Reconstructing the History of Harappan Civilization

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ABSTRACT

The Harappan Civilization (HC) was spread over large parts of western region of the Indian Subcontinent. Its earliest roots can be found from 7000 BC in Mehrgarh but its peak urban period is around 2500 to 1900 BC. It declined completely by 1300 BC. At its peak, it covered more than 30 per cent of the present landmass of the Indian Subcontinent. Its entire evidence is archaeological. It is classified as proto-historic since in the absence of deciphered written records it is not possible to create a detailed scenario of its evolution (Possehl 1999). From archaeological data, the timeline of HC can be discerned, but the archaeological evidence of individual regions is not detailed enough to permit a systematic study of the rise and fall of HC (cf. Wright 2010). However, a lot of work has been done to understand other cultures and their evolution.

We compare the knowledge on the evolution of other cultures (Snooks 2002) and evaluate the archaeological and other data available for HC based on ten parameters (Murdock and Provost 1973) to create a possible scenario of the Harappan Civilization's evolution. We show that the pattern of HC can be divided into four major phases. The first three phases mark an increase in the standard of living triggered by the arrival of a specific organizational change while the fourth phase is marked by a decline due to the society's failure to solve the problem of increasing needs of the civilization because of the delay in arrival of new technologies.

BROAD FEATURES OF HARAPPAN CIVILIZATION

The Harappan Civilization (HC) at its peak covered an area of about 1.5 million square kilometers (Agrawal 2009: 1). It was spread over

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the present day western parts of India, Pakistan and Afghanistan covering 30 per cent of the present landmass of the region. However, since all the evidence for HC is archaeological, it is generally classified as proto-historic. Here we use the knowledge from other civilizations to create a comprehensive scenario about the growth of the HC and its critical landmarks.

HC had several features indicating a high degree of uniformity in life-style at its several urban centres (see, *e.g.,* Wright 2010; Agrawal 2007; Possehl 1999). The most spectacular aspect of HC is that at its peak it boasted of large well-planned cities. Joshi (2008: 48–49) lists 10 distinct characteristics that identify sites of HC at its peak. These are:

1. Characteristic written materials and seals.
2. Beads and other jewellery.
3. Standardized brick sizes in the ratio of $1 \times 2 \times 4$.
4. Planned towns with citadels, platforms and podiums and specific burial patterns.
5. Standardized weights.
6. Black or red painted pottery.
7. Parallel sided blades.
8. Copper and bronze articles.
9. Terracotta toys.
10. Cotton, barley and wheat.

To this, features such as sophisticated water management can also be added. HC was complex and well spread out with a fair degree of sophistication and homogenisation even though regional variations did exist. Due to an apparent discontinuity between the HC and later Indian civilization and the lack of long written records, the manner of rise, stabilisation and eventual fall of the HC is not clear.

Farming and related activities arise in the subcontinent by 7000 BC in Mehrgarh (Wright 2010: 48). This was to prove crucial and Mehrgarh played an important role in developing early farming technology and keeping contacts with settlements farther west (Bellwood 2008: 91). It also had a large number of small and medium size sites all over the Indus plane by 4000 BC (Possehl 1999). However, the first large city-state arises, not in the region of Indus valley close to Mehrgarh but in a far away region of the Hakra Basin

in Harappa around 3200 BC and seems to be an indigenous development.[1]

There is substantial evidence in the form of the rise and nature of small town conglomerations all across the HC region to suggest that self-governing communities must have arisen at several locations that did not eventually transform into states with large population on their own (Kenoyer 2008). This can be discerned from the fact that the rise of habitation sites in the HC are not random but arise in clusters of different sizes with time (Possehl 1999; Kenoyer 2008). Only some of these later become cities. Even these cities do not rise at the cost of the dwellings in the neighbourhood but in concert with them (Kenoyer 2008) as can be estimated from the number of satellites sites that grow with them.

The city of Harappa rises as an isolated small cluster of communities around 3200 BC on one of the tributaries of the Indus River, more than 3000 years after the emergence of the first agriculture in Mehrgarh about 1000 km farther west. Other cities of HC such as Mohenjo Daro appear between Mehrgarh and Harappa on the banks of the Indus River around 2500 BC. Harappa also continues to be inhabited for about 400 years after other large cities in the HC are deserted and well after the drying of Ghaggar-Hakra further south. A conglomeration of small to medium size settlements appear along the Ghaggar-Hakra basin and comparable sized settlements also arise further South East of Harappa at the mouth of the Ghaggar-Hakra Basin around 2500 BC, a period which sees a very steep rise in the number of inhabited sites. After 1900 BC, there is a dramatic shift further East into the Gangetic Valley.

Dholavira – Lothal complex in the Gujarat region was apparently specifically set up for trade. It is situated in the middle of the great Rann of Kutch. At its active period, Dholavira was a busy prosperous city and Lothal was at the edge of the Gulf of Khambhat. Even then, it was an arid region severely short of fresh water. The Gujarat complex was created in a hostile environment made habitable by major hydro-engineering works. Dholavira was inhabited from 2500 BC and is deserted around 1900 BC. Other small and medium size sites continue to appear in the Saurashtra region after that.

Since the HC had no fast means of communication and since it lacked the knowledge of iron, it seems difficult that an ideologically homogenous single state could have existed over the vast

geographical and temporal scale. HC lacks several characteristics of a single nation state but it clearly shared a lot of knowledge giving a feeling of a homogenous civilization with a high level of technological uniformity.

For the states to emerge, it is necessary that they have a sufficient number of people to form a complex stratified society, control a specified territory and have a surplus to maintain the specialists and the privileged categories (Claessen and Oosten 1996: 5). This apart, a defining ideology must exist, which explains and justifies a hierarchical administrative organization and socio-political inequality (see also Grinin 2003).

Most civilizations go through various stages of growth from the family to the local groups to collective fiefdoms, chiefdom, and archaic state to the nation-state (Johnson and Earle 2000: 245). It should be noted that formation of state is not inevitable and that if pre-warned a society may actually not adopt to transfer to being a 'state' since state necessary involves stratification of society (Claessen 2002). Since the HC can be taken to be a civilization, it is likely that it went through some of these stages, too. However, it is also not clear how and when the different regions of HC evolved since very little is known about the social organisation of this civilization. The exact level of the civilization and its transformation from early state analogues to the state (see Grinin 2003 for general discussion) is unclear (cf. Wright 2010: 16–17 for specific issues of HC). It is not even clear if it had the social structure of one or more nation states. The town layout, on the other hand, clearly suggests that there was stratification in the society.

The HC was formed by a conglomeration of at least three distinct groups with their own pattern of development, growth and time line (Wright 2010: 311). They were interrelated with cultural and technological exchange. While their high level of standardisation has been noted by several authors (see, *e.g.,* Joshi 2008: 48–49) but detailed studies show that even in the highly standardized world of writing signs of the HC there are small and important differences between regions. At the same time, their miniature art collected in CISI volumes (Joshi and Parpola 1987; Shah and Parpola 1991) shows a very high level of sophistication and complexity. Their best art work in miniatures, highly standardised use of bricks and weights (see, *e.g.,* Vahia and Yadav 2007, 2010; Yadav and Vahia 2011) all

seem to arise around 2500 BC to the extent that Kenoyer (2008) has suggested that the truly urban period of HC should be considered from 2500 BC to 1900 BC and this too can be divided into smaller finer time lines of growth and decay.

Possehl (1990) has pointed out that in a small time interval of about 100 to 150 years around 2600 BC the civilization seems to have transformed from pre-urban to Early Harappan State with sudden emergence of the following features:

1) writing on well designed and carefully made seals with high quality animal motifs;
2) town planning and development of:
   a) massive brick platforms,
   b) well-digging,
   c) drainage system,
   d) grid plans for city;
3) appearance of widely used system of weights and measures;
4) other changes in a wide variety of lifestyle material such as ceramic corpus;
5) new art forms and stylistic growth such as new human and animal figurines;
6) distinctive Harappan black on red slip painting style;
7) core trends of urbanisation such as:
   a) social stratification,
   b) apparent emergence of the state and political differentiation,
   c) craft and career specialisation,
   d) creation of cities and a new form of social regulation.

He notes that these changes are in continuity rather than discontinuity.

It therefore seems that around 2500 ($\pm$ 100) BC, the HC transformed from a loose confederation to a state. Precipitation into a state comes generally in response to internal pressures rather than external threat as there is no clear evidence of large-scale conflicts in HC. Once the internal stresses become severe, the pre-state is forced to create surplus to permit specialization and the state came into being. In many ways, the civilization shows the signs of rising from internal dynamics. There are few signs of large-scale conflicts. There are no megastructures to glorify the great. At the same

time, the technology for large-scale structures was used essentially for utilitarian purposes such as the Great Bath or raised platforms to set up a whole city. Their water management was far in advance of their period.

Possehl (1999) has listed more than 2,500 sites that were part of the region that marks the spread of HC at its peaks. However, most of these sites are small to medium-sized and less than 10 sites have an area exceeding 0.5 square kilometers (Joshi 2008). Also, the urban centres continue to be surrounded by smaller sites indicating that the formation of an urban centre neither stunted the sustenance of small habitation sites nor did it destroy them. This suggests that the relation between the urban and rural sites must have been more symbiotic rather than adversarial.

Given the fertility of land and the mobility that the rivers in that part of the subcontinent, all three kinds of population groups – trading groups, self-governing groups and rogue groups – would have all found easy subsistence in the region. With these conditions met, even small groups of population of about 5,000 or more can form seed societies. These societies can borrow from the ideas of urbanization and city-state from developments elsewhere.

Kenoyer (2008) has noted that the major step in standardization and expanded urbanisation in all three sub-regions arises around 2500 BC. At that stage it is by far the most extensively spread out civilization. Turchin (2009; cf. Fig. 2) has compiled the data of several civilizations and shown to cover an area well below 0.3 million square kilometers while HC had an area of 1.5 million square kilometers indicating that no equivalent cultures existed elsewhere. Hence, a lot of developments must have been internal to HC. This is also borne out by the uncommon nature of their art and writing as well as architecture.

HC went through several phases of development. In the initial phase, it went through early phases of farming and animal domestication at Mehrgarh, probably, induced by the knowledge developed in West Asia (Bellwood 2008: 89–90) around 7000 BC. Mehrgarh was on the steppes of Tobe Kakkar Range near Bolan Pass. This was followed by a general expansion across the Indus and the Ghaggar-Hakra Valley over the next 3000 years with several small and medium size sites. Then around 3000 BC, the first urbanisation begins with a sudden and spectacular rise in several

major cities by 2600 BC (Wright 2010: 96; Joshi 2008; Possehl 1990) and formalization of many important aspects such as weights and bricks *etc.* over the entire region (Kenoyer 1998). Around 1900 BC, for reasons that are not at all apparent, the civilization went into a sudden decline and the last of the cities were de-urbanized by 1700 BC. The reasons for these sudden and dramatic changes are not apparent and their precipitating factors are not clear.

Conventionally it is assumed that the civilization ended due to natural calamity, overexploitation of resources or drying up of one of its important rivers called Ghaggar-Hakra due to an earthquake in its upper reaches. However, Mehrgarh and Mohenjo Daro are both deserted around 1900 BC *even though neither is close to the Ghaggar-Hakra basin*. Hence, the sites must have had symbiotic relations with other sites on the Ghaggar-Hakra basin to the extent that the catastrophic drying out of this river had equally disastrous effects on them. Wright (2010: 42) has attempted to correlate the decay of these cities as arising due to changes in monsoon patterns. However, the changes seem to be small and cannot fully account for the fall of the civilization. It seems that the fall of the civilization seems to have been triggered by internal reasons rather than external factors (*Ibid.:* 308–320).

The fact that this was a decay rather than destruction is highlighted by Kenoyer (2008). Discussing the environmental evidence, he concluded that there was no substantial evidence of change in weather pattern. He also shows that the decay was gradual, at least in Harappa with signs of overcrowding, the decay beginning with loss of the elite along with the disappearance of signs of complex mercantile activities such as weights and seals.

Wright (2010), Kenoyer (2008) and Possehl (1999) have created a detailed time line of the HC and have identified three different subcultures within the broad HC. Based on these and other studies, the following observations can be made.

1) The HC has its roots in Mehrgarh, west of the Indus River. The site shows earliest evidence of farming dating to 7000 BC. However, it remains a medium sized one all through the growth and decay of the HC (Wright 2010: 51–78).

2) The first urban city, Harappa, makes its appearance in the Ghaggar-Hakra basin much further east from Mehrgarh and far from the Indus River around 3200 BC.

3) Its most sophisticated city, built on a specifically created platform, Mohenjo Daro appears on the Indus Valley around 2600 BC (Possehl 2002: 101–103).

4) Later cities also appear further south in the arid region of Kutch in Gujarat that apparently had a sea link to West Asia (Wright 2010: 216–217).

5) There are several sites and site clusters distributed over the entire region.

6) There are at least three distinct clusters of cultures with similar traits and physical proximity (see, *e.g.,* Gangal *et al.* 2010; Wright 2010: 311–312).

7) There is no clear evidence of powerful central authority or large-scale evidence of militarization or standing army of the cities.

8) The rise of its urban centres also coincides with the rise in the number of rural centres indicating a symbiotic relation between the two (Wright 2010).

9) Considering that the sites are essentially along a river basin, the rivers seem to have been their primary mode of communication, but models of carts have also been found which seem to have been a local mode of travel.

10) It was not a highly religious or heavily centralised Civilization but did accept a high level of standardisation in some vital aspects such as writing and seal making, weight measures, brick dimension and manufacturing, pottery *etc.* from around 2600 BC.

11) The culture makes a dramatic increase in sophistication around 2500 BC and dies out equally dramatically around 1900 BC (*Ibid.:* 308).

We try and interpret this evidence of the general growth of HC with regard to other civilizations. We assume that given the level of sophistication of architecture of the HC cities, its high quality of art on miniature objects and archaeological evidence of social organisation, it must have been a state and a civilization in the formal sense of the word. In a detailed recent study, Wright (2010) has discussed the changes in the lifestyle and economy of the Indus people from early settlements at Mehrgarh to the post-urban phase showing that the civilization was clearly well established over an area of 1.5 million square kilometres (Agrawal 2009: 1). Its influence extended up to the West Asia where it seems to have been referred

to as Meluhha whose mercantile practices were adopted in West Asia (Wright 2010: 215–232).

Renfrew (1989) has suggested that the practice of writing and the development of a coherent system of signs, a script, is something which is seen only in complex societies and, hence, writing itself should be considered a feature of civilizations. Harappan writing certainly has a lot of characteristics of sophisticated writing (Rao *et al.* 2009a, 2009b; Yadav, Vahia *et al.* 2008a, 2008b; Yadav, Joglekar *et al.* 2010). Therefore, we can use knowledge obtained from other civilizations to gauge how the civilization must have developed and compare it with available archaeological data. For the present discussion, we assume that urbanisation is itself a *sufficient proof* of the formation of state (Possehl 1990). Kenoyer (1997) has suggested that they were not only cities but were probably republican in nature (see Wright 2010: 18–19).

In the absence of deciphered, and extensive writing, or comprehensive discussions in other contemporary cultures, detailed chronology of the HC cannot be created. The only way in which some semblance of history of HC can be created is by comparing its structure and landmarks with those of other well studied civilizations.

Against this background, we try and create a more quantitative picture of the rise and fall of HC.

ANALYSIS OF HARAPPAN CIVILIZATION

We adopt Snooks' model (2002) for the HC. The model suggested by Snooks (*Ibid.*) for the growth of civilizations is given in Fig. 1 below. Harper (2007) has discussed the limits of mathematical modelling in social sciences and our discussions here are subject to the same reservations.

Snooks (2002) suggests that societies keep expanding till their potential human productivity (P) exceeds the maximum capacity. When the two meet, the society is no longer able to expand to meet rising demands and the system collapses and quality of life falls until a new technological revolution increases the potential for increasing productivity again.

Societies can get into instability and populations can collapse due to a variety of reasons (Turchin 2005). Turchin (*Ibid.*) has emphasized the role of instabilities in the pre-industrial states in their political collapse and breakdown which can cause population collapse using the demographic – structural theory. We suggest that

at crucial stages, when a civilization reaches the level of maximal exploitation rate of its technological and organizational base, it must either invent a new level of organization or technology to improve its standard of living or instability will prove catastrophic.

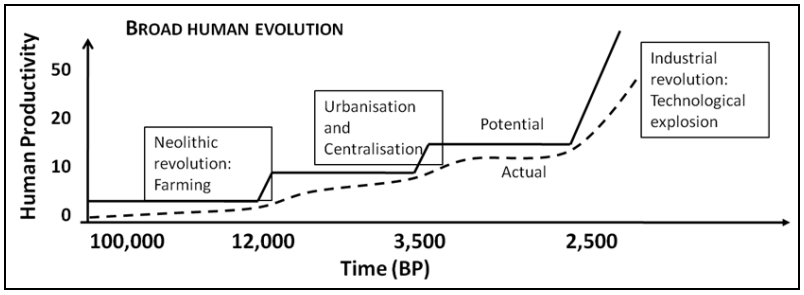

Fig. 1. Pattern of human productivity (based on Snooks 2002). The y-axis is arbitrary. The boxes represent the changes that mark the transition from one level of existence to the next

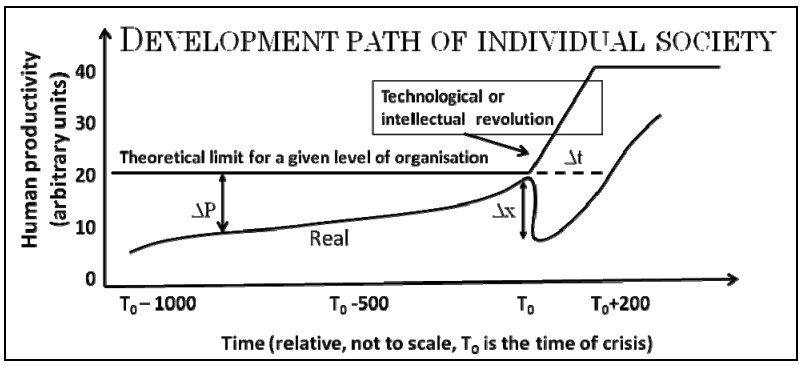

Fig. 2. Comparison of evolution of maximum and real productivity with time and effects of delayed innovation

We note that the new level of organization need not be a technological innovation. It may include a better reorganization of society, labour reorganization or better technologies. In extreme cases, even simple expansion of living space and occupation of surrounding habitations may provide a short-term relief but such solutions would be short-termed without a specific transition to a higher level of organization and significantly improved quality of life. Since it is generally engineering that has the best potential for providing these new growth avenues, at its peak, a civilization must invest

maximally in science and technology, not so much in the idle pursuit of the gifted but in the hope that they will come up with the next level of innovation that can increase the potential of growth once the presently available technologies have been fully exploited.

We formally include this feature in Snooks's model in Fig. 2 but note that Snooks (2002) suggests this possibility. In addition to the theoretical limit of the human development index, we plot the real growth by monotonically increasing curve below that approaches the theoretical limit as the culture expands. This generalization is also in line with the work of Harper (2007) who has analyzed Frank and Thompson's work (2005) for the Chalcolithic and Bronze Age civilizations.

Instabilities in civilizations

We define the difference between the real and theoretical growth pattern by a term ΔP. When ΔP approaches zero, the culture has essentially expanded to its maximum potential. The culture must then undergo a technological revolution in order to survive (Snooks 2002) since at this stage any other avenues such as expanding the physical span or even attacking neighbouring habitations will not produce enough long-term advantages for expansion of the culture. On reaching $\Delta P \sim 0$, the society is forced into a choice of either living in equilibrium or instability. We argue that living in equilibrium is inherently unstable.

Any technology and its increasing exploitation implies improved standard of living, reduced infant mortality and longer life expectancy. Hence, even if a community follows a minimal replacement policy for birth rate (how this can be achieved in the absence of sophisticated birth control mechanisms is a separate question), the longer life expectancy alone will increase the population with time. An aggressively pursued population control can invert the population triangle causing its own set of instabilities. Also, in an organized environment, the natural human tendency to acquire competitive advantage and improved standard of living (if nothing else, than to attract a better mate) will not allow an equilibrium to be setup.[2] Hence, it is difficult for any society to sustain equilibrium in standard of living by common consent since it is inherently an unstable condition.

Hence, change is the most constant part of human evolution. It can for better or worse depend on the situation. If continuously new technologies or organizational restructuring come then the society will progress to the next level of organization. But it can be self destructive if resources to improve living conditions are not available. In this case, individuals will try to improve their own lot by any means available (by migration or violence) and such a system will result in chaos. As we shall see below, in Harappa, for example, it seems that the drying up of a major river occurred at a time when the technological exploitation had peaked. The first group whose absence is felt at the beginning of decline is the rich and the merchants (Kenoyer 2008). Authority needs a lot of resources to maintain order and in the absence of authority chaos is inevitable. Hence at the peak of the exploitation of its current capabilities, a society is essentially in a self-contradictory course. It not only enjoys highest level of prosperity, but also must quickly come up with the next level of rise to avoid a collapse in near future.

In the absence of such a revolution that can bring about a quantitative change in living standards, the society will fail to meet the expectation of the culture and it will degenerate into chaos that will eventually engulf it (Turchin 2005). There is however, no *a priori* reason why the technological revolution should coincide with ΔP approaching zero (it can occur earlier), even though this is highly probable because, at the time when ΔP approaches 0, the society has maximum resources available for exploration of other avenues, as it is as rich as it can get with the existing technological base. As the society becomes ever richer, it finds it increasingly difficult to meet the increasing expectations of its population and heads to chaos. If the technological breakthrough does not come at its scheduled time, the chaos ensuing from the inability to meet the increasing demand and expectations may actually result in a fall in the standard of living (Turchin 2005) by a certain quantity Δx (Fig. 2) before the eventual technological revolution sets it on the path of increasing human cultural evolution again. The time taken for recovery Δt depends on the sensitivity of the culture, the fall Δx, and the leadership at that crucial juncture. The value of Δx and Δt are arbitrary and sensitive to the exact environment in which the civilization existed. We will discuss their quantitative values later.

With this in mind, we revisit the data presented in this study on the HC. We summarize its different stages as follows.

A model for HC

Murdock and Provost (1973) have proposed a manner of quantifying life-style based on ten major parameters each evaluated on a five-point scale. These parameters are given in Appendix. We evaluate the Indus Civilization against these parameters.

Criteria for quantifying the level of a culture's sophistication

In order to quantify the changes, we adopt the scales proposed by Murdock and Provost (1973). Each criterion is ordered according to a five-point scale of relative complexity (see Appendix).

Modeling the growth of the Indus Civilization

Based on these criteria, we evaluate the status of various phases of this culture in Table 1. We plot this data on the basis of above criteria in Fig. 3. We define four stages of growth of the culture with the first revolution in farming around 7000 BC, the second one of introduction of metals around 5000 BC, urbanization around 3000 BC. The induction of iron is shown in 1000 BC. Against this, we have plotted the real rise in cultural complexity based on general discussions.

Table 1

Quantitative evaluation of the Harappan culture's growth

Stages	Scales (0 to 4, with 4 being the best)										
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	***Total***
Nomadic	0	1	1	2	0	0	0	2	1	1	8
Barbarian	0	2	2	2	1	1	1	2	1	2	14
Rural	1	3	3	3	2	2	1	3	2	3	23
Urban	3	4	4	4	4	3	3	4	4	4	37
Post-urbanization	1	3	3	2	2	2	2	2	2	2	21
2nd Urbanization*	4	4	4	4	4	3	4	4	4	4	39

Note: *The second urbanization, in the Gangatic plains is very different from that of Indus Valley civilization. However, there is significant evidence (Gangal *et al.* 2010) of population movement from the Indus valley to the Gangatic plain

Scale 1: Writing and Records
Scale 2: Fixity of Residence
Scale 3: Agriculture
Scale 4: Urbanization
Scale 5: Tech. Specialization
Scale 6: Land Transport
Scale 7: Money
Scale 8: Density of Population
Scale 9: Level Integration
Scale 10: Social Stratification

We assume that when this curve approaches the theoretical maximum, a saturation effect sets in by which the society is no longer able to meet the increasing aspirations of its people. At this stage a major change in technology and complexity must occur for society to survive.

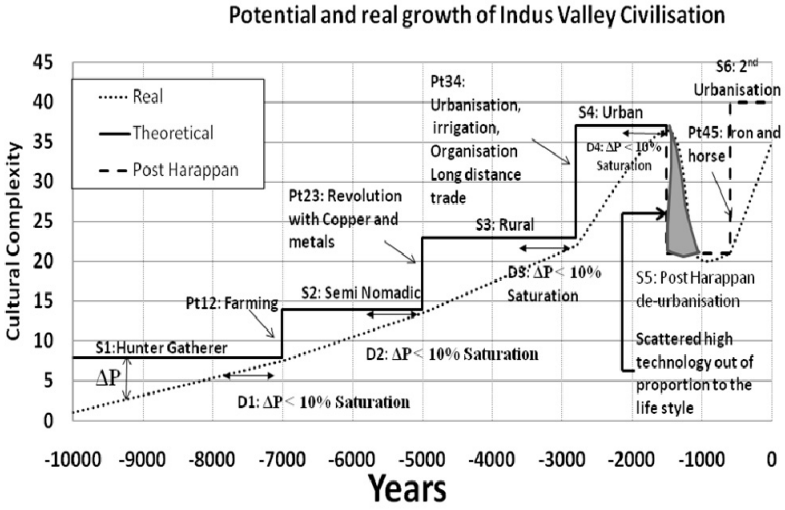

Fig. 3. Productivity and growth of the Harappan culture

We define the various stages in Fig. 3 below:

S1: A nomadic life-style where scavenging and hunting are the main sources of sustenance.

D1: Draught and overexploitation of resources can limit the growth of this life-style.

Pt12: Development of farming would be the first major revolution that can meet the increasing needs of population with increasing success in increasing population during the D1 period. This will result in sites leaving behind larger number of sites with sufficient long-lasting evidence.

S2: This defines a life-style of grouped population and would result in a conglomeration of sites that may be the first analogues of states discussed above.

D2: Over a period, in such chiefdoms or proto-states, population would expand to a level where simple farming cannot maintain the lifestyle.

Pt23: A revolution in metals such as copper and its alloys discovered in the low temperature furnaces would provide a major boost to storage and transportation technologies.

S3: Pt23 in turn would lead to a drastic increase in number of sites, and the rise in specialization would appear as first rudimentary writing as markers.

D3: However, there is a limit to S3 and with expanding life the states would reach an optimal level of production from scattered farming. The resultant population pressure would have to be met by the next level of sophistication, namely urbanization.

Pt34: Urbanization would immediately provide several benefits, including security, optimal use of resources and generation of additional wealth through specialized and organized skills in accessories and trade.

S4: The characteristics of the urban life, literacy, art and planning, trading, standardization, what would typically be called the Mature Phase or Golden Period of the civilization. In case of the HC, the saturation of the ability of this living environment would require induction of the next level of technological revolution in terms of iron age or some other form of technology that could have quantitatively improved the living condition. We suggest that this failed to happen in the HC.

D4: Due to the inability of the state to come up with the next level of sophistication, a decay phase of saturated productivity and reduced ability of the state to meet the increasing demands. At this stage, further spread over a larger area was not profitable. While, in principle a move towards the Gangetic plain was possible, it was a path open only to the citizens of Harappa and neighbouring area. Even then, the lack of iron meant that the tool technology was limited. Overexploitation of specialized skills and overstretched resources made growth unsustainable and the civilization imploded.

Pt45: For the HC, the next major revolution came too late. But with iron, horses and efficient travel mode the population at last had the capability of rising to higher level of sophistication. Stagnated and decaying population more amendable to new ideas and cultures. Indo Iranians or Aryans arrive. However, due to the time gap the HC was at a very low point before

it rose on the iron revolution to the next level of sophistication. So while iron can be seen in the subcontinent probably as early as 1800 BC, its purified, and usable form became available well after the HC had descended into a decay.

S5: Iron and possibly other revolutions such as fast transport with iron as well as the residual knowledge from the HC provided the environment for the second urbanization that was Harappan in nature and appeared in the Gangetic plane because that is where the residue of HC was the strongest (see Gangal *et al.* 2010; Wright 2010: 302–338).

DISCUSSION

Recent genetic data from Indian subcontinent clearly shows that there has not been a very significant addition of population in the subcontinent since about 40,000 years ago and that the population of the subcontinent has been from the same genetic pool since then (see, *e.g.,* Reich *et al.* 2009; Sahoo *et al.* 2006; Vahia 2009 for detailed discussions). Hence, the HC time-period S1 (in Fig. 3) marks the stage when the people were essentially nomadic and began to get first hints of what makes plants grow and the first farming of essentially nomadic people begins to be tried. Around 7000 BC, a major transition (Pt12) into settled farming can be seen in Mehrgarh and the human settlements begin to appear in archaeological finds. This would take the human habitation to a higher level S2. Over the next few hundreds of years, the knowledge and advantage of farming begin to spread, first over well-linked regions along the foothills of Hindu Kush. However, the number of sites does not change dramatically from 7000 to 5000 BC when a proliferation of archeologically visible sites along the Hindu Kush mountain ranges is seen. In this phase, as ΔP approached zero (D2) the success of farming would have meant increased population but wastage and other problems would have meant that both extension of area and better storage facilities would be required.

We suggest that this was possible due to another phase transition (Pt23) when metal, housing, transport or some other technological revolution made it possible to have a higher quality of life (S3). This would have also made spread of the culture and linking up with other inhabitants and other regions. More than a millennium later, farming sites appear in Gujarat and along the Ghaggar –

Hakra region around 4000 BC. This large expansion of populated area would have also produced a lot of nomadic hunter-gatherers tempted to live by raiding and scavenging on the settled sites. Hence, as ΔP approached zero in this phase (D3) forcing them to develop larger settlements (Turchin 2005) but the evidence for this is weak. Another point to note is the subcontinent has another peculiar characteristic that the monsoon season is very strongly defined and this requires a very judicious management of resources that encourages living in larger groups. The population patterns and movement in Mehrgarh (Wright 2010: 51–75) suggests that the needs of the HC people themselves required more stable settlement. The third phase transition Pt34 would have occurred. Increased urbanization will naturally produce its own set of specialization and development based on specialized skills and people. It is interesting that it is at this stage that the HC is at its peak producing a large number of technologies such as its famed miniature art (Kenoyer 1998), its standardized bricks and other features. It was also a phase of large-scale travel and trade well into West Asia and coverage of large areas including southern Iran where a script similar to the Indus Script (Proto Elamite) flourished and Indus seals are found in West Asia written in grammatically different form (Rao *et al.* 2009b).

Wright (2010: 106, 141) has discussed in detail the physical changes in lifestyle, demand for organization, state supported infrastructural requirements and other changes that urbanization produces. Clearly, urbanization is a conscious and predefined phase transition. But that it is a conscious transition is not necessarily universally accepted. In fact, Wright notes that urbanization of Indus settlements also coincides with a large rise in surrounding settlements with which these cities seem to have enjoyed a symbiotic relationship.

However, as this stage reached its saturation, the civilization failed to make the next transition to Pt45. Harper (2007) has discussed what happens when a civilization fails to make this transition. This could have occurred with the discovery of iron or arrival of new ideas and capabilities such as horse *etc.* but it came too late for the civilization to make a smooth transition. As a result, the human productivity dipped significantly in what we call the late Harappan period. We suggest that this trend was reversed and the developments began a fresh with arrival of new technologies partially precipitated

by arrival of fresh ideas and language from outside. While it is not possible to quantify Δx from our present study Δt can be estimated to be about half millennium when Mahabharata period is dated to 1200 BC (Sule *et al.* 2007). The next civilization that replaced the Harappan was essentially aggressive both to external threat and to internal organization. Hence, the transition Pt45 and the setting of the level S5 was post-Harappan induced by external events.

If we assume that this is the correct interpretation of the HC period, then one can assume a certain degree of continuity which can account for the sudden increase in sophistication of the Rig Vedic literature (including references to astronomical events of much earlier period, see, *e.g.,* Mahajani *et al.* 2007). Rig Veda provides unusually deep insights into the cosmogony and astronomy, other sciences but are absent from Avesta which is contemporaneous Indo-Iranian document. Also, the fact that Rig Veda has several different religious structures in the whole suggests that a large part of the Rig Vedic literature may be adaptation of knowledge and insights of the IVC people in Sanskrit. This type of transliteration occurred in the Subcontinent three and a half millennia later when the British arrived in India towards a period when ΔP again tended to zero, precipitated one more phase transition and, as a result English is a widely accepted language in India and most major Indian literature is now available in English.

In this context, we would like to discuss two specific cases of unusual developments in HC.

Development of cities and similarity to Greek Poleis

All the major cities of HC are known to be not only in agriculturally rich area but they also have highly standardized architecture (Joshi 2008). Also, these cities are not known for their capabilities to conduct wars or indeed major defensive fortifications. Wright (2010: 106, 142) has discussed the rise of five major cities in the region between 2600 and 1900 BC. These are Harappa, Mohenjo Daro, Dholavira, Ganweriwala and Rakhigarhi with an estimated population density of 150 to 200 people per hectare (*Ibid.:* 107). She has pointed out the rise in intra-city walls, segregation and modular organization of the city, and most conspicuously, large common non-residential structures such as the Great Bath (see, *e.g., Ibid.:* 238) in Mohenjo Daro, large circular platforms in Harappa and large artificial reservoirs in Dholavira. All these show

that the cities must have enjoyed access to considerable resources in terms of wealth, manpower and capabilities for systematic planning. The public works from utilitarian ones such as drainage systems to exclusive citadels all indicate a quantum jump in resource management and the discipline of compact housing and high density residential areas.

The cities had a more symbiotic relation which is clear from the fact that the rise of cities also coincided with the rise in smaller sites in surrounding areas. Their relation with the neighbouring areas does not seem to have been hostile or dominating. This is attested by weak external fortification and absence of any evidence of coercive state apparatus or weapons. All this precedes the growth of the poleis in Later Rome by more than a millennium but the archaeological similarities are striking and hence a comparison is inevitable (Kenoyer 1997).

Similar city-states are known to have existed a millennium later in Greece under the broad category of Poleis. These Poleis all had a democratic organization (van der Vleit 2008) that was restricted to non-slave, male adults living within the state and the administration was more like a pancake than a pyramid. All this seems similar to what could have existed in the cities of HC.

One more point that needs to be highlighted at this stage is that of the distance between the various cities of HC. This tends to be of the order of 500 kms. This may define the effective region of influence of a large city. We suggest that in the bronze environment of the HC with its limited reach due to poor transportation (except along the river) that restricted the reach of a poleis to no more than a couple of hundred kilometers or so.

Standardization of HC

In HC, there seems to be a sudden and dramatic growth that can be narrowed to around 2500 $\pm$ 100 BC. There are many scattered pieces of evidences on this (see, *e.g.,* Gangal *et al.* 2010; Possehl 1999; Kenoyer 2008). This includes appearance of a fully developed script though pot marks are seen earlier (Kenoyer 2006). There is also a sudden, across the board growth of HC sites and a sudden growth of standardized architecture across more than a million square kilometers area (Agrawal 2007: 1). Also a qualitative improvement in technologies and pottery can also be seen. These changes seem to have occurred over a large area but within a short time period. Given that the general mode of travel available to the HC was slow, it is

unlikely that such a large number of ideas, standardization and other features would have traveled informally across the civilization. Equally importantly, given that there was strong authority that could have imposed these ideas, the most likely suggestion is that this can be achieved more by mutual agreements amongst all concern. Hence, we may not be able to establish that this was precipitated by some development like meeting of a council of Elders or some such gathering like *Loya Jirga*[3] which standardized several aspects of the Indus culture. As we shall see in section 'Urban expansion', if such a meeting did occur, it must have been around 2600 BC towards the end of the Kot Dijian Period and beginning the Integration Era.

CASE STUDY OF HARAPPA

In light of the discussion above we look at the description of rise and decay of the city of Harappa as given in Kenoyer (2008). Unless otherwise stated, all the literature in this section is taken from Kenoyer (2008). Habitation of Harappa is divided into several distinct stages. They are given in Table 2. We discuss each of them below (Kenoyer 2008 and references therein).

Early settlement

Harappa is situated on a low Pleistocene terrace between two major tributaries of the Indus River, the Ravi and the ancient Beas (now the Sutlej) rivers.

The Ravi phase village (Period 1: >3900 BC – 2800 BC) is the earliest habitation phase. The ceramic vessels in the period 1A were entirely handmade and the pottery is similar to the pottery in the Ghaggar – Hakra river region. Towards the end of the Ravi phase (Period 1B), the potter's wheel began to be used, resulting in new and diverse vessel forms and rim shapes. At this stage, concepts of graphic expression using abstract symbols emerged. Some of them can be found later in the Indus writing system. Most of the raw material for craft (except for clay and bone) were brought to the site from distant areas indicating that the people living at the site were connected to all major regions that became integrated into the later Indus urban phenomenon.

Early urbanism

Early Harappan, or the Kot Dijian period, represented the initial urbanism in the greater Indus valley. The initial urban development

in the Indus region began between approximately 2800 and 2600 BC. Many of the diagnostic features of Harappan society began to appear during this phase. The presence of wide streets running into the core areas of the city reveals the importance of vehicular traffic in these early urban centers.

The Early Harappan Kot Diji phase, sees the development of more efficient forms of transportation for heavy commodities by wheeled carts and possibly by boat. There is an increase in technological complexity and new types of finished objects. Precious metals such as copper and gold were employed for both utilitarian and decorative purposes. Many additional styles of bangles, beads, pottery and other utilitarian objects reveal the need for increased variety for a more diverse urban population.

Wheel made pottery became common during this period. Red slip and black painted designs replaced polychrome decorations of the Ravi phase. Careful stratigraphic documentation of pottery forms and painted motifs have shown the development of the distinctive Kot Dijian style pottery and a gradual transformation into Harappa phase pottery. When combined with the evidence of other artefact types, it is clear that the Harappan culture emerged from the earlier Kot Diji culture and that it was not introduced to this area from outside regions.

One of the most important developments documented at Harappa is the emergence of the Early Indus script, incised on pottery and seals (Kenoyer 2006). The discoveries at Harappa and similar evidence from Mehrgarh and Nausharo, Rehmandheri, Kalibangan and possibly Dholavira suggest that regional styles of writing were developing at many sites throughout the Indus region.

Table 2

Periods of Harappan civilization (Kenoyer 2008)

Period	**Description**	**Time interval (BC)**	**Period reference in Fig. 3**	**Comments**
1	2	3	4	5
Regionalisation Era				
Period 1A–B	Ravi aspect of the Hakra Phase	>3900 BC – 2800 BC	S3: Rural	Semirural phase with handmade pottery and basic designs

1	2	3	4	5
Period 2	Kot Diji Phase	2800 BC – 2600 BC	S3: Rural – transition to Urban	Potter's wheel and heavy transport means become available. Writing emerged over the entire Indus region
Integration Era				
Period 3A	Harappa Phase A	2600 BC – 2450 BC	S4: Urban	Highly standardized working and living along with stratification of the society
Period 3B	Harappa Phase B	2450 BC – 2200 BC	S4: Urban	Large architectural monuments like the 'Granary' were built in this period
Period 3C	Harappa Phase C	2200 BC – 1900 BC	S4: Urban	Peak of civilization with influx of merchants, craftsmen *etc*. The Golden Period of Harappa
Localization Era				
Period 4	Harappa/ Late Harappa Transitional	1900 BC – 1800 BC(?)	S4: Decay to S5	Possible overpopulation, loss of script and weights. Loss of habitation pattern. Indicates decay due to internal parameters and not external interference
Period 5	Late Harappa Phase	1800 BC(?) – < 1300 BC	S5: Post-urban	

The emergence of writing, seals, and standardized weights implies the development of more complex social, economic, and political organizations that would have required these sophisticated tools and

techniques of communication and administration. During the late Kot Dijian phase, sites like Harappa were probably organized as complex chiefdoms or early states.

Urban Expansion

During the Harappa phase, which lasted around 700 years, the city grew to cover 150 ha and was made up of three large mounds and associated suburbs. At Harappa, three sub-phases can be defined on the basis of major rebuilding phases of the city walls and site expansion, changing artifact and pottery styles, and changes in styles of seals. Fired brick was used to construct multi-story houses that were laid out along north-south and east-west streets. Houses were equipped with bathing areas, latrines and sewage drains that were linked to larger drains, which eventually emptied wastewater outside the city walls. Massive mud-brick walls enclosed each of the mounds with access limited to narrow gates that were only wide enough for a single ox cart to enter or leave. Major streets were over 8 meter wide, and some had central dividers that may have been to regulate two-way traffic of ox carts. Major streets for cart traffic traversed the city and wide streets were also present on the interior and the exterior of the city walls. This feature appears to be distinctive of Indus cities and has not been documented in early urban centers of Mesopotamia or Egypt.

The city had links to smaller settlements in the surrounding hinterland, as well as to distant urban centers such as Mohenjo Daro. Raw materials from distant resource areas were brought to the city workshops to be transformed into valuable local commodities for both everyday use and as wealth indicators for the urban elites. Specialized crafts, such as stone bead making, steatite and faience ornament production, copper working, pottery manufacture and a variety of other crafts were carried out in workshops throughout each of the walled sectors of the city. The city was supported by a complex subsistence base that included wheat and barley agriculture; cattle and water buffalo animal husbandry, supplemented by sheep and goat herding; and a well-organized fishing industry. The hunting of wild animals also contributed to the support of the urban populations, both for food as well as for skins, ivory and other animal products.

There is no evidence for warfare or centralized ruling elite, and each of the walled areas may have been maintained by competing

elites, merchants, landowners and religious leaders. This type of decentralized, corporate rule has been documented during the later Early Historic period in northern South Asia. Harappa was clearly a meeting place for many different classes and ethnic communities.

At the beginning of the Harappa phase (Period 3A, 2600–2450 BCE) the earlier division of the settlement into two walled sectors was maintained. The transition from the Kot Dijian to the Harappan phase appears as a gradual transformation of pottery and artefact forms, along with strong continuities in settlement planning. The Harappan city walls were constructed directly above or slightly offset from the Early Harappan walls. Houses and streets were constructed along the same general plans with north-south and east-west orientation. The absolute sizes of bricks and the 1:2:4 ratios of the bricks remained the same in all parts of the site. In other areas of the site there are distinct and relatively abrupt stratigraphic indicators of change, as well as architectural changes. On the eastern edge of Mound E, domestic structures were replaced by Harappan streets, and the Harappan city wall was constructed along a different plan. While the city walls continued to be constructed of mud-brick, the architecture of the Harappan period is primarily made of fired brick with some wooden components. Fired brick has been reported from some Early Harappan sites, such as Kalibangan, where it was used in drains, but the widespread use of fired brick for architecture at Harappa does not begin until around 2600–2500 BCE.

During Period 3B, from 2450–2200 BCE, the city began to grow dramatically, with major walled suburbs constructed to the north and south of Mound AB, and to the east of Mound E. Parts of the settlement currently buried under modern Harappa date to this same period. The population increase was probably the result of agglomeration of merchant and craft communities, some migration to the city from the surrounding countryside, as well as normal population growth. This process of urban growth appears to have been going on at all of the large urban centres in the greater Indus Valley. The largest architectural feature of Harappa, commonly referred to as the ‘granary’, was constructed at this time in one of the new walled suburbs called Mound F. It was built in three major building episodes for this structure and no evidence for its use as a ‘granary’. Furthermore, this building or ‘Great Hall’ was built 200 years before the construction of circular brick platforms located to the south.

These circular platforms were originally thought to have been used to process grain but new excavations do not support this interpretation. The circular platforms were originally enclosed within small rooms and may have been used for some industrial purpose, possibly the production of indigo dye. They were constructed during the subsequent Period 3C, which dates from around 2200–1900 BCE and represents the largest urban expansion of the city.

During Period 3C, Harappa appears to have been directly linked to surrounding rural settlements as well as distant urban centres and resource areas. Impressed pointed base goblets made at Harappa have been found at Lal Shah, located a day's walk (16 km) to the northeast. Analysis of stoneware bangles made at both Harappa and Mohenjo Daro shows that these distinctive ornaments were worn by elites who traveled between the two sites. In addition to lapis lazuli and other minerals, the discovery of a pressure flaked arrow point fragment and carved steatite figurine wig at Harappa, provide evidence for close links to Central Asia. Harappa had trade items which provide evidence for contact with Gujarat, the Makran coast, Baluchistan, the foothills of the Himalayas, and possibly Rajasthan. It is during this period that the Indus script is executed on a wide variety of materials and in a wide range of public and private contexts.

Urban transformation

During the Late Harappan phase (1900–1300 BCE), most of the walled mounds were fully inhabited and the encroachment of houses and workshops onto the streets suggests that the city was overcrowded, possibly as a result of refugees from regions to the east, where the Saraswati-Ghaggar-Hakra River was beginning to dry up. Although most of the Late Harappan occupation levels were destroyed by brick robbing, a few remaining areas and a large cemetery (Cemetery H) show a gradual transition from the Harappa to the Late Harappan phase (Kenoyer 2008). Continuities in some technologies and art styles, and changes in other aspects of technology indicate that the transition was not abrupt or the result of replacement by new people.

Summary of Harappa

The evidence discussed in Kenoyer (*Ibid.*) and references therein, make it clear that the growth and evolution of Harappa was complex but clear evolutionary patterns can be identified. The period 1A is essentially that of rural community, even if it appears well

organized. This sophisticated level of organization must have required dependence on farm and other produce from very long distances. Hence, clearly, Harappa was set on a path where large development was essential. Kenoyer (2008) notes that other regions also came to this size but did not grow or sustain as well as Harappa. This may have been due to the intimidating presence of Harappa, or more likely, major technological changes were happening in Harappa. In the short Kot Diji period of 200 years there is a dramatic increase in the sophistication of technology but the full expansion into the great city is completed only in Harappan period 3C indicating that it took 700 years for the technologies developed in Kot Diji period to be fully exploited. Kenoyer (*Ibid.*) notes that there is a significant increase in population in the 3C period and probably included merchants, craftsmen *etc.*, probably migrating from surrounding area. The decay phase of Harappa is broadly classified as 1900 to 1300 BC. He notes that the decay is not due to war or any such catastrophic event and is marked by loss of signs of elitist life style such as seals, writing and standardized weight, all indicating a loss of long term contact. However, as Kenoyer notes, this is the period of drying up of Ghaggar-Hakra which would have produced additional strains on the city, putting it in decline. If the model suggested here is correct, then arrival of horse and/or iron could have allowed the City to extend its reach of organization and survive.

CONCLUSIONS

We have attempted to create a synthesized timeline for the Indus Civilization based on the available archaeological evidence and inferences drawn from other civilizations. We then quantify the various stages of evolution in terms of ten basic parameters to evaluate the quality of life. We show that the broad features of HC can be divided into four major phase transitions. The first three saw a positive improvement in life with the arrival of farming, metallurgy, and urbanization. The last transition occurred due to the *failure* of the civilization to come up with new quality improvements which could have stabilized them to a higher level. We show that the detailed discussion on the evolution of the city of Harappa agrees with the trends suggested here. In principle discovery

of iron could have provided the crucial change that could have sustained the civilization.

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NOTES

[1] Earlier to the first urbanization in HC, first urban centre of Uruk rises around 4000 to 3200 BC in West Asia. Uruk was an ancient city of Sumer and later Babylonia, situated east of the present bed of the Euphrates River. It can therefore be argued that HC had been arisen due to the influence of Uruk on Indus Valley population. Indeed the average number of signs in Indus writing (5 signs) to Uruk (7 signs) and the similarity of Harappan signs to the Elamite writing in southern Iran would indicate such an interaction. However, the urbanization of Indus Valley (as suggested by the location of the earliest of the Indus Valley City of Harappa) was in fact far from the possible contact region. This suggests that urbanization and transformation to civilization seems to have been indigenous to the HC (Kenoyer 2008; Wright 2010: 12).

[2] In India, Gandhiji was the last great advocate of it and the worldwide communist regime tried this against the trend of history. Eventually India had to open itself to commercial competitive market place and communism collapsed.

[3] A *loya jirga* is a grand or council of citizens from a large area that agree to work in a common manner. It is usually held for major events such as choosing a new king, adopting a constitution, or discussing important national political or emergency matters as well as disputes. It is a forum unique among the Pastun tribes in Afghanistan and Pakistan even today, in which, traditionally, tribal elders meet together.

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Appendix

Parameterisation of the standard of living of culture

Murdock and Provost (1973) have defined a set of 10 parameters that can be used to define the standard of living of any group. They define ten criteria on the basis of which cultures can be evaluated. Each criterion is ordered according to a five-point scale of relative complexity. We reproduce them below for completeness.

Scales 1: Writing and Records

This scale was devised to take account of the widely recognized distinction between literate and non-literate (or preliterate) societies. It assigns higher scores to writing and lower ones to non-written records and mnemonic devices.

4 The society has an indigenous system of true writing and possesses written records of at least modest significance.
3 The society has an indigenous system of writing but lacks any significant accumulation of written records, or alternatively has long used the script of alien people.
2 The society lacks true writing but possesses significant non-written records in the form of picture writing, quipus, pictorial inscriptions, or the like.
1 Writing and significant records are lacking but the people employ mnemonic devices, *e.g.,* simple tallies.
0 Writing, records, and mnemonic devices in any form are lacking or unreported.

Scale 2: Fixity of Residence

This scale is designed to indicate the extent to which the mode of life is sedentary or nomadic, cultural complexity having frequently been found to be correlated with settled life. It is adapted from Murdock and Wilson (1972).

4 Settlements are sedentary and relatively permanent.
3 Settlements are sedentary but impermanent.
2 The pattern of settlement is semi-sedentary.
1 The pattern of settlement is semi-nomadic.
0 The pattern of settlement is fully nomadic.

Scale 3: Agriculture

This scale, indicating the degree of dependence upon agriculture for subsistence and the intensity with which it is practiced, is intended to provide a measure of the extent to which the society subsists by food production as opposed to food gathering. It is adapted from Column 2 in Murdock and Morrow (1970) with additional information from Murdock and Provost (1973) and Murdock (1967).

4 Agriculture contributes more to the society's food supply than does any other subsistence activity and is conducted by intensive techniques such as irrigation, ploughing, or artificial fertilization.
3 Agriculture contributes more to the food supply than does any other subsistence activity but is not conducted by intensive techniques.
2 Agriculture yields more than 10 percent of the society's food supply but not as much as does some other subsistence activity.
1 Agriculture is practiced but yields less than 10 percent of the food supply.
0 Agriculture is not practiced or is confined to non-food crops.

Scale 4: Urbanization

This scale, indicating the average population of local communities, is designed to measure the degree of urbanization of the society, large concentrations of population having frequently been found to be correlated with cultural complexity. It is adapted from Column 3 in Murdock and Wilson (1972).

4 The population of local communities averages in excess of 1,000 persons.
3 The population of local communities averages between 400 and 999 persons.
2 The population of local communities averages between 200 and 399 persons.
1 The population of local communities averages between 100 and 199 persons.
0 The population of local communities averages fewer than 100 persons.

Scale 5: Technological Specialization

This scale is designed to measure the degree of complexity and specialization in technological crafts. It is adapted from data in Murdock and Provost (1973).

4 The society is reported to have a variety of craft specialists including at least smiths, weavers, and potters.
3 The society is reported to have specialized metal workers or smiths but to lack loom weaving and/or pottery.
2 Loom weaving is practiced but metal working is absent or unreported.
1 Pottery is made but metal working and loom weaving are absent or unreported.
0 Metal working, loom weaving, and pottery making are all absent or unreported.

Scale 6: Land Transport

This scale is designed to measure the degree of complexity in the means of land transportation and thus presumably indirectly the extent of intergroup trade. It is adapted from Column 7 in Murdock and Morrow (1970).

4 Automotive vehicles, *e.g.,* railroads and trucks, are employed extensively in land transport. Since these have commonly been introduced by foreigners in formerly colonial areas they are indicated only where they were thoroughly integrated in to the indigenous economy at the pinpointed date.
3 Animal-drawn wheeled vehicles are employed in land transport but motorized vehicles are seldom or never used.
2 Land transport is conducted to a considerable extent by means of draft animals dragging a sled, travois, or other vehicles without wheels.
1 Land transport is effected mainly by pack rather than draft animals.
0 Land transport is effected exclusively by human carriers.

Scale 7: Money

This scale is designed to measure the degree of complexity with respect to media of exchange and thus indirectly the level of economic organization. It is adapted from Column G in Murdock and Morrow (1970).

4 The society uses an indigenous currency in the form of metal coins of standard weight and fineness and/or their equivalent in paper currency.
3 The society uses indigenous articles of token or conventional value, such as cowrie shells, wampum, or imitation tools, as an elementary form of money.
2 The society lacks any form of indigenous money but has long used the currency of an alien people, *e.g.,* that of its colonial rulers.
1 True money is lacking but the society employs domestically usable articles, such as salt, grain, livestock, or ornaments, as a medium of exchange.
0 The society lacks any recognized medium of exchange, conducting mercantile transactions through the direct or indirect exchange of goods, *e.g.,* barter.

Scale 8: Density of Population

This scale, which indicates the mean density of population in the territory controlled or exploited by the society, is designed to provide an indirect measure of cultural complexity, which is commonly considered to correlate with population density. It is adapted from Column 4 in Murdock and Wilson (1972).

4 The mean density of population exceeds 100 persons per square mile.
3 The density of population averages between 26 and 100 persons per square mile.
2 The density of population averages between 5.1 and 25 persons per square mile.
1 The density of population averages between one and five persons per square mile.
0 The density of population averages fewer than one person per square mile.

Scale 9: Level of Political Integration

This scale indicates the complexity of political organization in terms of the number of distinct jurisdictional levels recognizable in the society. It is adapted from Columns 1 and 3 in Tuden and Marshall (1972), Column 15 in Murdock and Wilson (1972), and Column 32 in Murdock (1967).

4 Three or more administrative levels are recognized above that of the local community, as in the case of a large state organized in to provinces which are subdivided into districts.
3 Two administrative levels are recognized above that of the local community, as in the case of a small state divided into administrative districts.
2 One administrative level is recognized above that of the local community, as in the case of a petty state with a paramount chief ruling over a number of local communities. Societies which are politically completely dependent lacking any political organization of their own and wholly absorbed in to the political system of a dominant society of alien culture are likewise coded as 2.
1 The society is stateless but is composed of politically organized autonomous local communities.
0 The society is stateless, and political authority is not centralized even on the local level but is dispersed among households or other small component units.

Scale 10: Social Stratification

This scale is designed to indicate the relative complexity of graded status distinctions within the society. It is adapted from Columns 67, 69, and 71 in Murdock (1967).

4 The society exhibits a complex stratification to three or more distinct classes or castes regardless of the presence or absence of slavery.
3 The society is stratified in to two social classes of freemen, *e.g.,* nobles and commoners or a propertied elite and a property less proletariat, plus hereditary slavery and/or recognized caste divisions.
2 The society is stratified into two social classes of freemen but lacks both caste distinctions and hereditary slavery.
1 Formal class distinctions are lacking among freemen, but hereditary slavery prevails and/or there are important status differences based on the possession or distribution of wealth.
0 The society is essentially egalitarian, lacking social classes, castes, hereditary slavery, and important wealth distinctions.