[redacted] U O D E C I M A L

N E W S C A S T

Year 6
No. 1
April
*1178 (1964)
Price:
1 shilling.

The Duodecimal Society of Great Britain,
106, Leigham Court Drive, Leigh-on-Sea, Essex.

Contents

Editorial

Here we are again in our sixth year!

We cannot claim in the previous years to have enrolled vast numbers of members or to have amassed great wealth. On both of these scores we have done just a little better than keeping going.

What have we done then?

Our cause is now known and championed by many who for personal reasons are reluctant to join our ranks: it is odd how often duodecimals are debated and defended by persons who have never had any direct contact with the society and it is often a point of wonder how many people who write in could have heard of us.

This year will probably be critical for our cause.

It therefore behoves all Members and sympathisers to ensure that, firstly, the true dangers of decimalisation and, secondly, the advantages of duodecimalisation are recognised generally.

N E W S F R O M A M E R I C A

Mr. Tom Linton is the new Executive Secretary of the Duodecimal Society of America. He and Mr. Jamison Handy who is Treasurer will make a strong team. They take over from Mr. Ralph Beard who has done a wonderful job of the combined office of Secretary and Treasurer for many hard years, bringing the Society to its present success. His successors will have a hard task to equal his genius; but it is certain that they will have a good go at it, and we can now look forward to a new epoch in the story of our sister Society.

"In this year of the quiet sun, the annual meeting of the Duodecimal Society will be held in Denver, Colorado, on Saturday and Sunday, April eleven and twelve, 1964 (1178;)". So starts the notice of the Annual General Meeting of the D.S.A. We hope to report this meeting as soon as possible afterwards.

N E W M E M B E R S

Ordinary Members

E.T. Rowland	109, Dalton Green Lane, Huddersfield, Yorks.
R.F.J. Deacon	21, Gresley Road, London, N.19.
Tom Linton	11561, Candy Lane, Garden Grove, California 92640, U.S.A.

Younger Member

R.A. Percy	'Valley View', Highfield Lane, Compton Martin, Bristol

Subscribing Supporter

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A little job for you

It won't take a jiff!!

Whenever you notice anything in the newspapers and magazines you read -- perhaps by pure chance -- anything to do with duodecimals, decimals, number systems, weights, measures and money, or anything our Society is interested in, will you please cut it out and send it straightaway to the Secretary of our Society. Just pop the cutting in the post with a note of the periodical it was in and the date.

If, better than that, you can write a letter or article in reply -- all to the good; for the Secretary is a very busy man. If you can't, don't worry -- just send it along.

Factors

by J. Halcro-Johnston

The case for a change from ten to twelve as the base of arithmetic rests almost entirely on the practical value of factors. Twelve is richer in these than ten; ten lacks the factors 3 and 4 and it is because of this that all efforts to introduce a universal system of decimal measures have failed. The importance of factors was stressed in a report dated 5 April 1859 of a Royal Commission appointed to consider a proposal to change to a decimal currency: 'Mental calculations', it states, 'were readily performed under the existing monetary system which divides readily into halves, thirds, quarters. So long as weights and measures kept their existing values with conversion factors involving chiefly 2, 3, and 4 it was inadvisable to make a change in currency'.

But why are factors so important? This is a question that might with advantage receive further investigation. There appears to me to be three main advantages in factors:

1. small factors lead to economy in packaging,
2. richness in factors leads to a wide range in choice of numbers with smaller steps between them,
3. richness also leads to a simpler arithmetic.

Consider the factors 2, 3, 4, ... Counted from one upwards, every second number has the factor 2, every third the factor 3, and so on. This means that the contribution a factor makes to richness is inversely proportional to its size: the smaller a factor the more useful it is.

As the reader may have noticed the contents of cartons and packing cases are often marked on the outside. If these numbers are examined in the grocer's shop, on the railway platform or pier he will notice how often they contain the factor 6. This is because small factors lead to economy in packing. Twelve small cheeses can be arranged in a carton 2 X 2 X 3, and such a carton is about a third cheaper per cheese than one to contain ten would be. If trades packed all their goods in multiples of five their losses would be heavy. The value of the small factor is seen again in a book of postage stamps each page of which contains six. This is of a size convenient for purse or wallet, and the cost is a simple multiple of 6d.

Consider next how richness in factors affects the range of choice. Let us suppose that a reward of a few shillings is given to a small party of children and they wish to divide it equally among themselves in whole pennies. Their chances of doing so with the present shilling of twelve pennies are greater than they would be if the shilling contained ten or even sixteen pennies.

The number two dozen is rich in factors and, thanks to this, the day can be divided into 2, 3, or 4 equal shifts, into 6 watches of twelve dog-watches, into 8 periods of 3 hours or 20 periods of one hour. And all seven periods find practical applications.

Again, thanks to the division of the year into twelve months, meetings and other periodic functions can be arranged annually, half yearly, trimonthly, quarterly, bimonthly, or monthly as found most convenient. It often happens that two or more meetings may be attended by the same person or be held in the same building and it is necessary to avoid the dates clashing. This is done by fixing dates for different days of the month, say the first Monday or last Tuesday. How much more difficult it would be if there were ten instead of twelve months in the year!

Many examples of the same kind can be found on the building site. Consider for instance the construction of a reinforced concrete slab for a building or bridge. The designer calculates the correct spacing of the steel bars according to their diameters and the loads they have to carry but practical considerations may call for a spacing slightly less than this. If, for instance, one of the following range of spacings is adopted, 2, 3, 4, 6, 8, or 9 inches, the bars can be easily and quickly located and with little risk of a mistake with the help of the foreman's three-foot rule. That rule is rich in factors and this allows a wide range of possible spacings and the smallest step between the spacings as calculated and as adopted.

Graph or section paper is used for many purposes such as

1. plotting algebraic curves or formulae,
2. plotting a variety of graphs such as
   - the height of boys of different ages
   - the rainfall for each month of the year
   - meter readings at different hours of the day
3. making plans to different scales
4. keeping simple accounts of numbers of articles

Because of the present decimal arithmetic the paper most commonly available is ruled ten lines to the inch, a ruling that gives a poor range of choice. Because it is unsuitable with pure numbers paper r[redacted] in twelfths is not so common but this drawback would be removed on changing to duodecimal arithmetic. Different rulings such as twelve, six, four, three or two divisions to the inch could then be available and each ruling could be used equally well for pure numbers.

It is because twelve is rich in factors that the arithmetic based on it is simpler than decimal arithmetic. With few exceptions the small fractions most commonly used can be expressed more simply as duodecimals than as decimals:

1/3 = 0.4
1/4 = 0.3
1/6 = 0.2
1/8 = 0.16
1/9 = 0.14, etc.

The multiplication tables are simpler and the greater number of products ending in 0 makes mental arithmetic easier. In decimal arithmetic the simplest way to multiply by 5 is to add 0 and divide by 2. To multiply by 25 add two 0s and divide by 4. Because it is richer in factors such short-cuts are more numerous in twelve arithmetic. Thus to multiply by 6 add 0 and divide by 2:
4236 x 6 = 21190.
To multiply by 3 add 0 and divide by 4: 4920 x 3 = 12060
To multiply by 4 add 0 and divide by 3: 6094 x 4 = 20314
To multiply by 14 add two 0s and divide by 9: 939 x 14 = 10500
To multiply by 16 add two 0s and divide by 8: 448 x 16 = 6700

Testing for factors is simpler and prime numbers easier to spot. Reducing fractions to their lowest terms simplifies calculations. Not only are the common factors more easy to spot but round numbers, which are always more common than others, will contain more factors.

The reader may know of other practical instances illustrating the value of factors which if they were better known would strengthen the case for reform.

Let us use the Newscast as a forum for any ideas on numbers and number systems, on weights, measures and currency. The articles can be as long or as short as you like, four pages, four lines, even four words.

Have you ever read P.C. Wren's "Beau Sabreur"?

Most great men can see
That you can't divide three
Into ten -- but they still will not hear
Of a way to relate
All numbers and state
That we've got Duodecimals here.

There are men who can count
Up to ten and surmount
A great number of difficulties
But the one who counts best
Just adds two to the rest
And overcomes troubles with ease.

For twelve will do wonders
Where ten always blunders
And gets you stuck up in a fix
The numbers recur
Giving some remaind-er
And that is not true Mathematics.

David A. Sparrow

(It's not poetry -- but it's fun for some! EDITOR)

A THOUGHT

The troubled waters of the surface have little effect on the ponderous deep morning tides. We have come a long way, and view tomorrow's gains as founded firmly in today's talks.

Ralph H. Beard
until lately Secretary, Duodecimal Society of America

M O N E Y

P L E A S E L E T U S H A V E Y O U R
S U B S C R I P T I O N I F Y O U H A V E
N O T Y E T P A I D

WEIGHTS AND VOLUMES: STREAM-LINED AND CO-ORDINATED

by Robert C. Gillos, Ph. D.

The field of integers is dominated by three major numerical systems, the binary, the decimal and the duodecimal, which for present purposes will be called the triumvirate or the Big Three.

Eight, rather than two or four, may best be regarded as the basic number of the binary system. Certainly no one would recommend writing as 1 and 0 anything smaller. The decimal base of course is the number ten, and the duodecimal twelve, as denoted by their names.

The binary system, while the simplest of the three, is in many ways the most important because it epitomizes the balance of nature: positive and negative, male and female, left and right, etc. The English system of measures, so far as these relate to capacity, is also grounded mainly on binaries, four gills to the pint, two pints to the quart, eight quarts to the peck, etc. No matter what the unit, partition by halves - a half bottle, a quarter section - springs first to adult minds and is most easily grasped by children. A standard ruler thus divides the inch into 8th's, 16th's and possibly 32nd's or even 64th's, the plan favoured by architects and used regularly for thickness of lumber, steel, glass and other articles.

Two is also a cardinal element in the other systems. The decimal is built around two and five, which stand rather offish to each other and cause most of the awkwardness in the metric system. Its primary advantage is that only the decimal notation of numbers is universally recognized. The duodecimal tribe alone includes as a charter member the number three, along with two repeated, making it apparent at once why twelve is the most inclusive and at the same time the most flexible of the three bases.

Using the three prime numbers two, three and five, we find that of the first ten numbers only one, viz. seven, is foreign to the triumvirate, of the first twelve only two, and of the first score only six, all of these except 14 being themselves prime numbers. It is evident that by fashioning a scheme of money, or of time, or of weights and measures which combines successfully the merits of the Big Three we can achieve the utmost in factorability and adaptability. The oft-maligned English pound is a case in point. With 240 pence it admits binary factors as high as 16, binary-decimals up to 80 and decimal-duodecimals to 120, with a bewildering variety in between. Sixty, the number of minutes to the hour and the degree and the number of seconds to the minute, has no less than ten integral factors higher than unity. The decimal number 100, nearly twice as large, has only seven, all of them decimal except four. If we jump to 1,000, the next decimal landing, we introduce only one new non-decimal factor, eight. Rather a sorry showing for the metric system. Three is a complete metric stranger.

Seeking a three-sided solution for English measures, I came to the conclusion that the linear and surface measures in that system could hardly be improved to any extent worth the effort. We already have 12 inches to the foot and three feet to the yard. The rod, at $5\frac{1}{2}$ yards, seems suspect at first glance until we consider that eleven is a factor of 5,280, the number of feet in a mile; and that $5\frac{1}{2}$ is half of 11. It then works out that 320 rods = one mile and 160 square rods an acre. Since 640 acres = one square mile, the linear rod and the square rod give us excellent binary and decimal factors for both the mile and the square mile. Both English and American engineers work continually with the decimalized inch, producing decimal factors at the small end of the scale too. My problem was in this manner reduced to finding if possible some practical method of bringing order into the British-American world of weights and cubic measurements. As most of us know, the manifold and often conflicting standards of these types in the English-speaking world are an unholy mess. To tolerate them longer endangers our whole house.

In 1963 I published two articles on this general question, the earlier one called "Let's Not Go Metric!" and appearing in the January issue of the F B I Review (Federation of British Industries); and the second in the same journal for September. This article bore the title, "New Light on a Weighty Problem" and presented a table - Table 5 in the article - embodying a radical consolidation of the standards just discussed. The "Review" copyrighted this table in my name to protect us from commercial exploitation in the event that the table some day actually came into effect. We have no wish to discourage its reproduction, in whole or in part, merely for comment or for discussion, as that is the only way in which the table can become known. For the benefit of "Newscast" readers I am therefore laying the table before them here. It should be understood that the weights shown are for so many cubic inches of pure water, the temperature of which would have to be agreed on by Britain and America:

PROPOSED NEW STANDARDS FOR BRITISH-AMERICAN WEIGHTS AND VOLUMES

One Ounce	=	One-Sixteenth Pound	=	$\frac{27}{16}$ (1.6875)	Cubic Inches
" Gill	=	Four Ounces	=	$\frac{27}{4}$ (6.75)	" "
" Pint	=	One Pound	=	27 (= 3"Cubed)	" "
" Quart	=	Two Pounds	=	54	" "
" Gallon	=	Eight "	=	216 (=6" ")	" "
" Peck	=	16 "	=	432	" "
" Bushel	=	64 "	=	1728 (= 1 Cu. Ft.)	" "
" Barrel	=	256 "	=	6912 (= 4 " ")	" "
" Hogshead	=	512 "	=	13824 (= 8* " ")	" "
" Ton	=	2048 "	=	55296 (=32 " ")	" "

*= 24" Cubed

and (20 Grains = One Pennyweight
(20 Pennyweights = One Ounce
(64 Grains = One Drachm
(6400 " = 100 Drachms = One Pound

Note: The drachm does not appear in original table.

The preceding table can be fully successful only when the pound is altered so as to weigh 64 to a cubic foot of water, instead of 62.33

as in Britain or 62.4 as in America, where the standard temperature of the water for such purposes is 39.2° F. In Britain it is 62° F. The new pound would then be about 2.5% lighter than the avoirdupois pound, which is coeval with the metric system and has no great claim on our affection through hoary tradition. In considering the new ton, it must be emphasized that the controlling variable in the proposed system is the cubic content in pure water at a fixed temperature reached by official agreement. The weight of 32 cubic feet of water at 4°C. or 39.2°F. would be about 1997 pounds avoirdupois. If that temperature became the British-American standard, then the new ton would be the weight just stated. If 62° F. were adopted, the proposed ton would be a bit lighter. In any case it would have 2048 pounds, the eleventh power of two.

With this table we would slough off Troy weights, liquid ounces, scruples - who in this day and age wants to be bothered with scruples? - replace two gills and three drachms with one, and eliminate all differences between Britain, America and the Dominions. Only one ton, and no more distinction between wet measures and dry. The English system of weights and measures would be relieved for all time of its only valid reproach among men.

Let us now see to what extent the above table achieves the sought-for combining of binary, decimal and duodecimal systems under one roof. Binaries are certainly provided for in customary British fashion with successive units in the relation one to two, or one to four, etc. and in the same order as we know them today. Since there are 400 grains to the ounce, we can divide the latter repeatedly by two until we reach 25 grains without incurring fractions. Decimals are recognized by making 6400 the number of grains in the pound, and most of all by the introduction of the drachm of 64 grains. The pound is thereby decimalized. A weight of 325.72 pounds would be 325 pounds and 72 drachms. We also have 20 pwt. to the ounce. The new drachm would weight about 68 of the present grains. Although 15 of the new grains would be almost exactly the same weight as 16 of the old, the new grain would still be 14.5 times more precise than the gram, since it would require that many to counterbalance a gram. The new plan of weights therefore makes ample provision for fine weighing, as in pharmaceutical work. Whether it could recapture that field from the metric system, only time could tell.

It has already been stated that cubic capacities are the key to the table. All are in the duodecimal system, if we include the numerators in the ounce and the gill; and culminate with the bushel as one cubic foot. The stress given to water equivalents in determining weights may now be explained. Until now the metric system has had the unique advantage of easy convertibility from volumes to weights, e.g. a liter of water weighing a kilogram, etc. From the table it is seen that a pint of water would weigh an even pound, also that a cubic container three inches on a side would hold a pint. Six inches on a side it would hold a gallon, twelve inches a bushel, 24 inches a hogshead and with 32 cubic feet a ton. In the other direction, a cube 1½ inches on a side would weight two ounces in water, and one 3/4" on a side 100 grains. If we know the specific gravity of a substance, we can at once modify these figures to take care of the new substance; furthermore, a cubic foot of

concluded on page Ɛ

RAPID CALCULATIONS

by Shaun Ferguson

Decimal: multiplying by 99

We note that 99 = (100 - 1).
64 x 99, for example, is thus 64(100-1), which is easily seen to be 6400 - 64, i.e. 6336.
Thus 15 x 99 = 1485   36 x 99 = 3564   99 x 99 = 9801
A simple rule for this is: deduct 1 from the number, and write this answer down. Subtract the answer from 99, and write down the result to the right of the answer.

64 x 99   64 - 1 = 63
            99 - 63 = 36
            6336

57 x 99   57 - 1 = 56
            99 - 56 = 43
            5643

Dozenal: multiplying by ℰℰ.

We note that ℰℰ = (100 - 1).
59 x ℰℰ = 59 x (100 - 1) = 5900 - 59 = 5863.
Or, following the rule for 99 in decimals:

59 x ℰℰ   59 - 1 = 58
            ℰℰ - 58 = 63
            5863

64 x ℰℰ   64 - 1 = 63
            ℰℰ - 63 = 58
            6358

Any base: multiplying by (100 - 1)

This rule can be applied to any base of numeration. In other bases use (100 - 1) where 100 is the square of the base.
Thus, for base 5, (100 - 1) = *20; in base 7, (100 - 1) = *40.

Example: 7 - base   100 - 1 = 66

53 x 66
53(100 - 1)
5300 - 53

53 - 1 = 52
66 - 52 = 14
5214

Example: 8-base   100 - 1 = 77

53 x 77 = 53(100 - 1)
5300 - 53

53 - 1 = 52
77 - 52 = 25
5225

This device also works in any base for any multiplier of the form $(10^n - 1)$ where n is any power. Notice the figures required for the result are twice the value of n,
e.g. $(10^3 - 1)$ needs 2 x 3, i.e. 6 figures
$(10^{10} - 1)$ needs 20 figures

PUZZLE SECTION

(Dozenal numeration used throughout)
(answers on page 10)

1. Some criminals, wishing to hold up a mail train at a certain point on its journey, found that if they drove there at 60 leagues per hour they would have 30 minutes ($\frac{1}{4}$ hour) to hang about. On the other hand, if they drove there at 30 l.p.h. they would arrive 30 minutes after the train had passed. At what speed should they drive to arrive at just the right time?

2. "Which would you rather have?" asked the manager of his new clerk, "You can have £600 a year, with an increase of £10 every year, or £6 every half-year."
"I'll have the £10 increase every year."
Why did the manager smile when the clerk had left?

3. A boy was asked to think of a number, add 10, multiply by 4, subtract 3, find the square root, multiply by 6, subtract 6, and divide by 4. If his answer was 10 what did he start with?

4. In a mental arithmetic lesson a class was asked to write down the product of three given numbers. Jack thought this meant adding them together, but strangely enough his working gave him the answer required. What were the three numbers?

5.
```
  *1 x
  1*
 ----
 1**
  *1
 ----
 *21
```

6.
```
  ABC x
  DEF
-----
DGHHH
 EJCH
  KAF
-----
ECFDF
```

7.
```
 CATS +
 DOGS
-----
RIGHT
```

8.
```
FOOT -
BALL
----
GAME
```

continued from page 9
anything would be a bushel, as only one example, affording easy checks.
Standard containers in exact inches would surely come into general use. E.G., a quart carton for milk or ice cream would be 3" x 3" x 6". Two convenient sizes for bushel boxes would be available, 8" x 12" x 18" and 9" x 12" x 16". A gallon canister would be 4" x 6" x 9". The customer could protect himself from cheating with nothing handy but a foot rule. A tank 2'x4'x4' would hold a ton of water, and so ad infinitum.

PUZZLE ANSWERS

QUESTION 1 — 40 l.p.h.

3 — 9

4 — 1 2 3

5 — 11 x
11
110
11
121

6 — 123 x
456
49000
5Ɛ30
716
53646

2 — £10 p.a. £6 per 1/2 yr

1st year 600 — 300) 306) 606

2nd year 610 — 310) 316) 626

3rd year 620 — 320) 326) 646

etc.

7 — Ɛ3ᘔ5 +
8265
1764ᘔ

8 — Ɛ887 -
1ᘔ55
9ᘔ32

Solutions to questions 6 to 8 are examples from possibles

DUODECIMAL PUBLICATIONS, etc.

The following publications are available through this Society Prices are in dozenals, packing and inland postage a penny in the shilling extra. Please obtain those marked Ø through shops.

Logical Money, Weights and Measures	free
Duodecimal Leaflet	free
Duodecimal Newscasts for *1174 (1960) to *1177 (1963)	1.0s (1s.0d.)
Offprints:- New duodecimal notations (2) Duodecimal metric proposals (4), Report of Duodecimal Summit Conference (5), Measuring our way (6), New duodecimal notations and names (7), A set of symbols (8), A suggested series of notations and names (9), The 1, 2, 3 of dozenals (ᘔ, Ɛ, 10)	.2s (2d.)
S. Ferguson A revised currency	.3s (3d.)
ØProf. Aitken The case against decimalisation Oliver & Boyd	2.6s (2s.6d.)
F. E. Andrews An excursion in numbers (English or Esperanto)	free
F. E. Andrews Numbers, Please (Little, Brown-Boston, U.S.A.)	20.0s (£1.4s.)
R. H. Beard Antipatio al aritmetiko (in Esperanto)	a few free
ØJ. Halcro Johnson The Reverse Notation (Blackie & Son)	13.0s (15s.0d.)
ØJean Essig Douze notre dix futur (in French) Dunod	ᘔ 0s (10s.0d.)
Ø " " La Duodécimalité: Chimère ou vérité future	6.6s (6s.6d.)
Duodecimal Society of America Manual of the Dozen System	7.6s (7s.6d.)
" " " " The Duodecimal Bulletin	3.6s (3s.6d.)
" " " " Circular Slide Rule $ or £2:0:0	