit had three numbers in grammar: singular, dual, and plural. And that, I think is giving the numbers one and two their fair share of distinction. And oh! To speak nothing of nothing will not do, so, naught or nought, must be there too!

Vive la zero, one, two, many!

Note to the Reader

This blog first appeared on 28 December 2007 as a *Daily Dose*—an informal essay that I circulated each day on a private email list. I have retrieved and refreshed it to allow its reincarnation as an online blog now. Its purpose is to inform and educate. Accordingly, *sme* words that are likely to be unfamiliar to the reader are shown in blue and hyperlinked to entries on the Web that will explain their meaning. The rest are left for the reader to explore. ☺

Feedback

Please email me your comments and corrections.

A PDF version of this article is available for download here:

https://swanlotus.netlify.app/blogs/zero-one-two-many.pdf

References

[1] Tom Christiansen and Nathan Torkington. 2003. *Perl Cookbook* (2nd ed.). O'Reilly, Sebastopol, CA, USA.

[2] Robert Kaplan. 2000. *The Nothing That Is: A Natural History of Zero*. Oxford University Press.

