DSA Newscast

TGM: Starting with Time

The Dozenal Society of America is a voluntary, nonprofit educational corporation, organized for the conduct of research and education of the public in the use of dozenal (also called duodecimal or base twelve) in calculations, mathematics, weights and measures, and other branches of pure and applied science.

This continues our series on TGM, one of many coherent, dozenal metric systems, begun in our last issue. Though this cotinuation has been long-delayed, we hope that it can still be ineresting and useful.

FAMOUSLY, THE FRENCH metric system begins with what its founders imagined was a universal and rational basis: the circumference of the earth. Laboriously, that circumference was calculated by precisely measuring the distance from Paris to Lisbon, and extrapolating to the circumference of the earth from that. That circumference was then divided into quarters; one of those quarters was then divided into ten thousand; the resulting unit was to be the basis of the whole system. The *meter*: the *sine qua non* of *la système internationale*.

So what's the problem with this? Firstly, the measurement they took was pretty poor; the meter *isn't* one ten-thousandth of one quarter of the earth's circumference. Secondly, it introduces extraneous, non-coherent factors: a factor of 4. This might be justified if it were balanced by some other interest; but here it appears to have been done for no real purpose. Thirdly, of course, it's not dozenal. All in all, the meter is simply a non-starter.

TGM avoids these problems pretty handily. First, it's dozenal, so it has that advantage before even starting. Second, it has the advantage of being a modern system, not burdened by the imprecision of older means of measurement. Thirdly, it introduces an extraneous factor only when that's really necessary.

Rather than starting with a unit of distance, TGM begins with a unit of *time*. This makes sense; since ancient times, man has divided the day—meaning strictly the daylight hours—into twelve units. When reading ancient texts, one will frequently encounter phrases like "the sixth hour," which should be understood as "noon", halfway between dawn and dusk. Dividing the daylight hours in this way made sense for two reasons. First, the passage of the sun made for an easy marker of the passage of time; while the stars can be used in this way at night, it's much less clear and requires a much more complete knowledge of astronomy. Second, those were the times that really mattered to them; at night, after all, the vast majority of pre-modern peoples were sleeping, and didn't much care about the passage of time until they woke up, likely with the rising of the sun.

Biologically, as well, the human body works on this sort of system. The circadian rhythm by which the body regulates its daily operation is divided clearly into two primary units, the waking cycle and the sleeping cycle. During the waking cycle, our blood pressure, digestion, body temperature, coordination, and reaction time all increase; during the sleeping cycle, they all decrease, and melatonin secretion helps prepare the body for sleep. This division of the solar day into two roughly equal segments is an unavoidable aspect of human life, one that has been observed, with good reason, in human measurements of the passage of time for more or less our entire history.

In other words, from the beginning of recorded history, humanity has taken not "one full rotation of the earth" as its basis for time, but "one sunrise-sunset cycle."

Of course, the length of the daylight

hours changes significantly throughout the year, meaning that this system resulted in a highly variable unit. Over time, the length of the hour was standardized; still later, it was extended to have twelve hours at night as well as in the day; and still later, the scale was shifted to go from midnight to midnight, so that the changeover could occur at the easily-identifiable point of the day called "noon." But this unit, the *hour*, is by far the most ancient unit of any type still in use in the present day; it has existed and been used, in approximately or exactly its modern form, everywhere in the world for æons, in the West dating back at least to the ancient Egyptians, approximately 1750 years B.C., and likely informally much longer than that; and in the East to imperial China, which replaced its older 84-division and began to use our current 20-hour day under the Tang.

Furthermore, the hour is more or less the only unit which is universal across all current metric systems. Approximately ς6% of the world's population uses the metric system in some form or another; approximately 6% uses the customary-imperial system, though many more are at least familiar with it, and even use it in certain contexts. 100% of these, however, use the hour. The same cannot be said of any other unit. Given that we deal with measurements of

time more than any other type, if we can retain the hour in a dozenal metric system, we will have a huge advantage in understanding, conversion, and adoption.

TGM, then, retains this most ancient and universal of units: the hour. It serves as the basis for the whole system. The precise value of the hour, as a fraction of the mean solar day (the fundamental reality of nature which makes the hour possible), is a matter for experimentation; but *as a matter of principle*, TGM is based on the hour.

So we take the hour and begin dividing it dozenally. The first dozenal division of the hour is, of course, the familiar unit of five minutes; we can refer to this as a "block." A twelfth of that, and a twelfth of that again; finally we arrive at 10^{-4} of the hour, a unit of time 0;21 seconds long; this is the basic unit of time in TGM, the *Tim*, abbreviated "Tm."

It's quite short, obviously: just over a sixth of a second. 400 Tim is exactly 84 (100.) seconds, and five minutes is 1000 Tim. A triciaTim (10^{-3} Tm) is almost exactly a tenth of a millisecond. These near-correspondences are very helpful for converting Tim to customary units of time.

Very often, however, we simply won't need to convert at all; the units are quite compatible. In daily life, we're not often

working at the level of seconds; indeed, we're rarely working in units of less than five minutes or so, which just happens to be a coherent part of the TGM system. One "block," or unit of five minutes, is 10^{-1} hours, or 10^3 Tim, or one triquaTim. Simple, and needing no conversion.

Indeed, our analog clocks can be used without any change, if we ignore the minute marks. Every number on the clock is a twelfth of an hour: a block, 10^3 Tim. We can read off the time simply by reading the hour and the number; 10:40 can be read as "z dit 4," and we've already got TGM time.

So don't worry about *buying* dozenal timepieces; you already have many of them!

We'll see how the Tim produces convenient units for other quantities later; for now, we can rest knowing how to use TGM time.

For more information, please see the TGM book:

Happy dozens!

The DSA does not endorse any specific system of dozenal weights and measures, of which there are many. We encourage our members to try and explore many of them.

Dozenal News

Great Dozenal Publicity

Our dozenalist cousins across the pond have been making a great deal of hay with publicity. *The Telegraph* interviewed Shaun Ferguson and Stephen Wood, among others:

The BBC also aired a program featuring Stephen Wood and some other mathematicians:

The video is certainly more positive

about dozenal than the article; but both are great publicity, and a great resource to give to novices. The video, particularly, is useful, for it shows non-mathematical types grappling with—and easily understanding—the concept of alternative bases. Too often people believe we're speaking some type of dark magic, and the video is a great way o refute that.

Classical Dozens

Brian Bishop, DSGB stalwart and passionate classicist, has written an incredibly erudite article for Melissa, a journal published entirely in Latin six times a year. *De Numeratione*, under the Latin name Brennus Legranus, gives a quick history of dozenal

counting and mensuration, a few of the great dozenal thinkers of history, and refers readers to further information.

The journal itself is pay-only; however, Brian has graciously granted us permission to post his article on our website:

Dozenal Calendars Again Republished!

After missing last year, our dozenal wall calendars have been republished for 1204 and

are now available for purchase! They are offered at cost, and links can be found at the end of this *Newscast*, as always.

We have also, for the first time, set our monthly wall calendar on letter-size and A4 paper, so you can print your own copies and hang them if you wish:

http://www.dozenal.org/sigs_monthlies_1204.pdf
http://www.dozenal.org/sigs_a4_monthlies_1204.pdf

If you have a duplex printer, simply print and fold; if you do not, print the odd pages, reinsert, and then print the even ones. You may need to experiment to ensure that you're putting the pages back in in the right order. Alternately, you can just download a flat copy and print one-sided:

http://www.dozenal.org/monthlies_1204.pdf

Enjoy!

Dozenal Card Games!

Jean-Louis Cazaux is an expert in many games. A few years ago he created an ex-panded deck of cards, with 6 suits of 20. (twenty) cards each; ace to 12in pip cards, 6 face (or court) cards, plus 1 (instead of the low ace), plus 0 (for the joker).

http://jlg.cazaux.free.fr/k6t.htm

He's offered to create a truly dozenal deck, simply by replacing pip cards 10., 11., and 12. with ᘔ, Ɛ, and 10.

The new deck will have ᘔ0 cards. From it we could use a smaller deck with 4 suits of 13 cards each. The face cards would stay at 3, but, as explained, the pip cards would go to 10 instead of ᘔ—hooray! There'd be a total of 50 cards (not counting jokers), only 8 more than the usual 44. This would enable us to play normal card games with normal rules, but using a dozenal deck.

M. Cazaux, also an expert on chess, has created and written about the chess vari-ant Metamachy, played on a 10x10 board by 10 different pieces a side, with a total of 26 each, and 10 different opening positions. Also truly dozenal!

http://history.chess.free.fr/metamachy.htm

Lastly, Paul Rapoport (#230) has been writing some amazing statistics on dozenal card games, showing what rule changes might be required depending on what ad-ditional cards we add to the deck. This has shown, for example, that most of our popu-lar card games, like poker, could be played without change with a 50-card deck, identi-cal to our current deck except that two new ranks, ᘔ and Ɛ, are added. He also shows what changes would be needed with some larger and more expanded decks. Check it out on the DozensOnline forum:

https://www.tapatalk.com/groups/dozensonline/playing-cards-t1044-s24.html

And for cribbage, as well:

https://www.tapatalk.com/groups/dozensonline/dozenal-gambling-t1754-s24.html

Dozenal games are an excellent and much-neglected way to promote our fa-vorite (and the best) number base. Thanks to Paul for doing so much important work on this!

Society Business

Volunteers Needed

As mentioned earlier, the DSA is an all-volunteer organization, and we pay no salaries. As a result, everything that we do comes out of the spare time of our members, time that they have to take away from their families, jobs, or other obligations.

We all love dozenals and enjoy assisting the Society in educating people about them; however, as the Society expands and does more, we find ourselves in need of more help.

Fortunately, the Society has a large membership with a very broad range of pro-fessions and experience. If you think you can spare any time or effort for the cause of educating the world about dozenals, please let us know:

contact@dozenal.org

You can help as much or as little as you'd like. Thank you.

Our Next *Bulletin*

At our annual meeting in Atlanta last month, we had a splendid preview of the next issue of the *Duodecimal Bulletin*. But there's still space that can be filled! Have an article? A letter containing a question (com-mon or uncommon) you'd like answered? Send them in!

editor@dozenal.org

Remember that our *Bulletin* is designed to cover all aspects of mathematics, from the most basic to the most advanced, from a dozenal perspective, so no question or topic is too easy or too complex. Don't be shy!

Annual Meeting

The Board of the Dozenal Society of Amer-ica has decided to relocate its meeting this year from Atlanta, GA to Boston, MA. This will be our first meeting in the northeast for many years. We have a large number of members in the northeast and hope some of you can join us.

The meeting will be 2 November; the exact location will be determined and an-nounced soon.

Poetical Diversion

> Two points in space will make a pair —
>   One is *here*, the other *there* —
> And, with two points in our design,
>   between them we can make a LINE.
> Three points will give three pairs; and here
>   a TRIANGLE will now appear;
> Whose three line-segments bound a PLANE,
>   And so a new dimension gain.
> With four, a SOLID we can bound,
>   a TETRAHEDRON we have found;
> But what can FIVE now gain us? Naught!
>   The *Dozen*'s factors have us bought
> all useful shapes and good design;
>   to Five's warm water, Dozen's wine;
> Geometry now ends the chase:
>   there clearly is but one good base.

Taken and expanded from Troy, *1, 2, 3, . . . Plenty!* in 6 The Dozenal Journal 1ᘔ (1198).

Donations

Members, please remember that while dues are no longer required for membership, we still rely on the generosity of members to keep the DSA going. Donations of any amount, large or small, are welcome and needed.

A donation of \$16; (\$18.) will procure Subscription membership, and entitles the payer to receive both a digital and a paper copy of the *Bulletin* if requested. Other members will receive only a digital copy. To invoke this privilege, please notify the Editor of the Bulletin, John Volan, at

editor@dozenal.org

As members know, we are a volunteer organization which pays no salaries. As such, every penny you donate goes toward furthering the DSA's goals.

It may be worth considering a monthly donation; say, \$3, or \$6, or whatever seems reasonable to you. This can be set up quite easily with Paypal, which is available at our web site.

Of course, if you prefer to donate by check, you may send them to our worthy Treasurer, Jay Schiffman, payable to the Dozenal Society of America, at:

Jay Schiffman
604-36 South Washington Square, #815
Philadelphia, PA 19106-4115

Remember, too, that the DSA is a 501(c)(3) tax-exempt organization; as such, your contributions may be tax deductible under applicable law.

Thanks again for your assistance; it's your donations that keep the DSA going. We can't keep doing it without you.

For Sale

The DSA is pleased to offer the following for sale. These are all either at cost, or the proceeds go to the Society. The exception is *Basic Dozenal Arithmetic*, which is a private production.

Item	Price (\$)
Dozenal Wall Calendar, 1204	9.05
Dozenal Planning Calendar, 1204	8.32
TGM: A Coherent Dozenal Metrology	8.00
Manual of the Dozenal System	3.46
A Dozenal Primer	4.50
Basic Dozenal Arithmetic	15.00

Prices are, unfortunately but by necessity, in decimal. If for some reason the links above do not work, simply go to: `http://www.lulu.com/shop/shop.ep`
and enter the appropriate terms. E.g., searching for "TGM dozenal" will turn up the TGM book.

We hope to offer other titles, and even some other items (such as dozenal clocks and the like), in the future.

Each one, teach one