available opportunities? Is there no way to channel some funds and expertise along these lines?

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. . . A quite common factor in achievement in all fields is energy level—not motivation or drive or push but the physical energy a person has available to follow his motivation. We are all familiar with the man of ordinary, even inferior, native ability who has risen high simply because he is always alert, alive, and brings to every act an uncommon amount of energy. We are equally familiar with the man who is always tired without apparent cause and who fails to rise to the level indicated by his native ability. Yet I have never heard of any testing program—academic or in placement centers—to measure the physical energy the person can bring to bear. . . . The man who found some way of truly increasing this energy would be making at least as great a contribution as those who have found ways of increasing longevity.

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Harder by the Dozen

S. T. Fisher ("More on metrics," Letters, 24 Sept., p. 1450) says, "We count by tens because we have ten fingers. But twelve is a much better base. . . ." But is it? The argument usually given in favor of base 12 is that 12 has five divisors: 2, 3, 4, 6, and 12, while 10 has only three divisors: 2, 5, and 10. So let us see what happens, in practice, when we divide a number A by a number B.

1) To start with a truism, A divided by B will give a whole number, with no remainder, if and only if A is a multiple of B. This is quite obvious, but what is apparently less obvious to some people is that it is quite independent of the base m in which A and B are written. In base 10, the number 195 is not divisible by 6; if you rewrite the two numbers in base 12, you find that 143 is still not divisible by 6. The only advantage of B's being a factor of the base m is that you can see at a glance, by looking at the last digit of A, whether A is divisible by B or not. But in the case considered (10 vs. 12) even this advantage is illusory, because it happens that it is fairly easy to find out if a number A written in base 10 is divisible by 3, 4, 6, or 12, and much harder to see if a number A written in base 12 is divisible by 5 or 10.

2) When A is not divisible by B, if we accept the use of common fractions to write the result there is obviously no difficulty, whatever the base used.

3) When A is not divisible by B and we wish to write the result as a decimal fraction (in base 10), we find that, because $10 = 2 \times 5$, the result will be a terminating fraction if B is of the form $2^a \times 5^b$; in all other cases we have an unending (in fact periodic) fraction. In base 12, as $12 = 2 \times 2 \times 3$, we have a terminating fraction if B is of the form $2^a \times 3^b$. Is this an advantage? Only if numbers of the form $2^a \times 3^b$ are more frequently used than those of the form $2^a \times 5^b$, which seems doubtful. In fact the smallest base to give us an advantage in this respect would be $2 \times 3 \times 5 = 30$ (with seven divisors). All those in favor of adopting 30 as a base for our future computations please hold up their hands!

4) So much for the mathematical operation of division. It is easy to see that it is directly applicable to the field of weights and measures. But it may be worth while to consider briefly the special case of a sum of money S which has to be divided equally among B persons. Whatever the currency used, there is always one coin which is smaller than all the others (the cent in the United States). Let us call A the number of such coins to which the sum S is equal. We are brought back to the numerical problem of dividing A by B discussed above, with the additional conclusion that, if A is not a multiple of B, it is impossible to perform the operation exactly. The fact that the currency is based on a scale of 10, or 12, or any other multiple has no influence at all. If anyone is not convinced of this, let him try to divide £5 11s. 7d. into six equal parts. . . .

If the "French and Russian revolutionaries" had indeed adopted the duodecimal system of counting, as Fisher wishes they had, it would have meant a long period of utter confusion. And even when this period was over, schoolchildren learning their addition and multiplication tables would have had to memorize, for each of them, 121 results instead of 81. . . .

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