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How Humans Domesticated Themselves, Invented Agriculture and Became Civilized

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I. A Systemics of Ancient History

It was Immanuel Wallerstein [1974] who is said to have done it. In his study of economic development, each region was shown to be part of a world-wide systemics, and in this way, a systematic approach was introduced into history. Relatively modern history, that is. The general system shows that division of labor exists between regions, with some regions being deeply dependent upon some others.

Sherratt enthuses and why not? It is so wide-spanning, it is so systemic – but Sherratt finds himself inspired by both Gordon Childe and Wallerstein, “Both of them have made major contributions but both need very major re-writing” [1993a:249, also 250] For ancient Europe, Sherratt [1993b, 1994, 1995, 1997] provides some of the requisite re-writing, but he also states repeatedly that certain approaches, taken by both Childe and Wallerstein, are now out of date. There has been a shift “from economic calculations to a more nuanced concern with how individuals manipulate their positions and symbolize their thoughts.” [Sherratt 1997:vii, viii; also 1-34, 68, 488]

It has recently been proposed that Wallerstein’s work be generalized. Chase-Dunn & Hall [1997:2] wish to modify and expand it to be applicable to any period of history. This would require a systematic approach to time if all of history is to be encompassed. Such a delightful and significant vision! I am enthused, but...Their vision is important, but I disagree with how they execute it (especially ch. 6 of their 1997 book.)

I am motivated by Sherratt [1997:2]: “The movements which broke surface during the 1980s were explicitly concerned with individualism, expression, symbolic structures and contextual relativism with a concern for historical specificity.” Sherratt also asks us “to develop a sensitivity to time and to realize how different things were at successive stages in the past.” [ix].

Inspiring is the vision provided by Chase-Dunn & Hall; engrossing is the reality revealed by Sherratt, one so systemic, the
other so humane. I try to emulate each, while telling my own story and in my own way. I follow Sherratt in providing history, because only the specifics of history can reveal depth. I dare to provide evidence that illustrates our very origins, for I wish to help each of us to begin to envisage.

How We Came to Be the Way We Are.

The Systemics of Technology. In providing a systemics for history, part of my vision is to take advantage of certain systemic properties of technology. (a) Technology is cumulative. (b) Some technological developments inherently evolve out of other such developments. A most notable example of such inter-relationships is shown in Wertime’s [1973] analysis of pyrotechnology which provides a unified treatment for pottery, copper, bronze, glass, iron and steel. (c) Whenever a technology matures, it is apt to spread very far— that is, to become “transferable.” [Kohl 1987:17] The terminology for such a spread was, at one time, “diffusion,” but the term has taken on bad connotations, so Sherratt [1993a:246] would say that when a technology spreads, this involves “continuous innovation” or “chain reactions.”

A major problem with technologies, however, is that they can tend to remain stuck, even to stagnate. [Chernykh 1992:297] This did not happen in the Near East which continued to be, for a long time, a hot spot [Sherratt 1993a:245], that is, continued to make technological advances. A major problem is to explain why it was that the Near East was unique, in the Eastern Hemisphere, in being a spot so hot. The continued advances occurred, I will argue, because trade networks came into existence, and these permitted promotion of novelty, that is, they rewarded innovation. (See Section III below.)

In a normal situation, Chernykh [1992:297] tells us, stagnation is interspersed with occasional energetic explosions. The story that I am reconstructing reports two such explosions, each for rather different reasons.

Technologies and major developments in civilized history. Let me tersely sketch the significance of a technological approach in the analysis of important junction points in ancient history. For the Eastern Hemisphere, the origin and major developments of the civilizations can be explained by focusing upon three technologies:
(1) the consolidation and spread of agriculture, (2) domestication of the horse coupled to fast chariots, (3) the spread of the technology of iron.

**Date BC Technologies and Their Impacts**

- **8500**: A cluster of domesticated crops and animals.
- **7000**: Spread to the Balkans, and east to Pakistan.
- **3500**: A sudden increase in wide-spanning interdependence.
- **3100**: Civilizations in Mesopotamia and Egypt.
- **1650**: Chariots first used in warfare in civilized world.
- **1200**: Check-mate in Near East. End of the Bronze Age.
- **1200**: Shang form Chinese Civilization, with chariots.
- **700**: Iron becomes mass-produced from sea to sea.
- **zero**: Empires extend from the Mediterranean to the Pacific.

Each of these technologies accounts for one of the great periods in ancient Eastern Hemisphere history: (1) the origins of the civilizations of Mesopotamia and Egypt, (2) the end of the Bronze Age, and (3) the formation of the early great empires.

Not directly did technologies create historical change. Conditions were created, and social dynamics accomplished the rest. But it was changes in technologies that established the conditions such that humans could make their monumental achievements. (It might seem odd to refer to the beginning of the Iron Age, 1200 BC, as an achievement since it began as a Dark Age. But it was, in fact, a considerable achievement.)

I will cover only the first part of this history – the developments in agriculture, its spread, the complex developments in many places in 3500 BC, and the ensuing rise of civilizations in Mesopotamia and Egypt. That is quite enough for one paper. Furthermore, that period of history has a certain cohesion because, as will be shown, it can be based upon a specific mechanism – the formation of trade networks – that permitted promotion of novelty, growth of technology.

A consideration of chariot warfare, or of the spread and impact of iron, would introduce entirely different mechanisms, and the story becomes considerably more complex. These are stories that I hope to tell sometime in the future.
But part of my aim is to establish origins, so I will begin rather far back in time, to a period that is a distant precursor. Let us turn our attention to Cro-Magnon hominids and their competition with Neanderthals.

II. Who Are We?

Neanderthals we are not. Not even a bit, apparently. DNA, recently taken from a fossil, implies that genes of Neanderthals do not survive in living people. [Krings et al 1997; Bichakjian 1997, 1998] Neanderthals were out-competed by Cro-Magnons, a group that arrived in Europe, apparently from Africa, around 40,000 years ago. Clive Gamble has written three books [Gamble 1986; 1994; Stringer & Gamble 1993] probing the advantages that Cro-Magnons had. The difference was only partly in anatomy and brain structure. The advantages, he keeps emphasizing, were mainly in the society and culture of Cro-Magnons.

According to Stringer & Gamble, Neanderthals stayed home, minding their own business, and this placed them at the mercy of the environment. They “were probably extinct by 30,000 years ago.” [1993:195] Cro-Magnons were able to transcend the difficulties posed by weather, severe in Europe at the time, by creating “social networks – alliances between relatives, trading partners, friends. These alliances act as ‘insurance policies’ in habitats (such as today’s Arctic) where the only certainty is that resources will sometimes fail.” [1993:210] Where have the big animals gone? What new opportunities are there? It would be helpful if people far away would answer such questions. People in areas of high risk – the Arctic; the Australian deserts – used to depend for their very survival on such shared information.

Cro-Magnons created the needed social networks by producing elaborate, standardized jewelry. [White 1989; 1993] “The raw materials used to make ornaments and other items of dress and display travelled the greatest distances.” [Stringer & Gamble:208] That is the point! Some people had to have traveled far, because it was important to them to exchange raw materials (such as fancy stones and seashells) which were used to make objects of display. They traded trinkets that would be truly treasured. In the exchange, each person acquired materials exotic in his region that provided prestige, and the trader could show that he had seen the world, or at
least, some distant parts of it.

The ornaments conformed to accepted styles: "the early Upper Palaeolithic in Europe was marked by regional styles, such as the small groups of animal and anthropomorphic carvings from southern Germany. As the climate begins the long drop to its nadir at 18,000 years ago, however, we find the first pan-continental art-style: the so-called Venus figurines." [Stringer & Gamble:209]

"We believe it is no coincidence that the figurines appeared in central and eastern Europe at a time when climates were deteriorating and food resources dwindling, as the ice sheets expanded towards their maximum extent. For without the social alliances which such objects symbolize, these areas would have been unoccupied during the period 23,000-21,000 years ago." [Stringer & Gamble:211] The location of figurines is shown in Gamble 1982:96.

In the competition between Cro-Magnons and Neanderthals, our nature was revealed, and apparently consolidated in large part. Cro-Magnons were more advanced technologically and socially. They created social networks over large geographical areas, and they did this by considerable travel, acquiring exotic goods that provided prestige while building distant relationships that could be relied upon during emergencies. The statement, "Look what I brought back from where I’ve been!" is apparently as old as Cro-Magnon humans.

It is rather sad that archaeological analyses so frequently treat people as if they were like Neanderthals, merely responding to the environment. It is common to minimize the possibility of distant travel and the importance of luxury goods in providing prestige, the very things that were important to Cro-Magnons. But Neanderthals they were not! Cro-Magnons out-survived Neanderthals, and their genes have been living in their successors ever since.

Cro-Magnons went forth bravely, and so will I, by assuming that ancient people moved, just as far as the evidence permits. I will assume three things motivated ancient peoples: a concern for safety in the face of variable weather; a desire to show off, to be the top dog; and finally, an intrigue with novelty and beauty. New foods to feast on, gems and jewels and stylish jerkins, these are such that make life interesting. Such possibilities might entice one to produce more, to innovate.
This is the argument by which Sherratt [1997:6] would have us escape the Malthusian trap. Focus analysis not on production and its constraints, but upon consumption and desires.

A very recent paper, this past November, introduces a fundamental elaboration in historical awareness that depends upon three kinds of evidence.

(1) The paper is McBrearty & Brooks [2000] which reconstructs hominid evolution in Africa sufficiently well that it becomes clear that human nature derived more from events in Africa than they did from the Cro-Magnon experience in Europe. In particular, the long range trade, so touted by Gamble, had begun in a preliminary way in Africa earlier than 100,000 years ago. African archaeology shows regional differentiation in tools that indicates wide-ranging shared communication within regions.

(2) Then 71,000 years ago, these promising developments were struck by a monumental catastrophe, the largest volcanic eruption of the last few hundred thousand years. It was the eruption of Toba, a volcano in Indonesia, which provided a “volcanic winter” for a surprising six years, and from weather feedback, was followed by 1000 years of severe glaciation [Ambrose 1998]. Two volcanologists, studying various kinds of evidence, posit that much tropical vegetation would have been affected disastrously. [Rampino & Self 2000; 1993a; 1993b] Probably most hominids in Africa would not have survived.

(3) Turning to information on human genetics is like fitting in the last pieces of a jigsaw puzzle. It is like putting a key into a key hole and turning it. There is a sudden fit. Harpending et al [1993] report that when data are collected from many living individuals and “are compared, the information from various people is so strikingly similar that it is clear that all living people can trace their ancestry back to a single population that went through an extreme bottleneck. The population sharply reduced, and quite a long time later, re-expanded.”

This, of course, is what happened in Africa because of Toba, and this implies that when the African population expanded, the people moved out of Africa and replaced any other hominids that they encountered. We have already seen that that is what happened in Europe, that Cro-Magnons replaced Neanderthals. The available genetic evidence insists that such a replacement occurred.
The African population would have been sharply selected and deeply affected. When population recovered in Africa, people were for the first time wearing beads [McBrearty & Brooks 2000], which is the beginning of individual status, meaning greater social structure within the group. This was carried into Europe where Cro-Magnons, possessing a tropical-type body, used elaborate jewelry made of materials exotic to the region.

The implicit theories. Some steps in biological evolution. A formative social experience. These are what have been discussed. The theories behind them are not that familiar. The theory of biological evolution has been with us for so long, and yet its perspective is so perverse, so unexpected. When something is selected, for whatever reason, then it immediately becomes an entirely new beginning. It is not averages, but the occasional, unusual events, a selection from it, a redefinition of the situation, that is the mainstay of biological evolution. [Noble1998] Thus, Dawkins [1997] can liken the path of evolution to climbing, slowly, step by step, a Mount Improbable. While each step may be improbable, if it did happen, then selection takes over, and each step becomes successively the new norm.

Part of the reason we are the way we are is because we were selected biologically. And under climatic condition not at all like what we are used to. That awful many-yeared “volcanic winter” in Africa, living up against the glacier in Europe during the last severe glaciation of 18,000 years ago, these were selective experiences.

The Cro-Magnon’s abilities in communication, to use symbols, may have been untypical of hominids. But these abilities were important. Driven by ever harsher weather, there occurred an experience of sharing symbols – the figurines – with other people over a large geographical region. It was this sharing that gave humans the ability to survive in such extreme circumstances.

The surviving hominids were unusually involved with symbolism, with mobility, with the ability of these to establish contacts over much of Europe. Soffer [1985] shows that this experience was retained, that some people continued to establish contacts with distant people after the weather improved. This experience of Cro-Magnons, their ability to create shared symbols, will be part of the
continuing story.

III. Promotional Networks: The Basis of an Evolving System

So the glaciers went away. Some people spread far and wide. Then what happened? There emerged a “hot spot” – a region where technology continued to evolve very quickly. This did not come into being in Europe, where Cro-Magnon competence was visible. The major hot spot, after the glaciers subsided, was in the Near East. [Sherratt 1993:245] How come? The answers are ecological and cultural. Ecological: the Near East had propinquity of variety: different environmental zones that were rather near one another [Redman 1978:49]. Cultural: trade networks developed. Because they can be so supportive of innovation, it was the creation and continuation of trade networks that made the Near East the hottest spot around.

Agriculture was beginning to appear in the Near East. Or can we really call it agriculture? Does the word “farming” fit the “combination of cereal cultivation and gazelle-hunting practiced by the early inhabitants of Jericho?” (8th millennium) [Sherratt 1997:156] Or Catalhoyuk, (this is the new spelling of this village) 7th millennium, which had wall paintings showing wild cattle being captured. [Sherratt 1997:254] What all the early sites did possess “are abundant supplies of localized surface – or ground – water”. [1997:87] Hunting wild animals, seeds tossed onto wet ground, is that really “farming?”

According to Runnels and van Andel [1988], trade existed earlier than agriculture, and it was trade that provided “incentives for experimentation with domesticates.” Agriculture had no definable origin. The word is too slippery, it means too many things. Humans had long known enough to spread seeds, eliminate weeds, burn off reeds. They had long made pets of tameable infant animals. “Agriculture was practiced initially because it provided some communities in appropriate environments with storable and portable commodities suitable for conversion into wealth by trade through an already ancient exchange network for goods available elsewhere.” [Runnels & van Andel 1988:85]

Resources unevenly distributed; mobility and a willingness to trade; uncertain weather, with some locations having easy access to storable food; ancient exchange networks, revitalized; that’s how it began. There is no need to posit population pressure, and it’s a
good thing because “There is little to indicate that, in the late 7th and 6th millennium BC, population density in the Near East was even remotely large enough to cause food stress.” [Runnels & van Andel 1988:96]

**The core area of the origin of agriculture.** It has recently been shown [Lev-Yadun et al: 2000] that domesticated agriculture first developed in a small area in the upper reaches of the Tigris and Euphrates rivers, and dates to 7500 BC. (This is a non-calibrated date, so it is approximately 8,500 BC in real time.) This is a region where all eight founder crops are found, and the wild progenitors in this region match the crops now domesticated. The authors suggest that in this region, “Competition within these communities for social status may have intensified plant domestication and crop production and encouraged the accumulation of surplus food” [p. 1603]. This region of rich villages also contained Cayonu which is the earliest site known to produce copper jewelry from virgin copper. [Muhly 1988:5, 6] The dates given are 7250-6750 BC (again uncalibrated).

It has already been mentioned that in his study of metallurgy, Chernykh [1992:297] says that the normal mode for technologies is to change little, even to stagnate. People are apt to resist any change in the way they make a living, the way they produce. There is less resistance to changing what is consumed. If novel goods show up, some people at least, are apt to try them. The society may frown, the daring ones may be said to be showing off. But if the new goods are effective are interesting to eat, are beautiful to view, they may finally become the new norm.

Also there are a few individuals who are willing to produce new things, to innovate, to explore what is around them. But try taking these new items to their neighbors. It is a bummer. Everybody’s smelt the pitch that makes incense, noticed the wool on some sheep, eaten the olives on some trees. So what will be the response? The best place to promote the local goods - a new smell, a new gemstone - is far away where the novelty makes them exotic. Successful promotion of new products will generally require going the distance, traveling to somewhere unfamiliar. It is through travel that support is most apt to be found for something new.

Repetitive travel is what I mean by a network. The most simple kind of network is where an individual travels repeatedly to
another place where the people know him. That is what early Cro-Magnons did when they moved considerable distances in order to obtain exotic materials for jewelry. But in this case, one's potential market consists of only one other site.

A better situation, providing more opportunities, is for a set of villages to be linked such that the inhabitants trust one another. Then a promoter can go to any one of them to show off his novelties. Notice that this requires that very thing - a widespread sharing of symbolism – that was first created by Cro-Magnons when they shared figurines during the depth of the last severe glaciation. I cannot connect these events, but the latter development may well have been connected to the former.

One of the ways for a network to form, a network that includes many villages, is for it to be formed by one dominant village. Each of the others need only have a trusting relationship with this one village. Such a village must be located near points of natural mobility, and there will be an advantage for the village that possesses ground-water with which it produces storable agricultural goods. Such sites did appear in the Near East. The best known are Jericho (eighth millennium) and later, Catalhoyuk. These villages were in position to maintain contact with a large nearby region, and to accumulate all the interesting innovations that occur in it. This meant that they provided an incentive for anyone producing better pottery, doing early metallurgy, locating and domesticating new crops.

So a dynamic situation arose. New villages were forming, based upon the wealth that agriculture made possible. Trade networks were expanding, providing ever new places in which an innovator could promote novelties. Everything seemed to be progressing perfectly, the entire system of villages was in energetic expansion, and just because of this.

IV. Dramatic Widening of the Network

It went to pieces, it exploded, it grew too much, it blew apart! What happened?

The facts are the following. Zohary & Hopf report 12 sites with agriculture by 7000 BC, and they are all located in the Fertile Crescent. One thousand years later, that is, by 6000 BC there are 20 additional sites with agriculture, and while a few of the additional
sites are in the Fertile Crescent, most of them are far away, and some are very far away – as far east as Mehrgarhin Pakistan and as far northwest as Starcevo in Serbia and west to Sicily. (See the map, pp. 232, 233 in Zohary & Hopf 1993. They use uncalibrated radiocarbon dates. The actual dates, when calibrated against tree-ring data, are about 1000 years earlier.)

Some Definitions
Fertile Crescent: a region of rain-fed upland in what is now Israel, Palestine, Syria, Iraq, and western Iran. This is where the earliest agriculture in the Near East has been found.

Early domesticated crops: emmer wheat, einkorn wheat, barley, lentil, pea, flax. More rarely, bitter vetch and chick pea.
All of these are self-pollinating and can be stored.

Early domesticated animals: sheep, goats, cattle.

In short, the domestication of agriculture succeeded too well. People were able to, and did just move away, sometimes far away, taking with them their domesticated seeds, and generally driving domesticated animals. Mehrgarh is over 2000 kilometers (1.3 thousand miles) to the east of the Fertile Crescent, and Starcevo and Sicily are about equally far to the west.

What happened is something like what happened at the end of the glaciation, when people in Europe just dispersed in many directions. The glaciers ended, the animals spread out, and people followed them. And the culture of Cro-Magnons slowed and finally stopped altogether. This time, with the expansion of agriculture, the central sites continued, and presumably their trade networks continued. The difficulty is not with the situation, but is with our terminology. Certainly there was no single trade network that encompassed such great distances.

Did People Move Away? I say, “yes, people did move, taking their domesticated crops with them.” Is it possible, instead, that all that moved was the idea of farming? Did people, hearing of it, say, “I can do that!” and then proceed to domesticate the wild plants
around them? I say, “No, that is not what happened.” Blumler and Zohary and Cavalli-Sforza and Schmandt-Besserat give me reasons for saying that it was real live people that moved, taking with them real live crops. The following are reasons for saying that.

1) **Emmer wheat.** The starkest evidence comes from one single crop. “Cultivated emmer wheat appears to be the most important Neolithic crop all over south-west Asia, Europe, and Egypt” and its wild progenitor is confined to the Fertile Crescent. [Zohary & Hopf 1993:229 & 41] A person cannot create a plant that is genetically emmer wheat by having heard of the properties of this kind of wheat.

2) **Monophyletic founder crops.** It has been determined which plants, now wild, are the progenitors of the eight neolithic founder crops. [Zohary 1996] There are a considerable numbers of ways in which the variability of plants can be measured. For each of the ways that this has been done, the wild plants are invariably found to represent many distinct kinds, whereas the domesticated plants represent a single kind (or in one case, two kinds). Often the variation in kinds is so subtle that only recent techniques have revealed the variation.

The domesticated plant would not be a single kind if the plant had been domesticated over and over again [Zohary 1996; Blumler 1992]. The available evidence suggests that each type of plant (except barley) was probably domesticated only once, that it underwent a genetic change giving it better qualities and was not domesticated again. Zohary concludes, “soon after the first non-shattering and easily germinating cereals, pulses and flax appeared, their superior performance under cultivation became decisive, and there was no need for repeated domestication of the wild progenitors.” [1996:156]

For barley, however, there is clear genetic evidence that the transition from wild-type brittle ears to non-brittle ones apparently occurred twice. [Zohary 1996:154, 155]

3) **Population Movement.** Cavalli-Sforza, working with others [Ammerman & Cavalli-Sforza 1984; Cavalli-Sforza et al 1993; 1994], has analyzed both the rate of movement of agriculture from Turkey into various parts of Europe, and various genetic traits of the present-day populations of Europe.

What they are attempting to establish is whether agriculture
moved into Europe as an idea, taken up by the existing population, or was carried into Europe by a set of Near Eastern farmers. Their data suggests that some of each happened. The populations in Europe that are closest to Turkey have the greatest amount of genes found in Turkey, and the genetic effect becomes weaker and weaker as one moves further away from Turkey. These studies interpret this to mean that a population moved into Europe, taking its domesticated plants along. This population successively bred with some of the local populations, picking up more and more genes as it moved deeper into Europe.

Sherratt’s archaeological data [1997: ch. 6] suggests a comparable genetic impact, but a somewhat different scenario. When agriculture first moved into Europe, it went to very selective locations where there was ground-water, and it involved no clearing of forests. In such a situation, the new farmers and the existing hunter-gatherers could afford to ignore one another. However, around 3500 BC, traction (the use of oxen to pull plows and wagons) began to spread into the regions where agriculture had previously progressed. Using the plow, it was possible to use more forms of land, and land clearing became commonplace. At that point, the two populations had to confront one another, and interbreeding occurred.

There is no comparable genetic data to the east of the Fertile Crescent. However, in this direction, clay tokens provide very important evidence.

4) Clay tokens as administrative tools. Schmandt-Besserat [1992] noticed that some archaeological reports referred to small clay objects, so she decided to record as many of these as she could. She found that they were found in most sites in the Fertile Crescent and in sites to the northeast and east of there. [1992:33, map] They are found in only a few sites in eastern Turkey [1992:35], and are not found in Europe nor in Egypt. They occur as early as 8000 to 7500 BC [1992:36], before domesticated crops are found but as early as storage of wild wheat is occurring. The clay tokens are found as far away as the Caucuses and also in Mehrgarh [1992:36] in today’s Pakistan.

The tokens consist of a few distinct shapes and she came to conclude that they were used in administration, which is why she calls them tokens. They were made of clay and had been hardened in campfires, later ovens and kilns. What were they used for? They
were used “to count products of the farm, such as animals and measures of cereals;” and also units of work. [1992:197] They appear to be the surviving form of some method of management.

In the words of Schmandt-Besserat: “Political power, which relied upon the control of real goods, depended upon counting and accounting...The fact that tokens wielded power is illustrated by counters found in the tombs of prestigious individuals. These artifacts suggest that tokens were status symbols and that counting was the privilege of the elite.” [1992:197]

The shape of the tokens “remained remarkably the same for five thousand years. Wherever they were adopted, the tokens preserved the same character: regional variations are practically unknown.” [1992:195] This is an indication that, whatever their role, it was an important one. People would not have created strikingly similar objects merely by being told of them. Someone must have carried tokens from where they first appeared, in the Fertile Crescent, to the many other sites where they have been found. Whoever carried them was presumably trained in their proper use. They document a comparable social practice being practiced over a wide geographical area.

For all these reasons, I conclude that each type of plant (except barley) was probably domesticated only once, and barley was probably domesticated only twice. These domesticates appeared first in the Fertile Crescent, and later the seeds of their progeny were carried far away. In fact, we today eat the progeny of these very crops that were domesticated by 7000 BC. And it is the progeny of these same crops that eventually spread north as far as possible in Europe [Zohary & Hopf 1993], and that have since spread to many other parts of the world.

For animals, molecular studies reveal a more complex story. Humped zebu cattle were a separate domestication, and are known in the earliest level at Mehrgarh. [Meadow:403] Another kind of cattle, as well as pigs and sheep have produced similar diversity, suggesting that “the earliest herders were not confined to the Near East.” [Loftus et al 1999, with references] This is not surprising. Some time ago, Mellaart [1975] indicated that during the time of origins, domestication and herding of animals occurred separately from domestication of crops and may have occurred separately in different places. There is now appearing some evidence
The new situation: a potential for trade. The sites with agriculture are so far apart that their inhabitants can no longer easily reach one another. However, the possibility of innovating has increased, not decreased, because innovation depends mainly on what is nearby. The spread has brought farmers to a very much wider set of niches, and while there is no encompassing trade network, there is the potential for trade over the entire domain of villages. After all, the people once knew and trusted one another. That has not gone away. All that has been lost is the ease of reaching one another.

These are some examples of what were found:

- New domesticated animals (donkey, camel, horse) and plants (grape, olive).
- New stones now referred to as semi-precious (turquoise, carnelian).
- New locations could cause change in existing plants and animals (e.g., emmer wheat picked up a gene in the wild and became bread wheat; the sheep surviving in some climates had sufficient wool to be worth shearing.)
- New locations provided new opportunities for people who were sufficiently observant. As Sherratt [1997:9] illustrates, “innovations were thus propagated around the network, so that at Nahal Mishmar in Israel there is evidence for olives, dates and wool by 4000 BC.”

The most interesting region – for which there is a puzzling question – are the several sites on the northern border of the distant east: Mehgarh in Pakistan and Djeitun and Altyk Tepe in southern Turkmenistan. These latter two sites are on the southern side of the Kara Rum desert, across which are outcrops of turquoise. Mehgarh is located near sources of lapis lazuli and carnelian. In the earliest layer at Mehgarh, by 6000 BC, are found beads of turquoise, lapis lazuli, and copper. [Jarrige & Meadow 1980:128] Very soon after that, the unusual funnery site of Tell es-Sawwan, back on the Tigris River, has “a few hammered copper objects” [Oates & Oates 1976:106] as well as graves containing turquoise and carnelian beads. [El-Wailly & Abu es-Soof 1965: 25, 26]

These sites – Mehgarh, Djeitun, Altyk Tepe – all used clay tokens. Did they know where they were headed before they took off
with a collection of domesticated crops? Did the example of the monopolizing of obsidian by Catalhoyuk suggest to them that they should move to whether other resources could be monopolized? This raises the question of how well information was dispersed in the Near East as early as 7000 BC. I have no evidence. I am merely suspicious that information on gemstones might have been quite widely dispersed at that early a date. After all, of the people living then, we are certain that Neanderthals they were not!

The logic of a trade network continues to apply, but it is now on a scale much more grand. It continued to be natural for traders to favor relationships with those who continued to be able to grow food even during droughts. Contacts with such a location would provide somewhere to go and survive while others were starving. But by now, this meant making contact with the emerging cities in Mesopotamia with their extensive graineries. We are now talking about major rivers, the Tigris and the Euphrates. Instead of a village, such as Catalhoyuk, we are now talking about the emerging urbanization at the mouth of these large rivers.

There are clear signs of competition for resources. After all, as densities increase, so does the significance of status, and at that time, as often continues to be, this depended significantly on having jewelry and other symbols of power.

V. Intensification of the Interdependence

And then, a large part of this region was converted into an actual trade network, an immense one that extended over a thousand miles, from Iraq and Egypt as far east as Mehrgarh in Pakistan. What was required, apparently, was some positive action at the center, which occurred with what is called the Uruk Expansion. This story can be pieced together from separate reports from different locations. Since that is how the story appears in print, that is how I will tell it.

1) The precursor. As early as 4400 BC, the sanctuary of Eanna began to manufacture some goods, probably wool cloth and clothing, and by 3500 BC it was exporting these in considerable quantity.

Evidence: a new type of clay token appeared around 4400 BC and reached a climax of use by 3500 BC. These new tokens are called “complex tokens” and first appear in the sanctuary of Eanna,
and spread in parallel with the “entire bureaucratic paraphernalia typical of Eanna.” [Schmandt-Besserat 1992:92]

“Complex tokens kept track of industrial products famous in Mesopotamia such as textiles and garments; luxury goods such as perfume, metal, and jewelry; manufactured goods such as bread, oil, or trussed ducks.” Complex tokens appear in cities in southern Iraq, and in some locations where Uruk spread its influence. “The geographic distribution of complex tokens in strategic administrative centers outlines the area controlled by the southern Mesopotamian bureaucracy.” [1992:197, 198]

Regarding wool, Sherratt [1997:224] points out that in the Kermanshah region of western Iran, in the fifth millennium BC, “the sheep were now kept to a greater age, and it is likely that wool was being extensively used for the first time.” This is approximately the time that the sanctuary of Eanna began producing complex tokens.

2) Daily Rations. In Uruk, there developed a means of feeding some of the population who were employed in work for the establishments. This included the production of products manufactured from agricultural produce.

Evidence: in Mesopotamia, around 3500 BC, ceramic bowls first appear that are unesthetic but useable. “The capacity of one of these vessels corresponds almost exactly to what we know to have been a laborer’s daily ration. In addition, the symbol for ‘to eat’ in the most ancient texts is made up of the pictorial reproduction of a human head and a bowl that has the same shape as the ‘bevel-rimmed bowl.’” [Nissen 1988:84, 85] The large quantity of such bowls is viewed as an indication of the large number of people working for the temple complex. (Nissen’s interpretation differs from Schmandt-Besserat [1992:180] who regards them as being used to pay taxes, that is, for presentation to the gods. Algaze finds them at all the many distant locations governed by Uruk in its expansion, which is more compatible with Nissen’s interpretation that they were used by the temple to feed their laborers.

3) Colonizers. Some people from Uruk, in connection with the sanctuary of Eanna, moved far out along the trade routes. They developed enclaves that used Uruk’s iconography, and presumably they traded with local people, and their location to acquire the exotic materials that were available, directing them back to Uruk.
Evidence: Uruk took control of Susiana (in western Iran today) which can be reached in about a week to ten days from southern Iraq. [Wright 1981:264] It set up enclaves, stations and outposts in other regions [Algaze 1993] which often could be reached only after one or more months of travel. [Hallo 1964] This was to ensure control of goods coming from much further away.

4) Widespread Impact. The impact can be seen quite widely. Sherratt notes “a very widespread horizon of change across prehistoric Europe in 3500 BC, coincident more or less with the onset of urbanization in Late Uruk Mesopotamia.” [1997:496] He refers to this as the secondary products complex. “Its most tangible characteristic was its association with the first evidence for the plough and wheeled vehicles, but this was quickly followed by the first evidence for wool and the spread of the domesticated horse beyond the steppes. Innovations in animal husbandry were paralleled by changes in plant husbandry, such as the domestication of tree-crops.” [1997:496, 497]

5) Far-off Baluchistan. The impact is visible as far away as Baluchistan which is the mountainous, arid region of western Asia that includes part of south-east Iran, some of Afghanistan and western Pakistan.

Evidence: “At the end of the 4th millennium, a very important change could be noticed in Baluchistan including stamp seals, human figurines, elaborate architecture, and semi-precious stones such as lapis lazuli and turquoise suggesting the beginnings of long distance trade” [Jarrige 1979:93, 94].

6) New precious materials. It was from these events that Mesopotamia acquired two new exotic materials: lapis lazuli and gold.

Evidence. In Mesopotamia, in the period 5000 to 3500 BC, little metal is found. Starting around 3500 BC, “The quantity of both precious and base metals available had sharply increased.” [Moorey 1988:29, 30] Where formerly there had only been objects of copper, turquoise, and carnelian, now gold and lapis lazuli appear “fairly suddenly in the Uruk period.” [Algaze 1993:77] Lapis lazuli had been used to make jewelry in far-off Mehrgarh much earlier. It was only in 3500 BC that it began to appear in Mesopotamia and, as will be seen below, in Egypt.

I think we can say that by 3500 BC, Uruk (Mesopotamia)
and other regions were in interaction with one another. Where before there had been sporadic impacts, by 3500 BC a full-fledged trade network had formed, which also resulted in the cultural influences that generally accompany a trade network. Uruk had taken on the central role of organizing this, and incidentally, then saw to it that exotic materials (such as lapis lazuli) did not get to the regions upstream. As the Mesopotamian civilization evolved, eventually to have writing, these developments also did not spread upstream. Uruk had taken hold, had expanded its influence, and was monopolizing the goods that provided prestige.

The story is far from complete. There are loose ends, such as: where did the gold come from? What is the role of Egypt in all of this? Apparently these two questions are closely related.

VI. The Special Case of Egypt

The Gerzean period in Egypt is dated around 3500 to 3100 BC. [Trigger 1983:6] In the periods preceding it, "the villages of Upper Egypt probably had largely self-sufficient economies. By contrast, the Gerzean period appears to have been one of rapid change, marked by abundant evidence of contacts with south-western Asia and the evolution of complex social and economic institutions. For the first time, there is positive evidence of south-west Asian influences in Upper Egypt." [Trigger 1983: 32]

"Within the Gerzean culture, there is evidence of increasing craft specialization and wider markets." [33] "Copper artifacts become much more common during the Gerzean and at the beginning of the Early Dynastic Period" [33]. "There was also a marked development in other crafts." [34] "Increasing social stratification can be traced in the varied size and design of Gerzean tombs and in grave-goods being put into them." [36]

At the time that lapis lazuli was reaching Mesopotamia (3500 BC), it was also reaching Egypt. [Payne 1968] That is when a type of boat is pictured on Egyptian pottery and on rock art, near the site where the Red Sea is nearest to the emerging capital of Egypt and its gold mines. [Noble 1995a:72, 73]
Comparable Dates for Mesopotamia and Egypt

<table>
<thead>
<tr>
<th>Date BC</th>
<th>Mesopotamia</th>
<th>Egypt</th>
</tr>
</thead>
<tbody>
<tr>
<td>4400</td>
<td>Earliest complex tokens in the sanctuary of Eanna.</td>
<td>Self-contained economy.</td>
</tr>
<tr>
<td>3500</td>
<td>Tokens reach their peak. Susa invaded.</td>
<td>First positive evidence of Asian influences.</td>
</tr>
<tr>
<td>3100</td>
<td>Jamdet Nasr: civilization.</td>
<td>First Pharaoh.</td>
</tr>
<tr>
<td>2500</td>
<td>First writing of ordinary speech.</td>
<td></td>
</tr>
</tbody>
</table>

"In the late Gerzean period, some of the Mesopotamian-style cylinder seals found in Egypt appear to be actual imports from Mesopotamia. In addition, a selection of Mesopotamian (and in some cases more particularly Susian) artistic motifs was adopted at this period. While these motifs did not outlast the early "years of the First Dynasty, their influence on the elite artistic production of the transitional period appears to have been quite far reaching and suggests intensive contact with Mesopotamia. The niched brick architecture of tombs and other buildings that appears suddenly at the beginning of the First Dynasty was also probably derived from south-western Asia." [Trigger 1983:36, 37]

Trigger has a conjecture that the contacts arose because Egypt had gold mines. "Perhaps beginning early in the Gerzean period, knowledge of the mineral wealth of the eastern desert induced traders from south-western Asia to establish trading relations with Upper Egypt, in order to obtain gold and other valued minerals." [39] This may have led to a response within Egypt. "Efforts to control this trade and to exploit the eastern desert more effectively may have been important factors encouraging the development of greater centralized control and leading to the emergence of small states at key locations in southern Egypt." [39, 40]

Whatever the reason, it is clear that the trade system that formed, stretching as far as to Mehrgarh and resulting in the consolidation to civilization in Mesopotamia, had the wider effect of including Egypt in the same trading system. This is the period when influences of south-west Asian influences upon Egypt are strong, and it is the period when lapis lazuli, coming from far to the east,
began reaching Egypt. Since Egypt had gold mines, and during this period, Mesopotamia first began using gold and lapis lazuli as featured exotics, it is very likely that all of this is one single story. We may not know the precise details of the story, but some form of connected story is apt to be involved.

In 3100 BC, at the point when Mesopotamia began to write, the Egyptians found that they had achieved being equally civilized, and they sharply reduced their contacts with Mesopotamia. They gave up some patterns, internalized others, and began writing themselves, not using the Mesopotamia script but using a script of their own. Their independence is further indicated by the fact that they had a single ruler: the first Pharaoh.

The early writing in Mesopotamia and Egypt was rather tentative. The Mesopotamians wrote accounts. The Egyptians used writing mainly on royal inscriptions. It was many hundreds of years later, by 2500 BC, that each system evolved to the stage where it could handily handle any spoken word. At that time, each writing tradition became able to represent ordinary speech and began recording older literary traditions. Such a fundamental simultaneity suggests that Mesopotamia and Egypt continued to influence each other, but rather distant. It was not until each of them was overwhelmed by foreigners driving horse-drawn chariots – Egypt by the Hyksos, Mesopotamia by the Kassites – that these two great civilizations began to have frequent and continuous contact at the political level.

A mini-review. The story begins with the sanctuary of Eannain Uruk which in 4400 BC introduced a new type of clay token – complex tokens – which were used to administer manufacturing. By 3500 BC, there was significant trade with outsiders, a response to the export of something, quite possibly, wool clothing. Further, Uruk invaded nearby Susa, and began to establish enclaves in other regions, presumably to control trade. Between the two, the increased flow of raw materials and the increased control of them, Uruk became flooded with prestige goods - old ones as well as new ones such as lapis lazuli and gold. Apparently Egypt provided the gold, and this contact with outsiders provided the spark that vitalized the Egyptian economy. [Trigger 1983] What resulted were two river systems with rulers, administrators, writing, artisans, and with resources sufficient to build monumental architecture, which they proceeded to do. Civilization had arrived, not once, but twice. Simultaneously, but not accidentally so, since the two regions had
been in active interaction before they jointly became civilized.

VII. Alternative Languages as a Form of Review

As a review of this paper, let us appraise it from the point of view of other languages. This might provide criticism of the paper, and that would be useful. It would place the paper in other contexts. It would introduce an external perspective.

The technology of early domesticated crops. In a sense, my paper is a history of a technology, in particular, the domestication of plants. How well is the history of agriculture discussed? A major source, Zohary & Hopf [1993], is organized by type of crop: cereals, pulses, oil and fiber crops, fruit trees, and vegetables. It has recently been argued [Lev-Yadun et al 2000] that the eight founder crops were all domesticated in one small region in a brief period. These eight founder crops include all the major cereals and pulses, and one major oil crop, flax. The other oil and fiber crops come from scattered regions.

These founder crops are all self-pollinating – whichever plants were selected is what one got. Of course! But no, that is not what happens when there is cross-pollination. In such cases, to keep pure strains, one must avoid using seeds, because they are apt to carry aberrant genes. For some fruit, this can be solved by using cuttings (grape, figs), but Zohary & Hopf think that fruit from 4000 BC came from wild trees, that domestication did not occur until after the time of the earliest civilizations. Other fruit trees require grafting, which was learned much later. So apple, pear, plum, cherry were domesticated well after the time of this paper. Vegetables do not survive well archaeologically, so the data on them are quite unreliable.

Wallerstein's Language. A very different perspective, in a very different language, is provided by Wallerstein [1990], who reviews what has been accomplished by then, with a view towards future analyses. The accomplishments he mentions are the following. (1) The "unit of analysis" is a world-system. (2) Hence his insistence upon historical systems, where a system has a beginning, a life, and an end. (3) The world-system that we live in today is a capitalist world-economy, which first appeared perhaps in the 16th Century.

I have followed the first proposal and obtained the unexpected result that a system wide enough to be called a world-system
appeared with the dispersion of agriculture, long before there were any civilizations. Using Wallerstein’s concept of history as being a succession of world-systems, then the Cro-Magnon period was a world-system; the domestication of crops established a new world-system; and another world-system came into being with the origin of the two civilizations in Mesopotamia and Egypt. Schneider [1977] is correct, however. It is a world-system where the dominant kind of exchange was in luxury goods such as lapis lazuli and brightly colored wool clothing. Sherratt keeps emphasizing that the dynamic of history was the consumption of novelties by elites.

Wallerstein [1990] identifies twelve characteristics of a capitalist world-system. Many of them do not pertain to earlier world-systems. The dual concept of core and periphery, however, is very interesting. The developments in Africa and among Cro-Magnons can each be viewed as world-systems, but they do not have a core-periphery structure. While the domestication of crops has a starting point, I do not see that the concept of core-periphery is relevant. But the developments leading up to the Mesopotamian civilization involve the producing of a core and peripheries. Actually, every civilization has a strong core with peripheries.

Let us continue the historical developments. In the world-system of civilizations, Mesopotamia and Egypt produced a demand for luxury goods that had a dynamic impact on other regions, for example, in Sudan and in Palestine. This demand also set off major surges in eastern Iran, where Lamberg-Karlovsky [1985; 1986] refers to four conjunctures, around 3300 BC (This would be what is called the Uruk expansion); around 2900 BC; around 2400 BC; and around 1600 BC. The Indus civilization arose with the third conjuncture, and India de-urbanized with the fourth conjuncture.

Horses were being ridden apparently by 4000 BC [Anthony 2000:101], and this helped spread modernization in a northeast direction into the Russian Steppes. Anthony [2000] shows that the civilizing of this region led to opening of the Silk Route by 2000 BC, and provided bronze metallurgy and horses-drawn chariots to the Chinese as they began civilizing around 1500 BC.

The Indus civilization was intimately intertwined with the Mesopotamian world-system, but it is appropriate to regard the Chinese developments as the birth of a separate world-system. Only with the advent of mass-produced iron (around 700 BC) did there arise a new world-system which incorporated the Mediterranean.
and spread all the way across to China. This world-system proceeded to create empires, and these empires traded actively along the Silk Route.

This world-system was almost dead with the fall of China (304 AD) and of Rome (410 AD) to barbarians. (The Byzantine world had some energy, India had very little.) A new world-system formed with the Sui (581 AD) and the Tang (618 AD) in China, which was soon joined by the rich Abbasid dynasty in Islam (750 AD). The west intruded into this story only with what are called the Crusades. A new world-system came into existence with the fading of the followers of Genghis Khan. In China, the Yuan dynasty became very weak by the 1360’s. The Tatars ceased to be influential in Russian after 1396. I would pick these dates as the beginning of the world-system which became organized around capitalism.

This is nothing more than periodization in history, but Wallerstein adds a new concept, that these periods represent historical systems, and that it is desirable and valuable to analyze the systemic nature of each one. If this is ever carried through, it will change markedly how history is viewed and is taught. While Chase-Dunn & Hall [1997] and Frank [e.g. 1993; Gills & Frank 1991] speak as if they aspire to a Wallerstein program, no one of them is analyzing a succession of historical systems. Chase-Dunn & Hall have too much comparative sociology, Frank has too much economics. No one is focusing upon the problem of historical periodization and of historical systematics.

They argue that capitalism is much earlier than Wallerstein says. This is an indication, to me at least, that they are not thinking structurally. Yes, there is an economic component for all humans and, for that matter, for all animals. There was exchange long ago - McBrearty & Brooks trace it back to Africa at least 100,000 years ago. But the structure of capitalism does not mean accumulation nor differential wealth. It means that businesses have a peculiar kind of power, which they did not have until recently, and do not have even today in Islamic countries. Wallerstein’s criticism of these analysts [1994] urges them to study the transitions between world-systems because that is how and when fundamental social change occurs.

Impressive as the Wallerstein program is, it is incomplete in a significant manner. Wallerstein regards each world-system as being distinct, which in a way, it is. But in an important sense, the
world-systems are not distinct, but build upon each other. Each world-system, as it dies, leaves a strong residue, some of which is basic for the world-system that then follows. Such continuity is shown in technology - the system of the empires was built upon iron, but iron technology evolved from the technology of bronze. The chariot warfare of the civilized period depended upon the horse, which was domesticated near the end of the world-system of domestication. World-systems grow out of one another technologically.

**Hayek’s vision.** This continuity, within a succession of world-systems, is shown in a surprising way by Hayek. Hayek is probably the world’s major interpreter of the information base that underlies markets. This makes him very aware of the morality that is necessary for a market system to operate. It is not the morality that we use with those we know, it is an impersonal morality that is applied to strangers. It needs also to be backed up by a court system that enforces against cheating.

Hayek is interested in how this came about historically and he calls for “an evolutionary account of moral traditions.” [1988:10] I did not know of this argument when I wrote the core of my paper, so I repeatedly used the words “trade network,” not mentioning how different was the nature of exchange during the time of Catalhuyuk as contrasted with the time of emerging civilizations in Mesopotamia and Egypt.

Hayek’s vision is not about technology. It discusses change in human nature over time and is applicable to the broad sweep of my paper. The evolution of morality can consider the developments in Africa earlier than 100,000 years ago, the patterns of exchange of Cro-Magnons, the turquoise found along the Tigris River around 5000 BC, the exchange of lapis lazuli for gaily-dyed wool clothing in Mesopotamia, and on and on, to the Greeks, to Islam, eventually to the patterns of modern capitalism. The nature of exchange evolved and continues to evolve. It is a story that needs to be told.

Morality has recently acquired a theoretical base. There is the morality that animals show (and humans should show) to their genes, hence sacrificing themselves for near-kin. [Hamilton: 1963;1964] For people one is not related to, game theory provides a basis for morality – specifically, repeated play of the game called prisoner’s dilemma [Trivers 1985, ch. 15; Nowak et al1995] shows
the advantage of helping others. Recently, two philosophers have analyzed the problem. [Sober & Wilson 1998] All this is theory. I am not aware of any empirical work along the lines proposed by Hayek.

The following table is my quick, preliminary attempt. Starting with homo sapiens in Africa, I enumerate possible world-systems, with possible dates. Then I make a preliminary classification of the type of exchange system that is involved. I must emphasize that this is done off the top of my head, without having read in depth the literature for each period. It merely shows that the task is feasible. It provides a preliminary basis. Hopefully, sometime someone (perhaps myself) will take this problem sufficiently seriously to study it, quarrel about it, and establish a base for research upon it.

<table>
<thead>
<tr>
<th>Name of World System</th>
<th>Time (Years Ago)</th>
<th>Type of Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>African Homo Sapiens to Toba's volcanic Winter</td>
<td>71,000 to 50,000</td>
<td>Marriage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elites</td>
</tr>
<tr>
<td>Cro-Magnons</td>
<td>40,000 to 12,000</td>
<td>Elites</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shared Figurines</td>
</tr>
<tr>
<td>Domesticated agriculture</td>
<td>8500 to 3100 BC</td>
<td>Visiting friends</td>
</tr>
<tr>
<td>Civilizations</td>
<td>3100 BC</td>
<td>Home-town enclaves</td>
</tr>
</tbody>
</table>

Some background. For all primates that live in groups (and most do), all males or all females leave their group of birth at puberty [Pusey & Packer 1987], thus avoiding incest. I believe that Homo sapiens lived in female-based groups, so the males left to join other groups. However, Homo sapiens are unique among primates in keeping track of their relatives after they have moved elsewhere. [Rodseth et al 1991] In Africa, the males left to marry, but returned home to visit, often bringing exotic stones from their new locale.
The eruption of Toba with its severe weather meant that most people died off. The survivors survived because they had developed a tighter structuring of their groups, indicated by the beginning of use of personal jewelry. So in some way, exotic materials moved, and skilled artisans became valuable. This is referred to as having “elites.” What was new for Cro-Magnons, was the distribution of figurines over a large space. This indicated contacts that had been established that made possible the survival of groups during the most extreme glaciation, around 18,000 years ago.

With the domestication of agriculture, which provided a storage surplus, outsiders would make friends with farmers, bringing them exotic materials and being fed over some winters. There is some indication, at this early stage, of home-town enclaves, notably, Tepe Gawra seems to have been a colony of artisans from different regions who settled in the Mesopotamian region and would welcome travelers from back home who brought exotic materials that the artisans needed.

Once the civilizations formed, cities had some enclaves of foreigners that mediated trade with their own kind of people, moving towards the patterns described in Curtin. [1984]

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