The Duodecimal Bulletin

Whole Number 2Ɛ

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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; Charles S. Bagley, President; Ralph H. Beard, Editor. Separate subscriptions $2.00 a year, 50¢ a copy.

TABLE OF CONTENTS

The Duodecimal Bulletin

All figures in italics are duodecimal.

ALAMOGORDO

Ever since Charles S. Bagley became President of our Society, his home community of Alamogordo, N. M., has occupied an increasingly prominent place in the news of duodecimals. And, several years ago, answering to the call of the West, Founder George S. Terry moved his residence from Hingham, Mass., a suburb of Boston, to the small town of Sonoita, in Arizona, New Mexico's western neighbor.

Last October, the Terry's visited Alamogordo. Messrs. Terry and Bagley put the favorable occasion to good use, and staged a duodecimal tour de force. The prominent local weekly, The Otero County Star, devoted considerable space to the report of an interview, with an excellent photograph, which the Star has kindly permitted us to reproduce. Time on the local air was accorded them. Extensive discussions with president Bagley's friends and associates also developed.

Pres. Bagley Shows Founder Terry The Good News

The active response to these duodecimal transactions impressed Mr. Terry with the potentialities for further development. He suggested that the next meeting of the Board be held there.

Our Directors are spread from coast to coast. Many of them find it impractical to attend the sessions of the Board in New York City. As with our membership, there is naturally a concentration about the New York Area. But it is one of our basic considerations to de-emphasize this focus, and to diffuse our representation, functions, and operations as widely as possible. And this is a significant action in the desired direction.

Consequently, the next meeting of the Board of Directors is scheduled for the Desert Aire Motel, in Alamogordo, New Mexico, on the 10th, 11th and 12th of April. Although only the Directors are entitled to vote at these sessions, members and friends of the Society are invited to attend them, and other meetings for the general public are planned to spread the general familiarity with duodecimals, and to stimulate interest.

Our preliminary canvass promises that this will be the most fully attended series of sessions that we have ever had.

Director Henry Churchman has proposed that the grades of membership be revised, and that the dues for all grades of membership be increased. This action is suggested as a means of correcting some of our present inadequate charges.

It is of primary importance to the welfare of the Society that membership dues be better aligned with our costs, while the appeal of membership is the Society be stimulated. Under present schedules, we would face serious financial difficulties if there were any large and rapid growth in the number of our members. Since we exert considerable effort toward this end, it is only reasonable that a better economic status be established.

The costs of the Duodecimal Bulletin present a similar situation. Both mail costs and printing costs are rapidly increasing, and these increases can be expected to continue. Much of the Society's growth is attributable to the impressive publicity value of the articles and information presented to the public through the pages of the Bulletin. Plans for increasing its frequency of issue only aggravate these problems, and some remedy must be provided.

Thus for many reasons, the coming meeting of the Board of Directors at Alamogordo promises to be of the utmost importance.

PUBLICITY

A valid gage of the progress of duodecimals toward their culmination is the growth of publicity about them. The outstanding recent event of this character has been the article, "Do, Gro, Mo," in the August 5th issue of the New Yorker. We have received many inquiries as a result of it.

In Power, for July, 1960, Theodore Baumeister of the School of Engineering of Columbia University, had a paper on "Energy Systems Engineering and the Metric System," in which he suggested that 8 and 12 are better bases for a metric system than 10. An abstract of this paper was published in Product Engineering for September 4th, 1961. To us, the core of the article is the statement that:- "Adopting the duodecimal system would bring many beneficial results. It would introduce some new complications that would have to be resolved. But it would bring many fundamental and lasting advantages." This is a concise yet comprehensive statement of the case for dozenals.

No review of the publicity about duodecimals would be complete without mention of the continuing effective work of three of our members, Paul Van Buskirk, William C. Schumacher, and John E. Whiteside.

Paul van Buskirk

For twenty years, Paul van Buskirk has devotedly promoted duodecimals, - which he calls "uncials". At his own expense, he has published a modest brochure on "Nomenclature for Base Twelve Numbers". By profession a civil engineer in Detroit, he has written many outstanding duodecimal papers, and letters to the editors of the engineering magazines.

With equal assiduity, William C. Schumacher and John E. Whiteside scan the engineering publications for comment for or against duodecimals and the duodecimal metric system. Little escapes their attention, and their cogent letters of response present the case for dozenals with great clarity. They have well earned the Society's hearty commendation.

And our revered F. Emerson Andrews has just written a new book, "Numbers, Please", (Little, Brown & Co.), for young folks. The book discusses number bases in its latter chapters and devotes the entire final chapter to duodecimals. Mr. Andrews mentions the Duodecimal Society in this chapter, and this has earned us citations in the reviews of the book in the literary sections of the prominent newspapers.

TOPSY – TURVY MAGIC SQUARE

by Clifford R. Dickinson,
R, 2, Box 820, Camas, Wash.

1Ɛ	3X	69	88	96	X3	Ɛ1
86	93	X1	ƐƐ	1X	39	68
ƐX	19	38	66	83	91	XƐ
63	81	9Ɛ	XX	Ɛ9	18	36
X9	Ɛ8	16	33	61	8Ɛ	9X
31	6Ɛ	8X	99	X8	Ɛ6	13
98	X6	Ɛ3	11	3Ɛ	6X	89

Each row or column adds to 440, and even when viewed upside down.

REMARKS ON THE METRIC AND ENGLISH MEASURES

by Charles S. Bagley
1314 Ohio Ave., Alamogordo, N.M.

When the metric system, brought forth as it was from the morass of confusion existing in France during the eighteenth century, began to make its impact felt throughout Europe, proponents became so elated over its apparent advantages that they began to assert that a consummately perfect system had been discovered. There now remained only one thing and that was universal adoption by all civilized nations and it is towards this goal that major efforts have been directed. This is unfortunate because it tends to limit if not prevent the exploration of other possibilities.

Originally the english pound bore a very simple relationship to the gallon and a cubic foot of sea water. The latter weighed 64 pounds; 1/8 of this was called the gallon. A quart was equal to 1/4 gallon and weighted 2 pounds. The half quart or pint was one pound in weight. Later, when the advantages of the metric system became apparent, an attempt was made to metricize the english system by putting 1000 fluid ounces in one cubic foot, however, the sea water standard having become obsolete in view of more recent measuring techniques, required adjustment of both the gallon and the weight of a cubic foot of water, considerably confusing both standards. To obviate this dilemma, the fluid ounce was made equivalent to 1/10 of a foot cubed of pure water at maximum density, resulting in 62½ pounds per cubic foot, (62½ x 16 = 1000) and 16 ounces per pound. Thus the pound was made equivalent to a volume of water 4/10 of a foot square and 1/10 of a foot deep, or a colum 1/10 of a foot square and 16/10s of a foot high. The effects of this attempt to divide the foot into 10 instead of 12 parts persists in the graduation of leveling rods common in civil engineering, however, it failed to eliminate the inch as a standard in other fields. Had the quantity "1/10 of a foot cubed", or even 1/10 of a foot been given a catch-phase name such as liter, kilo or meter it probably would have survived with much greater meaning than it can presently claim.

That our measuring techniques are in a state of flux is evidenced by the fact that the standard gram, derived from the weight of one cubic centimeter of pure water at maximum density, failed to conform to the standard kilogram determined later on the basis of the liter, or 1000 cubic centimeters of c.p. water at maximum density. The classical attempt to make the meter equal to one ten millionth of the arc length between equater and pole fell short of realization, as did the effort to make it the exact length of a one second pendulum. The extremes to which men have gone in seeking at least one omnipotent "standard of endless duration" is the suggestion that the value of the international standard meter be defined as 1,553,164.13 times the wave length of the red line of cadmium, in air at standard conditions. The fact that this value ends with a three carries the odium of approximation. One is tempted to think of other digits following the three endlessly, and unimportant as the actual value may be, the impression persists that it is not an exact value. Nevertheless if such a standard is obtained, let us hope for the benefit of science two or three millenia hence that the value of this wavelength will not be appreciably effected by possible variations in temperature, pressure, or media in which the measurement is made; or at least that means of duplicating these conditions will also be maintained in perpetuity.

To restore the original simplicity of the gallon, pound, cubic foot relationship the dozenal system offers an excellent opportunity. Accepted standards have been fixed by law as well as custom and can be changed by legislative action as necessity or advantage dictates. Consequently the suggestion that our standard pound may require some adjustment to fit in with progress need not be viewed as catastrophic or significantly inconvenient. It was the promiscuity and confusion existing in France during the eighteenth century that spawned the metric system. Even so it required powerful legislative action to introduce it.

MENTAL SQUARING OF SOME NUMBERS

by Tom B. Linton
11561 Candy Lane, Garden Grove, Calif.

Rearrangement of the expression $n^2 - a^2 = (n-a)(n+a)$ to $n^2 = (n-a)(n+a) + a^2$ provides a form for the easy squaring of some numbers.

If $a = 5$, two-digit numbers ending in 5 may be mentally squared, and the method is quite well known; e.g.,

$$35^2 = 30 \times 40 + 5^2 = 1200 + 25 = 1225 \qquad (1$$

Some 35 years ago my high school algebra instructor drilled us in this method in our first class, and in the more general relation for two-digit numbers: $(n+a)^2 = n^2 + 2an + a^2$.

$$\text{Example: } 23^2 = 20^2 + 2 \times 3 \times 20 + 3^2 = 529 \qquad (2$$

which is rather easy, mentally. For numbers ending in digits greater than 5, the similar relation is used: $(n-a)^2 = n^2 - 2an + a^2$

$$\text{Example: } 27^2 = 30^2 - 2 \times 3 \times 30 + 3^2 = 729 \qquad (3$$

Equation (1 is also useful for relations other than those ending in 5. If $a = 1$ we have quite usable relations for such numbers as $99^2 = 98 \times 100 + 1 = 9801$, $49^2 = 48 \times 50 + 1 = 2401$, $999^2 = 998 \times 1000 + 1 = 998{,}001$, etc. If $a = 2$ we have $98^2 = 96 \times 100 + 2 = 9604$, etc.

These relations hold for any number base. On the 6-base, *55* which is five sixes plus five, $55^2 = 54 \times 100 + 1 = 5401$, which equals $5(6)^3 + 4(6)^2 + 1$. On the twelve base, $\mathcal{E}\mathcal{E}^2 = \mathcal{E}\mathcal{X} \times 100 + 1 = \mathcal{E}\mathcal{X}01$.

The difference between the squares of successive numbers is sometimes of interest. $98^2 - 88^2 = 2 \times 10 \times 88 + 10^2 = 1860$. (4
The example illustrates the rule that $n_1^2 - n_2^2 = 2dn_1 + d^2$, (5
where n_1 is the smaller of the two numbers, and d is their difference. Also, $n_2^2 - n_1^2 = 2dn_2 - d^2$. (6

See "Terminal Digits of $MN(M^2-N^2)$" by Charles W. Trigg, Duodecimal Bulletin, Vol. *14*, No. *2*, p. *4*$\mathcal{X}$.

These relations allow mental calculation of the differences of squares of squares of numbers where either n_1, n_2, or d are simple numbers of one digit, or of one digit followed by zeros. Thus:

$$200^2 - 150^2 = 2 \times 50 \times 200 - 50^2 = 20{,}000 - 2{,}500 = 17{,}500 \text{ and}$$
$$160 - 100 = 2 \times 60 \times 160 + 60 = 19{,}000 - 3{,}600 = 15{,}600.$$

The differences of squares of numbers advancing by small amounts is sometimes useful. For a difference of 1, the difference of the squares of the successive numbers is $2 \times 1 \times n_1 + 1$, or $2n_1 + 1$. For example:

$$201 - 200 = 2 \times 200 + 1 = 401. \qquad (7$$

Here is a table for such simple relations.

Differences $n_2 - n_1$	$n_2^2 - n_1^2$
1	$2n + 1$
2	$4n + 4$
3	$6n + 9$
4	$8n + 16$
5	$10n + 25$
6	$12n + 36$
7	$14n + 49$
8	$16n + 64$
9	$18n + 81$
10	$20n + 100$
20	$40n + 400$
30	$60n + 900$
40	$80n + 1600$
50	$100n + 2500$
100	$200n + 10\ 000$
1000	$2000n + 10^6$

Some of these are easier than others, but all are easier than calculating the squares to obtain the difference.

In an arithmetical series, the differences between successive squares of these numbers is $2dn_1 + d^2$, where n_1 is the smaller of the two numbers. (8

Of some interest is the relation between successive differences of the squares:

$$2dn_2 + d^2 - (2dn_1 + d^2) = d_2 \text{ (second difference)}$$
$$2dn_2 + d^2 - 2dn_1 - d^2 = d_2$$
$$\text{Now, } n_2 = n_1 + d$$
$$\text{Then, } 2d(n_1 + d) - 2dn_1 = d_2$$
$$2dn_1 + 2d^2 - 2dn_1 = d_2$$
$$2d^2 = d_2 \qquad (9$$

Thus the second differences are twice the square of the arithmetic difference, a constant for a given arithmetical series.

d	$d_2 = 2d^2$	d	$d_2 = 2d^2$
1	2	9	162
2	8	10	200
3	18	20	800
4	32	30	1,800
5	50	40	3,200
6	72	50	5,000
7	98	100	20,000
8	128	1,000	2,000,000

NEW SYMBOLS

by Charles S. Bagley
1314 Ohio Ave., Alamogordo, N.M.

Creation of two new symbols that can stand erect with our ten basic numbers and lend them dignity is not easy. The characteristic beauty, individuality, facility of execution and simplicity of construction, developed thru centuries of constant use, can only be duplicated with thoughtful and objective methods over a period of time. It has taken years to evolve our writing system that permits rapid continuous strokes to make words without lifting the pen, except to dot the i and j and cross the t and x. Because this must be done, these four letters have long been considered inferior to the others.

Numbers, unlike letters, must be separated by lifting the pen in order to express discrete individuality.[1] This is an essential characteristic of numbers. On the other hand, the rhythmic continuity of easily manipulated strokes to form successive numerals is a rare gift of our common notation. To inject an impediment into it would be little short of criminal but to lend embellishment would be most praiseworthy. Who undertakes to add two symbols to the established Hindu group assumes a grave responsibility and a serious and difficult task. Such symbols must have the following characteristics:

1. *Simplicity.* They must be easy to make, preferably single stroke characters.
2. *Individuality.* They must be easily recognizable for what they are. Not confusable with any other symbol.
3. *Facility.* They must be easy of execution. Not susceptible to confusing distortion by careless handwriting or printing.
4. *Invertibility.* They must have the quality of erectness and be recognizable no matter from what angle they are viewed. Value and meaning must not change when inverted. The six and nine are unfortunate but substantially established exceptions.
5. *Rhythmic Execution.* Rapid writing should be possible with equal ease in either direction thus giving the writer some freedom of selection as to his best way of making the symbol following any other sequence.

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(1) The only exception is a series of connected zeros.

Most writers prefer to end a figure with the termination of a downward stroke. This is easy with most integers and rapid writers do it routinely. Exceptions are the five, eight and zero. It appears that proper rhythm could be best obtained if the new symbols were made with simple strokes, beginning at the top, terminating at the bottom but capable of reverse execution. Formation should result from natural handwriting and hand-printing motions. It should require an extra effort to distort rather than to make them. Such symbols as the genius of Issac Pitman might have created.

Having established criteria we can now analyze our ten common characters. In order of simplicity, the one has no peer. Nor can it be easily confused with any other symbol. It was considered so advantageous by early peoples that they used it to express the two, the three and the four. However, it was soon learned that the original advantage diminished rapidly with added strokes. Emulation of the one might well be an objective.

The *one* has a different meaning when placed horizontally. A *one* "lying down", as grade school pupils know, indicates subtraction. To the ancient Mayas, of Central America, the horizontal bar meant five and a dot or small circle was used to designate one. In other ancient languages the dot and small circle gradually evolved into our second most important symbol, the zero. To us, who take this symbol so much for granted, it is difficult to appreciate the problems involved in its invention and evolution. Important as it is, it took centuries before the zero was recognized as a full fledged number. Customarily it was made much smaller than the other symbols thus implying that men were almost ashamed to admit its use. It reminds one of the small nines, used on Service Station signs to indicate the price per gallon of gasoline. But now the zero stands equally with the other nine integers and it has all of the necessary characteristics defined above.

The seven is a combination of a horizontal and vertical stroke. Sometimes the stem is curved to add variety. Four was one time a cross, made with a vertical and horizontal line. The equivalent of our plus sign. The extra vertical arm was probably added later to secure a sense of erectness. Two, three, five, six, eight, nine and zero are characterized by curved lines. The two and five employ horizontal strokes. The six and nine, however, appear to have developed from the skillful curving of the straight line or the combination of a straight line and a loop. Of interest is the fact that the written nine is frequently made with a small closed loop, essentially a small zero, then an added stem. The six, on the other hand, which is merely an inverted nine, is not made this way.

The introduction of loops in certain figures, of which the three and eight are typical, goes back into antiquity.[2] There is something fascinating about constructions of this kind that make them valuable. Their principal drawback is the ease with which such forms are distorted to the point of confusing them with others. Aside from the six and nine, exact invertibles, the eight and three are confused more than any other numbers.

It is a paradox of our modern basic numerals that in their evolution, the symbols for several of them exchanged places.

Some figures can be reversed and yet maintain the property of invertibility. An example is the symbol for a partial derivative. It is made like a six but has the stem on the right. Upside down it is still recognizable as the same symbol. Erect it is not confused with the six. Inverted it is not confused with the nine. But it has the characteristic appearance of either or both. This tends to destroy, in a measure, an otherwise great advantage. I.e. while the symbol itself is not readily confused, the making of it in rhythmic sequence can be quite disturbing. One is repeatedly asking himself "do I make it this or that way?" The seven, if made with the stem on the left and the four when made like a capital el but with the stem, instead of the foot, crossed, are comparable examples. But this type of seven, when hurriedly made, becomes an ordinary check mark and it ceases to look like a number when upside down. A four of the type suggested is awkward to make and has the disadvantage that the pen must be lifted to complete. Like the i, j, t, and x in the alphabet, it is inferior.

Although the zero came late, it is one of the most versatile of all symbols. Viewed from any position it is not confused. Its simplicity is exceeded only by the one. For rhythmic ease of construction, only the six and nine are comparable. If suitable symbols can be found they must, undoubtedly, assume characteristic akin to the one, zero, six and nine.

The simplest modification of the one is a slight curve. If this curve is placed at the top and to the right, we get a figure resembling a lower case ef without the cross. It is almost as effortless to make as the one. It is capable of stylistic variations and not readily confused with other symbols. When carelessly made it could be confused with one but probably not with any other integer. When standing alone it might be mistaken for an ef. If the stem is not crossed this would be less likely. When rapidly made, following any other number, it seems a little awkward at first. No doubt facility of execution will develop with usage. It is quite

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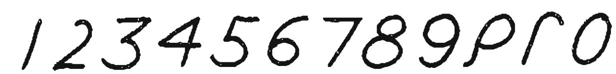
(2) An excellent treatment is found in Smith, D.E. History of Mathematics. Vol. 2 pp 36–87.

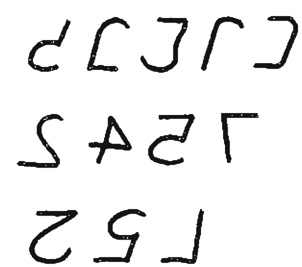
probable that the manual exercise of this symbol will tend toward a stylistic modification, that will maintain its simplicity and add to it distinctiveness, clarity and beauty.

The Greek letter rho has possibilities for stylizing comparable to the ef. It can be made as easily as a six or nine. Confusion with the letter pe, the symbol for partial derivative, the six and nine can be avoided by slightly modifying the construction. It appears to have the same easy flowing lines, the simplicity of execution and pleasing appearance of its counterparts. It can be drawn in normal or reverse form with equal ease. But here again it will take some years of constructive evolution to develop its complete potential.



OTHER DOZENAL SYMBOLS FOR TEN AND ELEVEN

by Tom B. Linton
11561 Candy Lane
Garden Grove, Calif.



Among the best new ideas

Reversals

Inversions

Thus: 

PRACTICES DESERVING UNIVERSAL ACCEPTANCE

Remarks extracted from papers by

Henry Clarence Churchman
403 Wickham Bldg., Council Bluffs, Iowa

Since May of 1957 in any duodecimal paper repared by this writer without exception the semicolon (;) has been employed to represent the dozenal unit point. It was not first used by this writer but initially came to his attention consistently through correspondence constantly originating in the office of H. K. Humphrey, Treasurer of The Duodecimal Society of America (probably dunning for unpaid dues), and for that reason was called by this writer the Humphrey point (Duodecimal Bulletin Volume 11, No. 1, May 1957, p.11, A Duodecimal Point Worth Making).

And since then, in a most interesting and far advanced paper by Kingsland Camp published in The Duodecimal Bulletin Volume 3, No. 1, February 1947, page 14, Duodecimal Nomenclature (locating principal cities around the earth by dozenal techniques), I have found that he also employed the semicolon (some fifteen years ago) to represent the dozenal unit point. Hence age and usage join necessity in support of the semicolon.

Should we not, I submit, adopt the Humphrey (;) point as our universal duodecimal point, placing it at the righthand end of a dozenal whole number and at the lefthand end of every duodecimal fraction, thus 123;0 and 0;456, to separate the duodecimal fraction from the zero or whole number which precedes or the whole number from the zero or fraction which follows it?

We would merely substitute the duodecimal Humphrey (;) for the decimal comma (,) or decimal period (.) if the number is to be understood by all readers in its duodecimal sense. We would (with only a few exceptions such as multiplication tables and perhaps tabulations of whole numbers alone) express all duodecimal whole numbers by joining the suffix (;0) or (;00)---which is the essence of this plea. Actually and scientifically it is no more burdensome than the writing of 1.00 for one round dollar, or 1,25 to indicate, as do the French, a quantity of one and a quarter decimally.

And it does magnify one of our strongest fields---in the area of dozenal fractions, *even when we write a whole number.* Let this dozenal point be the universal sign TO SUGGEST twelve-base digits to all mankind. If the dozenal point is absent, the number is ten-based. The man in the street can understand this simple signal. Its appearance serves not only as a conjunctive between the whole and fractional parts of a duodecimal number, but also serves to indicate that the number itself is duodecimally based.

I should take a moment here to state that the colon (:), but not a semicolon, is now used as a sexagesimal point or conjunction by many persons between hours and minutes and seconds. Thus, 11:32 hours is sometimes used to indicate eleven hours and thirty-two minutes, or, actually, 11-32/60 hours or eleven and thirty-two sixtieths hours.

This suggestion does not and should not require abandonment of the italic digits of The Duodecimal Society of America or the lifting of the Essig box or rectangle. In fact all of our efforts should be directed towards union and growth and attempts to increase the tools of our trade. And when we shall have gotten ourselves accustomed to the duodecimal signal and then find elsewhere a written number neither in italics nor surrounded by a rectangle box, but containing a duodecimal point indicated by a Humphrey (;) such as 0;789, or 872;00, or 1234;56, we will give to it a duodecimal base value and not decimal, the absence of an italic slant or rightangled parallelogram to the contrary.

The semicolon (;) is as accessible as the period (.) or comma (,) on the typewriter, the typographical machine, or in any printer's box. It is available to the girl at the desk, to the man in the street, to the farmer in the feedlot. It is equally capable of understanding in America, in England, and on the continent. In fact, anywhere in the world.

Webster defines a semicolon as a mark or point(;) used to distinguish the conjunct members of a sentence (or, he could add, duodecimal number). Let us say it is, specifically, the point (;) which separates a duodecimal whole number from a duodecimal fraction, and which at the same time serves to indicate dozen-based digits.

The question is not whether the duodecimal point (;) is already preempted by some nonduodecimalists, but will it serve our purpose to establish a claim upon it for all duodecimalists. A custom begins with the first step. Mr. Humphrey has made it a part of every stride he takes. It might be a duodecimal point worth making.

As for the single uniform characters or symbols for ten and eleven, the solution of this problem is more philosophic than political or to be founded on reason. It could be as insoluble as the question of which is more correct, for traffic coming head-on so as to collide absent an agreed rule, to give way each to the driver's right or each to the left of his current path. Either direction is a solution. Which is correct?

The answer has to be, of course, both are correct. The direction depends on custom. In the U.S. the correct rule is to give way to your right or veer to the right as you approach oncoming vehicles which otherwise you would meet head-on. In England, give way to your left. In Rome, do as the Romans do.

Fortunately there is a single solution in the case of motor traffic. In many American cities and elsewhere they have designated certain streets as one-way, everyone heads in the direction indicated by posted signs, and the police arrest any culprit who believes he has an individual right to do only what pleases him.

But in the duodecimal field of single symbols for ten and eleven we find ourselves still in the area where custom alone prevails. Like pioneers initially settling on prairie virgin soil, every frontiersman has exercised his own ingenuity. In America, when people settle in a community, the custom is to remove one's private sidearms, to put the rifle over the fireplace at home.

For some eighteen years uninterruptedly, and for many years longer by individuals who incorporated the society, The Duodecimal Society of America in its official papers, bulletins, and records has employed the ancient Roman X for ten and a script capital E for eleven. Dozens and dozens of papers still extant and pertinent to today's problems are written in those characters. These writings are a substantial if not a preponderant part of the growing body of works and tables upon present day dozenal arithmetic.

And while many books have been written on duodecimal arithmetic, each employing its author's intriguing and original symbols for ten and eleven, the single symbols of X and Ɛ used commonly by a whole group has tended to create in The Duodecimal Society of America over the years of struggle a certain cohesion which has come to stand for permanency, progress, a persistent determination to plant the duodecimal flag in every land held by decimalists.

The writer has individual symbols for ten and eleven which he employs privately although in his opinion they are more facile and more distinctive than any which have yet come to his attention. In addition they follow the rules of script and curvature developed by the Arabs who have furnished

us with the zero and the first nine symbols above it. It is easy to write them manually on the wallboard in a classroom. They involve no checks or reversals.

Yet it is very unlikely that anyone who reads this paper has ever seen them. From the first dozenal paper written by him for the Duodecimal Bulletin, probably 1955, this writer has never used anything except the old Roman numeral X and the script capital E as the single symbols for ten and eleven.

Mr. Bagley, who published his Redivivus Reckoning before he had heard of The Duodecimal Society of America (this is still possible, although we are trying to overcome this apparent shyness), uses the official symbols, as does this writer, in official business. Yet his individual characters for ten and eleven which he used in his book Redivivus Reckoning are easily recognized, differentiated from the other nine, just as reasonable as any you have seen thus far, and they are available to anyone with a typewriter, a pencil, a stick at the seashore.

Mr. Humphrey, these long lean years treasurer of The Duodecimal Society of America, has his own individual characters for ten and eleven which he uses privately. They are just as reasonable and distinctive as yours or mine and in addition are found on anyone's typewriter, while mine are not.

In addition to the single symbols for ten and eleven just mentioned all of us are acquainted with those employed by M. Essig in his book Douze Notre Dix Futur, 1955, Dunod, Paris. And I have seen other symbols different from any here mentioned and different from my own. In fact, the possibility of procreation of single symbols for ten and eleven is not to be exceeded by the national annual birth rate of any country.

Now as I have said reason will not aid us, for each symbol is reasonable. And politics will not come to our assistance by bowing once in this direction and once in that, for there are too many of us involved and only two symbols to be selected.

There is a philosophical line which is presently running wild, the pitch of which is Que sera, sera; what will be, will be. I have a proposal which will not make me happy, and it most likely will not make you happy, because I personally do not know who first selected and used in The Duodecimal Bulletin the old Roman X for ten and the script capital E for eleven, but it must have been one or more of the Founding Fathers, those stalwarts who initiated The Duodecimal Society of America.

I propose that we adopt, for international usage what the first duly constituted duodecimal society in modern times adopted as the single symbols to represent ten and eleven in its official papers, records, and bulletins. I suggest we use in England, in France, in Canada, in Germany, in the politically restless Tyrol as in the politically stirring USSR, in Asia as in Africa, in Australia as in the Americas, the old Roman numeral 𝒳 for ten and the Roman script capital ℰ for eleven, as heretofore set forth by The Duodecimal Society of America, and that we select these single symbols permanently.

If we change these two symbols merely (those who know me at all, know I do not say this in derogatory fashion) because a new duodecimal society has been erected in England, who is to say we shall not change them in another few years when we shall have, I sincerely trust, the Societe Duodecimale Francaise. And if by some good fortune we do not change them then, what guarantee have we that Germany will accept the same symbols, or Denmark, or Italy, or the USSR?

The answer, I think, must come from the pre-emption just mentioned and from history. Cumbersome as were the Roman numerals, Europe accepted them as furnished by the Romans. And peculiar as must have seemed the Arabic curves and twists, when Europe was ready for the Arabic-Indian system of numeration it took them, curves and twists notwithstanding. (Now we find we have been reading the digits in reverse for countless years, from the time we adopted them. Look here, this is one Arabian horse in whose mouth no one looked, and all were glad to get purely as a gift.)

Now this is not to suggest that the old Roman numeral X or the script capital E was first used in America. And do not believe because some persons – a great many perhaps – think the Roman numeral X stands for the unknown quantity, or for an experimental aircraft, or for an unknown brand of cigarettes or washing powder, or unbranded toothpaste, that we are foreclosed from using it now as our universal single symbol for ten.

Historically, a Roman-based European culture received from the Arabs the ten-base system of numeration we now use, not excluding the digit symbols from zero through nine. If historically Europe is to use that talent wisely and return it to its giver in an improved state, is it not to be expected that the increased number of symbols (ten and eleven) should be derived from the Roman characters? Both the Roman numeral 𝒳 and the script capital ℰ are of Roman styling, and might countless regroups of years hence suggest to posterity the fact – and it is an undeniable fact – that the Arabs furnished to a Roman or Western culture the ten-base system of arithmetic which had originated in India, and that this Roman or Western culture, in turn, furnished to the world the twelve-base system of numeration.

Henry Martyn Parkhurst, interested particularly I believe in spelling reform (editor and publisher of The Plowshare in the nineteenth century), performed the prodigious task of preparing duodecimal tables, his logarithm tables being entirely dependable today and extended to two dozen and two places. He utilized the Roman numeral X for ten. On Big Ben in old London, in tower clocks in Germany and Switzerland, in the mountains of the Tyrol, the single symbol for ten is the Roman numeral X. Before its use on clock faces it fulfilled a similar purpose on sundials.

The man in the street, throughout Europe, knows that X is ten when telling quantity. Is there anyone in Europe or America who thinks that part of the name of King Haakon X, King Christian X, or Pope Pius X stood for an unknown quantity or was only the initial for Xenophen, Xerxes, or Xavier? Why should we puzzle the man in the street when it is totally unnecessary? He might never forgive us.

Only a dozen years ago, the British Parliament (1949 perhaps) came breathlessly close to passing a proposed spelling reform in the English language, the effect of which would have been to dispense with "c" and "q" and "x" as letters of the English alphabet.

Any letter may represent the unknown quantity; it need not be X. The initial letter of the five imponderables, Who? What? When? Where? Why?, which must be answered before one can make a proper estimate of any situation, is "w". When "X" is no longer listed as one of the letters of English alphabet – and it will not bother this writer if that never happens – the more up to date teachers of arithmetic will long before have changed to "W" as the unknown quantity. What is the required number? Find "W", and you have it. True, X is called chi by the Greeks and kh by the Russians, and "the spot" by newspaper photographers, but Western civilization is based on the Corpus Juris of Justinian and his Roman culture.

There is one more point I must suggest to you – I would only tire you with a possible dozen more – and that is the availability of these two proposed single symbols to everyone, plus no difficulty in recognizing them and telling them to another. Every student in college today either has a typewriter or it is available to him. Every businessman has one. Nearly everyone in fact has one. The X and the E are already there. And without a typewriter, writing on blank paper, anyone who can write, can write them.

Recognizability and pronounceability are even more important. If I hit a slant over any letter, thus, you and I might in advance agree what is shall mean, but what will the man in the street call it? Now apply this point to X or to E. If you and I shall have agreed in advance that the first is ten and the latter is eleven, we may so call them. But suppose our mythical or average "man in the street" is run over by a truck or camion or lorry, but his eyes have caught the license tag number 13X5E. At the hospital he may tell the authorities: I have the number – it was one, three, ex, five, ee.

That man in the street, who had never attended a single duodecimal class, has conveyed to that officer the correct license tag number because the officer, from what the man has just whispered to him, can write down 13X5E. In this changeover period when the ten-base and the twelve-base may be both employable, both used interchangeably, in that shaky period of grouping by the common man to reach something better, let's not confuse him, let us not confound him, let us not make it possible for anyone to call him ignorant. Such people have risen up in times past and cut off the heads of their tormentors.

Observe that I have not suggested names for X and E other than ten and eleven. In French, this would be dix and onze. In fact, let ten in any language be ten in duodecimal arithmetic. I see no objection to the names of dek and el, or anything you may concoct which is not confusing, as the names of these *symbols*. Anything would be more efficient than being compelled to say: please use the single character to represent eleven or ten.

In the long years ahead, before we reach the promised land, it may be anticipated that X or E will be used occasionally in ten-base adding of items during a stock inventory. It can do no harm. For instance, the auditor might manually write:

prs, socks, large,	21	or equally as	prs, socks, large,	21
med	10		med	X
sm	11		sm	E
total	42		total	42

In the event last suggested, the total is the same regardless of the manner expressed, even when used in ten-base arithmetic manually. We must, it seems to this writer, insinuate these two symbols in ten-base arithmetic as often as possible, and in as many places as practicable, long, long years before the common man DEMANDS twelve-base arithmetic EXCLUSIVELY, or even perhaps initially.

The most likely places to begin, because necessity is making it the most receptive governmental division, is on motor vehicle license plates. Decimally, in six places you may list 999,999 vehicles; duodecimally, 2,985,983 – nearly three times as many vehicles. Telephone numbers will be second perhaps. There, as in license plates, economic pressure to save space is almost unbearable and the ten-base system must yield to twelve-base – but X and E must not be made so complicated the common man can not readily grasp them for ten and eleven, though initially they be thought only the letters X and E.

These suggested points of agreement should be, I venture to hope, acceptable to any one.

There is so much work to be done the problems might seem insoluble, but time like a poultice has a way to heal the wounds of strife. Let everyone freely advance all of the suggestions of which he is capable and let us read and digest every slightest idea. Let no one's ideas be shunted around as a side issue, but presented to the whole duodecimal world. Let no one fear ridicule or criticism or a rude reception of the most outlandish ideas, so long as they are duodecimal ideas. Time will sort them. Even the lonely delegate who sometimes fearfully rises to vote occasionally becomes the nucleus of a majority.

The only crime it would be possible for duodecimalists to commit, in this writer's opinion, would be to deliberately suppress the expression of a single dozenal idea in any field in which there today exists a similar ten-base idea. And that would be a heinous crime indeed.

INDEX OF THE DUODECIMAL BULLETIN

Volumes *10–15*, 1956–1961

INDEX OF ARTICLES

INDEX OF PERSONS

SUBJECT INDEX Vol., p.