

Several elements are absolutely essential for civilization to exist at all. Fire, settled agriculture and smelting are some. Money is another. Civilization could not exist without it. Barter economy certainly exists within a civilization, indeed early civilizations were largely that, but money is still an essential ingredient. Specialization of labor is part of the definition of civilization and that means that there will be a vast array of products. A carpenter is not going to make his own bread so he has to have some way, via exchange, to get it. The only way to value one material product or one service against each of several thousand others is to have an abstract yardstick. Even if physical money did not exist the idea of money would still be needed as a measure. Money is then, as the dictionary definition would have it, a medium of exchange.

It is a technology, meaning a mechanism for providing something that a society wants. Like many other technologies it quickly went beyond simply serving its essential function and began to create its own reality. Our lives are shaped by money in unexpected ways. Money is a store of value and so its first unexpected effect is to demonstrate to us that it is possible to store value. Material things tend to deteriorate so that there is an incentive to either consume or exchange them right away. It is liberating to hold something that we know can be converted into anything else at any time in the future. Hunter gatherers presumably had a fairly short



time horizon, concerned with the day or at most with the seasons. Money expands our time horizon. The future is less of a haze. Money makes the world a more predictable place.

It allows us to reduce the future to the present. A borrower promises to pay something in the future and in return receives a substantial amount right now. This is a transfer of wealth that would otherwise not be available to the debtor. It liberates him from his present circumstances and allows him to operate on a much larger stage. The lender also receives something of value, the assurance of an income stream in the future. The borrower shifts future value to the present while the lender shifts present value to the future.

Money reduces existential risk and allows us to allocate resources through time. If we have money we are no longer dependent upon the objects that we hold. A dead rabbit and a sack full

of roots and berries can all disappear very quickly. Money on the other hand is not consumed and does not decay, but can be converted into any commodity whatsoever. It can be marshalled at one point and spent at another. Today a young couple can borrow to buy a house, when they themselves have no money, then over the course of their lives put aside money for other big items like the children's education or retirement.

Money facilitates individual liberty. If we can freely contract to sell our labor in return for money then we are no longer dependent upon the clan or family.

The origin of money is intimately bound up with the beginnings of accounting and arithmetic. The first indications are from Mesopotamia sometime before 3000 BC. Tiny baked clay figurines were used to symbolize a commodity. Presumably these were handed out to dependents so that they could go to a central repository to claim a sheaf of grain or a lamb. Over time these tokens were represented by pictographs on clay tablets. In other words writing, at least in the West, began with the requirement for accounting. As the volume of material under consideration increased so too did the need to count it. The first pictographs usually included a number. Five sheep were denoted by the symbol for a sheep followed by five vertical slashes. Ten was a circle. Twenty was two circles, twenty-two was two circles plus two slashes.

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Once begun, the progression of numbers exploded. As a result of a land dispute one Sumerian king essentially sent a bill to a neighboring king for an amount that included compound interest. Round marks within round marks, plus some punch marks at certain points, were used to represent a sum of 8.6 million. Circles within circles did not represent additions, as in the first example above, but instead represented multiples of the same number. In other words they represented an exponential increase. Moneyed civilization created the ability to imagine an infinite series of numbers. Contrast this with genuinely primitive societies which have no name for a number above two or three; 'one, two, many'.

Commercial requirements drove the move beyond arithmetic to mathematics. Although algebra's origins are subject to dispute its arrival in the West came via a book, *Liber Abaci*, a commercial manual translated from Arabic. The book is full of practical problems, often requiring solving for an unknown variable in the calculation of profit or amortization. It is a complicated process to determine how much is owed periodically, at a given rate of interest, to repay a loan. The basis of this calculation is called

'net present value'. In other words what is a future stream of payments worth right now today. It gets more complicated if the payments are of different amounts and at odd intervals. Net present value calculations are at the bottom of modern finance. One investment is compared to another on that basis. Sophisticated mathematics is necessary to create that single standard by which we evaluate what is otherwise a random mass of future amounts and dates.

Our concept of probability also has its origin in finance. Medieval states were the first to issue annuities. In return for a given amount of money the government would guarantee the purchaser a future stream of payments and of course the debt would disappear with the purchaser's death. No adjustment was made for the purchaser's age. If an annuity paid eight per cent it would do so whether the beneficiary was five years old or sixty. It took a number of centuries before someone finally recognized the problem here. A five year old will likely collect payments far longer than will the sixty year old. That someone decided to study an actual population to determine what is the likelihood that a five year old will live to ten or how many more years will a sixty year old, on average, live. The calculation is not as simple as it might initially seem and, again, requires development of some sophisticated mathematical techniques.

Conceptually, the opposite of seeing life through the lens of probability is to see it as a series

of random occurrences which are willed by spirits or the gods. The first implies that there are natural laws underlying both human events as well as the movement of the physical universe. The sensible course of action for the second view is to pray to the gods, to appease them, to flatter them, to try to understand what they might like or dislike. The obvious reaction to the first is to try to discover those underlying natural laws.

Money, or perhaps better said accounting requirements, imposed an artificial human time on top of natural time. Mesopotamians created a 360 day accounting year, meant to approximate the natural year, but using 360 because it is much better for the juggling of fractional periods of time and fractional amounts of money or commodities. 360 can be divided into whole numbers by 21 different whole numbers. 365 can only be so divided by two whole numbers. The earliest example deals with a temple's distribution of grain. A certain amount would be distributed every thirty days, not every month, and the whole annual amount could be divided by twelve. The result, one twelfth of the whole, could in turn be easily divided by two, three, four or six. The accounting year made it far easier to pinpoint a time in the future when an agreed economic event would occur. It converted natural time marked by the sun, moon and seasons into a homogenous continuum of time, made up of discreet identical

units. The whole process made the future far more predictable.

The accounting function encouraged the idea of an economic process leading naturally to increase. A document from circa 2100 BC calculated the natural increase of a cattle herd over ten years. It posited a birth rate per cow, the number of years a cow would give birth, the amount of milk, cheese and meat produced. The increase in herd size had to be calculated as a percentage rise on the basis of the number at the beginning of the year. In other words the authors had to think logarithmically. The total product was converted into units of silver and production value was measured against the original investment. This was the first recorded economic forecast.

Money then is not just fundamental to civilization but has played a central role in

creating the modern world. It has aided in the process of individuation, liberating the individual from the ties of clan and overlord. It has made life a far more predictable process. It has secularized the world, overturning the old one populated by spirits and gods, and subjugated a natural time of days and seasons to a time measured by human social needs. It encouraged the habit of symbolic notation. Beyond arithmetic it has also forced the creation of basic elements of modern math, with logarithms, infinite number series, algebra and probability.



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