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14 The emergence of health and social inequalities in the archaeological record

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Historians and philosophers have long debated the meaning of civilized progress for human health and the quality of human life. However, the popular presumption which dominates most Western thinking and teaching about our history is that history is synonymous with progress and progress means improvement in health. A corollary of this presumption is that inequality or class stratification, which is a relatively recent phenomenon intimately associated with the rise of civilization, actually benefits even the poor because the rich lead the poor 'upwards' so that, despite disparities in wealth, the poor actually do better than they would if left uncivilized. However, we now know a good deal about the modern significance of 'civilized' behavioural patterns for health and nutrition, and a great deal of data are now available about the comparative health, nutrition and demography of the 'primitive' versus the 'civilized' poor. Moreover, patterns of health through prehistory can be traced in skeletons from prehistoric cemeteries. All three sets of data tell a story very different from the image of civilized 'progress'.

Anthropologists commonly recognize three broad categories of human society with special reference to inequality—those described as egalitarian, those which display ranking and those which are socially stratified. We have found that an enormous variety of societies, across both time and space, fits reasonably well in these broad categories. The three categories have two broad, major correlates. Firstly, they are clearly and conspicuously related to the size and density of the populations involved. The smallest societies are generally the most egalitarian; the largest are the most sharply stratified.

Secondly, larger and denser societies have, as a rule, progressively replaced smaller societies in human prehistory (although only in a statistical sense, not in the sense of a universal, unilinear sequence or law) so human societies have tended to move from egalitarianism to stratification.
The three types of society fall crudely, statistically, along a time line. We think that most of the human societies of early prehistory were egalitarian although there are some notable exceptions. Societies which display ranking become more common beginning 10,000 to 15,000 years ago. Stratification is more or less synonymous with the origins of civilization and ‘the state’ beginning about 5000 years ago, although a dwindling number of egalitarian and ranked societies persisted well into the twentieth century.

Stratified societies, which can wield a great deal of political power whether or not they are otherwise superior in any adaptive or moral sense, have replaced more egalitarian societies through growth, incorporation or competitive elimination, or have driven them to extreme environments such as deserts, the Arctic or central rainforests in which the more powerful groups have (until recently) had little interest. Human ‘progress’ is synonymous with population growth and the displacement of smaller societies by larger ones; and it is therefore also synonymous with increasing stratification. For anthropologists, ‘civilization’ is not merely coincident with the emergence of stratification, it is defined by the emergence of stratification and coercive power as much as, or more than, by any other quality.

The density of human population and the size of human groups are in turn closely correlated with food-getting technology. It has been customary to assume that the correlation is Malthusian in nature: that population hovers below a limit set by technology until a new invention raises the limits of the food supply. In contrast, I (Cohen, 1977, 1989) among others, following Ester Boserup (1965), have argued that it is the growth of population itself that stimulates both technological and social reorganization. That point is moot; but the correlation itself is not.

The smallest and most egalitarian groups typically live by foraging or hunting and gathering wild resources. Under reasonable circumstances, hunting and gathering provide a rich and varied diet with a moderate workload. But under all but the richest circumstances it only does so when human population density is low and groups are small. Such groups typically average no more than 30–50 people and exploit territories averaging at least one square mile per person. Such egalitarian hunting and gathering communities also tend to be relatively open with individuals coming and going at will and this freedom to move is one of the major underpinnings of their egalitarian structure. At the same time, low population densities and the absence of any form of transport mean that the number of people who are in direct or even indirect contact in any defined time period is relatively small.

The adoption and subsequent intensification of farming increases human efficiency in the use of land and permits more people to feed themselves in a given territory (although farming probably does not improve the efficiency of labour). Agriculture began, I believe, only as some combination of the growth of the human population, and the decline of preferred wild resources (particularly large wild game) made hunting and gathering increasingly labour intensive and unattractive. Farming techniques, in turn, also demand sedentism and the storage of foods since harvests tend to be seasonal and crops need to be tended and then stored.

Sedentism and farming also appear to increase human reproductive rates for several reasons further stimulating population growth and density. Natural human fecundity may increase with sedentism possibly because of reduced strain on women carrying children, changes in diet and food processing, and the ready availability of weaning foods, although the reasons are hotly debated (see Cohen, 1989). Farming economies also utilize the labour of children more readily than foraging economies, affecting birth control decisions in the direction of larger families (Hassan, 1981).

But farming, storage and sedentism not only permit people to aggregate in larger groups at higher densities, they also encourage or even require people to choose larger population aggregates for two reasons. Firstly, sedentary farming populations, stored foods and towns or cities are vulnerable to attack, conquest, expropriation of stored resources, and even enslavement and there is safety in numbers. Hunter–gatherers are notoriously difficult to conquer or enslave although they can be driven out or killed. One can take their territory but not their stored resources. Secondly, economic or craft specializations, which may begin to emerge, encourage people to congregate because specialization reduces the need to spread out over the land and because proximity improves the efficiency of specialized tasks.

Agriculture (and certain kinds of space-intensive foraging with storage) and/or the larger denser populations which cause or accompany them, also change social rules slightly. They broaden the definition of ownership of resources so that at least farmed and stored foods are private property and planted trees or improved fields may also be. Sedentism and prior investment in resources also mean that the mobility that foragers use to resolve conflicts and resist social pressures are no longer available. Groups are less likely to split and they are less likely to welcome new members.

The combination of sedentism and vulnerability in turn makes stratification and central government control possible. Earlier in human history people simply moved away from anyone ‘who would be king’ or who simply wanted a greater share of the food, just as members of modern foraging societies did in the twentieth century. Stratification and civilization did not emerge because someone invented them, they emerged be-
cause the conditions enabling people to resist being stratified were gradually undermined.

Civilizations in turn are defined by several principles:

(1) They are often heterogeneous assemblages of specialists who are functionally interdependent — but often with conflicting interests — rather than just neighbours, friends and relatives farming in parallel to one another.

(2) Stratification involves marked class-based inequalities in which one class permanently owns all the natural resources or means of production and members of the other class(es) own nothing but their labour.

(3) Civilizations employ real physical coercive power (execution, forced exile, maiming, police, jails, armies) to reinforce the system of heterogeneous occupations and classes with their conflicting needs since the correct participation of the lower class is no longer likely to be maintained by individual self-interest.

(4) Civilization involves urbanization to concentrate specialized functions for efficiency and defence.

(5) Civilizations are often defined at least in part by fixed spatial boundaries (lines on a map) and not by the (often temporary) location of groups of people.

Civilizations appear to have emerged independently in several areas of the world. (The Middle East and Egypt, India, China, sub-Saharan Africa, Peru and Mexico are often mentioned but the exact number of truly independent centres is in dispute.) From these centres, civilization then spread outward. The presence of a civilized state appears to act as a catalyst for the development of others.

While increases in group size and the incorporation of smaller groups have resulted in internal stratification of individual societies, competition between such groups has also resulted, often through conquest, in a second kind of inequality, inequality of power and exchange between societies. Differentiation and class stratification refer not only to people within a community but to differences among communities themselves, since civilization implies a loss of community self-sufficiency and participation in networks of trade (and therefore of politics) which are inevitably hierarchical (see Strickland and Shetty, Chapter 1). In recent years it has become common to refer to the unequal world distribution of wealth and power as the modern 'world system' but similar power networks are quite literally as old as civilization itself, i.e. as much as 5000 years old in some parts of the world. For example, regional satellite communities of ancient Egypt can be identified throughout most or all of the history of that civilization.

Civilizations are typically built in part by outright conquest, which, as Robert Carneiro pointed out (1970), involves both power and circumscription or limits on people's ability to expand their resource base or move away resulting from physical barriers to movement, sharply declining resource potential in possible areas of expansion, or the proximity of other people. Warfare did not begin with civilization, but warfare for conquest of territory and/or enslavement of people is a civilized phenomenon. Archaeologists identify these trends in the archaeological record in a number of ways. The increasing number and size of habitation sites testify to increasing density of population and the increasing size of individual communities. The increasing depth of habitation refuse (thickness of cultural strata), the presence or absence of permanent construction of houses and storage facilities and preservation and recovery of resources representing all of the seasons of the year indicate permanence or sedentism. The increasing local differentiation in art and artefact styles reflects the closing of social boundaries. The elaboration of non-economic or symbolic goods indicates social differentiation and ranking. The presence or absence of particularly demanding crafts and their distribution in archaeological sites indicate the presence of specialists. The scale of corporate construction implying massive amounts of labour, evidence of large scale inter-regional trade, and the elaboration of special tombs implying massive differences in wealth, are characteristics that signify civilized society and stratification. The most visible trappings of civilization in the archaeological record are monumental constructions requiring co-ordinated labour well beyond the command of any tribal 'chief'. I often ask my students what it takes to build a pyramid like those of ancient Egypt, one of the first civilizations, and they always talk about architectural design, stone cutting tools, water power, pulleys, ramps and perhaps a stable food supply or even engineering. What they fail to realize is that pyramids are, more than anything else, a sign of a major social and political transformation. What it really takes to build one is the ability to put thousands of people to work on a basically questionable task and keep them there for periods of decades or more. That requires coercive power. And it is that demonstrated ability that is the keynote of civilization in the archaeological record.

The satellite communities of such civilizations can be identified by the presence of shared artefact styles and the movements of raw materials which can often be traced to their source. Archaeologists are also aided in their reconstructions by the predictability of certain aspects of ethnographic and historical data in relationship to group size, house size, labour costs, etc., which permits us cautiously to fill in or flesh out the archaeological record. And of course, once civilization emerges written records
may describe the structure of the society, although they are often as incomplete or biased in their own way as the archaeology itself.

The combination of these trends towards stratification occurring repeatedly in various regions of the world (the regions at least partly independent of one another) suggests that they represent independent parallel evolution of common solutions to common social and economic needs, and not simply invention, historical chance or cultural diffusion. It has been suggested (Cohen, 1977) that, like agriculture, they primarily represent common solutions to the problems of increasing population density. That interpretation remains controversial although the correlation with population density is unmistakable.

What does ‘egalitarian’ mean?

Individual members of ‘egalitarian’ societies are not necessarily equal in their wealth or power – and ethnographic descriptions make clear that the individual inequalities can have dramatic effects on the health, nutrition and survival of individuals, primarily those who cannot fend for themselves. However, in such societies, all able-bodied persons (including children from a relatively young age and the surviving, capable elderly) are free to obtain food and have the same access to resources as others. Individual ownership is recognized only after labour has been invested in specific resources in the act of gathering or processing – or, more rarely, ownership may be invested in tending selected long-lived resources such as trees. But the rights of such ‘ownership’ are typically far more limited than they are in our own system. No one (other than some footsies, some infants, and, sometimes the crippled or incapacitated elderly) is denied access. Moreover, such groups lack storage of food or accumulated possession of other types of symbolic wealth (because they move frequently and so minimize the accumulation of ‘things’) so that inequalities resulting from superior performance tend to be temporary. Prevailing ethics tend to make hoarding or private accumulation difficult, and there is no mechanism for storing wealth for the long-term. Those ethics are not really very different from ours – or at least not very different from the rules we obey when we are dealing with family, friends and kin. The difference is that in egalitarian societies everyone falls into the categories of family, friends and kin. So sharing is common. Your family, kin and friends have a ‘right’ to a share of what you have, in much the way that we cannot really refuse to let a friend or kinsman come to Christmas dinner and we cannot refuse to serve as much food as people want to eat. Moreover they know they have the right so they take what they want. A hunter who gets a large animal will expect to be met by kin, friends and neighbours wielding knives to take a share. And the prevailing ethic, which is the real ‘power’ in the group, supports the knife-wielders rather than defending the ‘property interests’ of the hunter.

It is important to note that, in such groups, aggressive sharing refers not only to essential resources such as food, it also extends commonly to symbolic wealth items such as jewellery. This is one major reason why storing wealth is difficult which in turn makes it difficult to accumulate or demand disproportionate shares of real resources. An anthropologist friend of mine had a prized necklace ‘stolen’ in the field by a member of such a group who simply made admiring noises and took it off her neck like an aggressive sister might in our own culture. The ‘thief’ wore it quite openly for a brief period until it was taken by the next person (following fairly strict rules of etiquette) and so on until everybody had had a chance to take/share/steal it. After this, having understood the pattern, my friend ‘stole’ it back again mouthing the appropriate admiring noises. It is clear that status differences based even on symbolic wealth would be hard to maintain in such a society.

In such a system differential success implies not differential wealth but differential obligation to share and to be rewarded with friendship, respect, reciprocity or sexual favours. Respect is a wonderful commodity because it is diffuse, poses no economic threat, and is potentially infinite in its expansion so that unlike exchanges for other commodities, exchanges for respect never become too one-sided to function. Moreover, respect dissipates and requires constant renewal, motivating the successful to continue their participation. In short, strong pressures reinforce equal access to economic goods.

Anthropologists describe such economic exchange as ‘reciprocity’ or even as ‘tolerated theft’. Rather than being exchanged with strangers in a market for profit, goods are exchanged through pre-existing social ties, thus reinforcing those ties. Much like our exchange of presents within a family, there is an unspoken ethic of ‘from each according to ability, to each according to need’, and repayment may be in the form of small tokens, respect and prestige or awareness of future obligations.

Such societies are also ‘egalitarian’ in their leadership. Differences in ability and success certainly exist and leaders emerge from among the successful. But five qualities distinguish such leadership from that of more complex societies and limit the potential for inequality. Firstly, such leadership tends to be achieved by success and is not ascribed. Secondly, it tends to be ephemeral, lasting only as long as one is successful. Thirdly, it tends to be specialized, applying only in the context of success and not extending to other spheres (so a good hunter will be asked to lead the hunt
but not necessarily to settle disputes, etc.). Fourthly, leadership implies authority (judgment which is respected) but not power (i.e. the ability to coerce through physical force.) A good hunter can direct others because his judgment is respected, but they are free to stop obeying whenever they wish. Fifthly, leadership conveys no economic privilege. Such leaders, in short, are very like the leaders we choose or elect within our own small groups.

If an individual tries to be too ‘big’ he is likely to face the ridicule of the group, as Richard Lee demonstrated graphically in an oft-cited paper entitled ‘Eating Christmas in the Kalahari’ (1969b); and if he tries to enforce his leadership or privilege he will find that others in his group exercise the ultimate freedom of hunter–gatherers. They leave, taking their individual self-sufficiency with them to forage somewhere else. Groups commonly split after disputes which get more common as the groups get larger and the splinter groups may coalesce in new patterns through a pattern known as group ‘flux’, a fluidity reflected in the relative absence of stylistic boundaries in the archaeological record.

**Ranking**

At this second level of size and complexity (i.e. in ranked societies), it is common for people to tolerate private ownership and unequal ownership of forms of symbolic wealth (e.g. jewellery) and of economic goods including produced food and improvements to resources. But the inequalities tend to be on a graded scale of individuals, small and temporary, rather than sharply bounded categories; and they do not imply ownership of (or even privileged access to) basic economic resources such as food, land, water, etc., or to other ‘means of production’. One’s crop can be owned, and storage makes possible the perpetuation of unequal success – but there is nothing but prestige and reproduction to reward unequal success beyond a certain point. Moreover, everyone has the right to farm some land and to own what is produced and there are no striking contrasts in the equipment with which people farm.

The elaboration of symbolic wealth and the tolerance of unequal symbolic wealth results at least in part from problems of information processing as the number of ‘other’ people gets larger (Cohen, 1985). Since people no longer recognize all of their fellows as individual friends and kin, they begin to classify and stereotype others into groups, based on large scale kin affiliations (clans or lineages) or on craft specialities, and they begin to use various types of symbolic wealth as visual signs and symbols which allow discrimination and stereotyping. I refer to discrimination and stereotyping here only in their most benign sense, sorting people into categories for the sake of organization but without judgments about inequality or rank. A genuine need for classification and stereotyping to simplify information processing underlies the secondary development of discrimination in its more malignant sense since classifications, initially involving relatively benign, parallel or segmentary divisions, lead easily to invidious comparisons.

As the number of people becomes too large to co-ordinate informally through ad hoc leaders, ascribed leaders marked by symbolic wealth also emerge because of the need for predictable, permanent foci of communication and decision making. And, since the group is too large to accomplish all necessary sharing on a face to face basis, centralized sharing or redistribution emerges in which the central person (‘big man’, ‘chief’, etc.) acts as a central repository for produce and redistributes it to members of the community. There is the obvious possibility here for the differential control of wealth and in fact such a ‘chief’ may use such wealth for political favours or for small corporate projects (e.g. by assigning earth moving and building tasks and feeding the workers). But often chieftainship may be more of an economic drain than a privilege to an individual. Just as the treasurer of one of our own informal associations or projects who is acting as a redistributor, often ends up making up a shortfall from his own pocket, the redistributor chief may end up poor. Such chiefs still generally lead from authority, not power, although their authority is now more permanent and more reinforced by symbolic reminders of office – and people are not so free to move away as they once were.

**Stratification**

The real watershed in social organization and inequality occurs with the appearance of civilizations. Unlike what came before it, class-based stratification is permanent, ascribed, inflexible and largely unrelated to individual capabilities. It no longer refers to inequality in personal ability or individual investment but to prior ownership of essential resources and to capital goods produced by prior investment. Moreover, we are no longer talking about slight inequality on a graded scale in which a successful individual or one with a better piece of land, has 110%, 120% or even 200% of what a less successful individual has. Class stratification is a system in which members of a privileged class may own even up to or over 10,000% of what a poor person owns. Members of the lower class have no rights to those resources – unless they trade their labour or their daughters, or are fed by benign masters.
Civilization is related to potential inequality in another way. Whereas smaller societies are based on the fact (or sometimes the fiction) of kinship relationships and presume an inherently positive relationship towards family, friends and kin who are essentially like oneself, civilizations are commonly built of heterogeneity – different ethnic groups and different craft specialists whose needs may be (or may be perceived to be) in conflict, but who are actually more dependent on one another than are farmers because specialization reduces self-sufficiency. The combination of interdependence and perceived difference and conflict of interest makes all individuals more vulnerable, but particularly those of the lower classes. The modern economist Amartya Sen (1981; see also Pelto and Pelto, 1985) has described how social and political ‘entitlements’ (the obligations of others) increasingly replace individual self-sufficiency in the food quest as civilization becomes more complicated. For present purposes, Sen’s key point is that individuals become increasingly dependent on economic, social and political relationships, socially defined rights to food (entitlements) and the obligations of others to provide food which once people obtained for themselves. Overall efficiency may increase through specialization of labour, but each individual becomes more vulnerable because he/she risks not only the failure of food supplies per se but also the failure of the entitlement rights. The problem is that the most reliable entitlements – those involving the obligations of family, friends and kin – gradually lose their power, leaving people to the mercies of fickle governments or equally fickle commerce. Famine can result, even when food is plentiful, from, among other things, the fact that trade routes are blocked, that governments cut off supplies or stop providing food stamps, or that one’s own economic speciality, required to enable one to earn the money needed to buy food, is no longer viable.

The benefits and costs of civilization and stratification for health

Civilized organization can make major contributions to human well-being by allowing professional managerial skills and other specialized skills to emerge, by permitting stored foods to be used for emergencies, by permitting organized labour to be directed at essential large tasks like building irrigation ditches, and by permitting corporate investment of centralized wealth, potentially for benign ends like medical research, weather forecasting (or forecasting the Nile’s annual flood). Civilized size and organization also enhance the aggressive and defensive power of groups, which clearly and significantly contributes to the biological welfare of their citizens although of course it commonly acts to the detriment of others. Civilization, of course, also makes it possible to withhold rights and privileges from one’s own citizens to an unprecedented degree (Wittfogel, 1957). Anthropologists and archaeologists agree that civilization is both exploitative and managerial. We disagree as to which function came first and which has prevailed or in what balance they occur.

It is a common part of our historical mythology to assume that these managerial contributions have offset the disadvantages of class stratification and enhanced the well-being of all the people, reducing the burden of disease and malnutrition and increasing life expectancies. But in fact the advantages must be balanced against the disadvantages inherent in stratification, in the spatial and economic organization of civilizations, and in governmental ability to deprive people of their means of survival. It becomes an empirical question whether, and for whom, life has been enhanced (see chapters by Macintyre, Wilkinson, Stephens, and Ben-Shlomo and Marmot). This is a question that can now be addressed using three types of data:

1. ‘Uniformitarian (natural science or “natural law”) predictions’ about the probable behaviour of parasites, nutrients and human physiology under different conditions in prehistory based on contemporary observations and epidemiological knowledge, models, computer simulations, etc.

2. Study of the health of ethnographic (i.e. living) members of small societies that, despite their inevitable participation in the modern world system, retain some features of behaviour and health associated with smaller, more egalitarian groups.

3. The skeletons of prehistoric populations unearthed through archaeology. Human skeletons respond to the presence or absence of various kinds of insult – wounds, workload, infection and malnutrition and episodes of unspecified stress leaving non-specific and specific scars on the skeleton. They also display variations in growth and mortality.

The empirical analysis of data on health in small ‘uncivilized’ contemporary groups and in recorded history as well as in the skeletons of prehistoric populations suggests that, in fact, throughout most of history and prehistory, the rise of class stratification, with all its enhanced power for managing investments and solving human problems has not offset problems inherent in larger populations and class stratification itself. Rather, civilization has exacerbated health and nutritional problems for most people throughout most of history. There is little if any evidence of ‘permanent’ improvement in health, nutrition or longevity anywhere in the world until sometime in the nineteenth century, and in fact there is a great deal of evidence to the contrary. Even in the nineteenth century, improve-
ments were largely confined to politically privileged upper classes or rich countries and may have resulted more from world dominion than from scientific progress. The benefits did not reach most contemporary populations until well into the twentieth century. Moreover, the clearly progressive history of the last 50 years may well be partly a fluke. It certainly is not the culmination of a steady trend. It would appear to be related more than anything else to the fact that we are enjoying a relative hiatus in the onslaught of new epidemic diseases that has little relationship to anything people have done. And in fact the hiatus has been so brief, in historical terms, that it may not be a hiatus at all, rather just a minor dip on a curve. We have done very little that could discourage the spread of the next world pandemic by an unknown disease and we have done a great deal to encourage one (Fenner, 1970; Cohen, 1989; Garrett, 1994; Mims, 1995; Fenner, pers. comm.; see also chapter by Porter and Ogden).

There is a great deal of evidence to suggest that lower class status and participation of satellite communities in the networks of civilizations have had negative effects beginning with Ancient Egypt and its Nubian satellites (Martin et al., 1984), and extending well into the twentieth century.

The pattern of data from skeletal pathology suggests a widespread, parallel, increase in many common indicators of pathology as hunter-gatherers become farmers and as they participated in larger scale civilizations, although the latter data are less complete (Cohen and Armelagos, 1984; Cohen, 1989; Larsen, 1995). Caution needs to be observed in inferring community health from skeletons because a cemetery may not be a representative sample of the living population and because several factors, other than disease itself, affect whether or not a given skeleton records an insult. For example, an individual who dies from an infection too quickly will not display the insult in the skeleton because skeletal lesions develop slowly. An individual who lives longer with the insult—presumably because the individual is actually healthier in other ways—is more likely to display a skeletal scar. So skeletal pathology and health may actually be positively correlated. An increase in the frequency of visible skeletal lesions such as that which commonly occurs as groups become more sedentary could theoretically reflect an improvement in community health in which more people lived long enough to develop skeletal lesions. (For a full discussion see Wood et al., 1992; Harpending, 1990; Ortner, 1992.) However, it is possible to show that these other factors, though unquestionably real, cannot account for the pattern of increasing pathology we observe (Cohen, 1989, 1997; Cohen et al. 1994). Briefly, this paradoxical interpretation can be ruled out in the data discussed here for several reasons. Firstly of course, the other lines of evidence—ethnographic descriptions of health and uniformitarian ‘predictions’ from the known behaviour of parasites and nutrients—suggest that infection and malnutrition should and do increase when human groups become denser and more sedentary so concurring patterns in the skeletal pathology should hardly surprise us. But, secondly, and more importantly the interpretation of pathology as reflecting improved survivorship can simply be ruled out on quantitative grounds. The trends occur widely, in parallel, ruling out purely local or random problems in cemetery sampling (who gets buried and who does not). Archaeological preservation can often be ruled out since (with the obvious problem of poor preservation of infants and the elderly) most of the data being compared come from the relatively well preserved core of the population and since differences in preservation do not clearly parallel the trends seen. And the arguments based on improved survivorship in later populations can also as a rule be ruled out because we can show quite easily that survivorship cannot have improved to any significant degree across the board after the adoption of farming or through the period of the early civilizations. Simply summarized, the known pattern of population growth rates over the past 100,000 years of prehistory makes it impossible to contend that there was a general improvement in human survival which could account for the widespread prehistoric increase in visible pathology. Population growth did not accelerate (and could not have accelerated using any reasonable population estimates) to any significant degree during the period of prehistory under discussion; and what did occur probably reflects increased fertility, for which there is good evidence, not increased survival, for which there is little if any such evidence.

The data are clearest with regard to the quality and quantity of human nutrition. Our own experience suggests that an array of animal and vegetable foods eaten fresh with minimal processing is the best way to achieve a balanced diet, so we ought to expect that hunter-gatherers who eat that way would be well nourished. And, the new field of evolutionary medicine can be, and has been, used that way to suggest that our bodies are probably designed for the kind of diet hunter-gatherers enjoy (Eaton et al., 1988). A comprehensive review of the world’s few remaining foraging communities (Cohen, 1989) suggests that their nutrition is, in fact, clearly superior to that of modern satellite communities of the ‘Third World’, and of the modern poor of any country, despite the fact that those modern foragers now live in some of the world’s poorest environments. Reports of vitamin deficiencies among hunter-gatherers are rare, except under extreme physical conditions where individuals are starving—either in extreme, central deserts or the Arctic where no one else even tries to live. Secondary deficiencies due to parasites are reported in some tropical rainforest groups; but most hunter-gatherers have only light parasite loads. Even in
the tropics nutrition is generally good; and the problems increase rather than decrease as people grow in numbers or become sedentary, and as parasite loads increase. Protein deficiency is almost never reported at all among hunter-gatherers and we now wonder whether protein deficiency was ever a problem in the hunter-gatherer world (Speth, 1988). Mineral deficiencies (iron, calcium, magnesium) are almost unknown outside the arctic or in rainforest populations with heavy parasite loads. Caloric intakes in all but the most extreme cases average at or above modern Third World averages (Cohen, 1989). People like the Hadza in East Africa, in environments which are still relatively rich in game, have caloric intakes similar to those of affluent Westerners. But even the !Kung, whom we now think of as a relatively impoverished foraging group, who live in a hot dry desert where heat and the lack of water restrict their activities, and who have few resources, and are legally forbidden to hunt some large animals, have caloric intakes that match Third World averages, for example equalling the average caloric intakes estimated for India and China. And, they do far better than the Third World poor (see Cohen, 1989 for an overview and other citations; for specific studies Jelliffe et al., 1962 (San); Lee, 1969a (San); Truswell and Hansen, 1976 (San); Jones, 1980 (Anbarra); Sen Gupta, 1980 (Onge); Ichikawa, 1981 (Pygmy); Hill et al., 1984 (Ache)).

Moreover, optimal foraging studies or studies of foraging efficiency in various activities (e.g., Winterhalter and Smith 1981; others summarized in Simms, 1987; Russell, 1988; Cohen, 1989) provide ample evidence that prehistoric hunter-gatherers in a world rich in large game, which is the most efficiently exploited of wild resources when plentiful, would have fared far better than later groups. In any case, it is important to note that the natural ratio of calories to other nutrients is lower in hunter-gatherer diets than in modern diets (and 'standard' dietary studies) in which calories are more common. For hunter-gatherers, calories and fat are the elements most likely to be in short supply - that is not true of the modern world. Hunter-gatherers in fact may discard hunted game that has no fat presumably because fat is scarce but protein is not. So a hunter-gatherer's diet with a caloric intake matching that of the modern Third World is actually a far superior diet.

Farming, particularly as it intensifies gradually eliminates dietary variety. It results in loss of freshness, and therefore of water soluble vitamins, as reliance is placed on stored foods. It often reduces the nutritional quality of individual foods such as wheat, and it requires heavy dependence on foods chosen for the density of calories per unit area and for the ability to be stored, not for nutritional value. Large scale transport of food, without expensive modern refrigeration, further reduces the variety and quality of foods consumed by putting a premium on 'shelf life' and packaging.

In addition, and again with the exception of extreme environments in which many hunting and gathering groups now live and where reported starvation biases our picture of hunter-gatherer life, there is little evidence that extreme hunger or starvation is a more significant problem for these populations than for more 'modern groups' (sources have been reviewed in Cohen, 1989). Although farmers can store food, their domesticated and concentrated crops, which have often been removed from their natural environment, are more vulnerable to crop failure than wild ones. Storage has always been imperfect; and it has always increased the danger of human predation.

Trade networks are also a double-edged sword. Modern satellite populations may benefit from world trade networks when those systems work. But people's inability to generate economic demand for food, political boundaries, politically motivated or required specialization in failed crops or disfavoured industries, political with-holding of food, the ability of the rich to exert disproportionate demand on resources even from far away, failure of transport and economic institutions, fluctuations in world markets, cheating and market manipulation by managers, and the movement of resources away from populations in need, are all factors which apparently make modern Third World groups more, not less, vulnerable to malnutrition and starvation. The USA, for example, imports beef from areas of Central America where peasants have no land on which to feed themselves, including from the Maya (with whom I have worked). In short, where natural disasters may cause hunger or starvation in primitive groups, the very political mechanisms that supposedly protect civilized people from starvation can actually harm them. The rich clearly benefit, the poor do not. It seems very clear to me that the problem in the modern world is not a lack of supply of food, it is lack of economically viable demand for food on the part of the poor, which no new food technology will correct.

Skeletons of early, Palaeolithic hunter-gatherers indicate that they were commonly rather large people. The overall trend in human stature until fairly recently, if mixed, has been downward although it has been reversed for affluent people and nations in the last 100 years (Cohen and Armelagos, 1984; Fogel, 1984; Fogel et al., 1985). The seventeenth- and eighteenth-century Europeans against whom we proudly measure ourselves to demonstrate our progress, were actually some of the smallest people who ever lived. The skeletons of hunter-gatherers also commonly show fewer stigmata of malnutrition than later populations. For example, rates of porotic hyperostosis or iron deficiency anaemia are generally lower for hunter-gatherers than in later populations. However, it is not clear whether the widespread temporal increase in anaemia reflects reduced dietary iron intake or secondary loss to parasites, or even the body's own
tendency to withhold iron from circulation to fight parasites and infections (Stuart-Macadam and Kent, 1992). Where comparisons are possible, childhood growth patterns and signs of prenatal stress, assessed through growth disruption markers of teeth and the length of long bone diaphyses compared to dental ages, suggest that childhood was healthier among hunter-gatherers than among later populations. Rickets is found almost exclusively in the skeletons of relatively recent populations. Infectious disease also seems to have increased through human history not only with population growth, sedentism and urbanization, but also with such class-based factors as trade patterns serving primarily the wealthy, conquest, troop movements, the imposing of 'civilized' lifestyles and the resettlement of conquered populations. Tuberculosis is very clearly a disease of crowded urban poor and of ghettos and reservations. Bubonic plague spread over large scale trade routes (Biraben, 1968), and international military operations are clearly implicated in the spread of influenza and cholera.

This increase lasted at least until the end of the nineteenth century, and, after a brief respite, may well be increasing again. This involves not only AIDS and tuberculosis (see Porter and Ogden), but also a myriad of regional infections, as for example Ebola, which may now spread through modern trade networks. This raises the spectre that our 'progress' is not the historical norm but a brief deviation from the norm fuelled by privilege. Contemporary hunter-gatherers, for example, display low rates of infantile and other diarrhoea, and of anaemia related to parasitic worms, as a function of their small group size, low population-density and mobility. It is thought that the range of infections which could have plagued such populations before civilization would have been comparatively limited. We usually assume that only two classes of disease could have afflicted such populations: (1) zoonotic and soil-borne diseases which do not depend on people for survival and transmission; and (2) chronic diseases able to survive in small human populations because they remain in each individual for long periods.

In contrast, the major epidemic diseases are commonly thought to require urban civilizations for their survival and to require civilized trade and military manoeuvres for their dissemination. One model of the history of such epidemic diseases suggests that, because they kill or immunize each victim, depriving themselves of fuel, any local epidemic in a small and isolated group of people (or groups connected only by speed of foot) would burn out before it could spread very far. Therefore, although mini-epidemics might have occurred in prehistory as the result of local mutations in the structure of common or zoonotic viruses, the modern epidemic or pandemic diseases in widespread, ongoing form must have originated from mutations which occurred after human beings were living in large dense populations with trade networks so that new victims could be recruited as fast as old victims were eliminated. According to this scenario, these are entirely diseases of civilization (Black et al., 1974).

An alternative model suggests that the epidemic diseases could have existed and snaked their way slowly around populations in the prehistoric world with devastating consequences in each location (CIBA, 1977). But even by that model they would have moved faster and wreaked havoc more often, presumably contributing more to overall mortality in later, denser populations, until they reached such high frequency in civilized populations that they returned while survivors of previous epidemics were still numerous and only young children were vulnerable, making their diseases of children who could survive because they were cared for by healthy parents as occurred in recent history.

In prehistoric skeletons, epidemic diseases (except possibly smallpox) are rarely visible by present techniques, although new techniques of DNA analysis are promising (Spigelman and Lemma, 1993; Rafi et al., 1994). But periostitis and osteomyelitis – non-specific signs of infection – almost invariably increase in frequency as group sizes increase, as would be expected from basic epidemiological principles. Even yaws, a chronic disease handed directly from person to person; and therefore considered a disease likely to have plagued human populations throughout our evolutionary history, clearly increases in frequency through time in most regions as a function of group size and aggregation (Cohen and Armelagos, 1984; Cohen, 1989; Larsen, 1995). New skeletal evidence suggests that yaws was present in both the New World and the Old long before Columbus (DuTour et al., 1995). But congenital syphilis, which is identifiable through congenital malformations of teeth, and therefore also presumably venereal syphilis resulting from the same (S) organism as yaws, appears only after Columbus on both sides of the Atlantic; and this disease thus appears to be associated either with his voyage, or with newly emerging civilized social patterns of the sixteenth century (Baker and Armelagos, 1988; DuTour et al., 1995). Similarly, tuberculosis appears in the skeletal record with a clear concentration in late, dense, civilized settlements. Leprosy was once widely considered the 'older' form of mycobacterial infection, predating tuberculosis. But it, too appears in skeletons only in fairly recent (pre-)history.

Historically, cholera, which is not visible in the skeleton and therefore in archaeological evidence, but which does not commonly attack small isolated groups unless they are connected to an urban centre, appears to have been spread around the world by British occupation troops. Bubonic plague (also not visible in the skeleton but known only as a rare zoonosis in
primitive groups) may originally have spread by caravan routes and later certainly spread by shipping. As late as the eighteenth century in France, it was still primarily a plague of major cities and seaports, not of rural communities (Biraben, 1968). As is well known, many diseases spread to the New World by European and African colonization and conquest (Crosby, 1972; McNeill, 1976).

William McNeill (1976) has pointed out that disease has even acted as an agent of inequality. Epidemic diseases which circulated through European civilizations eventually attacking only those children born since the last epidemic, killed all or almost all individuals in ‘virgin soil’ populations without previous exposure. The physical decimation of those populations accompanied by the apparent immunity of Europeans (who had been infected as children) was a powerful demonstration of the superiority of Europeans and their gods and contributed to the collapse of American Indian resistance as well as population. The archaeological record of this episode is now being pursued actively (Verano and Ubelaker, 1992; Cohen et al., 1994; Larsen and Milner, 1994).

The teeth of human skeletons display scars of growth disruption which act as markers of biological stress on the individual during childhood, i.e. when teeth are forming. These indicators are ‘non-specific’ in the sense that they are known to be caused by an array of insults ranging from starvation to severe disease. It is not clear whether or not they refer specifically to famine or epidemics, or even that they have the same cause in different cases (even on the same tooth) or different populations. But their record is one of increase through time in most regions of the world. Neither these nor any other indicator provide any suggestion or indication that individuals came to be in a general way better ‘buffered’ against episodes of stress as they became more civilized (Cohen and Armelagos, 1984; Cohen, 1989; Larsen 1995).

There is some direct evidence suggesting the declining health of satellite communities in prehistory. Teams working with skeletons of ancient Nubians now suggest that nutrition and health fluctuated in response to the changing political climate, and that the quality of life tended to decline when political connections and trade with Egypt were at their most active. Ancient Nubia was apparently one of those satellite regions where trade moved resources from rather than to people in need (Martin et al., 1984). A sequence of declining health associated with agricultural intensification, at the American site of Dickson Mounds in Illinois, was originally interpreted as a function of agricultural intensification but may (also) reflect a sequence of progressive economic exploitation by a nearby major population centre (Goodman et al., 1984).

The most pathology-ridden skeletal population that has been described is not any prehistoric population at all but a free black American population from the state of Arkansas early in the twentieth century (see Ross, 1985). This population may be skewed by the effects of the documented northward migration of young, healthy adults, although there is not much reason historically to think that ‘real’ health and nutrition in the group were particularly good, but it nonetheless calls into question the sense that pathology is most common among ‘primitives’.

Although reconstruction of life expectancy from (undocumented) cemeteries is very difficult (Sattenspiel and Harpending, 1983), the best estimates of prehistoric life expectancies based on such cemeteries, in combination with calculated rates of population growth and the observed fertility and mortality of living hunter–gatherers, suggest that hunter–gatherer groups probably had average life expectancies of about 25–30 years. This is a poor figure by affluent twentieth century standards (see Wilkinson, Chapter 4), but one which compares quite reasonably with figures from Europe as late as the eighteenth and early nineteenth centuries. The figure is better than those from many European urban centres from earlier periods and better, particularly, than recorded figures for lower classes of those cities. It is also conspicuously better than the figures for India, one of the few satellite countries for which good data are available, prior to about 1920.

There is no evidence from either ethnography or from archaeology that primitive populations lost a higher proportion of their infants or their children than populations as late as the nineteenth or even early twentieth centuries. For example, infant mortality rates in many major cities in the USA at the beginning of the twentieth century were worse than the average of the smallest groups. My own collection of available data on living hunter–gatherers and skeletal populations (Cohen 1989: 195–201, 215–22) suggests that infant mortality rates of about 200 per 1000, and child mortality rates (death prior to age 15 including infant mortality) of 400–500 per 1000, are typical of hunter–gatherers. Most of Europe did not improve ‘permanently’ on that until sometime in the nineteenth century, and most of the world did not improve on it until well into the twentieth century.

But what of the record of population growth? Why did the growth of world population accelerate at all after the Neolithic adoption of farming and the rise of civilization, as we normally assume (see Hassan, 1981, for a fairly standard reconstruction)? One interesting new possibility is that it did not. Work by geneticists (Harpending et al., 1993) now suggests that the major increase in prehistoric population occurred much earlier, and that we are underestimating the size of the human population which existed at the dawn of farming. In this case, in keeping with the data
presented here, the real acceleration in growth may have occurred at the
time of efficient and relatively well nourished hunters. But that remains
speculative.

Returning to more traditional perceptions, it is assumed that, after the
Neolithic and through the period of early civilizations, population growth
the average ‘for the species, worldwide) accelerated from near zero to
about 0.1 or 0.15% per year. But, as mentioned above, there is a good deal
of evidence, both from ethnography and from archaeological samples, that
human fertility increased when people became sedentary. Fertility probably
increased again as agriculture intensified and women’s roles changed
(Ember, 1983), and it probably increased again under European coloniza-
tion, as several ethnographers have suggested (e.g. O’Brien, 1994). As
such, it is possible and, given the evidence, probable that population
growth accelerated despite the fact that life expectancy was actually redu-
ced.

In summary, the available evidence from prehistory and from the com-
parison of ‘primitive’ and ‘civilized’ contemporary societies does not sup-
port the image that civilization has brought progress in the form of
improved health. The structural changes inherent in civilization – large
cities, dense populations, complex patterns of economic interdependence
and large scale trade, actually threaten health by introducing new threats
of infectious disease and reducing the probabilities that individuals will
gain varied diets of fresh food. The patterns of economic interdependence may
also increase, rather than reduce, the possibility that some people will get
no food at all. Class stratification, which is also an inherent, defining part
of what we call civilization, exacerbates these problems by further reducing
the economic demand which the poor can exert while simultaneously
allowing the rich to exert disproportionate demand for luxury goods.
Stratification therefore reduces the resources available to the poor far
below the level that world crowding would otherwise create. It also in-
creases population density artificially in some portions of the civilized
(society (‘inner cities”) resulting in crowding and poverty which may reach
such heights that the areas become breeding grounds for infectious disease
which in turn can affect the whole society. The only advantage which
civilization confers for health is its capacity to invest accumulated wealth
to help alleviate some of these problems. We certainly need to invest in
maintain our vigilance against new epidemic diseases. We also have a
moral obligation to invest in the health and nutrition of those whom class
stratification and civilization otherwise harm.

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