

The Domestication of Man: The Social Implications of Darwin

La domesticación del hombre: las implicaciones sociales de Darwin

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Abstract

It is often assumed that human evolution ended by the time of the Neolithic Revolution, which brought settled agrarian societies. This paper argues that instead the period from 8000 BC to 1800 AD was a period of greatly accelerated human evolution, where we can observe marked changes in some basic human behaviors. Humans “self domesticated” themselves to the conditions of market economies. They may thus bear the same relationship

Resumen

Se suele asumir que la evolución humana termina en el momento en que acontece el Revolución del Neolítico, es decir, con el asentamiento de las sociedades agrarias. En este artículo, en cambio, se sostiene que el período comprendido entre el 8000 AC y el 1800 DC se produjo una aceleración en la evolución humana, algo que puede observarse en algunos cambios importantes que han tenido lugar en comportamientos humanos básicos.

to their hunter gatherer forbears as the modern dog bears to the wolf. The source of these changes was “survival of the richest” in the pre-industrial period.

Key words: Evolution, Malthus, Darwin, Domestication, Pre-Industrial Economy.

Los seres humanos se han auto-domesticado adecuándose a las condiciones de las economías de mercado. Pueden compartir la misma relación con sus predecesores cazadores tanto como el perro moderno comparte con el lobo. El motivo que dio lugar a estos cambios fue la “supervivencia del más rico” en el período preindustrial.

Palabras clave: evolución, Darwin, domesticación, economía pre-industrial.

Introduction

Modern humans evolved 250,000 years ago. The Neolithic Revolution, the shift from hunting and gathering to settled agriculture, occurred around 6,000 BC. The history of mankind is overwhelmingly the history of hunter-gatherers.

With the arrival of settled agriculture and stable property rights 8,000 years ago people domesticated a large number of plants and animals. The wolf became the dog, the wild boar the farmyard pig. Dogs, cattle, sheep, pigs, chickens all were transformed from wild animals to domesticated servants of humanity. Fundamental aspects of their natures changed. Dogs have their origin in East Asian wolves, but they have acquired traits wolves do not possess. Dogs, for example, can read human faces and human actions in a way that wolves cannot, even when wolves are socialized with people from birth.

Until recently, however, the one creature in the modern farmyard that was believed to be unchanged from Paleolithic times was man himself. We are assumed to still remain in our original wild form. “Our modern skulls house a stone age mind”¹. For humans the Darwinian era was presumed to have ended with the Neolithic Revolution.

Based on ethnographies of modern forager societies, at the dawn of the settled agrarian era people were impulsive, violent, innumerate, and lazy. Abstract reasoning abilities were limited. If we are biologically identical with these populations then only the thin patina of civilization separates us from

1. Cosmides & Tooby, 1997.

the underlying violence and impulsivity of human nature. Scratch away that restraint and we would revert to our natural passions.

In my recent book, *A Farewell to Alms: A Brief Economic History of the World* I argue two things. First that all societies remained in a state I label *the "Malthusian economy"* up until the onset of the Industrial Revolution around 1800. In that state crucially the economic laws governing all human societies before 1800 were those that govern all animal societies. Second that was thus subject to natural selection throughout the Malthusian era, even after the arrival of settled agrarian societies with the Neolithic Revolution.

The Darwinian struggle that shaped human nature did not end with the Neolithic Revolution but continued right up until the Industrial Revolution. But the arrival of settled agriculture and stable property rights set natural selection on a very different course. It created an accelerated period of evolution, rewarding with reproductive success a new repertoire of human behaviors – patience, self-control, passivity, and hard work – which consequently spread widely.

And we see in England, from at least 1250, that the kind of people who succeeded in the economic system – who accumulated assets, got skills, got literacy – increased their representation in each generation. Through the long agrarian passage leading up to the Industrial Revolution man was becoming *biologically* more adapted to the modern economic world.

Modern people are thus in part a creation of the market economies that emerged with the Neolithic Revolution. Just as people shaped economies, the pre-industrial economy shaped people.

This has left the people of long settled agrarian societies substantially different now from our hunter gatherer ancestors, in terms of culture, and likely also in terms of biology. We are also presumably equivalently different from groups like Australian Aboriginals that never experience the Neolithic Revolution before the arrival of the English settlers in 1788.

The argument here thus unites the doctrines of Malthus and Darwin in studying human history. This is intellectually satisfying since Charles Darwin himself proclaimed his inspiration for *On the Origin of Species* was Malthus's *On a Principle of Population*².

2. Darwin, 1969.

The Darwinism of Pre-industrial Societies

The reason there was opportunity for significant cultural and genetic change even after the Neolithic Revolution is that up until the Industrial Revolution all societies were kept in balance with their resources by Malthusian forces.

Pre-industrial technology advanced so slowly that material living standards depended on population pressure on fixed land resources. When people were few, living standards were good. But good living standards produced more births, and better childhood survival. Population would thus always grow until births and deaths were in balance.

This can be illustrated in one simple diagram, figure 1. The horizontal axis for both panels is material income. In the top panel birth and death rates are plotted on the vertical axis. The material income at which birth rates equal death rates is called the *subsistence income* denoted in the figure as y^* . This is the income that just allows the population to reproduce itself. At material incomes above this the birth rate exceeds the death rate and population is growing. At material incomes below this the death rate exceeds the birth rate and population declines. Notice that this subsistence income is determined without any reference to the production technology of the society. It depends only on the factors which determine the birth rate and those that determine the death rate.

In the bottom panel population is shown on the vertical axis. Once we know population, that determines income, and in turn the birth rate and death rates.

With just these assumptions it is easy to show that the economy will always move in the long run to the level of real incomes where birth rates equal death rates. Suppose population starts at an arbitrary initial population: N_0 in the diagram. This will imply an initial income: y_0 . Since y_0 exceeds the subsistence income, births exceed deaths and population grows. As it grows, income declines. As long as the income exceeds the subsistence level population growth will continue, and income continue to fall. Only when income has fallen to the subsistence level will population growth cease, at the equilibrium level, N^* , and the population stabilize.

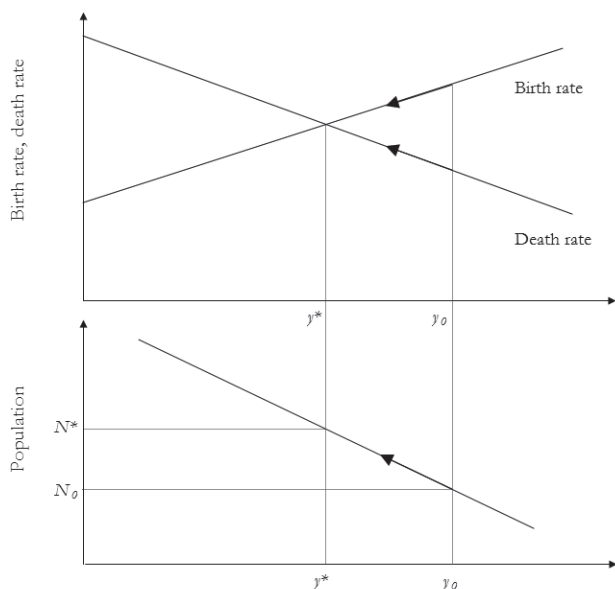


Figure 1: Equilibrium in the Malthusian Economy.

With population in Malthusian balance the average women in pre-industrial society produced 5 children, but only two survived to adulthood. But these two had to be selected by some mechanism from the average of 5 children each women had in the pre-industrial era. And as long as mothers and fathers varied in their characteristics this survival process favored some types of individuals over others. The Darwinian struggle that shaped human nature did not end with the Neolithic Revolution, but continued indeed right up to 1800.

Figure 1 implies that reproductive success, the number of offspring a person leaves on their death, increased with income. The curves in figure 1 are drawn for society as a whole. But within any settled agrarian society there are huge variations in income per person at any time. The existence of land and capital as assets that generate rents allowed some individuals to command much greater shares of output than others. The same Malthusian logic thus implies that those who are successful in economic competition in settled agrarian societies, those who acquire and hold more property, or develop skills that allow for higher wages, would also be more successful reproductively.

There is ample evidence for England in the years 1250-1800 that this Darwinian selection based on wealth did indeed operate. While the average man in England before 1800 produced two surviving children, rich men typically produced many more than two surviving children: 4 was the norm for the rich in pre-industrial England from 1250-1850.

Figure 2 shows the numbers of surviving children per male testator in England in 1630, where men are grouped by wealth at death. Even though these testators were drawn from the wealthier half of the population, the poorest of them had fewer than two surviving children. Those too poor to even leave a will presumably produced even fewer offspring. The children of the rich, their culture as well as their genetic material, were taking over pre-industrial society.

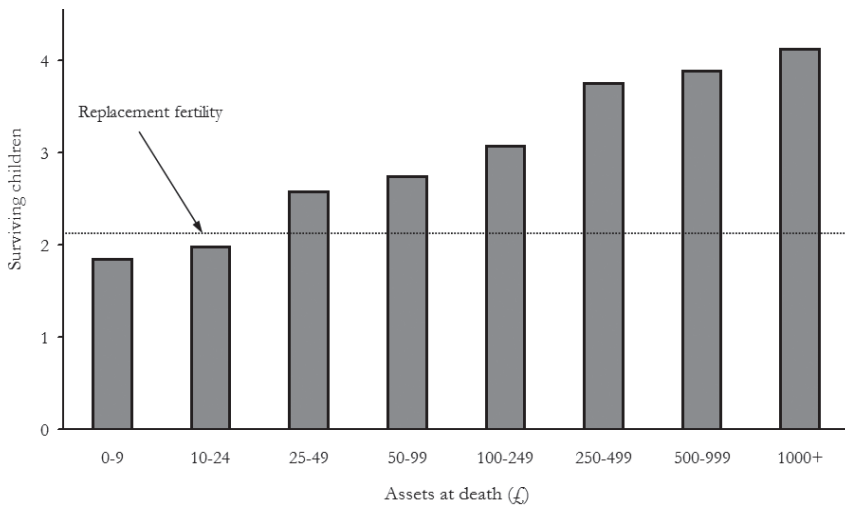


Figure 2: Surviving Children per Male Testator, by Wealth at Death, England c. 1630.

This association between wealth and reproductive success stretches back in England as far as the written record extends. Figure 3 shows the average number of surviving sons per father for England for the decades 1250-1650 inferred from data on the aggregate movement of population. As can be seen, except for the phase of population growth up to 1315, this number was close to one. The second series in figure 3 is the implied average number of adult male children produced by royal tenants in chief, a rich segment of the population.

In the two periods in medieval England where the population was stable or growing, 1250-1349, and 1450-1500 the tenants in chief were producing on average about 1.8 surviving sons, nearly double the population average. Even in the years of population decline from 1350 to 1450, though implied surviving sons per tenant in chief declined, it remained at above the replacement rate of in most decades. Thus, as later, in medieval England the rich were out-reproducing the poor.

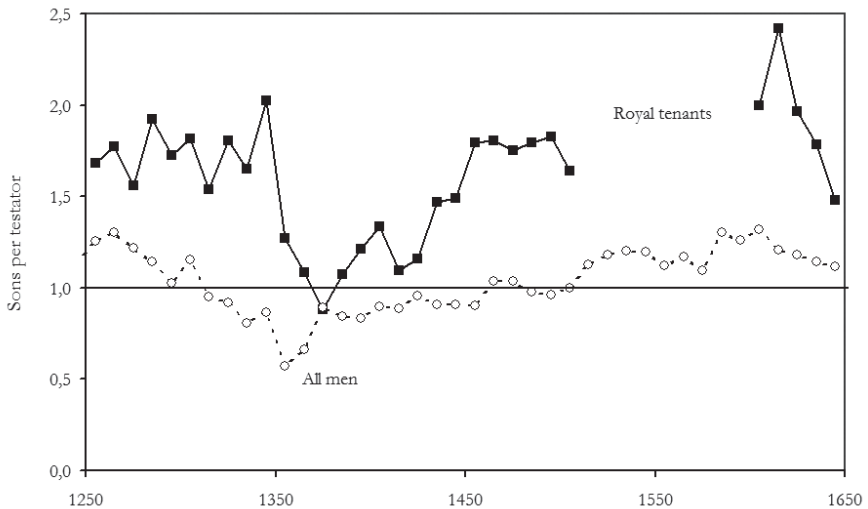


Figure 3: Sons per Father, England, 1250-1650.

We can show the Darwinism of pre-industrial England directly in a further way through looking at the distribution of surnames over time³. Much more than in Spain, there are many surnames in England held by very small numbers of people. I identify two groups of rare surnames in England 1560-1640. The first was rare surnames held by economically successful men in Essex and Suffolk, as revealed by their leaving a will. The second group was rare surnames held by a man on the margins of society, someone indicted in the Essex courts in the years 1598-1620 for assault, burglary, theft, poaching, robbery and murder. The indicted were overwhelmingly from low socio-economic groups, as revealed by their occupations and literacy levels.

3. Clark, 2009.

For rare surnames a significant fraction of the holders will typically be related: brothers, cousins, second cousins. We know wealth and social status was strongly correlated between fathers, sons and brothers⁴. Thus the average man holding the same rare surname as a successful man in 1600 will be relatively wealthy. The average man holding the same rare surname as someone indicted in 1600 will be relatively poor. That is we can identify a subset of surnames where the typical holder was wealthy or poor in 1600.

I can then look 250 years later, in the census of 1851, for the frequency of these rare surnames which will be held by the genetic descendants of the men we observe in 1600 or their close relatives. We can compare the frequency of the names of the rich versus the criminal of 1600 in the same area of England. Table 1 shows the frequency of the occurrence of these names in 1851 in the south east of England. At the median the richest testators left more than seven times as many descendants 250 years later than did those indicted in the criminal courts. Survival of the richest was a very real phenomenon in pre-industrial England.

Group	N	Median Occurrence	Name disappeared by 1851 (per cent)
Indicted (Criminals)	337	9	35
Poorest Testators	147	36	21
Middling Testators	289	48	19
Richest Testators	204	67	17

Table 1: Name Frequencies in 1851

Preindustrial England was thus a world of constant downward mobility. Given the static economy, the superabundant children of the rich had to, on average, move down the social hierarchy in order to find work. Craftsmen's sons became laborers, merchant's sons petty traders, large landowner's sons smallholders. Attributes that ensured later economic dynamism – patience, hard-work, ingenuity, innovativeness, education – were thus spreading throughout the population by biologically.

4. Clark, 2008.

Were the Rich Different from the Poor?

In 1936 Ernest Hemingway remarked to the critic Mary Colum, “I am getting to know the rich”. Colum replied, “The only difference between the rich and other people is that the rich have more money”⁵.

If Colum was correct then the differential survival of the rich would have had no long lasting impact on culture or genetics in these societies. But we know from pre-industrial England that economic success was highly heritable. The sons of the rich also tended to be rich. And indeed the connection was more powerful than in modern economies.

Figure 4 shows the wealth of sons who left wills in England compared to their fathers. Wealthy fathers tended to produce wealthy sons. This implies in turn that the rich were passing on their reproductive advantage to their children.

The rich in pre-industrial England also had different abilities and aptitudes than the poor. Had the advantage of the rich been only their inherited wealth, the fortunes of their sons would depend crucially on how many siblings they had. The more siblings, the less of the assets of the father each child would receive, and the poorer would be sons.

But even the sons of wealthy fathers with many siblings tended themselves to die wealthy. Rich fathers produced rich sons, even when they had so many children that the inheritance explains little of the son’s wealth. Mainly what the sons of rich fathers inherited was the economic abilities of the fathers.

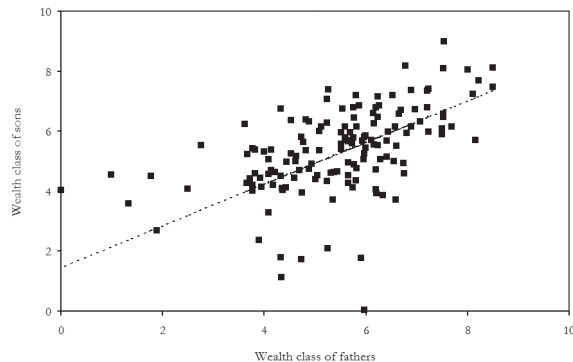


Figure 4: Sons’ Wealth compared to Fathers’, England 1550-1850.

5. Eddy Dow, New York Times, Nov 13, 1988.

How Human Behavior Changed in the Last 6,000 Years

Modern ethnographies suggest that hunter-gatherers were impulsive, violent, innumerate, illiterate, and lazy. Death rates from violence were much higher than in modern societies. Impatience dominated economic activities. And abstract reasoning abilities were limited. Most of these societies have no other words for number than “one”, “two” or “many”.

There have been at least three major observable changes in very basic human behaviors since the adoption of settled agriculture. People have become more patient, less violent, and harder working.

Interest rates, which measure the average level of patience, fell from astonishingly high rates in the earliest societies to close to modern levels by 1800. The interest rate is the reward for waiting to consume, rather than consuming now. Since the Industrial Revolution the gross return for waiting, for investments in the safest assets, is around 3 per cent per year correcting for inflation. The net return after tax is more like 2 per cent.

The earlier we go, the higher measured interest rates were. Figure 5 shows, for example, the return on land investments in England from 1200 to 2000. Medieval England had interest rates typically 10 per cent or greater. By the eve of the Industrial Revolution these had fallen to 4 per cent. All societies before 1400 show high interest rates. In ancient Greece the temple of Delos, which received a steady inflow of funds in offerings, invested them at a standard 10 per cent mortgage rate. Temple endowments from tenth century AD South India typically yielded 15 per cent. Quoted interest rates for earlier agrarian economies are higher. In Sumer 3000-1900 BC interest rates on silver loans were 20-25 per cent.

In forager societies evidence on rates of return is indirect. There is no capital market. Anthropologists, however, can measure time preference rates through the relative rewards of activities with immediate benefits compared to those with future benefits: digging up wild tubers now, compared to clearing ground and planting gardens with a reward months in the future.

Mikea forager-farmers in Madagascar, for example, have enormous returns from maize cultivation: 74,000 kcal. per hour of work. Foraging for tubers, in comparison, yield hourly returns of only 1,800 kcal. Despite this the Mikea forage for most of their food, since maize takes time to grow. This implies extraordinarily high time preference rates.

The Pirahã of Brazil are even more indifferent to future benefits. A brief overview of their culture included the summary,

Most important in understanding Pirahã material culture is their lack of concern with the non-immediate or the abstraction of present action for future benefit, e. g. 'saving for a rainy day'⁶.

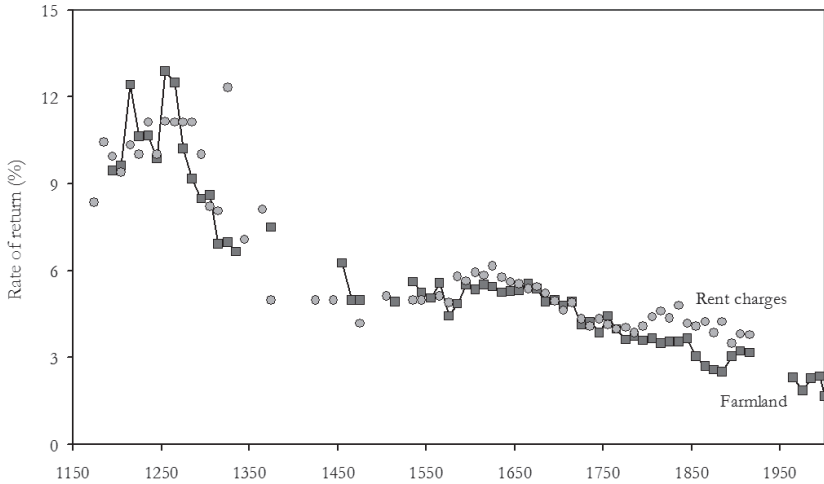


Figure 5: Return on Land Investments in England, 1200-2000.

We can also observe that societies have become less violent over time. Hunter-gatherer societies are characterized by high rates of death from violence. Typically 10-20 per cent of men would die violently. Within the agrarian era we see the rates of violence within societies decline substantially.

Figure 6 shows the death rate per 1,000 men per year from murder in England from 1190 to 2000. Even in the middle ages these rates were only 0.2 per thousand, which is less than a tenth of the typical hunter-gatherer rate. Less than one man in a hundred would die as the result of murder. But these rates declined substantially subsequently. By 1700 they were at rates lower even than for the modern USA.

6. Everett, 2005, Appendix 5.

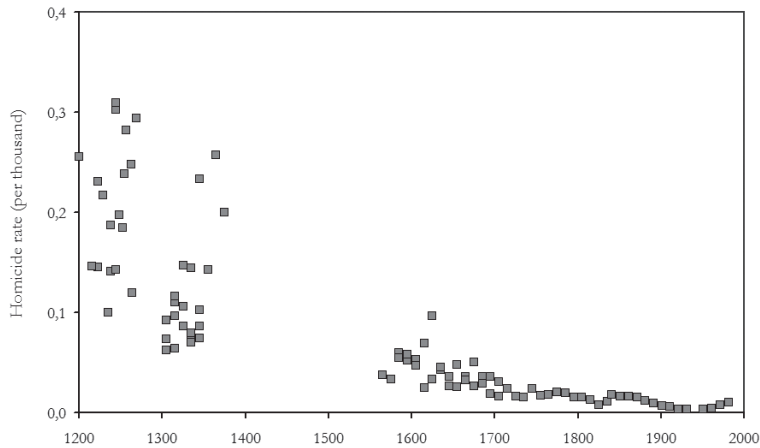


Figure 6: Homicide Rates for Males, England, 1190-2000.

Work hours rose between the hunter gatherer era to modern levels by 1800. The typical male hunter-gatherer worked only 5-6 hours per day, counting all work activities. In England by 1800 paid work alone was nearly 9 hours per day, counting across every day of the year.

As a whole these changes show societies becoming increasingly *middle class* in their orientation. Thrift, prudence, negotiation and hard work were imbuing themselves into communities that had been spendthrift, violent, impulsive and leisure loving.

Can Survival of the Richest Explain Changing Human Behaviors?

While we observe Survival of the Richest going along with significant changes in behavior in pre-industrial England, could Darwinian forces explain this association? This is simply a matter of how heritable these traits were, and how much reproductive advantage they gave.

Heritability is simply the correlation between parental behavior and child behavior. For traits important to breeders of farm livestock – milk yield, fleece weight, litter size, body weight – heritability varies, but averages around 0.4. This relatively low number implies that most of the variation in features like offspring body weight comes from random features.

Yet despite this just by selection animal breeders have been able over a few hundred years to greatly change the attributes of domestic animals. The medieval cows and sheep in England were tiny compared to their modern equivalents.

Economic success, measured by the correlation of wealth at death between fathers and sons, was much more heritable in the pre-industrial world than the average animal trait. The correlation here for father-son pairs in England was more than 0.6. And the reproductive advantage that economic success gave was very great.

Suppose for simplicity we assume that economic success mainly came from possession of some complex trait, Z, which depended additively on the inheritance of a favorable draw of many factors (for the moment we can be agnostic about whether this was passed on genetically or culturally). This trait, for example, would include how hard people worked, and how patient they were. How much would possession of this trait change between generations in pre-industrial England?

Figure 7 shows an assumed initial distribution of the trait, assumed to follow a normal distribution in the first generation with a mean at 0.5. Assuming the reproductive advantage of the rich was as shown above for England, and a heritability of 0.6, the figure shows how the trait would be distributed among the offspring in the next generation. The average level of trait Z in the next generation increases by nearly 7 per cent on the base.

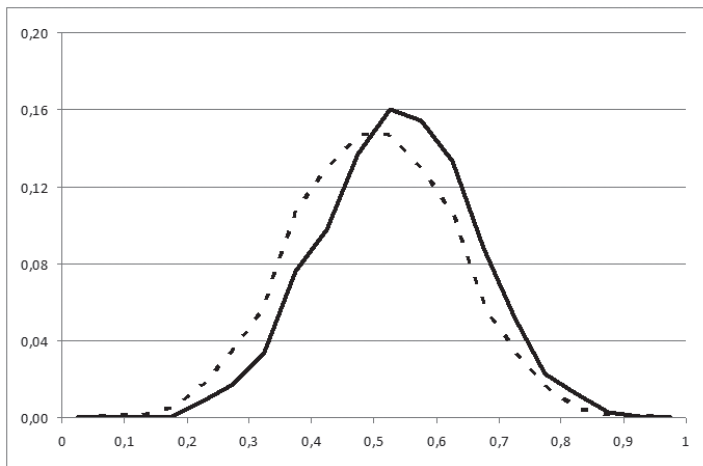


Figure 7: The Distribution of Economic Abilities across Generations, England, 1630.

Thus even one generation in pre-industrial England is enough to change the distribution of the expressed trait significantly. There would be 18 generations between 1200 and 1800, plenty of time for significant changes in peoples' economic aptitudes. If we take the much longer interval between the Neolithic Revolution and the Industrial Revolution we are talking about 8,000 years, 240 generations. Time enough for significant changes in the way people behaved.

Changed Genetics or Changed Culture?

We see changes in basic behaviors before 1800. We see also the much greater reproductive success of those who embodied the more modern economic behavior.

The mechanism of inheritance might still be purely cultural, a culture passed down vertically within families. For practical purposes of social policy this has the same impact as genetic inheritance, since the overwhelming majority of children are raised by their genetic parents.

If one society experienced this process for a longer time, or more severely, than another then its members would have a persistent advantage in economic competition whatever the source of this advantage.

However modern information on the transmission of economic success and educational attainment between generations suggests most of these changes would be genetic. The rich in modern industrial society are genetically different from the poor. Stated thus boldly and starkly this seems a shocking, elitist statement. Nevertheless this genetic difference shows in a number of ways.

First we can look at how closely identical twins resemble each other in incomes compared to same-sex fraternal twins. With random mating identical twins share 100% of their genes and fraternal twins only 50%. Under any reasonable assumption environments will be equally similar for fraternal as for identical twins. If genetics made no difference to income the income correlation for identical and fraternal twins would be the same. In fact, identical twins show a stronger correlation of income than for fraternal twins: 0.4 versus 0.2⁷. That implies that at least 50% of the transmission of income earning abilities from parents to children is genetic.

7. Bowles & Gintis, 2002, 14.

However marriage is assortative. People marry those who are like themselves in education and income. Thus even fraternal twins share more than 50% of their genes. The higher correlation of incomes between identical as opposed to fraternal twins is thus based on even less than a 50% difference in genetic material. Genes must explain even more of income. With reasonable assumptions about the degree of assortativeness in modern mating, genetics explains at least 60% of the correlation between brothers' incomes.

The second source of information we have on the role of genes is the outcomes for adopted children compared to their biological and adoptive parents. The educational attainment of adopted children in Sweden depends on both that of their adoptive and biological parents. But the impact of the biological parents education is roughly double that of the adoptive parents⁸. This is not directly evidence on income and wealth, but education levels are important predictors of both of these. Clearly genes explain the majority of educational attainment in modern Sweden.

Studies of criminality, using either twins or adoption methods, similarly reveal a strong genetic connection. The chance a Danish adoptee would end up with a criminal record when neither set of parents had one was 13.5 per cent. When only the adoptive parent had a criminal record this chance rose very slightly to 14.7 per cent. However if only the biological parent had a criminal record the chance of the adoptee having a criminal record rose much more, to 20.0 per cent. If both sets of parents had a criminal record the chance of the adoptee having such a record was 24.5 per cent. Genetic influences on criminal propensities are much greater than environmental influences⁹.

These studies imply that a large fraction of the changes we observe in human behavior in the historical period, indeed the majority of these changes, are indeed genetic in nature.

8. Bjorklund, Jantti & Solon, 2007.

9. Mednick et al., 1984.

Conclusion

8,000 years ago people discovered the benefits of sedentary agriculture and abandoned the hunter-gatherer lifestyle. This led, however, to what was likely an accelerated period of evolution for humans as they adapted themselves to the new environment of markets and capital.

Evidence from pre-industrial England suggests that economic success in agrarian society was rewarded with reproductive success and was highly heritable. Evidence from the modern world establishes that economic success is mainly genetically determined. There must thus have been rapid genetic change from generation to generation in these genes in societies like pre-industrial England.

This suggestion fits well with recent claims that the rate of evolution among humans speeded up in the past 10,000 years. A recent study of variations in DNA across individuals concluded that “Rapid population growth has been coupled with vast changes in cultures and ecology, creating new opportunities for adaptation. The past 10,000 years have seen rapid skeletal and dental evolution in human populations, as well as the appearance of many new genetic responses to diet and disease”¹⁰.

In one particular case, the evolution of lactose tolerance has been traced in Northern Europeans to only the last 5,000-10,000 years¹¹.

The different histories of different human populations over the last 8,000 years may thus have lasting effects on the outcomes of economic competition between these groups in the modern world. The long histories of societies may have a surprisingly persistent effect within the modern world, and explain some of the persistent disparities in incomes between social groups and countries.

10. Hawks et al., 2007, 20,753.

11. Bersaglieri et al., 2004.

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