COUNTING IN DOZENS

1	2	3	4	5	6	7	8	9	X	Ɛ	10
one	two	three	four	five	six	seven	eight	nine	dek	el	do

Our common number system is decimal - based on ten. The dozen system uses twelve as the base, which is written *10*, and is called *do*, for dozen. The quantity *one gross* is written *100*, and is called *gro*. *1000* is called *mo*, representing the meg-gross, or great-gross.

In our customary counting, the places in our numbers represent successive powers of ten; that is, in 365, the 5 applies to units, the 6 applies to tens, and the 3 applies to tens-of-tens, or hundreds. Place value is even more important in dozenal counting. For example, *265* represents *5* units, *6* dozen, and *2* dozen-dozen, or gross. This number would be called *2 gro 6 do 5*, and by a coincidence, represents the same quantity normally expressed as 365.

Place value is the whole key to dozenal arithmetic. Observe the following additions, remembering that we add up to a dozen before carrying one.

94	136	Five ft. nine in.	5.9'
31	694	Three ft. two in.	3.2'
96	3Ɛ2	Two ft. eight in.	2.8'
19Ɛ	1000	Eleven ft. seven in.	Ɛ.7'

You will not have to learn the dozenal multiplication tables since you already know the 12-times table. Mentally convert the quantities into dozens, and set them down. For example, 7 times 9 is 63, *which is* 5 dozen and 3; so set down *53*. Using this "*which is*" step, you will be able to multiply and divide dozenal numbers without referring to the dozenal multiplication table.

Conversion of small quantities is obvious. By simple inspection, if you are 35 years old, dozenally you are only *2Ɛ*, which is two dozen and eleven. For larger numbers, keep dividing by 12, and the successive remainders are the desired dozenal numbers.

```
12 ) 365
12 ) 30  + 5
12 ) 2   + 6
     0   + 2     Answer: 265
```

Dozenal numbers may be converted to decimal numbers by setting down the units figure, adding to it 12 times the second figure, plus 12^2 (or 144) times the third figure, plus 12^3 (or 1728) times the fourth figure, and so on as far as needed. Or, to use a method corresponding to the illustration, keep dividing by *X*, and the successive remainders are the desired decimal number.

Fractions may be similarly converted by using successive multiplications, instead of divisions, by 12 or *X*.

Numerical Progression

1	One			
10	Do	.1	Edo	
100	Gro	.01	Egro	
1,000	Mo	.001	Emo	
10,000	Do-mo	.000,1	Edo-mo	
100,000	Gro-mo	.000,01	Egro-mo	
1,000,000	Bi-mo	.000,001	Ebi-mo	
1,000,000,000	Tri-mo	and so on.		

Multiplication Table

1	2	3	4	5	6	7	8	9	X	Ɛ
2	4	6	8	X	10	12	14	16	18	1X
3	6	9	10	13	16	19	20	23	26	29
4	8	10	14	18	20	24	28	30	34	38
5	X	13	18	21	26	2Ɛ	34	39	42	47
6	10	16	20	26	30	36	40	46	50	56
7	12	19	24	2Ɛ	36	41	48	53	5X	65
8	14	20	28	34	40	48	54	60	68	74
9	16	23	30	39	46	53	60	69	76	83
X	18	26	34	42	50	5X	68	76	84	92
Ɛ	1X	29	38	47	56	65	74	83	92	X1

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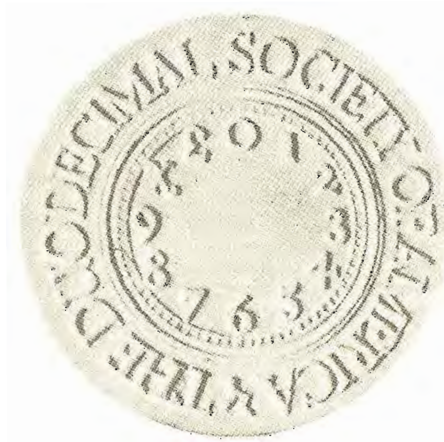

THE DUODECIMAL SOCIETY OF AMERICA
20 Carlton Place ~ ~ ~ ~ ~ Staten Island 4, N. Y.

THE DUODECIMAL SOCIETY OF AMERICA

is a voluntary nonprofit organization for the conduct of research and education of the public in the use of Base Twelve in numeration, mathematics, weights and measures, and other branches of pure and applied science.

Full membership with voting privileges requires the passing of elementary tests in the performance of twelve-base arithmetic. The lessons and examinations are free to those whose entrance applications are accepted. Remittance of $6, covering initiation fee ($3) and one year's dues ($3), must accompany applications.

The Duodecimal Bulletin is the official publication of the Duodecimal Society of America, Inc., 20 Carlton Place, Staten Island 4, New York. F. Emerson Andrews, Chairman of the Board of Directors. Kingsland Camp, President. Ralph H. Beard, Editor.

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The Duodecimal Bulletin

All figures in italics are duodecimal.

ESPERANTO

The Tower of Babel is an allegory that is so pictorially true that it could be real. Speech, which sets man apart from the animals, is man's greatest asset, and is the origin of all social organization. But languages are the strongest of the natural barriers separating one people from another, accenting differences that often result in war.

Ease of intercommunication between peoples of different nations establishes a bond that is not easily broken. It is difficult to conceive any interruption of the friendly relations between Great Britain, Canada, Australia and the United States. Yet any language differences even within the same nation require careful attention, as within the Swiss cantons.

The stranger within our gates is not an alien if he uses our language naturally and comfortably. There is a principle at work in this involution, that is a form of feed-back. To some extent, man's ideas are fashioned by the way his ideas are fitted into words, by the form in which he thinks, by the sounds, the intonations, the inflections. Each language has a character of its own, and influences the character of its people and its culture. Every one is familiar with the eloquent grandeur of the tropical tongues. When we can think with someone, we are amiable, relaxed, effusive. Our tongues form our thoughts and our attitude helps to communicate them. We are drawn to people it is easy to communicate with.

There is a massive program under way to reduce the barriers between peoples so that they can know each other better, so that they can understand each other more easily, so that they can share goods and services more companionably.

To reduce the barrier of language differeces, it is suggested that everyone learn his own language and Esperanto. There are other interlanguages that might serve equally well, but none with the weight of between four million and ten million people. None with 70 years of growth behind it. None with an equal volume of translations of the great literary works of the world, - in addition to a fine and extensive literature of its own. None that equal the vitality and expressiveness of Esperanto.

There are two great tests for an interlanguage. More exactly, there is one definite limiting condition, and one test. Most of us feel that if the others would only adopt our language, everything would solve itself. But, if we think honestly about it for a while, we must acknowledge, that no natural language, no native tongue, can become an interlanguage for world use. The test is that it must be easy to learn, - meaning easy to learn to read, to write and to speak. There is a classic instance about Esperanto and this test. Henry Phillips, Secretary of the American Philosophical Society, (founded by Ben Franklin), translated Dr. Zamenhof's book on Esperanto into English, added an English-International Vocabulary, had the whole published in 1889 by Henry Holt & Co., New York, and wrote a letter "in this language to a young friend who had previously never seen or heard of it, enclosing the printed vocabulary." He received an answer in the same tongue, with no other aid. As a spoken language, its ease is attested by the hundreds of international conferences using it exclusively.

Esperanto is easy to learn, so why not learn it now? Its grammar is simple and completely regular. There are only sixteen rules, which can be learned in an hour. Its root words are familar friends. It is absolutely phonetic. Each letter of the alphabet represents a single sound, and that sound is always represented by that letter. The accent always falls in the same place, the next-to-last syllable.

Its alphabet is mainly familiar to us. Some of the letters of our alphabet are not used, but six of them are used either with or without a diacritical mark. The circumflex adds an "h" sound to the original, - as: s is pronounced as in see; but ŝ is pronounced as sh in shall. There are 29 characters in the alphabet. The vowel sounds conform to their pronunciation in European tongues.

Many of its simple words are combined into compounds, and a lucid system of prefixes and suffixes permits the utmost in flexibility and discrimination. Esperanto is more distinct, more pliable, more exact than English.

The Esperantists use a clever device, - the Esperanto Key. Each Key contains the whole grammar and a vocabulary for one language, sufficient for daily use. There is an Esperanto Key for each major language. If you write a letter in Esperanto to a Hindu and enclose an Esperanto Key, your letter can be understood. These Keys are tiny pamphlets which cost about a nickel apiece. We could print an English-Esperanto Key in one-third of the pages of this Bulletin, and some day we probably shall. We will send one to any member on request.

No proof of the ease of Esperanto could be clearer than that we - with the merest acquaintance with it, - have answered 280 inquiries by personal letters in Esperanto.

We Dozeners have an involvement rather similar to that of the Esperantists. We are already working in an international tongue, number-arithmetic. This is used almost universally; in fact only music approaches number in the generality of its use. Number is the base of both, and we have come to realize that the ten-base numbers that we use are inferior and not adequate for today and tomorrow. Only the best is good enough. And dozenal numbers are best.

Even in number-arithmetic there is limitation and division between different usages. We know now, thanks to the decimal metric system, that number-arithmetic must include a system of measures that divides its scales in the same way the numbers are divided. But we know, too, that ten is an unsatisfactory base for numbers and measures, lacking ease of division. And for some measures, ease of division is so essential that the use of the ten-base is not feasible; such as the months of the year, the hours of the day, longitude and other measures of angle and the circle. Only the twelve-base will serve for them, and we universally continue to use their older patterns of division, which include the twelve factor.

The ultimate necessity is to use the twelve-base for all our number-arithmetic and standards, including measures of time, angle, music, color, - adopting one system for all number and measure.

But this is a tremendous change. All men would need to learn the twelve-base arithmetic, and become so familiar with it that they will not be stayed from its advantages. It is conceded that the learning is easy, since they are already familiar with the twelve-times tables. But, nevertheless, there is a mountainous task of public education to face.

Well, let's face it, as we are facing other challenges of limitation and division. This too is only a problem of general diffusion and time. And barriers dissolve in the common understanding among men.

Here we are now, Esperanto and dozenals with similar need for diffusion and time. Why not explore whether together they might not aid each other? The Esperantists might find the prospect of an ulimited and universal number-arithmetic an incentive to expedite common understanding and communication. The Dozeners might find the absence of a language-barrier a tremendous aid in the diffusion of education in the use of the one adequate number system. Why not test it?

We did just that. And it seems to work. It appears that the mutual appeal has a stronger drive, a more impelling attraction. Items about duodecimals appeared in several Esperanto magazines recently, which started a rain of inquiries for information in Esperanto. We had no Esperanto duodecimal literature to send them, but we answered each inquiry by personal letter in Esperanto, promising to send them Esperanto material on duodecimals as soon as it could be prepared. And we had an article with the unappealing title, "Aversion to Arithmetic," translated into Esperanto and published in a recent issue of Amerika Esperantisto. Copies of that magazine were sent to all members of the Duodecimal Society, and the article itself appears a little further back in this issue of the Bulletin.

We plan to reprint the Esperanto version as a 4-side folder with material similar to the back page of this Bulletin (but in Esperanto), to send to the Esperanto inquirers. For Dozeners interested in learning about Esperanto, we have the small Key to Esperanto available on request.

These developments constitute a challenge to us. We have grown to be recognized as a center for duodecimal literature and information. There is no other similar center nor organization in the world. We are confronted with larger responsibilities than we are ready to assume. But, within the limits of our resources, it seems to be up to us to meet them.

Should the demand become too great for central handling, local groups can be formed. For their own countries they can assemble adequate reference material in the libraries of their major cities, arrange for the appearance of duodecimal terms in the encyclopedias and dictionaries of their language, and the translation of basic duodecimal literature for local diffusion. They can more advantageously arrange for government and university co-operation.

Until that time, it is our responsibility to provide Esperanto material suitable for their needs, and to announce its availability in the Esperanto magazines. It should be possible for us to enlist the aid of Dozeners among our Esperanto friends to deal with the correspondence and co-ordination this involves. Perhaps this should be the responsibility of an official of our Society, with a supporting committee.

When one meditates on the progressive stages of growth of our Society and on the general phases of the penetration of the dozenal idea, extravagant constructions occur to us from time to time. This is natural because of the mere size of our objectives. However, when one of these constructions recurs repeatedly in similar form, it is well to give it more careful scrutiny, and to analyze its necessity. Familiar to

(Please turn to Page 3X)

DOREMIC SYSTEM OF TIME MEASUREMENT

by H. C. Churchman

Introduction

Let us once again fill our pockets and minds with Do-Re-Mi and take an easy journey, merely a pleasure trip, to that beautiful island of Do-Re-Mi and base twelve, just off the Continent, to that land of Ever-Ever, a land which always will be, a land where you will be always welcome. Since most travel entails some inconvenience, this trip may prove to be no exception.

Somewhere, I think on the south facade of the Washington, D.C., local postoffice building, there is cut in stone this statement: "If you would bring back the wealth of the Indies, you must take the wealth of the Indies with you." Preceding our island jaunt, let us therefore learn about its customs, mode of counting, and method of telling time.

To begin with time, a clock or wristwatch which is used to indicate a day divided into a dozen equal parts, and again and again subdivided by base twelve, is called in Do-Re-Mi nomenclature of the duodecimal system a KRONODORE, rather than a clock or watch, for reasons which hereinafter appear compelling.

The Doremic tongue and signs are not difficult to master. In the Doremic language of the duodecimal base, the names of the first three notes of the musical scale, Do-Re-Mi, are used to describe place value universally. In other words, Do-Re-Mi are used in a dozenal system of notation just as Tens-Hundreds-Thousands are presently used in America to tell decimal place value.

Wherever the duodecimal or Humphrey (;) sign is found in place of a unit colon (:) or comma (,) or period (.) in any number shown below in Arabic digits, the place values are to be understood in terms of a duodecimal base. As a part of the doremic language, the fractions of edo, ere, and emi (pronounced édo, ére, and émi) are to be understood, respectively, to equal decimally 1/12, 1/144, and 1/1728 part of any given unit.

Thus, while one "dofut" (shown *f10;00*) equals twelve U.S. standard feet or two fathoms or four yards, on the other hand one "edofut" (shown *f0;1*) equals one-twelfth part of one foot, and, therefore, one U.S. standard inch. One "erefut" (shown *f0;01*) equals one line or 1/144 part of one foot. And one "emifut" (shown *f0;001*) equals one point or 1/1728 part of one U.S. standard foot.

Years

Time, above the length of the four seasonal quarters of a year, avoids generally the denominate prefix (d) which indicates, as shown later, a given number of days and fractions of a day, and the year itself becomes a larger unit of time measurement. For instance, one re (shown *100;00*) equals one gross, or, decimally, 144 objects; and one gross of years is known merely as a regroup. Consequently, regroups overshadow centuries with which we are so familiar, and centuries are found only in the dictionary in the land of Ever-Ever.

Anno Domini 2016 is to be, without doubt, an occasion which the people of Do-Re-Mi and all Doremitarians around the earth will want to celebrate. Those in the land of Do-Re-Mi are today (1957) living in mi, re, seven-do-one (shown *1171;00*) of our common era, within the do-second regroup Anno Domini, i.e., in the Fourteenth regroup of our common era. And in just four dozen and eleven years they shall have (admitted by some) moved into the Fifteenth (do-third) regroup, in the year in Do-Re-Mi language of mi, two-re, or do-two re if you prefer, shown *1200;00* Anno Domini.

Let us now, to make our visit in Do-Re-Mi more pleasant, study the periods of time less than one year in length.

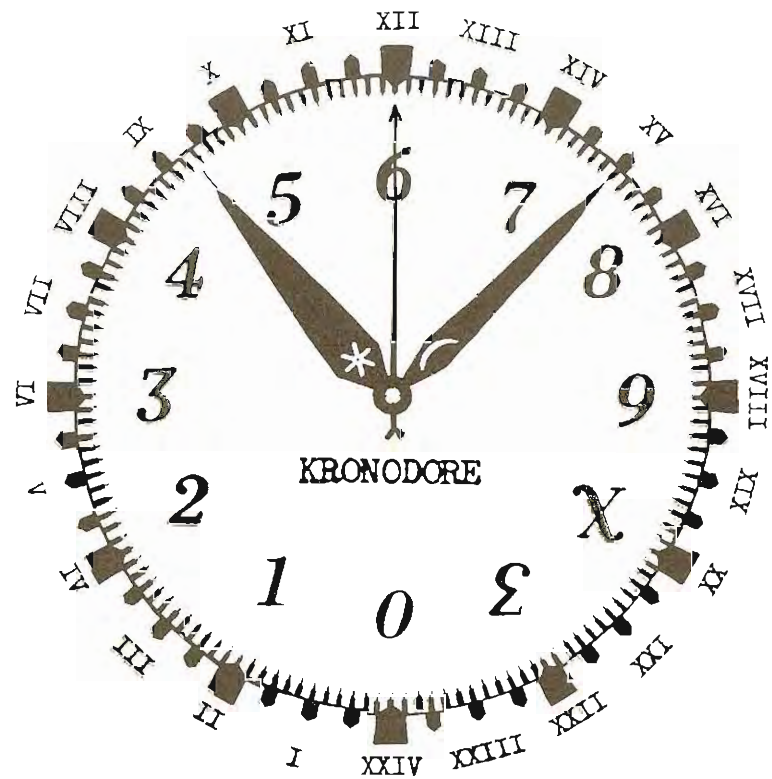
Days

The Plain Kronodore may have one hand alone, called the Sun hand. The sun hand moves at one-half the rate of travel of the hour hand of a clock. It requires, by present method of measurement, two hours to move from one to two, two to three, etc., and ten minutes to move one-twelfth of that distance. This single hand or indicator completes a circle in the same average length of time required by the earth to turn from midnight to midnight. Zero is found at the bottom of the circle, which is midnight or twenty-four hours on the dot. The sun hand moves clockwise.*

If another hand is employed, it moves in the same direction at twelve times the rate of travel of the sun hand, and is designated the Moon hand---because of the relationship of

- - - - - - -

*This writer has in his library an inexpensive electrical defroster mechanism which rotates a knob once in every period of 24 hours. Attached to this knob is a "sun" hand, placed in front of a 12-inch diameter Kronodore face. From it, the edo is expressed in three digits, the last being a zero, i.e., four-six-oh, four-seven-oh, etc. Easy to construct. You are faced at once by all of the 24 hours of a day.



twelve natural lunations in the solar system. The moon hand requires ten minutes of time, present method of measurement, to move from one to two, two to three, etc., and, therefore, fifty seconds to move one-twelfth of that distance.

If a third hand is employed, either in a smaller, separate circle or as a sweep hand, it moves clockwise at the rate of one complete circle in ten minutes by present method of measurement, and is designated the Arrow hand. It requires fifty seconds of present time to move from one to two, two to three, etc.

Anywhere on earth, if the Kronodore faces north in the plane of the earth's orbit (quite generally indicated by the plane of a triangle whose points are the earth, sun, moon), the sun hand points direct to the momentary position of the sun, if it was pointed towards the sun 24 hours earlier, if the Kronodore remains today at the same point on the earth's surface, and, allowing the proper correction for annalemma changes.

Each principal or twelfth part of the day is called an "edo", which coincides with "one-twelfth" in the language of THE DUODECIMAL SOCIETY OF AMERICA.

We might note that every kronodore contains, on the outer side of the arc, only FOUR divisions (instead of the usual five found on the face of a clock) between one and two, two and three, etc. Each of those four divisions is spaced to equal a quarter edo, or thirty minutes of movement of the sun hand, two and one-half minutes of movement of the moon hand, and twelve and one-half seconds of movement of the arrow hand, in our present method of telling time.

On the inner side of the arc each quarter edo, or thirty minute period of present time, is shown subdivided into three equal parts by hatch marks, each mark representing one per gross of a circle or ten minutes as told by the sun hand, and, therefore, fifty seconds of movement of the moon hand, by our present measurement of time. The moon hand measures a "moment" (5/6 of a minute of time) as it moves from one hatch mark to the next.

The twenty-four hours of a day may be shown beyond the circle of a kronodore face, in archaic Roman numerals, to aid in orientation and so that one may from them tell the edo, and time o'clock, by the same kronodore.

The twelve characters or signs on the face of the kronodore, employed to designate the principal divisions of the day, and all subdivisions thereof, are as follows:

0 pronounced oh, zero, or cipher, in English-speaking lands.
1 " one, " " "
2 two,
3 three,
4 four,
5 five,
6 six,
7 seven,
8 eight,
9 nine,
𝒳 ten, dek, or dix,
ℰ eleven, el, or onze,

A purely imaginary, horizontal line, if drawn through all numbers as shown in their above positions, should be parallel to one plane when these numbers are placed on the face of a Kronodore, so that no digit is made to stand on its head or lay on its side.

Telling Time

More readily to see the subdivisions of one "die" (which is equal to the standard worldwide length of twenty-four hours) in its dozenal parts, and to understand their equal in minutes and seconds of time presently in use, let us consult the table of time, given in Doremic nomenclature of the duodecimal system. A die is the basic unit of measurement of one diurnal rotation. In America, generally, "die" is pronounced to rhyme with the word dye. Its Latin pronunciation is equally proper

TABLE OF TIME

Die (d) Symbol for Doremic Measurement of Earth's Rotation.

Division	Doremic Value	Common Value	Decimal Value	Present Terms
1 die, shown	d*1;00*, period of a	Day, equals	1 day,	24 hours
1 edo die, "	d*0;1* "	Watch, "	1/12 day,	2 hours
1 ere die,	d*0;01*	Break,	1/144 day,	10 minutes
1 emi die,	d*0;001*	Moment,	1/1728 day,	50 seconds
1 edomi die,	d*0;0001*	Flash,	1/20736 day,	4-1/6 sec.
1 eremi die,	d*0;00001*	Dot,	1/248832 day,	1/3 fat sec.

On the kronodore our "Ten O'clock Night News" becomes merely eleven edo news. Nothing is said about day or night. Eleven edo equals 22 hours. Please note, while traveling in the land of Ever-Ever, that twice the number of edo are exactly equal to the number of hours of the day. For instance, ten edo are the same as twenty hours, six edo equal twelve o'clock high noon, and half past three edo equals seven o'clock in the morning. A quarter past three edo equals, in present clock measurement, six-thirty in the morning. A quarter to four edo equals, in our present scheme, seven-thirty A.M.

When asked "What is the edo?" one usually calls three digits, such as "Three, six, one," meaning three edo, six ere, and one emi, which is to say, in that case, fifty seconds after seven hours. But if the question had been asked fifty seconds earlier, the answer might have been "Half Past Three edo." If the answer were "Three, six, two," it would have been one hundred seconds after seven hours. And if the answer had been "Three, six, three," it would have indicated one hundred and fifty seconds or two and one-half minutes after seven hours in present terms of reckoning.

By the use of only three digits, written or spoken, time is communicated within a range of fifty seconds. Of the clock, when we say "Two, twenty-one," or "Two, twenty-two," for instance, we tell time within a range of sixty seconds. The kronodore, therefore, is a wee bit more precise, in one sense, with a similar economy of digits. If the minute is satisfactory today for time tables of arrival and departure of trains, planes, etc., the moment (technically speaking) can not be less so.

The illustration of the kronodore face shows the edo at four-seven-six, the arrow hand pointing to six, the moon hand being half way between seven and eight, the sun hand between four and five, and, therefore, 9:15 o'clock in the forenoon is indicated. It will be 9:20 o'clock, or four-eight-oh, when the moon hand reaches eight, in just five minutes by present reckoning.

On the arc of the kronodore, the recommended width of the edo block is two per gross of the circumference, and the width to indicate each quarter edo station is one per gross or, decimally, 1/144 part of the periphery. The width of each hatch mark is four per mi, one-third of one per gross, of the circumference.

Zero edo is, of course, midnight. At midnight, the sun hand must point through the axis of the earth to maintain its aim towards the sun. The sun hand at midnight, therefore, points "down" like a plumb line, drawn to the sun. At high noon, or six edo, it points "up." On the first day of either the Spring or Autumn season, that is to say, at the beginning of either the second or fourth seasonal quarter, the sun hand points quite generally to the rising sun at three edo, to the setting sun at nine edo, local time.

Let me suggest at this point, as an experiment, that you remove your wristwatch and, purposely replace it upsidedown, i.e., with the "12" at the bottom of its face. The first effect is confusion. But if you will carry it in this unusual position up to seven days of normal use, it is surprising how soon one will be able to read the hour and minute from that position. Whether a day shall commence at the top or bottom of a circle, like the problem of meeting and passing oncoming vehicles on your righthand or your lefthand side, is tied to custom and nothing else. But, in the case of a kronodore, if the edo hand is to be tied to the sun---and logically, it should be---then zero belongs at the bottom.

Window Kronodores

While the plain Kronodore contains a single hand, called the Sun hand, which makes one complete circle in 24 hours, the window Kronodore (used in Do-Re-Mi airports, factories, large offices, public streets, etc.) contains five windows which, to my best recollection, are shown thus:

First	Seasonal		Quarter	
7	7 ;	3	5	Ɛ
do	die	e'do	e're	e'mi

These windows indicate the number of dozens and units of DAYS accrued in the first, and succeeding, seasonal quarter-years, as well as the number of e'do, e're, and e'mi, i.e., two hour, ten minute, and fifty second periods of time as now told, in the progress of a day.

The five windows enable one to count in dozenal steps from fifty seconds of time (current reckoning) through ninety-one days by use of only five digits at any one moment.

These five windows look and operate like the mileage windows of an automobile speedometer, but CONTAIN THE DOZENAL DIGITS ON EACH DRUM. Each dum rotates one-twelfth of its circumference each time it makes a change of position. The e'do drum completes one rotation in each period of twenty-four hours and by each of its dozen digits indicates the passage of every period of two hours of time by present reckoning. The e're digits record the length of ten-minute periods. The e'mi digits tell periods of fifty seconds each---the Do-Re-Mi moment.

Do-Re-Mi Seasonal Quarter Years

The digits shown in the two windows to our lefthand size of the duodecimal or Humphrey (;) point (see window kronodore) are read "seven-do-seven die." That is to say, seven dozen and seven days. If the "do" window showed a zero instead of the seven, we would merely say "seven die", and not "zero seven die." If the "die" window showed a zero instead of seven, we would say "seven-do-die." If both "do" and "die" windows showed zeroes, we would say "cipher die," or zero die---to indicate the Mean Southern Solstice day (December 21 of the Gregorian common calendar). That date comes but once every year, at the beginning of a seasonal year. It is sustained by the natural law. It required no legislation in Do-Re-Mi. It just grew.

Cipher day is the initial day of a seasonal channel or commercial year. The first day after cipher is the initial day of the first seasonal quarter. Decimally speaking, there are 364 days in addition to the initial day of the year, in every Gregorian calendar regular year. In a natural or commercial calendar, these 364 days may be divided into seasonal quarters, each containing 91 days, each quarter having a first day which is entirely separate from the initial day of the year. The supplemental day arrives as the LAST day of a seasonal year in every Gregorian calendar or World Calendar leap year. The Supplemental day, in those years, coincides with December 20; a new seasonal year begins with December 21 of every Gregorian calendar or World Calendar year.

Natural or seasonal quarter-years, each containing an equal number of days in every year, and year after year, can not be said to be disequal and unscientific calendric periods of time for world wide commercial use---as the present unequal Julian month-lengths are sometimes described. Once one gets in the groove of the seasonal, commercial, or channel years, he can not become lost, for each seasonal quarter-year is nature-regulated by the earth's solar orbit. Each of these seasonal years begins in every commercial nation with a cipher day on the Mean Southern Solstice day. This does not prevent cipher day bearing the local day name, month name and date. It is not a legal holiday, unless local custom so decrees. Every seasonal quarter-year contains a dozen-and-one Sundays, Mondays, Tuesdays, Wednesdays, Thursdays, Fridays, and Saturdays, but Sunday is not always the first day of a seasonal quarter. This might be said to indicate the basic religious tolerance of the seasons among all nations.

First Day of Spring

The left two digits in the windows (see window kronodore) disclose the arrival of the duodecimal seven-do-seventh day of the first seasonal quarter (91st day after the Mean Southern Solstice day, and, therefore, the day before the Second Seasonal Quarter). The three windows to our right of the duodecimal (;) point indicate three e'do, five e're, and eleven (el or onze) e'mi die. And in just fifty seconds of time (less than one minute) by our present method of measurement of time, those windows should disclose, in Do-Re-Mi language, the digits "three e'do, six e're", or half past three of the kronodore.

That is to say, in place of *3 5 Ɛ* (three, five, eleven) we shall find *3 6 0* on the window kronodore, pronounced as half past three e'do. If we concede that twelve e're equal one e'do, it follows that six e're add up to a half e'do.

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ANOTHER FAULT IN THE DECIMAL SYSTEM

by Dr. Herman Reichenbach
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The fundamental change of our system of numbers is a task for a Hercules. Since we are at it we may as well do a complete job. The structural weaknesses of the decimal system have been pointed out here very lucidly, yet there is another inconsistency which to my knowledge so far has escaped detection.

To begin with we speak of 13 as thirteen, but of 23 as twenty three. In the first case we begin saying the units and follow with the tens, in the second case we begin with the tens and follow with the units. In old English it was customary to speak of three and twenty just as the German language consistently does up to hundred. The duodecimal system is consistent the other way round, speaking of "one do three" or "two do three" and so on. I would draw your attention to the fact that this is perpetuating another mistake of decimal tradition. The correct way would be to say the units first, then the dos (or the tens respectively) and so on. The German language, however, is not consistent with regard to the hundreds etc. Thus in German they say first the hundreds, then the units, then the tens which does not make any sense and accounts for many mistakes on German typewritten numbers. I used to work at a German bank and speak from experience. It is only natural to write the numbers in the way we speak them. But what about two hundred eighteen? It should be rather two hundred teen eight. All Germanic, Slavic, and Romanesque,languages have the same inconsistency in the tens. The French language has further inconsistencies in that the decimal system is mixed up with the base of twenty, "quatre vingts quintz", like the traditional "four score and fifteen" in place of "ninety-five."

But these troubles are solved in the duodecimal system; for instance: two gro one do and eight, the digits following each other in systematic order ending with the units. As far as I know only the Chinese language is in the same way consistent in respect to the decimal system.

Which one is correct, the way of writing numbers or the way of speaking numbers? We have taken for granted that the written order is correct. However, this point deserves examination. When the Europeans accepted the written Arabian numbers they took them in one lump and overlooked the fact that the Arabians read from right to left, while the Europeans read from left to right. Thus the number 65 meant five and sixty as was upheld in the old English custom and still to this day in the German spoken language, but not in the script. For the Arabians 65 - reading from right to left, is five and sixty. The Europeans should have written the same number as 56, spoken, as they actually did, five and sixty. To my knowledge this historical mistake has never been pointed out before; but the historical fact in itself is not convincing. If the Arabians do it their way it may be better the other way, even though this way originated by mistake.

But the reverse writing is indeed more logical, which we realize when it comes to addition. Every tyro learns in grade school that we have to start addition on the right side, that is at the end of the number instead of at the beginning. The awkwardness of such an operation becomes obvious when we do an addition of long numbers on a typewriter. After every single addition the typewriter moves to the right and we have to move it back two spaces. Evidently there is a systematic mistake in this procedure. The same difficulties occur in subtraction, long-hand multiplication, and logarithmic computation. Only division starts at the other end. However, we may look for other arguments for the order of digits. Psychologically the question arises whether it is more important to have the most weighty numbers first or last. I hold that they should be at the end where the whole attention is focused, this especially holds true for long decimal numbers as well as duodecimal numbers. "Three point one four one five nine" is not as pointed as "Nine five one four one point three." In scientific notation we have only numbers of this type, multiplied with powers of ten or twelve respectively.

If, then, we desire full agreement between spoken and written numbers we have both to speak and to write in a way opposite to the decimal tradition. The number of days in a year should be 563, read five and sixty and threehundred or just five-sixty-threehundred. There is not a ghost of a chance to change the decimal system in this way but as we are beginning a fundamentally new system we may as well do it right, right from the beginning. The number of days in a year is not 265, read "two gro six do and five", but rather 562, read five and six dos and two gros," or, if you prefer, five and sixdo twogro. And then in our system to the infinite blessings of all grade school kids, the addition begins at the beginning.

I know that my suggestion does not make easier the lot of the Duodecimal Society. There are ample prejudices against your goals as they stand now. Why increase the difficulties? I can only say that my system would be helpful in preventing a confusion of both systems because the numbers become so different that you know right away in which system you are. Before all I hold that my thesis is sufficiently supported by evidence to warrant thorough consideration.

THE BEBERMAN EXPERIMENT IN TEACHING MATHEMATICS

Under grant from the Carnegie Corporation of New York, the Committee on School Mathematics at the University of Illinois is experimenting with the introduction of mathematics in line with what the adolescents feel and think rather than as a scheduled progress toward an objective. The adult concept of what the student should learn is often unpalatable to the pupil.

Chairman Beberman and his colleagues seek to intrigue the pupils interest by the fascinating things numbers can do, rather than explaining the mathematical process involved. The language of mathematics is the most exacting tongue man has devised. They seek to avoid the mathematical explanations, while getting the student absorbed in the number relations developed by his operation. This approach is more inductive. The pupil is more likely to formulate his own idea of the underlying principles in non-mathematical words.

The report in the Quarterly of the Carnegie Corporation states that, "Grownup antagonism to math is so widespread in America that any approach as seemingly effortless as Professor Beberman's is bound to be greeted with skepticism. But Beberman and his colleagues have accumulated impressive evidence in the last six years to support their argument. Seventeen hundred high school children in a dozen schools are already studying math according to his method and are successfully learning principles not ordinarily grasped, if at all, until college years."

Last year's survey of Problems in Mathematical Education exposed the degree of disinterest in mathematics. Since then we have watched the increasing attention given to the favorable results of introducing pupils to the use of different number bases.

Discipline and drill are no longer adequate as an answer. But the pupil and the teacher will remember the excitement of seeing numbers do their stuff cleanly, when stated on a good number-base. They will more often ask, "Why do we continue to use ten as the base for our numbers, when there is a better one?"

PROJECTS FOR EAGER DOZENERS

Many of us would like to do something for the progress of duodecimals, but are stymied by indecision about what. To help get something going, here is a list of ideas and projects. It may stimulate an idea of your own.

Local meeting, luncheon, or dinner.
Letters to Editors of Newspapers and Magazines.
Duodecimal material in your public library.
Write in names for duodecimal literature.
Do-Metric Units for your own work.
Additional mathematical tables.
Learn Esperanto, to correspond with folks of other lands.
Duodecimal Instruments and Tools,
  Machinist's steel rule, 6",
  Pocket rule, 6", perhaps plastic.
  Micrometer, 0 - 6",
    9 - 1 Quan.
  Vernier caliper.
  Inclinometer.
  Thermometer.
  Carpenter's Square.
  Conversion machine.
  Computer.

Send us other items to list.
Send us pictures.

ESPERANTO

(continued from Page 2X)

us by now is the idea of the Akademio de la Dozeno. This is conceived to serve as the technical authority for the Society in scientific matters. But foremost of its responsibilities would be the preparation of adequate educational material It might well be the first institution devoted to education in a common tongue, and in a common, comprehensive system of numbers, weights and measures. The incentives and satisfactions inherent in this work are so powerful that it has a sort of life now.

EVENTS IN DOZENS

The work of Henry Churchman on the units of the duodecimal metric system deserves high praise. His application of the Do-Re-Mi terms from the solfeggio scale lends ease and familiarity to the steps of the system, and imparts an admirable euphony.

Strange names arouse a defensive dislike, and it is difficult to make them acceptable. But the names of his Doremic units please both the eye and the ear, and evade this antagonism.

We could not afford to neglect so important an aid to popularity for the units of the duodecimal metric system. We suggest that Mr. Churchman's proposals be carefully studied.

To us, some of the units he proposes are not satisfactorily related. The duodecimal system must be ideally integrated, and the absolute relation between length and mass is the most important. This must be exactly systemic, and this relation in Mr. Churchman's proposals needs, we think, revision. It is a matter for discussion, and we should write to him any suggestions we may have.

We expect that S-ro Churchman will have another paper - on latitude and longitude and angular measure - ready for the next issue of the Bulletin. It is pleasant to look forward to. We wish to insure that the advantages of his lovely names for our units are not appraised lightly.

* * * * *

F. Emerson Andrews, Chairman of our Board of Directors, had an article in the Saturday Review of 5 October 1957, in which he rates statistics as, "The Poetry of Science." For the information of our members, we extract some of the data from the biographical sketch by Naomi Weber, which accompanied that article.

Mr. Andrews graduated from Franklin and Marshall College in his native Lancaster in 1923. He has been with the Russell Sage Foundation Library Center was established, with him as Director. He was awarded the honorary degree of Doctor of Humane Letters by his Alma Mater in 1952. Among his pleasures are "informal" mountain climbing and tennis. The books he has written range from entertainment for children to his

"Philanthropic Giving," which is valued as the most important study in this field. His article, "An Excursion in Numbers," published in the Atlantic Monthly in 1934, and his book, "New Numbers," published a year later, led to the formation of our Society.

* * * * *

Tom B. Linton, of Cal. Tech., is making amazing progress with the preparation of the prototype of the duodecimal circular slide-rule. One face of the rule has been tentatively completed, and the calculations for the scales and their divisions for the obverse are well under way. His plan is to produce one prototype, and then to consider modifications that are proposed. Some change in the original may be found desirable. When settled, then produce it. As Tom says, "Let's get the show on the road."

Kingsland Camp and H. K. Humphrey are collaborating in the project. Sometimes the planning schedule gets fouled up. Someone comes out with a good suggestion about something that has already been completed. And this means doing it over. Quel damage!

But the heavenly time when we will be able to put our own duodecimal slide-rules to work is definitely coming nearer. If you are eager to have your own, you had better get your name on the list. Nobody yet knows what they will cost. But who cares?

* * * * *

Wm. C. Schumacher as an Ordnance Engineer is alert to all the modern developments of computer techniques. In the editorial columns of the fine new magazine in the electronics field, Military Automation, for March, 1957, he takes exception to the omission of duodecimals from a discussion of number bases:

> "I don't know what is common about trinary (number systems) that could not be applied with much greater emphasis to the "duodecimal" system, which was not even mentioned. This system, while not at present affording any remarkable benefits in computer work so long as we are saddles with the decimal system in common usage, nevertheless has areas of superiority when compared with other existing or proposed number systems. "Twelve" and its powers have more usable and practical factors than does any other radix of practical size.; and circle measure in this system displays a distinct advantage in that 1/12 of a circle is a common angle (presently called 30° the sine of which is ½). 2/12 of a circle measures the internal angles of an equilateral triangle, 3/12 of a circle those of a square, 4/12 those of a hexagon, and 5/12 those of a dodecagon. The great utility of 12-part division of a circle or of a revolution is exemplified in the extremely versatile wafer switches we are accustomed to seeing in much of today's complicated circuitry.
>
> For computer work, this radix would be implemented by using two binary factors and one trinary (2x2x3 equals 12), obviating any "translation" such as we must now resort to with decimal notation. It is true that trinary stages are not in wide use (they are neither as well developed as are binary stages nor as readily applicable to decimal conversion), but with the investment of a mere fraction of the effort that now goes into binary-decimal and decimal-binary conversion this circumstance would be a thing of the past."

* * * * *

The date for the Annual Meeting of the Society is always a problem. Our people are spread all over the map. Our friendly habit of writing letters to each other without the least reluctance is, thank goodness, spreading to all of our membership, and we hope it becomes the practice of each one of us. We become well acquainted. But the Annual Meeting brings us together in intimate touch and unrestrained discussion, and we know each other more intimately. So we must plan our meetings to suit the convenience of everybody who can possibly come.

This year we are tentatively scheduling Thursday, May 22nd, 1958, as the date, and the place is the Gramercy Park Hotel in New York City, as usual. Put it down on your calendar and come if you can.

Another phase of our geographical problem is the tendency to centralize on the New York Area. There are many advantages to centralizing our administration there. Committee meetings can be called with little notice. Important reference centers are there, and the offices of many other organizations. But we do want to have the benefits of personal contact to be as widespread as possible. Local meetings of members and friends would help. We will always be happy to send our members the names of any dozeners in their areas. Postcard invitations to some meeting, luncheon, or dinner need little preparation, and we know you will prize the fruits of your initiative.

* * * * *

Charles S. Bagley, Geodesist with the Air Force Missile Development Center, at the Holloman-White Sands Range, is a charter member of the Holloman Section of the American Rocket Society. His letters mention a paper of his, "Redivivus Reckoning," which we are panting to see. For your interest we cite part of his description of the missile range as extracted from the Monthly News Bulletin of the Holloman Section for June, 1957:

"To begin with, this area has been surveyed with a geodetic precision exceeding that of any comparable area in the world, not excluding the classic European surveys long held as examples of superiority. This precision was achieved through the combined efforts of the U. S. Coast and Geodetic Survey, the White Sands Proving Ground and the Air Force Missile Development Center. In it are found lines to 90 miles long, whose accuracies are known to less than one millionth of their length. Such lines make suitable fiducials for measuring the velocity of radio wave propagation and the effects of frequency, if any, on velocity.

"On the range are many optical and electronic instruments for determining position, velocity, acceleration and range for missiles and rockets. The value and accuracy of the end product of testing - the final data which these instruments make possible - are largely dependent on the precision of the survey which ties them together. Consequently this excellent survey is a range asset of great worth to all users.

"The Holloman range is also unique in that it has the longest and most unusual high-speed test track in existence. It is constructed of a continuous-weld monoferric prestressed

crane rail mounted on a monolithic continuous-pour reinforced concrete base. Imagine if you can, two huge fiddlestrings, each thirty-five thousand feet in length, requiring one hundred thirty tons of tension to "tune" and you will get some idea of the prestressing operation. Alignment of the track to tolerances hitherto considered impossible has been achieved, hereby reducing lateral accelerations on sleds to the smallest quantities yet accomplished."

DOREMIC SYSTEM OF TIME MEASUREMENT

(Continued from Page 36)

And twenty-four hours later, the complete reading of the kronodore would indicate seven o'clock in the morning of the calendric first day of Spring in the northern hemisphere, the moment that seems to set many poets aglow as the annual perfect moment in time.

Too many Americans today, instead of pausing momentarily, are literally running up escalator steps and getting bad hearts, Should we not, I submit, give some thought (in co-operation with Swiss watchmakers) to the possibility of slowing down our clock to half its present rate of travel, giving it a new face, and starting to live at a more natural tempo? From the same act we can achieve with the kronodore one-sixth more detail in telling time by the moment. Also, people can see a day as the whole of a circle and the several segments into which we divide social, economic, and personal pursuits---visualizing the small part of any day doremitarians devote to "earning a living."

Commerce, too, can profit by embracing a new fiscal year---the "natural year" of each particular business, beginning on a permanent date of any winter, spring, summer, or autumn quarter-year, and riding the earth's orbit to a like spot next year. Speaking decimally, they have 365 days from which to choose; and just as many (d265;*00*), speaking duodecimally. As dozens insinuate in place of decimals, commerce may be there waiting for us. The edo waits for no man.

AVERSION TO ARITHMETIC

by Ralph H. Beard

The general distate for anything that relates to mathematics is so well known that any experienced writer would never have used this heading. But since it is exactly that aversion that I want to talk about, any tactful subterfuge would be dissimulation.

We really must face this peculiar quirk in our thinking. We are sane and reasonable people, who have respect for cause and effect. We constantly appraise the relative importance of things and events. To a far greater extent than for our ancestors, every hour presents the need for evaluations and comparisons. Everyone will agree that these constant mental analyses add to the tension of our lives. But few realize that these are basic mathematical operations. We constantly calculate.

Even in the arts, - in music, in dancing, - and in our perceptive living, - in philosophy, in our search for truth, in our religion, in our hope for attainment of the ultimate reality, - we are applying measures of worth and growth that we would be amazed to know as the methods of mathematics. Pythagoras said that God constantly geometrisized.

In ways we are unaware of, then, we use mathematics. And we use them without interrupting the even course of our thinking and feeling. But if the names of arithmetic or mathematics enter our consciousness, we are repelled. The large part of the youth of our schools drop math. like a hot potato as soon as they can. The teachers are as much antagonized to the subject, and they help to develop the attitude in their pupils unconsciously. In a recent analytical study, three fourths of a class of elementary student-teachers expressed a hatred of arithmetic.

Pause now - for a moment - to think about tomorrow. We can know very little about it, but we are sure that the intrusion of science into every moment of our lives will be many times what it is today. And science is basically mathematics. Therefore we will have to make mathematics comfortable and convenient and likable.

Many studies have been made to determine the cause of the aversion and to find means to cure it. The only consensus

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ANTIPATIO AL ARITMETIKO

by Ralph H. Beard

La ĝenerala malŝato al ĉio kio rilatas al matematiko estas tiel bone konata, ke iu sperta verkisto neniam estus uzinta tiun titolon. Sed, ĉar estas ĝuste tiu antipatio kaj malŝato kiun mi deziras priparoli, iu diskreta ruzo por eviti tion estus trompo.

Ni efektive devas fronti al tiu stranga kaprico en nia pensado. Ni estas raciaj kaj prudentaj personoj, kiuj havas respekton por kaŭzo kaj rezulto. Ni konstante taksas la relativan gravecon de aferoj kaj okazoj. En multe pli granda grado ol por niaj prapatroj, ĉiu horo prezentas la bezonon por taksado kaj komparado. Ĉiu konsentos, ke tiuj konstantaj mensaj analizoj kontribuas al la streĉeco de nia vivo. Sed malmultaj konstatas, ke tiuj estas bazaj matematikaj procedoj. Ni konstante kalkulas.

Eĉ en la artoj, - en muziko, en dancado, kaj en nia percepta vivo, - en filozofio, en nia serĉado por la vero, en nia religio, en nia espero por atingi la finan realecon, - ni aplikas mezurojn de valoro kaj progreso, kiuj mirigus nin por rekoni ilin kiel procedojn de matematiko. Pitagoro (Pythagoras) diris, ke Dio konstante uzas geometrion.

En manieroj kiujn ni ne rimarkas, do, ni uzas matematikon. Kaj ni uzas ĝin sen interrompo de nia trankvila kutimo de pensado kaj sentado. Sed se la nomoj de aritmetiko aŭ matematiko eniras niajn konsciajn pensojn, ni estas mallogataj. La plimulto el la junularo en niaj lernejoj faligas matematikon kiel varmegon terpomon, tuj kiam tio estas ebla. La instruistoj estas same antagonismaj al la temo, kaj ili subkonscie helpas kaŭzi tiun sintenon en la studentoj. En lastatempa analiza studo, tri kvaronoj el klaso de komencantaj instruistoj por elementaj lernejoj esprimis malamon kontraŭ aritmetiko.

Paŭzu nun - dum momento - por pensi pri la morgaŭo. Ni povas scii tre malmulte pri tio, sed ni estas certaj ke la interveno de scienco en ĉiun momenton de nia vivo estos multoble tiom, kiom ĝi estas hodiaŭ. Kaj scienco baze estas matematiko. Do, ni devas fari matematikon komforta kaj konvena kaj ŝatinda.

Oni faris multajn studojn por determini la kaŭzon de la malŝato kaj por trovi rimedojn por kuraci ĝin. La sola komuna

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The English version of this article appears on the facing pages.

that has been reached is that greater emphasis on discipline is required. This is deplorable and is really an acknowledgment of our ignorance.

There is a cause and there is a remedy. And both have been accepted by many outstanding minds. But the cause and the remedy seem to have escaped the analysts. Let me tell you that the cause is that we count by tens.

We count by tens because our ancestors counted by tens, and not because it is best. The use of ten, doubtless, comes from our having ten fingers, and many still count by using their fingers instead of their heads.

Ten was good enough for counting; - for counting heads, and cattle, and wives, and beads. But ten is not good enough for calculating and computing. Nor is it good enough to form the base of a number system which must - today - include an integrated system of weights and measures.

When trade and commerce began to replace the pastoral economy, ten was found to be inconvenient. The busy little trader had plenty of time to hink - on his slow toilsome journeys by camelback and by sea. He reasoned that his bales and crates cost him least when they measured about the same in all three dimensions; - in length, breadth and thickness. One could pack ten articles in two rows of five, - laid the narrowest way. That seemed to be the best he could do.

Then he discovered the dozen. There were lots of different ways to pack a dozen. He could save money by the most cube-like packing. That gave him an advantage. He could cut his price a little, and still make a little more on each trade, and do more business at the new price. Because his bales and crates would cost him less for each article that he handled.

And the dozen came to be used all over the world. So too were developed the gross and the great-gross. It is in this way that the name grocer began, - one who traded in grosses.

Make your mind see the importance of that step. These people found it more convenient to trade by dozens, while they had no other way of making their numbers and records but by tens. You ask what is the matter with ten? Well, it has too few factors! It is literally "un-satis-factory." It has *not enough factors*. Ten is two times five. And that's all. Twelve is two times, six, or three times four, or two times two times three. It is the most factorable number for its size.

Out of trade and commerce came arithmetic. And out of arithmetic came measurement and mathematics. And out of

opinio kiun oni atingis, estas ke pligranda emfazo pri disciplino estas bezonata. Tio estas tre bedaŭrinda, kaj efektive estas konfeso de nescio.

Ekzistas kaŭzo kaj ekzistas rimedo. Kaj ili ambaŭ estas akceptitaj de multaj elstaraj intelektuloj. Kvankam la analizantoj ŝajne maltrafis la kaŭzon - kaj la rimedon - permesu al mi informi vin, ke la kauzo estas pro tio, ke ni kalkulas per dekoj.

Ni kalkulas per dekoj ĉar niaj prapatroj kalkulis per dekoj, kaj ne ĉar tio estas plejbona. La uzo de dek, sendube, venis de tio, ke ni havas dek fingrojn, kaj multaj ankoraŭ kalkulas per uzo de siaj fingroj anstataŭ per uzo de siaj kapoj.

Dek estis sufiĉe bona por simpla nombrado, - por nombri kapojn, brutojn, edzinojn, kaj globetojn. Sed dek ne estas sufiĉe bona por pli komplika kaj malsimpla kalkulado. Kaj ĝi ne estas sufiĉe bona por formi la bazon de nombro-sistemo, kiu devas - hodiaŭ - inkluzivi kunordigitan sistemon de pezo kaj mezuro.

Kiam negoco kaj komerco komencis anstataui la paŝtistan ekonomion, oni trovis, ke dek estis ne oportuna. La aferoplena simpla komercisto havis sufiĉe da tempo por pensi - dum sia malrapida teda vojaĝado per kamelvojo kaj per maro. Li rezonadis, ke liaj pakaĵoj kaj kestoj kostis al li malpli kiam li havis proksimume la samajn mezurojn lau ĉiuj tri dimensioj, - laŭ longeco, larĝeco, kaj alteco. Oni povis paki dek aĵojn en du vicojn po kvin, - metitajn laŭmallonge. Tio ŝajnis esti la plej bona, kion li povis fari.

Tiam li eltrovis la dozenon (aron da dek-du unuoj). Estis multaj diversaj manieroj por paki dozenon. Li povis ŝpari monon per la plej kubforma pakado. Tio donis al li avantaĝon. Li povis malaltigi la prezon iomete, kaj tamen profiti iomete pli en ĉiu negoco, kaj fari pli da komerco pro la nova prezo, - ĉar liaj pakaĵoj kaj kestoj kostis al li malpli por ĉiu varo pri kiu li negocis.

Kaj la dozeno komencis esti uzata tra la tuta mondo. Tiel ankaŭ oni elpensis la grocon kaj la grand-grocon. Estas pro tio, ke devenis la nomo "grocer" (angle) - t.e. iu kiu negocis per grocoj.

Faru la mensan penon por vidi la gravecon de tiu paŝo. Tiuj homoj trovis, ke estis pli oportune negoci per dozenoj kvankam ili ne havis alian manieron por fari siajn nombrojn kaj registrojn ol per dekoj. Ili negocis per dozenoj dum ili kalkulis per dekoj, kaj spite de kalkulado per dekoj. Vi demandas: kio mankas al dek? Nu, ĝi havas tro malmultajn faktorojn! Ĝi estas verdire, lau la angla vorto, "un-satis-factory" (sen faktoroj por satigi) - t.e. "ne sufiĉe da faktoroj". Dek estas double kvin. Kaj estas nur tio. Dozeno (dek-du) estas duoble ses, au trioble kvar, aŭ dufoje trioble du. Gi estas la plej faktorplena nombro por sia grandeco.

El negoco kaj komerco venis aritmetiko. Kaj de aritmetiko venis mezurado kaj matematiko. Kaj de mathematics came science. Lord Kelvin said, "When you can measure what you are speaking about, and can express it in numbers, yo know something about it." A thousand years after its Asiatic origin, we adopted the use of the zero, and the positional notation for our numbers. Now we have the means of counting by dozens, and numbering by dozens, and measuring all things by dozens.

While I take your time to explain how, - in the following single paragraph, - please lay aside several thinking habits and read this paragraph over and over again until it is entirely clear. If this paragraph becomes clear to you, it will remain clear for you - now and forever.

10 is not necessarily ten. It means one ten and no units, - only on the ten base. It means one two and no units - on the two base. It means one twelve and no units on the twelve base. It means one of the Base and no units. This is our positional notation. The number 365 means three tens of tens, six tens, and five units, on the ten base. It means three twelves of twelves, six twelves, and five units on the twelve base, a much larger figure. It could not be used on the two base, as each base uses only that many numbers including the zero. The two base uses only zero and one, and to express the 365 we would write 101101101. The twelve base would use for the same quantity, 265, meaning two gross six dozen and five. The twelve base uses two new single symbols for ten and eleven, perhaps X (dek) for ten, and E (el) for eleven. Of course, 10 is then twelve, and we carry one or borrow one every time we reach twelve, in addition or subtraction.

The benefits of the twelve base are many, but a few should be pointed out. The zero happens oftener, because there are more ways to make twelve. Parts of things more often come out evenly, as 1/3 is .4, and 1/4 is .3, and 1/6 is .2 . The numbers hold more, as 1,000 represents 1728, and 1,000,000 represents 2,985,984. The figures are more exact, just as .001 represents 1/1728, rather than 1/1000.

But it is in the measures and weights that the twelve scales show their great advantages. Thirds and quarters and eights and ninths are exact marks on the scales, as they cannot be on the scales of ten. And a dozenal metric system is offered, based on the yard, which coordinates the palm, the pint, and the pound, - the palm being .1 or 1/12 of a yard, or 3 inches. This dozenal metric system includes measures of time, and accommodates the twelve month world calendar, in

matematiko venis scienco. Lordo Kelvin diris, "Kiam vi povas mezuri tion, kion vi priparolas, kaj povas esprimi ĝin en ciferoj, vi scias ion pri ĝi". Mil jarojn post la origino de la nulo en Azio, ni adoptis ĝian uzon, kaj sistemon en kiu la valoro de cifero estas montrata per ĝia pozicio en la nombro. Nun ni havas la rimedojn por kalkulado per dozenoj, kaj por nombrado per dozenoj, kaj mezurado de io ajn per dozenoj.

Mi klarigos kiel, - en la unu paragrafo kiu sekvos. Mi petas vin, bonvolu formeti kelkajn pens-kutimojn, kaj legi tiun paragrafon denove kaj denove ĝis ĝi estos tute klara al vi. Se tiu paragrafo unufoje fariĝus klara al vi, ĝi restos klara por vi - nun kaj por ĉiam.

10 ne necese estas dek. Ĝi estas unu deko kaj neniuj unuoj, - bazita nur sur dek. Ĝi estas unu duo kaj neniuj unuoj, - bazita sur du. Ĝi estas unu dozeno kaj neniuj unuoj, - bazita sur dozeno. Ĝi estas unu Bazo kaj neniuj unuoj. Tio estas nia sistemo por montri valorojn de ciferoj laŭ pozicio en la nombroj. La numero 365 estas tri dekoj da dekoj, ses dekoj, kaj kvin unuoj, - bazita sur dek. Ĝi estas tri dozenoj da dozenoj, ses dozenoj, kaj kvin unuoj, - bazita sur dozeno, - multe pli granda nombro. Ĝi ne povas esti uzata sur la bazo du, ĉar ĉiu bazo uzas nur tiom da ciferoj enkalkulante la nulon. La bazo du uzas nur nulon kaj unu, kaj por esprimi la 365 ni devus skribi 101101101. La dozena bazo uzas por la sama kvanto 265, kaj tio signifas: du grocoj, ses dozenoj, kaj kvin. La dozena bazo uzas du novajn simbolajn signojn por dek kaj dek-unu - eble X (dek) por dek, kaj E (elf) por dek-unu. Kompreneble, 10 estas tiamaniere dozeno, kaj ni transmetas unu, aŭ prunteprenas unu, ĉiufoje kiam ni venas al dozeno en adicio aŭ subtraho.

La avantaĝ oj de la dozena bazo estas multaj, sed estas bone elmontri kelkajn. La nulo okazas pli ofte, ĉar estas pli da manieroj por fari dozenon. Divido en partojn pli ofte elvenas parnombre, kiel ekzemple 1/3 estas .4 kaj 1/4 estas .3, kaj 1/6 estas .2. La nombroj entenas pli multe, kiel ekzemple 1000 representas 1728, kaj 1,000,000 reprezentas 2,985,984. La nombroj estas pli ekzaktaj, ĝuste ĉar .001 reprezentas 1/1728, anstataŭ 1/1000.

Sed estas en pezo kaj mezuro kie la skaloj de la dozena bazo montras siajn grandajn avantaĝojn. Trionoj kaj kvaronoj kaj okonoj kaj naŭonoj estas ekzaktaj markoj en la skaloj, kiel ili ne povas esti en la skaloj de dek. Kaj dozena metra sistemo estas proponita, bazita sur la jardo, kiu kunordigas la polmon (manlarĝon), la kvartoduonon, kaj la funton, - la polmo estanta .1 (1/12) de jardo, aŭ 3 inĉoj (coloj). Tiu metra sistemo sur la dozena bazo inkluzivas mezurojn de tempo kaj angulo, (en simpla unuigita skalo), kaj konformas al la dekdu-monata mond-kalendaro, pro that monthly rates are .1 (1/12) of the yearly rates. In short it makes available a metric system more convenient and more comprehensive than the decimal metric system.

The overall result is that the twelve base affords a *system* in place of a host of unintegrated data that must be learned by rote and remembered. It is nearly exact to make the extremely broad statement that everything that is done in tens can be done better and easier in twelves. The tables of logarithms and functions and constants and coefficients are already available.

This brings us back to the student and the teacher. The teacher who introduces his students to the twelve base finds eager interest replacing the grimness of drudgery, and the students acquire a knowledge of the operations of arithmetic and of all numeration which they can get in no other way.

The aversion which decimal numbers engendered is eliminated. Why? Because this is a natural and convenient number system, and the students easily see not only how a thing is true, but also why it is true, and the resentment against a rigid discipline vanishes in the ease of accomplishment and competence.

tio ke monataj spezoj estas .1(1/12) de la jaraj spezoj. Mallonge, ĝi provizas metran sistemon pli uzeblan kaj pli ampleksan ol la decimala metra sistemo.

La fina resulto estas, ke la dozena bazo provizas sistemon anstatau amason da izolaj faktoj, kiujn oni devas lerni parkere, kaj memori. La tabeloj de logaritmoj, funkcioj, konstantoj, kaj koeficientoj estas jam haveblaj. Estas preskaŭ ĝuste, kiam oni faras la treege ĝeneralan aserton, ke - ĉio, kion, oni faras per dekoj, povas esti pli bone kaj pli facile farita per dozenoj.

Tio venigas nin ree al la studento kaj la instruisto. La intruisto kiu enkondukas al siaj lernantoj la dozenan bazon, trovas avidan intereson anstataŭ timon pri peza laboro. La studento akiras scion pri la funkciado de aritmetiko kaj pri ĉio rilate al la procedoj de kalkulado, kion li povas gajni en neniu alia maniero.

La antipatio kiun decimalaj nombroj naskis estas forigita. Kial? Ĉar la dozena sistemo estas natura kaj oportuna nombra sistemo. La studento povas facile kompreni, ne nur kiel io estas vera, sed ankau kial ĝi estas vera. Kaj kontraŭsento - pri tio, kio estis deviga disciplino - malaperas pro la kontenteco kaj la facileco de plenumo kaj kompetento.