Abstract

Table of Contents

Introduction

Part I
Chapter 1
Chapter 2
Chapter 3
Chapter 4

Part II
Chapter 5
Chapter 6

Part III
Chapter 7
Chapter 8

Part IV
Chapter 9
Chapter 10

Chapter III

Ancient High Civilizations

There is little doubt that the basic culture in Sumeria (and later on, in Babylonia and Assyria), in Egypt, and in the Indus Valley, in Northern Syria and in Crete, were all non-Indo-European. The Indo-Europeans were m fact not the *creators* of the cultures they subsequently became so indebted to, but rather -- as Vere Gordon Childe put it [78] -- the *destroyers*. Certainly this was true in the Indus Valley where they are first known from history as an organized body. China makes her great contribution to Indo-European Culture somewhat later, and can therefore be considered last.

The basic elements of Mesopotamian civilization in later times when the Babylonians and Assyrians (both Semitic in origin) had achieved ascendancy, were still essentially Sumerian. It is pretty well agreed that these Sumerians were not Semites, being clean shaven and comparatively hairless like the Egyptians. And from their language it is quite clear that they were not Indo-European either. Their civilization developed very rapidly and achieved a remarkable level of technical competence. In the earliest stages of their history, they seem to have shared many features with the Indus Valley people who were later overwhelmed by the Aryans, and with the first settlers in Northern Syria, and even with the earliest Egyptians. As further development took place in each of these areas, cultural similarities became obscured.

All these cultures seem to spring into being already remarkably well organized, with skills in weaving and pottery making, and in the erection of defensive structures and temple buildings, and with some use of metals from the first. It is assumed that the Sumerians were organized into city-states before the Egyptians were, although it was once held that the oldest centre of civilization was along the Valley of the Nile. While there is, as yet, no evidence of the Sumerians without the basic elements of civilization it is believed that they came from

78. Childe, Vere Gordon, "India and the West Before Darius," .*Antiquity,* vol.13, no.49, March, 1939, p.15.

the North and East, and it is expected that the origins of these people (and of the Egyptians and Indus Valley people also) will in due time be discovered in the general direction of Jarmo, Sialk, etc. What is now fairly clearly established is that civilization -- the arts and trades and organized city life, with the division of labour,

social stratification, a leisure class, written records, and so forth -- began, in so far as the Middle East is concerned, with the Sumerians.

Vere Gordon Chide put it this way: [79]

> On the Nile and in Mesopotamia the clear light of written history illuminates our path for fully 50 centuries; and looking down that vista we already descry at its farther end ordered government, urban life, writing and conscious art. The greatest moments -- that revolution whereby man ceased to be purely parasitic and, with the adoption of agriculture and stock raising, became a creator emancipated from the whims of his environment, and then the discovery of metals and the realization of their properties, have indeed been passed before the curtain rises.

And T. J. Meek confirms this by saying: [80]

> The Sumerian Culture springs into view ready made, and there is as yet no knowledge of the Sumerians as savages; when we find them in the 4th millennium B.C., they are already civilized highly. They are already using metals, and living in great and prosperous cities.

This is not a study of archaeology strictly speaking, and one cannot therefore digress into elaborate descriptions of the results of excavation in the Middle East. It can however be safely stated -- because easily defended -- that the most surprising aspect of the whole venture has been the discovery that technical skill seems to have been remarkably high from the very beginning and to have been applied in the fields of metallurgy, building, weaving, agriculture, medicine, art, pottery and ceramics, and transport (both on land and water) from the earliest times. In fact succeeding ages did not reach the same high standards as a rule. The problems of design, basic materials, methods of production in 'quantity,' control of quality, marketing and cost accounting -- all these aspects were successfully dealt with in ways that have been very little improved upon since.

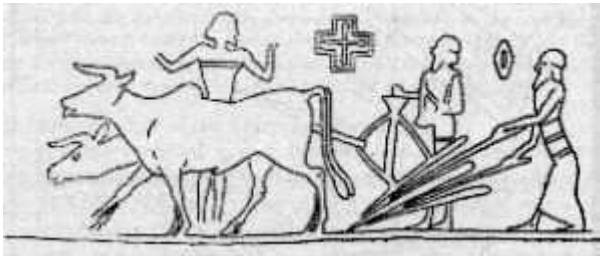
79. Childe, Vere Gordon, *New Light on the Most Ancient East,* New York, Kegan Paul, 1935, p.2.
80. Meek, T. J., in a lecture given in the Orientals Department, University of Toronto, ON, Fall, 1936.

A quotation from Abbott Payson Usher seems appropriate here: [81]

> In this connection it may be well to emphasize the fact that there is no direct connection between the character of the tools and mechanisms used and the quality of the craftsmanship. The highest quality of work has been done with the simplest appliances. Ancient gem cutting was, on the whole, superior to the modern work. So, too, periods of technologic advance are not necessarily periods of improvement, in the style or finish of the work. Many of the misconceptions of the technique of antiquity are due to the naive assumption that good work implies elaborate tools and mechanisms
>
> More frequently, technologic advances merely reduce costs and open up possibilities of a larger volume of production.

The Sumerians knew what percentages of metals to use to achieve the best alloys, casting a bronze with 9 to 10% of tin exactly as we find best today; their pottery was often paper-thin, tastefully shaped and decorated, and with a ring like true china, evidently having been fired in controlled-atmosphere ovens at quite high temperatures. Their methods of production led very early to a measure of automation including powered agricultural equipment that was in the strictest sense 'mechanical' (Fig. 12).

The control of quality production was early established by systems of inspection in their factories; were highly organized, and price controls and wage controls were established by law. They developed loan and banking companies where interest rates were outlandish, yet still legally controlled; their record keeping and postal systems were highly efficient, mail being carried in envelopes!



This seal impression is identified by Prof. A. Clay as UPMP II 66, University of Pennsylvania Museum Publications. It is interpreted by him as a plow. That it is in reality a mechanical seeder seems clear from the hopper, and the three 'drills.'

Figure 12.

In addition the upper classes lived quite sumptuously, well supplied in many cases with home comforts and 'all modern conveniences' -- including running water in some cases, tiled baths, proper disposal of sewage, extensive medical care, and so forth Even libraries existed, and well organized schools of course. By comparison their descendants did not sustain their inheritance, but came to live in that filthy squalor, precarious poverty and constant threat of disease, which misled earlier generations of Europeans to suppose mistakenly that they themselves were the creators of the superior civilization they were enjoying.

The greatness of Egypt today is 'monumental.' Sumerians did not build with stone, for they did not have it

81. Usher, Abbott Payson, *A History of Mechanical Inventions,* Cambridge, MA, Harvard University Press, 1954, p.154.

in sufficient quantity. They left another kind of monument -- imperishable written records. Once these began to be deciphered something of their achievement became

apparent. It is by such means that we know for example of their mathematics. Dr. T. J. Meek tells us that: [82]

> Like the Egyptians the early Sumerian used the additive method to multiply and divide, but before 2000 B.C. they had evolved multiplication tables and tables of reciprocals and of squares and cubes, and other powers, and of square and cube root and the like. They had attained a complete mastery of fractional quantities and had developed a very exact terminology in mathematics. The correct value of Pi, and the correct geometrical formula for calculating the area of rectangles was known before 3000 B.C. and in the years that followed came the knowledge of how to find the area of triangles and circles, and irregular quadrangles, polygons, and truncated pyramids; also cones and the like. By 2000 B.C. the theorem attributed to Pythagoras was familiar and they could solve problems involving equations with 2, 3, and 4 unknowns.

According to one of the best authorities in this area, they even had developed an equivalent to our logarithm tables! [83]

George Sarton, writing some 20 years later than Meek, could add to this accomplishment their knowledge that the angle in a semi-circle is a right-angle, that they could measure the volume of a rectangular parallelepiped, of a circular cylinder, of the frustum of a cone, and of a square pyramid. He sums up the achievement thus: [84]

> The Sumerians and their Babylonian successors left three legacies, the importance of which cannot be exaggerated: 1) the position concept in numeration -- this was imperfect because of the absence of zero: 2) the extension of the numerical scale to sub-multiples of the unit as well as to the multiples -- this was lost and was not revived until 15785 A.D. with reference to decimal numbers, and, 3) the use of the same base for numbers and metrology -- this too was lost, and not revived till the foundation of the metric system in 1795.

82. Meek, T. J., "Magic Spades in Mesopotamia", *University of Toronto Quarterly*, vol.7, 1938, p.243. 244.
83. Neugebauer, Otto and A. Sachs, *Mathematical and Cuneiform Texts,* New Haven, Yale University Press, (for the American Oriental Society and the American School of Oriental Research), 1946, p.35
84. Sarton, George, *A History of Science*, Cambridge, MA, Harvard University Press, 1952, pp.73, 74, 99 and 118.

Later, he writes of what we borrowed indirectly from this source:

> Many other traces can be detected in other cultures, even that of our own today -- sexagesimal fractions, sexagesimal divisions of the hours, degrees, and minutes, division of the whole day into equal hours, metrical system, position concept in writing of numbers, astronomic tables. We owe to them the beginnings of algebra, of cartography, and of chemistry.

But perhaps the greatest surprise of all is to find that the Greeks did not do so very well transmitting this heritage usefully! Thus Sarton concludes:

> The Greeks inherited the sexagesimal system from the Sumerians but mixed it up with the decimal system, using the former only for sub-multiples of the unit, and the latter for multiples, and thus they spoiled both systems and started a

> disgraceful confusion of which we are still the victims. They abandoned the principle of position, which had to be re-introduced from India a thousand years later. In short their understanding of Babylonian arithmetic must have been very poor, since they managed to keep the worst features of it, and to overlook the best. . . .
>
> The Greeks used their intelligence in a different way and did not see simple [i.e., practical --ACC] things that were as clear as day to their distant Sumerian and Babylonian predecessors.

It might be thought that if the Sumerians were really practical people they would have adopted a decimal system from the first, and quickly abandoned the sexagesimal system. But there is much to be said for the use of 12 instead of 10 as a base number. Ten has only two factors: 2 and 5. But 12 has 2, 3, 4, and 6 -- or twice as many: and in the higher multiples such as 60, the number of factors is of course greater than the corresponding 20 of the decimal system. Learning to think in terms of such a system would be difficult for us now that we are so accustomed to the decimal system., but there are some highly competent mathematicians who hold that the change could be made and would be advantageous. This is a matter of opinion of course, but since we have 10 fingers the choice of 10 as a base seems more obvious -- and one suspects therefore that these practical people saw a real advantage in using 12 instead.

Yet it was purely a practical matter, and not a theoretical one. The Greeks were more interested in theory than practice. The contrast between the Sumerian and the Greek attitude is seen in their treatment of problems

---

of Astronomy. In this connection, O. Neugebauer says: [85]

> A careful analysis of the assumptions which must be made in order to compute our texts shows nowhere the need for specific mechanical concepts such as are familiar to us fro the Greek theory of eccentrics or epicycles, or from the corresponding planetary models of Tycho Brahe or Kepler. . . . At no point can we detect the introduction of an hypothesis of a general character.

Samuel Kramer makes frequent reference to the fact that the Sumerians were an entirely practical people, with no urge to search for truth for its own sake, among whom there was not the slightest tendency either to theorize or generalize, who sought for no underlying principles, and undertook n experiments for verification. [86]

Sarton gives some illustrations to show how their mathematics arose out of a practical need, i.e., business records and transactions. In the same way geometry reached the Greeks after being developed to satisfy entirely practical needs of the Egyptians. This is why Thales termed it Geometry, for it was required originally to measure the land in order to re-establish property boundaries obscured each year by the flooding of the Nile. [87]

Among the Sumerians and Babylonians, banking houses sprang up and became the forerunners of world economics as represented by our international institutions. Two such Banks are known from cuneiform records by the names of Engibi and Sons, established about 1000 B.C. and lasting some 500 years, and Murasha Sons,

founded about 1464 B.C. and dissolved finally in 405 B.C. The latter established a system of mortgaging![88]

Glass was known to the Sumerians by 2700 B.C., and both they and the Egyptians were experts in the working of it. [89] For drilling such hard substances they used diamond drills, or some soft material coated with emery or corundum. [90]

85. Neugebauer, Otto, "Ancient Mathematics and Astronomy" in *A History of Technology*, edited by Charles Singer, *et al*., Oxford, UK, Oxford University Press, 1954, \vol.1, p.799.
86. Kramer, Samuel N., *From the Tablets of Sumer*, Indian Hills, CO., Falcon's Wing Press, 1956, pp.xviii, 6, 32, 58, 59.
87. Jourdain, Philip E. B., "The Nature of Mathematics" in *The World of Mathematics*, edited by James R. Newman, New York, Simon & Schuster, 1956, vol.1, p.10-13.
88. Reavely, S. D., "The Story of Accounting," *Office Management,* April, 1938, p.8ff.
89. Wiseman, P. J., *New Discoveries in Babylonia about Genesis,* London, UK, Marshall, Morgan & Scott, 2nd. edition revised, (undated), p.30.
90. Boscawen, St. Chad, in discussing a paper by Sir William Dawson, "On Useful and Ornamental Stones of Ancient Egypt," *Transactions of the Victoria Institute,* vol.26, 1892, p.284.

A tablet found a few years ago is inscribed by a certain Dr. Lugal-Edina, dated about 2300 B.C., and in it we are told how surgeons of the day had already learnt to set broken bones, make minor and major incisions and even attempt operations on the eyes. Sicknesses are given names, and symptoms carefully noted. Waldo H. Dubberstein of the Oriental Institute of the University of Chicago, in reporting on this says: [91]

> One hundred years of exploration and research in the field of ancient Near Eastern history have yielded such astounding results that today it is unwise to speculate on the further capacities and resources of these early people along any line of human endeavour.

Medicine was a carefully regulated profession with legally established fees for various operations and very stiff penalties for failure or carelessness -- evidently intended to protect the customer and prevent charlatanism. This certainly suggests that the profession was not simply a 'School of Magicians.'

Although their buildings have largely disappeared, they were noteworthy examples of the use of local materials, i.e., mud-dried brick and reeds. The former are easily visualized as promising materials; the latter are not. But as a matter of fact, "reed huts" (mentioned in some of the very earliest tablets are capable of a surprising beauty and spaciousness as the accompanying illustrations indicate. (Fig. 13 and Fig. 14). These are modem examples of course, but there is every reason to believe that the designs have not greatly changed through the centuries that intervene. Floor plans as revealed by excavation indicate similar structures.

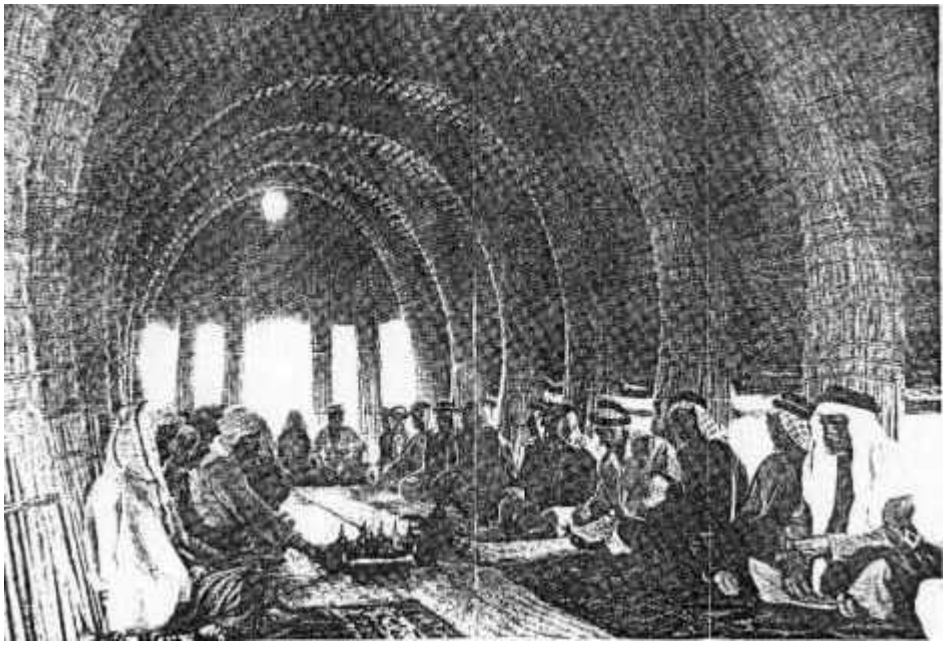


Fig. 13 A moderm Reed House in the Marsh Country of the Lower Euphrates.

91. Dubberstein, Waldo H., "Babylonians Merit Honour as Original Fathers of Science," *Science News Letter,* September 4, 1937, p.148, 149.

By the time the Sumerians arrived in Mesopotamia, they had domesticated as many animals as were ever domesticated in that area, with the exception of the horse which was tamed by the Hittites -- although they did have a draft animal, a mountain ass. And the same may be said of grains. N.I.Vavilov always considered that the Highland Zone to the north and east whence they had come, was for this reason the most likely home of all such domesticated plants and animal species as are commonly in use today. He called it the "Source of Species." 92

Written records appear at the very earliest levels, and

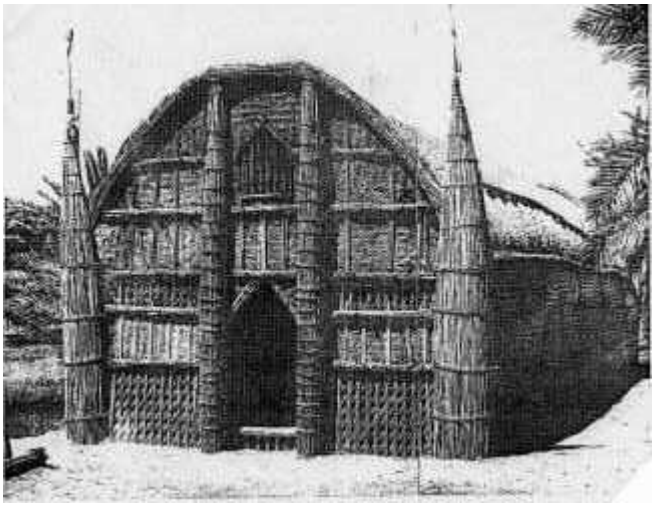


Fig. 14
An exterior view of th 'Reed House' shown in the previous photograph.

even at Sialk there seems to have been no period when they were without the use of metals. [93]

Egyptian Civilization

The same story is found to be true of Egypt. Here again there is no true beginning. The Egyptians, like the Sumerians and the founders of Tell Halaf, in Northern Syria, appear to have been culturally creative from the very beginning, and to have developed their technology exceedingly rapidly. Pastoral societies are slower to develop, and the Semites who were largely pastoral contributed little and borrowed much. Indo-Europeans meanwhile did not even have a word of their own for *City*, the organization of urban community life with all that this entails in terms of civilization did not originate with them. It has been shown that all their words for *City*, *Town*, etc., are loan-words. [94]

The speed with which Egyptian civilization developed was astonishing. P.J. Wiseman, who has spent a lifetime in the area studying its past history and closely in touch with the work of archaeologists, says in this regard: [95]

> No more surprising fact has been discovered by recent excavation than the suddenness with which civilization appeared. . . . Instead of the infinitely slow development anticipated, it has become obvious that art, and we may say "science", suddenly burst upon the world. For instance, H. G. Wells acknowledges that the oldest stone building known is the Sakkara Pyramid. Yet as Dr. Breasted points out, "from the Pyramid at Sakkara to the construction of the Great Pyramid less than a century and a half elapsed."
>
> Writing of the latter, Sir Flinders Petrie stated that, "the accuracy of construction is evidence of high purpose and great capability and training. In the earliest pyramid, the precision of the whole mass is such that the error would be exceeded by that of a metal measure on a mild or a cold day; the error of leveling is less than can be seen with the naked eye.

The same famous Egyptologist stated that the stone work at the Great Pyramid is equal to an optician's work of the present day. [96] The joints of the masonry are so fine as to be scarcely visible where they are not weathered, and it is difficult to insert even a knife edge between them.

92. Vavilov, N. I., "Asia the Source of Species," *Asia*, vol.37, no.2, February, 1937, p.113.
93. Childe, V. G., *What Happened in History,* Harmondsworth, UK, Penguin, 1942, p.64.
94. Eisler, Robert, "Loan Words **in** Semitic Languages Meaning 'Town'," *Antiquity,* vol.13, no.52, December, 1939, p.449 ff.
95. Wiseman, P. J., *New Discoveries in Babylonia About Genesis*, London, Marshall, Morgan & Scott, 2nd edition, revised, no date, p. 28, 31, and 33.
96. Petrie, Sir Flinders, *The Wisdom of the Egyptians,* British School of Archaeology. Publication No. 63, 1940, p.89.

Vere Gordon Childe, speaking of their earliest earthenware remarks: [97]

> The pottery vessels, especially those designed for funerary use exhibit a perfection of technique never excelled in the Nile Valley. The finer ware is extremely thin, and is decorated all over by burnishing before firing, perhaps with a blunt toothed comb, to produce an exquisite rippled effect that must be seen to be appreciated.

J. Eliot Howard states that the hieroglyphics of the earliest periods indicate that pottery, metallurgy, rope making, and other arts and techniques were well developed,[98] and W. J. Perry, quoting De Morgan, says. [99]

> What appears at a very early date in Egypt is perfection of technique. The Egyptian appears from the time of the earliest Pharaohs as a patient, careful workman, his mind like his hand possessing an incomparable precision . . . a mastery that has never been surpassed in any country.

A carved (or ground?) diorite head from Egypt was sold in London some years ago for the sum of $50,000, and it was considered by the experts at the time "never to have been surpassed in the entire history of sculpture."[100]

It is hard to decide which of these two civilizations produced the most remarkable metal wares. The jewelled weapons of their noble dead are simply beautiful and have to be seen to be appreciated. There are no essential metallurgical techniques which they had not mastered very early in their history. These include filigree, mold and hollow casting, intaglio, wire-drawing, beading, granulation (in water?), welding, inlaying of one metal with another, sheeting hammered so thin as to be almost translucent, repousse, gilding on wood and other materials, possibly spinning of metal, and later -- even electroplating using a form of galvanic cell catalyzed with fruit juices and housed in a small earthenware jar. [101] One of these is illustrated in Fig. 15.

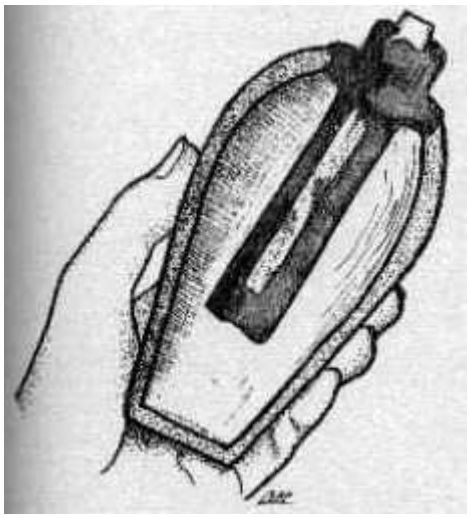


Fig. 15
One of the Parthian batteries, as reconstructed from parts found near Baghdad.

Egyptian medicine will be treated in a later chapter since both it and mathematics are areas of human endeavour in which these ancient people achieved much, yet were clearly prevented from achieving more

97. Childe, V. G., *New Light on the Most Ancient East,* New York, Kegan Paul, 1935, p.67, (note 85).
98. Howard, J. Eliot, "Egypt and the Bible," *Transactions of the Victoria Institute,* vol.10, 1876, p.345.
99. Perry, W. J., *The Growth of Civilization,* Harmondsworth, UK, Penguin, 1937, p.54.
100. Magoffin, Ralph N., "Archaeology Today," *The Mentor,* April, 1924, p.6.
101. Reported under the title, "Batteries B.C.", *The Laboratory,* vol.25, no.4, 1956, published randomly by Fisher

Scientific Company, Pittsburgh, quoting Willard F. M. Gray of the General Electric Company's High Voltage Laboratory, in Pittsburgh. Gray reconstructed these batteries on the basis of archaeological materials.

by reason of a certain attitude of mind which seems to have been responsible for their failure to develop the scientific method.

This failure had a fatal consequence. The high technical competence in so many fields which they developed rapidly and exploited to our continuing wonderment, halted at a certain point, maintained itself for a few centuries unchanged, began to decay rather suddenly, and finally passed out of memory altogether until it was recovered from the dust of the centuries by the labours of archaeologists during the past century or so.

Sir Arthur Evan's researches in Crete have revealed the same pattern of history. [102] The magnificent Palace of Minos with its system of hot and cold running water, its rooms often decorated with a kind of wallpaper effect done (as is done today) with a sponge,[103] its extraordinary architecture, its beautiful pottery -- in many cases patterned upon metal prototypes, its highly organized court life, and its evidence of extensive trade and commerce overseas -- all these achievements demonstrate clearly that the craftsmen of the ancient Minoan Empire were in no way behind the Egyptian and Sumerian in technical competence. Two sections of their water piping illustrated in Fig. 16. Like the drainage and sewage systems of the Indus Valley cities of Mohenjo Daru and Changu Daru, they are equal in

Some details of the plumbing found in the Palace of Knossos in Crete. It is dated in Middle Minoan I by Sir Arthur Evans. This would be somewhere about 2000 B.C., or slightly earlier. The sections are all made of clay, and are well baked.
The illustrations are taken from Evans' *Palace of Minos,* Macmillan, Vol. I, p.143.

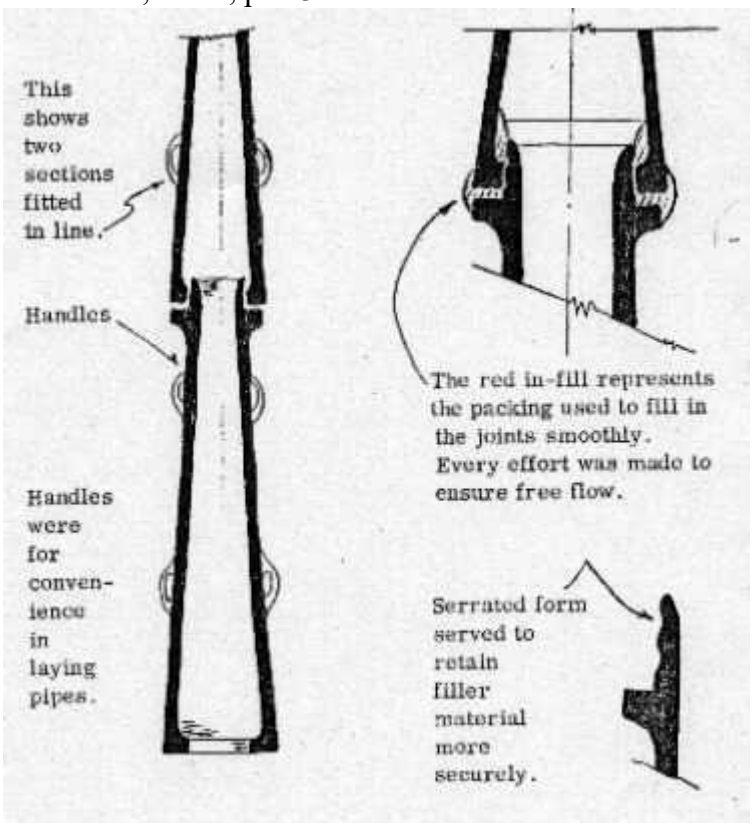


Fig 16.
The design of these pipes is based on sound engineering principles.
Turbulence is reduced to a minimum.

effectiveness to anything we can install today. The underground sewage disposal system illustrated in Fig. 17, from Northern Syria, is clear evidence of a highly organized city life that presupposes the same kind of technical achievement and awareness of the possibilities of community responsibility.

102. Evans, Sir Arthur, *The Palace of Minos,* London, UK, Macmillan, in 5 vols. beginning publication in 1921.
103. Painting with sponges: see *Bulletin of the Royal Ontario Museum of Archaeology,* no.11, March, 1932, p.7.

Indeed according to T. J. Meek, the people of Tell Halaf in Syria were never without metals, and their finely fired pottery "no thicker than two playing card" and beautifully designed, is equal to the best that the Sumerians produced.[104] It is closely parallelled by some of the earliest pottery found at Susa by de Morgan,[105] a city which was closely tied in with the Sumero-Egyptian Indus-Valley "Archaic Civilization" as W. J. Perry aptly called it.

In contrast with the sewage disposal system of modern Syrian towns this ancient 'main sewer' from Ugarit (or Ras Shamra) looks pretty impressive. It was built in the 2nd. millennium B.C., and is 9 feet underground, with room to walk in.

In the streets above, lead drains like this carried the water into the sewers, and kept the streets clean and dry. In the photograph, the holes are in the process of being cleaned out. It is difficult to realize that this was made and installed 4000 years ago!

Fig. 17

104. Meek, T. J., 'The Present State of Mesopotamian Studies,' in the *Haverford Symposium of Archaeology and the Bible,* published by the American Schools of Oriental Research, New Haven, CT, 1938, p.161.
105. de Morgan: quoted by Spearing, H. G., "Susa, the Eternal City of the East" in *Wonders of the Past*, edited by Sir J. Hammerton, London, Putnam's, 1924, vol.3, p.582.

Here, in these areas, lie the roots of all Western Civilization in its earlier stages of development. From these centres, sometimes directly, sometimes indirectly (as via the Etruscans), Europe derived the inspiration of its culture.

The indebtedness of the Greeks to the Minoans is now fully appreciated. [106] The Minoans had in turn derived much of their culture from the Egyptians. Some influences reached Greece directly from Asia Minor. Between these three sources can be divided almost everything in Greek culture that has a technical connotation: mathematics, architecture, metallurgy, medicine, games, and even the inspiration of much of their art -- all was borrowed from such non-Indo-European sources. Even their script was borrowed. In fact one might say their very literacy, for influential figures like Socrates, far from contributing anything to the art of writing, actually strongly opposed it as a threat to the powers of memory.

The same is true of Rome. The part played by the Etruscans in the foundation of Roman Civilization is immense. Sir Gavin de Beer in a recent broadcast in England said:[107]

> It may seem remote to us [to ask who the Etruscans were] and yet it affects us closely for the following reason. We regard the Romans as our civilizers, and we look up to them as the inventors of all sorts of things they taught us. But it is now clear that, in their turn, the Romans learned many of these from the Etruscans.

106. Bibliography on Aegean Pre-history:
Blegen, Carl W., *Zygouries: A Prehistoric Settlement in the Valley of Cleonae*, Cambridge, MA, Harvard University Press, 1928.
Bosanquet, R. C., *Excavations at Phylakopi in Melos* , Macmillan, 1904.
Dinsmoor, W.B., *The Architecture of Ancient Greece*, London, UK, Batsford, 1950.
Evans, Sir Arthur, *The Palace of Minos*, London, UK, Macmillan, 4 volumes, 1921-1935.
Heurtley, W. A., *Prehistoric Macedonia*, Cambridge, UK, Cambridge University Press, 1939.
Holmberg, Erik J., *The Swedish Excavations at Asea in Arcadia*, Lund, Sweden, Gleerup, 1944.
Mylonas, George, *Prehistoric Macedonia: Studies in Honour of F. W. Shipley*, Washington University Series, Language and Literature, No. 14, 1942, p.55 ff.
Pendlebury, John D. S., *The Archaeology of Crete*, London,UK, Methuen, 1939.
Seager, Richard B., "Explorations in the Island of Mochlos," American School of Classical Studies at Athens, published in Boston, 1912.
Valmin, M. Natan, *The Swedish Messenia Expedition*, Oxford, UK, Oxford University Press, 1938.
Wace, Alan J. B., *Prehistoric Thessaly*, Cambridge, UK, Cambridge University Press, 1912.
Weinberg, Saul, "Neolithic Figurines and Aegean Interrelations," *American Journal of Archaeology*, vol.55, April, 1951, 121 ff.
Xanthoudides, Stephanos, *The Vaulted Tombs of Mesara*, London, UK, Hodder & Stoughton, 1924.
And, of course, numerous articles on the Linear Scripts, which have now been deciphered and which originated in Crete, having been adopted by the Greeks subsequently.
107. de Beer, Sir Gavin, "Who Were the Etruscans?" in *The Listener,* BBC, London, UK, Dec., 8, 1955*,* p.989.

de Beer holds that whatever else might be said about these interesting people, their language at least was non-Indo-European, and they were not related either to the Romans or the Greeks. With this, agrees M. Pallottino, an authority on the Etruscans.[108] George Rawlinson, the great Orientalist and classical scholar says in this respect:[109]

> The Romans themselves notwithstanding their intense national vanity acknowledged this debt to some extent and admitted that they derived from the Etruscans their augury, their religious ritual, their robes and other insignia of office, their games and shows, their earliest architecture, their calendar, their weights and measures, their land surveying systems, and various other elements of their civilization. But there is reason to believe that their acknowledgement fell short of their actual obligations and that Etruria was really the source of their whole early civilization.

To this list D. Randall Maclver adds their martial organization -- and even the name of the city itself in all probability. [110]

African Civilization

Out of Africa has come to us far more than just the Egyptian contribution, even were this not a sufficient one. One does not think of Africa as particularly inventive. As a matter of fact, however, so many new things came from that great continent during Roman times that they had a proverb, "*Ex Africa semper aliquid,*" which freely translated means 'There is always something new coming out of Africa.[111] Among other things there came out of Africa "Animal Tales" from Ethiopia. Edwin W. Smith and Andrew M. Dale point out in this connection: [112]

> It might indeed be claimed that Africa was the home of animal tales. Was not the greatest "literary inventor" of all, an African, the famous Lokman, whom the Greeks not knowing his real name called Aethiops (i.e., Aesop)?

Even in medicine Africans have some remarkable achievements to their credit. To mention but two: the Pygmies of the Ituri Forest had invented an enema quite independently of its South American Indian

108. Pallottino, Massimo, *The Etruscans,* Harmondsworth, UK, Penguin, 1955, p.46-73.
109. Rawlinson, George, *The Origins of the Nations*, New York, Scribner, 1878, p.111.
110. MacIver, D. Randall, "The Etruscans," *Antiquity,* vol.1, June, 1927, p.171.
111. Holmyard, E. J., "The Language of Science" (editorial), *Endeavour,* vol.4, no.14, April, 1945, p.41.
112. Smith, Edwin W. and Andrew M. Dale, *The Ila Speaking Peoples of Northern Rhodesia*, London, Macmillan, 1920, vol.2, p.342.

counterpart, [113] and it is known that Caesarean operations were successfully undertaken in childbirth emergencies before the White Man had succeeded in doing it. [114]
Out of Ethiopia came also coffee. [115] And quite recently African art has been the

'inspiration' (for good or ill is a matter of taste) of new forms of art. Very recently a kind of rocking stool, inspired by an ingenious African prototype, has come into popularity.

Their engineering skill is often revealed in very simple things. A carrying chair, illustrated in Fig.18, is so designed that the rider receives the absolute minimum of jolts and rockings due to the unevenness of the ground. It is a kind of super-whiffle-tree sling that equalizes the load and guarantees smooth passage. It is simple and effective and designed on entirely sound engineering principles of which the makers were probably hardly aware.

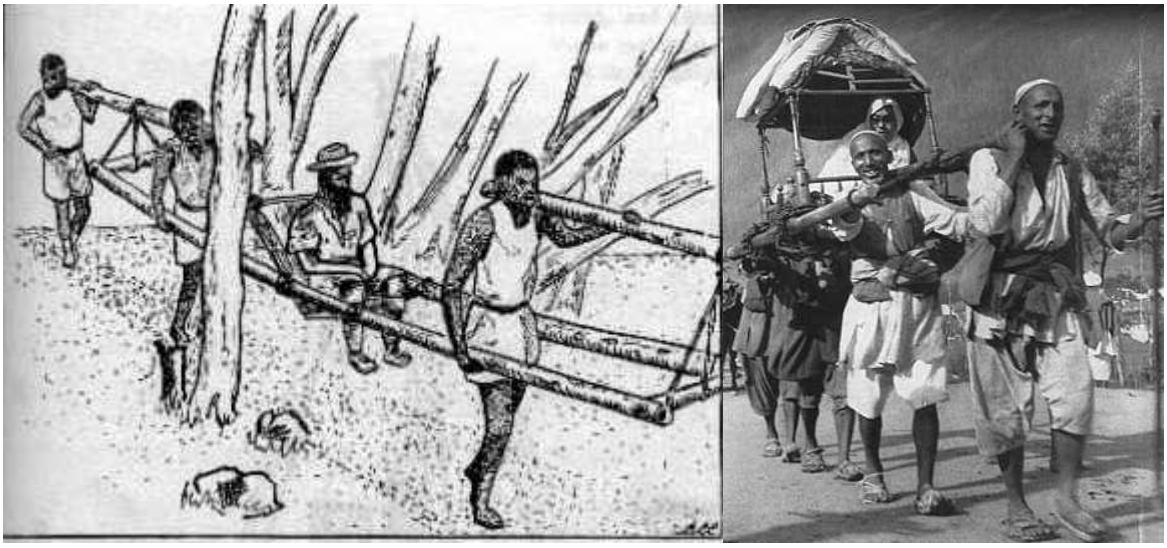


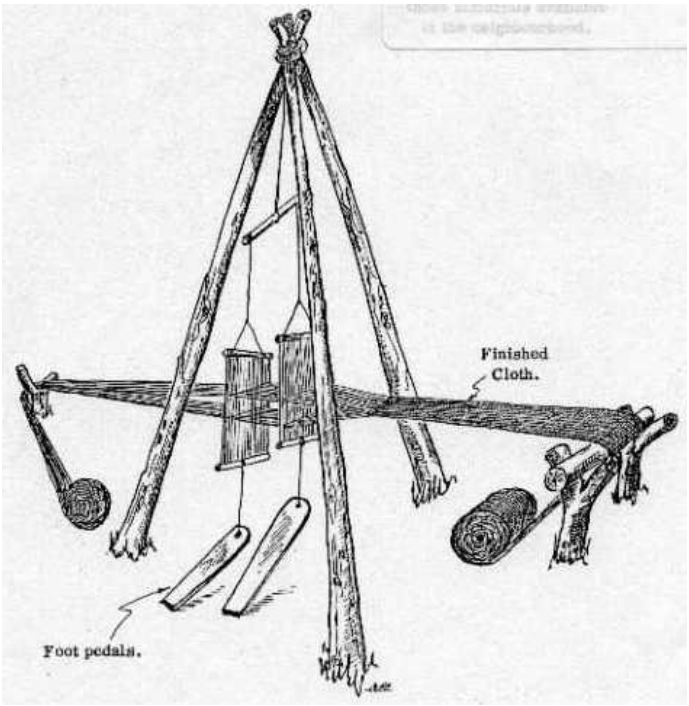
Fig. 18
A four-man chair from French Equatoril Africa.
Sandaled Moslem Porters Carry Ill and Aged Hindus on the Tortuous March

As a further witness to the same kind of genius for simplified construction an African loom is shown in Fig.19. It makes the most effective use possible of locally available raw materials, and in fact uses their actual form to the best advantage.

113. Coon, C. S., *A Reader in General Anthropology*, New York, Henry Holt, 1948, p.340
114. Ackerneckt, Erwin, "Primitive Surgery", *American Anthropologist*, New Series, vol.49, Jan.- Mar., 1947, p.32.
115. Anonymous, "The Story of Coffee" in *The Plibrica Firebox*, vol.22, July - Aug., 1948, p.4, 5.

Almost every African community of any size has its own smelting furnace and smithy. No part of this iron working art has been borrowed from Europe. The whole process (and the refinements found in some cases) is a native invention. The bellows used to increase the oxygen supply and thereby the heat at the hearth,

are of native design and manufacture and are very varied in form. The pipes which convey the air into the furnace are also home made. Suitable clay is plastered around pieces of wood of the proper size and shape (whether curved, straight, or even forked), and then the whole is burned in a fairly hot fire. This reduces the wooden insert to ashes and leaves the desired pipe form, shaped and baked all ready for use. When the ore has been reduced and the metal is removed from the dismantled furnace it is worked by hand. The metal may be hammered into sheet, drawn into wire, or forged into other forms such as vessels, blades, etc., as desired. It is not surprising that we, having largely learned from Africa the basic techniques of iron-working, should refer to our iron metalworkers as Blacksmiths. R. J. Forbes says that although today African smiths often obtain their raw materials from European sources, the Negro smiths "are very ingenious craftsmen in inventing and using new tools and types of bellows". [116]



A native loom whose design is common to many parts of the world,
and which uses only those materials available in the neighbourhood.

From *A History of Mechanical Inventions,*
Abbott P. Usher, Harvard University Press, 1954.

Fig. 19

116. Forbes, R. J., *Metallurgy in Antiquity*, Leiden (NL), Brill, 1950, p.64.

Invention "Firsts"

Samuel N. Kramer has recently published a volume resulting from a lifetime of cuneiform studies which he titles *From the Tablets of Sumer*, and his subtitle takes the following form: *Twenty - five Firsts of Man's Recorded History*. [117] It is an impressive collection of "firsts", yet one will feel at times that he has introduced a few cases which are only rightly termed so, by a kind of special pleading. But on the whole his collection shows that their inventiveness was by no means limited to mechanical things, but applies equally well to certain forms of literature -- and indeed to the very idea of collecting

libraries, writing histories, and cataloguing books for reference.

Among the literary achievements of the Egyptians are to be listed what was surely the first 'moving-picture' sequence, [118] and the first Walt Disney Cartoon. [119]. Gloves and camp stools are found first in Crete, [120] soap in Egypt, [121] virtually all carpenter's tools (saws, squares, bucksaws, brace and bit, etc.) from the Etruscans [122] -- with a novel brace and bit, [123] and the 'level' from Egypt. [124] The Etruscans invented lathes. [125] The Egyptians
built a pipe-organ using water to obtain a uniform air pressure apparently. [126] Folding umbrellas and sun-shades were first designed in China [127] and were not introduced into England until centuries later where the introducer apparently almost lost his life! The Sumerians used straws for drinking with, 128 (shown in Fig 20), and bequeathed to their successors chariot wheels which were made of plywood using exactly the same technique for the manufacture of it as we use today. [129] Africans were using vaccines long before the White

Fig. 20 Sumerians, drinking from Straws.

117. Kramer, Samuel N., *From the Tablets of Sumer*, Indian Hills, CO, Falcon's Wing Press, 1956.
118. "A Cinematograph Touch in Ancient Egyptian Art: Wall-paintings that Suggest Moving Pictures", reproduced from P. E. Newberry's "Beni Hasan" in the *Illustrated London News*, Jan.12, 1929, p.50,51.
119. Hambly, Wilfrid D., "A Walt Disney in Ancient Egypt" in a Letter to the Editor of 'animated animal figures' behaving like people! [*Scientific Monthly*, October, 1954, p.267-8 with illustrations].
120. Gloves and camp stools: see Axel Persson, *The Religion of Greece in Prehistoric Times*, Berkeley, CA, University of California, 1942, p.77.
121. Soap: see on this Rendel Harris, "Soap" in the *Sunset Papers*, published privately in England, 1931.
122: Tools: see George M. A. Hanfmann, "Daidalos in Etruria", *American Journal of Archaeology*, vol.39, April - June, 1935, p.192f.
123. Brace and bit: an illustration of this is given in *The Illustrated London News* [April 12, 1930, p.623] in a series of articles by G. H. Davis and S. R. K. Glanville entitled "Life in Ancient Egypt: Astonishing Skill in Arts and Crafts."
124. Levels: see George Sarton, *A History of Science*, Cambridge, MA, Harvard University Press, 1952, p.124, footnote 94.
125. Lathes: see *A History of Technology*, edited by Charles Singer, *et al*., Oxford University Press, 1954, vol.1, p.192, 518.
126. Apel, Willi, "Early History of the Organ," *Speculum,* vol.23, 1948, p.191-216.
127. Umbrellas and Sunshades: a number of bronze castings used in the construction of these large umbrellas are to be seen in the Royal Ontario Museum Toronto, Canada.
128. Drinking straws: well known from the monuments and from seals. The line drawing in Fig. 20 is probably from a seal.
129. Linton, Ralph, *The Tree of Culture,* New York, Knopf, 1956, p.114.

Man adopted the measure: [130] and there is a record of the invention of a malleable glass, the secret of which was destroyed by the ruling monarch, along with its originator, for fear of upsetting the economy. [131]

Every form of building technique now commonly used (including concrete) is found among non-Indo-Europeans, and in many cases long antedating the Romans, especially the arch, barrel vault, dome and cantilever principle of construction. The barrel vault was achieved in Babylon without the need of a supporting scaffold under it, by starting against an upright wall, which was later removed. The cantilever principle was used by the Egyptians (among others) in strengthening their larger seagoing vessels to prevent them from 'breaking their backs,' as marine engineers term it. One such vessel is shown in Fig.21. Speaking of boats, James Hornell, an authority on water craft as developed by primitive and ancient people, opens a paper on the subject with these words: [132]

> There can be no doubt that to Asiatic ingenuity we owe the beginnings of the world's principle types of Water Transport. Early man in Asia invented means of extraordinary diversity to enable him to cross rivers, etc.

Fig. 21
An Egyptian sea-going vessel from the tomb of Sahure, c. 2700 B.C., showing the rope tensioner
stretched from one end to the other, supported on a brace at the centre, and tightened with a torsion bar member
on sound engineering principles.

The vessels illustrated or referred to include every type of small craft from mere floats to coracles and large outrigger sailing vessels, etc. If we bear in mind that China gave us the stern-post rudder, and watertight compartment construction, as well as canal locks for inland waterways,[133] and that the Koreans built the first true battleship, with iron cladding -- notwithstanding the claims made for 'Old Ironsides' in Boston Harbor, it will be seen that we have not contributed a great deal basically to marine engineering. Isabella L. Bishop says of this Korean warship, that it was named Tortoise Boat, and was "invented by Yi Soon Sin in the 16th century, enabling the Koreans to conquer the great Japanese General Hideyoshi in Chinhai Bay.[134]

Naphtha gas was first used by the Sumerians,[135] eye salves in multiple tubes probably by the same

130. Vaccines: see Melville Herskovits, *Man and His Works,* New York, Knopf, 1950, p. 246.
131. Malleable glass: the details of this are given by Stanko Miholic, "Art Chemistry**,**" *Scientific Monthly***,** vol.63, December, 1946, p.460.
132. Hornell, James, "Primitive Types of Water Transport in Asia: Distribution and Origins," *Journal of Royal Asiatic Society*, London,1946, Parts 3 and 4, p.124-141.

133. Needham, J. *Science and Civilization in China,* Cambridge University Press, 1954, vol.1, p.240-243.
134. Article by Isabella L. Bishop, "Koreans," in the *Encyclopedia Britannica,* 14th edition, 1937, vol.13, p.489, with illustration.
135. Naphtha Gas: as we have already mentioned, the Chinese piped this gas as early as 450 B.C. But it was also used by the Babylonians for divination purposes according to R J. Forbes, ("Chemical, Culinary, and Cosmetic Arts," *A History of Technology*, edited by Charles Singer, *et al*, Oxford, UK, Oxford University Press, vol.1, 1954, p.251). It is said to have been used by the Sumerians probably, in furnaces for heating metals (R. J. Forbes, *Metallurgy in Antiquity*, Leiden, Netherlands, Brill, 1950, p.111.

---

people,[136] and spray-painting by palaeolithic man![137] Cigarettes were known to the North American Indians long before Europeans had even heard of tobacco:[138] spectacles are probably a Chinese invention:[139] and safety pins came from the Etruscans.[140] The Chinese did many things with glass, for according to Bruno Schweig there is evidence of glass mirrors as early as 2000 B.C.:[141] and although the source of my information here is not the best, there is a reference to the first 'windows' of glass in a collection of Chinese Stories. It is said that in the reign of Emperor Ming, a man named Wing Dow invented a 'device' which he called Looking-through-the-Walls, whence it is claimed we now derive our word *Window*, being a corruption of the inventor's name.[142]

Although the abacus seems a very slow and primitive way of making calculations, recent experiments undertaken by experts in both the ancient instrument and the modern electrically operated comptometer, have shown that in the hands of a skilled operator it can hold its own against all mechanical devices (excluding computers), except in one particular type of calculation.[143]

136. Eye salves: Forbes, R. J., in *A History of Technology*, edited by Charles Singer, *et al*., Oxford University Press, 1954, vol.1, p.293
137. Spray painting: Leakey, L.S.B., in '*A History of Technology*, edited by Charles Singer, *et al*., Oxford University Press, 1954, vol.1, p.149. This is possibly begging the point a little! It is assumed from the nature of certain paintings that they were done by blowing (or splattering)
the paint from the mouth (!) using baffles to limit it as required. Certainly it does seem to have been sprayed, somehow.
138. Cigarettes: see note, under the title "The Sacred Cigarette." It is reported that thousands have been found in cave-shrines as native offerings in Arizona (in section "Far and Near," *Discovery*, vol.19, no.6, June, 1958, p.262). We have already mentioned cigar-holders: and of course, the Indians were the originators of the pipe for smoking tobacco.
139. Spectacles: see Ethel J. Alpenfels, anthropologist with the Bureau for Intercultural Education, in an article entitled "Our Racial Superiority," abstracted in *The Reader's Digest,* September, 1946, p.81, from *Catholic World*, July, 1946, p.328 ff.
140. Safety pins: illustrated in *Antiquity*, June, 1927, p.170 in an article by D. Randall MacIver, "The Etruscans."
141. Mirrors: Schweig, Bruno, "Mirrors," *Antiquity*, vol.15, no.59, September, 1941, p.259.
142. Windows: see Phyllis R. Feuner, *Giants, Witches, and a Dragon or Two,* New York, Knopf, 1943, p.185.
143. Abacus: these experiments were reported as a note, in the Magazine *His,* (Chicago, IL, IVF publication. Oct., 1957), under the title "Misplaced Conceit." (no page numbering in this section).

Conclusion

Comte du Nouy, after a backward look at the 'rostrum of ingenuity' which meets the eye from antiquity, expresses the conviction that [144]

> Intelligence does not seem to have increased radically in depth during the last 10,000 years. As much intelligence was needed to invent the bow and arrow, when starting from nothing, as to invent the machine gun, with the help of all anterior inventions.

The point is well taken, and one demonstration of the wisdom of this observation is that the experts find it quite impossible to determine now, how the first bow ever came to be invented. Their reconstructions are as varied as can be: which tends to show that such a weapon would certainty not, as it were, occur easily to its originator if we cannot even imagine how it originated with one right in front of us.

144. du Nouy, Comte, *Human Destiny,* New York, Longmans Green, 1947, p.139.

Previous Chapter Next Chapter

Home | Biography | The Books | Search | Order Books | Contact Us