

Doorway Papers by Arthur C. Custance

Part II: Philosophy: the Contribution of the Indo-Europeans

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THE UNINVENTIVENESS OF INDO-EUROPEANS

It is very difficult to extract oneself from a familiar cultural background sufficiently to view the achievements of other cultures objectively. It comes as something of a shock to discover how little we, of Western tradition, have contributed to the world's Technology. It seems so obviously otherwise. But a recognition of this fact is salutary in so far as it can influence our thinking about other cultures by making us far more respectful of them. Moreover, it may have a practical value. If we discover where our real strength lies, possibly we shall take more time to cultivate it. This could mean some changes of emphasis in technical education, at least at the University level.

Perhaps it would be a good thing to give a few bold statements about our lack of inventiveness - though they may seem manifestly wide of the mark. We have already mentioned the debt of the Greeks to the Minoans, and the debt of the Romans to the Etruscans. These creditors, in turn, owed much to Egypt, Anatolia, and Mesopotamia. Sir Arthur Evans wrote:¹

1. Evans, Sir Arthur, *The Palace of Minos*, London, UK, Macmillan, 1921, vol.,1, p.16.

The proto-Egyptian element in early Minoan Crete is, in fact, so clearly defined and is so intensive in its nature as almost to suggest something more than such a connection as might have been brought about by primitive commerce. It may well, indeed, be asked whether in the times of stress and change that marked the triumph of the dynastic element in the Nile Valley, some part of the older population then driven out, may not have made an actual settlement on the soil of Crete. When it is realized how many elements drawn from the Minoan world lived on in that of Hellas, the full import of this very ancient indebtedness to Egypt at once becomes apparent. Egyptian influences, hitherto reckoned as a rather secondary incident among the later classical movements, are now seen to be at the very root of our civilization.

Indo-Europeans as modifiers but NOT inventive

Such threads are now even clearer than when Evans wrote. Later on in our

history, and via the Arabs, we became indebted both to native Africa and the Far East; and via the explorers and pioneers of the New World, we became greatly indebted to the American Indians. Our cultural and technical heritage has manifold roots. It is not difficult in the present state of knowledge to write down a list of some 300 basic elements or items of our technology which we have borrowed from non-Indo-European sources, and which cover almost the whole range of modern civilization, not excepting the use of electricity.

Admittedly we have done much to modify, extend, improve, and increase the general availability of the things we took over from these other Cultures. We have already quoted from M. D. C. Crawford to the effect that in the realm of natural fibres and dyes, we contributed little or nothing to the Technology of Textiles. But, inspired by the desire to be independent of outside sources of raw materials, we have succeeded in producing synthetic fibres which allowed us to develop certain new techniques of fabrication, such as extruding in sheet form and heat sealing seams instead of stitching them. Yet it remains fundamentally true that we have made no real advance upon the textile skills of non-Indo-Europeans who used natural fibres and dyes and therefore provided our fundamental knowledge, and by their non-woven materials inspired us to attempt alternatives. Nor did we advance the world's resources in other directions either.

Carleton S. Coon says: "The linguists tell us that the Indo-European speakers did not initially domesticate one useful animal or one cultivated plant."²

2. Coon, Carleton S., *The Races of Europe*, New York, NY, Macmillan, 1939, 178.

George Sarton quotes William H. Hudson as having remarked in 1892: ³

It is sad to reflect that all our domestic animals have descended to us from those ancient times which we are accustomed to regard as dark and barbarous, while the effect of our modern so-called humane civilization has been purely destructive of animal life. Not one type do we rescue from the carnage going on at an ever increasing rate all over the globe.

The picture has changed slightly, since. But there is one exception possibly -- a rather amusing one. Sarton adds, in commenting on this remark of Hudson's, "The only animal domesticated in historic times is the ostrich: this was a poor achievement which was justified only because some women and generals wanted feathers for their hats."

W. J. Perry, whose reconstructions of history are not too well accepted, was nevertheless essentially correct when he wrote: ⁴

The Celts, like the Teutons, never invented anything; the whole of their culture shows signs of derivation from the Mediterranean.

Lord Raglan says the same thing with respect to the Romans: ⁵

The old Roman ritual gave little encouragement to inventiveness, and later cults were imported ready-made from the East. As a result, the Romans invented almost nothing.

And to quote Joseph Needham again, ⁶

The only Persian invention of first rank was the windmill ... Unless the rotary quern be attributed to them, the ancient Europeans of the Mediterranean Basin launched only one valuable mechanical technique, namely, the pot chain pump...

3. Sarton, George, *A History Science*, Cambridge, MA, Harvard, 1952, p.5, fn.2.

4. Perry, William J., *The Growth of Civilization*, Harmondsworth, UK, Penguin, 1937, p.157.

5. Raglan, Lord, *How Came Civilization?* London, UK, Methuen, 1939, p.179.

6. Needham, J., *Science and Civilization in China*, Cambridge, UK, Cambridge University Press, 1954, vol.1 p.,240

In another direction, J. Grahame Clark emphasizes how little Europeans contributed to the labours of the American Indians within their own environment: ⁷

During the four centuries since the Discovery (1492) the White Man has failed to make a single contribution of importance.

Curiously enough this has been true also of the Semites who, although not Indo-European, should nevertheless be distinguished where possible from the Non-Indo-Europeans whom we have been considering thus far. Speaking of the Babylonians and Assyrians, both Semitic, who succeeded the Sumerians in Mesopotamia, Vere Gordon Childe says: "In the next two millennia one can scarcely point to a single first class invention or discovery. . . ." ⁸

Childe makes two exceptions -- the alphabet, and iron smelting. But the latter is doubtful. It seems more likely that the credit must be to the Hittites for this - rather than to the Babylonians. The raw materials did not exist in Mesopotamia as far as I know. Ralph Linton, referring to the same people, says categorically: "Not a single item of later technology was introduced by the invading Semites." ⁹

Semites NOT inventive, but carriers

The Arabs are largely (though by no means entirely) Semitic also. Speaking of them, Lord Raglan, after discussing the uninventiveness of the Romans, says: ¹⁰

Much the same can be said for the Moslems. There was a period of mild inventiveness while their religion was settling down into its various sects, but since that process was completed about 900 years ago, no Moslem has invented anything.

7. Clark, J. Grahame D., "New World Origins," *Antiquity*, vol.14(54), June, 1940, p.118.

8. Childe, V. Gordon, *New Light on the Most Ancient East*, London, UK, Kegan Paul, 1935, p.203.

9. Linton, Ralph, *The Tree of Culture*, New York, NY, Knopf, 1956, p.300.

10. Raglan, Lord, *How Came Civilization?* London, UK, Methuen, 1939, p.179.

Yet this is quite contrary to popular opinion. Their role as carriers from the Far East and from Africa, has led to the somewhat widespread belief that they originated what we received from them. But on this point Rene Albrecht-Carrie has this to say:
11

What is really relevant in this context is that the Arabs - or rather the wide variety of peoples whom they brought under their control and who came to pass under their name - were not so much innovators as collectors, organizers, synthesizers, and, most important, carriers of the contributions of other times and peoples. This is not to deny or minimize the crucial importance of their role or to ignore the fact that they made some valuable contributions of their own: but it remains largely true that the initiation of the "Scientific Revolution" was not of their own making. Nevertheless to this making they contributed mightily ... but the Arab contribution, was, to repeat, mainly in the form of a transfer of ancient learning. . . .

St. Chad Boscawen, one of the earlier cuneiform scholars to make known the findings of Archaeology in the Middle East, came to the same conclusion after studying Babylonian civilization: 12

There is a powerful element in the Semitic character which has been, and still is, a most important factor in their national life: it is that of adaptability. Inventors they have never shown themselves to be.

James H. Breasted illustrated this very clearly in pointing out how much the Babylonians borrowed from the Sumerians whose land they had invaded and conquered. He wrote: 13

Some of the Semites now learned to write their Semitic tongue by using Sumerian cuneiform signs for the purpose. The Semites in time therefore adopted their script, their weights, their measures, their mathematics, their system of numerals, their business terms, and a large measure of their judiciary systems.

In a similar vein, R. F. Grau pointed out that the *pure* Arabs developed "no new industry nor art [by which he means Technique ACC], nor trade." 14 The only thing they did invent was a style of architecture. He holds the same to have been true of modern Jewry.

11. Albrecht-Carrie, Rene, "Of Science, Its History and the Teaching Thereof" *Scientific Monthly*, vol.63(1), 1951, p.19. Even the so-called Arabic numerals are actually Indian.(Linton, Ralph, *The Tree of Culture*, New York, NY, Knopf, 1956, p.296.)
12. Boscawen, St., Chad, *The Bible and the Monuments*, London, UK, Eyre and Spottiswoode, 1896, p.18.
13. Breasted, James, *Ancient Times: a History of the Early World*, London, UK, Ginn and Co., 1935, p.160.
14. Grau, R. F., *The Goal of the Human Race*, London, UK, Simpkin, Marshall, Hamilton and Kent, 1892, p.88, 91.

It is not altogether clear to me how much the Arabs did actually contribute. H.J.J. Winter credits them with quite a few technical achievements. Yet he does say that in "the so-called Golden Age of Islam, Science owed its importance largely to the

Persian contribution."¹⁵ He also remarks that the language of Iran had assumed a new significance, and that those who wrote in this language made the greatest contribution. This, it seems to me, tends to favour my argument, for the language of Iran is within the Indo-European family. It is not then so surprising to find that some of their best known writers, such as Ibn Sina (980-1037), were noted for their "theoretical postulates." The reason for this observation will become clearer in the following Chapter. Ibn Sina in fact placed mechanics in the lowest level of a great scheme of speculative philosophy, according to Winter. Extracts are given by Winter of some of Sina's postulates, and these are completely in the tradition of 'modern' scientific observation.

Later works tended, it seems, towards mechanics and away from pure speculation as the Persian influence waned; only two Islamic treatises being particularly outstanding, one of which is entitled *The Book of the Knowledge of Ingenious Mechanical Contrivances*. Its main interest was in elaborate water-clocks - which, as we have seen, were derived from China and therefore not original with the Arabs. The other of these two outstanding books concentrates on various types of balances, with a clearly practical end in view particularly in connection with coinage and trade. Winter mentions the fact that the Arabs widely exploited natural sources of power especially wind-mills and water-mills. Again, the former was borrowed from Persia and the latter probably from China.

Yet it is obvious that Jewish people *have* contributed to the Technology of civilization: for example, Weismann in Chemistry, and Einstein in Physics. But there is a consideration of some importance here. In a paper which is nearer to my Thesis than any other I have yet come across, Jessie Bernard makes this significant observation: ¹⁶

It is not the Jews who remain within their own cultural setting who make the greatest contribution.... It is only, as Veblen says, "when the gifted Jew escapes from the cultural environment created and fed by the genius of his own people, and becomes a naturalized, though hyphenate, citizen in the gentile republic of learning, that he comes into his own as a creative leader in the world's intellectual enterprise.

15. Winter, H.J.J, "Muslim Mechanics and Mechanical Appliances," *Endeavour*, Jan., 1956, p.25, 26.

16. Bernard, Jessie, "Can Science Transcend Culture," *Scientific Monthly*, " Oct., 1950, p.271.

Jessie Bernard points out that it is not the result of mere chance that the great revolutionary ideas of our time -- Freudianism, Marxism, and Einsteinian relativity -- were promulgated by Jews who were no longer in any sense orthodox. She might also, perhaps, have mentioned St. Paul who, rejecting Judaism, became an apostle of a new faith to the Gentile world.

Influence of language and grammar

Now this is a generative idea. It suggests possibly that any non-Indo-European

can become 'Western' in his outlook, provided that he adopts, at least to some extent, the habits of thought and the worldview of the Westerner. It is not merely a matter of adopting the mechanics of Western Civilization.

This, I think, is an important point. It was with this in mind that I said at the beginning of this Thesis that adoption of the Scientific Method by non-Indo-Europeans involves some modification of the grammar of their language. The vocabulary of any people may change quite rapidly at times, but *grammar* (ie., the structure of language) tends to be preserved - because apparently it reflects a way of looking at things. Ernst Cassirer says in a paper on the influence of language on the development of scientific thought: "Modern linguistics does not hesitate to speak of a 'philosophy of grammar'." ¹⁷

Though I am aware of the controversy here, I think it is generally agreed among linguists that we do not think conceptually without symbols. Habitual thought patterns of a 'philosophic' nature will therefore be related to established grammatical forms. This was an area investigated with very great fruitfulness by Benjamin Lee Whorf, ¹⁸ and of course by Susanne Langer, ¹⁹ and a host of others. It will be discussed in Part III more fully.

Philosophy vs. practical wisdom

In the meantime, while non-Indo-Europeans are highly inventive, they have not been particularly -- if at all -- philosophical. In the opinion of many writers they have studiously avoided speculation about anything

17. Cassirer, Ernst, "The Influence of Language on the Development of Scientific Thought," *Journal of Philosophy*, vol.39, June, 1942, p.323.

18. Whorf, Benjamin Lee, *Collected Papers On Metalinguistics*, Foreign Service Institute, Dept. of State, Washington, DC, 1952.

19. Langer, Susanne, *Philosophy in a New Key*, New York, NY, Mentor Books, 1948, Chapters 2, 3, 4, and 5 in particular.

that was not of an entirely practical nature. It is partly a question of definition. Needham speaks freely enough of Chinese philosophy, but one wonders whether he is really using the term in the accepted sense. If our own definition is permitted to stand for the moment, none of these people whose ingenuity we have examined really produced philosophers.

The only organized attempt to present an opposite view, as far as I know, is that made by Paul Radin in his book, *Primitive Man as Philosopher*. ²⁰ I have found it difficult to assess this volume fairly because I had the feeling all the time that the best illustrations of primitive philosophy (mostly given from among the North American Indian tribes) could so easily be the result of Western influence. How is one ever to know for sure that a man's views are "native" as it were, when he has lived much of his adult life within the orbit of Western thought? In a lecture given in the University of Toronto, E. Carpenter of the Anthropology Department, stated that some Rorschach tests had been administered in primitive societies to individuals who were considered by their own culture to be abnormal, such as Eskimo shamans,

etc. "The results showed nothing, except in several instances a tendency towards abstract thinking," Carpenter claimed.

This is a slender platform for any argument, but certainly it does not stand against our view that primitive man does not normally concern himself with abstractions at all. If he does, he may be classed by his own culture as abnormal.

Levy-Bruhl was one of the strongest exponents of the view that primitives have a different kind of mentality from ourselves.²¹ It is unfortunate that his description for this -- "pre-logical thought" -- was misunderstood to mean *il*-logical thought. Native people are not illogical. They (and all other non-Indo-Europeans) tend to adopt different premises, and on these different premises to erect a quite logical superstructure. This can be demonstrated *ad infinitum*. Because we cannot understand one of their premises, namely that Nature is 'personal,' we tend to reject the superstructure on the grounds that it is not rational. We shall consider this later.

And Levy-Bruhl pointed out that one cannot define a society by one or two of its members, so that the discovery of one or two odd individuals who show some liking for the abstract does not tell us much about the culture as a whole. Following August Comte, he said: "The highest mental functions of man remain unintelligible as long as they are studied from the individual alone."²²

20. Radin, Paul, *Primitive Man as Philosopher*, New York, NY, Dover Publications, 1957.

21. Levy-Bruhl, Lucien, *How Natives Think*, translated by L. A. Clare, London, UK, Allen and Unwin, 1926.

22. Levy-Bruhl, Lucien, *ibid.* p.15.

Thus a few exceptions do not indicate too much. Radin at times seems to be confusing 'a philosophy of life' held by one or two outstanding members of a culture, with Philosophy. Maritain admits that all peoples have a little Philosophy too - but through 'sacred tradition' as much as anything, rather than by personal creation.²³ This does not make a man a Philosopher.

Radin admits Indo-European influences, but considers this of no great importance. He says:²⁴

For our purposes, it is immaterial whether some of this speculation is connected with recent European influence or not, since all I am desirous of proving is that a few individuals in every community indulge in speculation and enjoy it. Some of the examples I shall quote are definitely connected with recent Christian influence, but these are particularly instructive because the questions they develop are often quite new to Christian theology.

My own feeling is that this misses a point that makes all the difference; namely, that the Christian influence brought with it a new worldview and inevitably introduced modifications of language and of thought patterns. One of his examples is so obviously not original, since it reproduces (almost word for word at times) the Genesis account of man's creation, that one wonders why it is used at all.²⁵ He also admits that,²⁶

It is from instances where we know European and Christian influence to have been definitely present that our best evidence for the existence of thinkers, and for the philosophical quality of their thoughts, can be derived.

But this admission virtually proves my point! Yet Radin's book is provocative. The Winnebago Indians, with whom he is best acquainted, did much real thinking. Their poetry is quite remarkable. This I feel, ought to be said in fairness to the author of this very readable work, for I am aware of a strong prejudice that undoubtedly makes it far easier for me to see the borrowed elements than any original ones which may exist. Yet, of these people, Radin says "the Winnebago have been in contact with European civilization since the second quarter of the 17th century." ²⁷ This is a long time. Throughout the 18th century, the White Man

23. Maritain, Jacques, *An Introduction to Philosophy*, New York, NY, Sheed and Ward, 1937, p.25.
24. Radin, P., *Primitive Man as Philosopher*, New York, NY, Dover Publications, 1957, p.276.
25. Radin, P., *ibid.*, p.236.
26. Radin, P., *ibid.*, p.387.
27. Radin P., *ibid.*, p.396

settled increasingly among them.

Jacques Maritain sums up my own convictions in this matter by saying: ²⁸

Philosophic speculation... is unknown to all the so-called primitive races. Indeed, even of the civilizations of antiquity the greater part either have possessed no philosophy or have failed to discover its true nature and distinctive character. In any case philosophy only began to exist at a very late period about the eighth and especially the sixth century B. C.

Maritain proceeds thereafter to show that the Egyptians did not produce philosophers either - in spite of popular opinion to the contrary. They bent their mental energies to very practical ends, even their 'theology' being entirely a utilitarian affair. As Martin Engberg says: "Nowhere is there any indication that Egyptians were interested in theoretical problems." ²⁹

Egyptians not philosophers

Sir Alan Gardiner in the introduction to his *Egyptian Grammar* put the matter even more forcibly when he said: ³⁰

No people has ever shown itself more averse from philosophical speculation, or more wholeheartedly devoted to material interests.

Even in more popular articles where one might least expect to find it, authorities make the same admission, thus cutting right across a very common illusion about

these remarkable people. William Hayes remarks: ³¹

28. Maritain, Jacques, *An Introduction to Philosophy*, New York, NY, Sheed and Ward, 1937, p.23.

29. Engberg, Martin, *The Dawn of Civilization*, New York, NY, University of Knowledge Series, Cuneo Press, 1938, p.153.

30. Gardiner, Sir Alan, *Egyptian Grammar*, Oxford, UK, Oxford University Press, 1927, section 3, p.4.

31. Hayes, William C., "Daily Life in Ancient Egypt," *National Geographic Magazine*, Oct, 1941, p.425-428.

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Though intensely devout, the ancient Egyptian had neither the mental nor the spiritual equipment necessary to the creation or even the adaptation of a great religion. An analysis of the Egyptian religion shows that it consisted of at least four unrelated cults or phases, no one of which ever passed beyond what we should regard as a primitive stage

Though intelligent and quick to learn, he had a mind of the practical unimaginative type. He was a materialist, and not given to deep speculative thought, and was unable either to evolve or to express a purely abstract idea.

Writing for a more scholarly audience, James Newman, speaking of the Rhind Papyrus, says: ³²

The Egyptians, it has been said, made no great contributions to mathematical knowledge. They were practical men, not given to much speculative or abstract inquiries. Dreamers were rare among them, and mathematics is nourished by dreamers - as it nourishes them. . . .

The Rhind Papyrus, though it demonstrates the inability of the Egyptians to generalize, and their penchant for clinging to cumbersome calculating processes, proves that they were remarkably pertinacious in solving everyday problems . . . and uncommonly skilful in making do with the awkward methods they employed.

Philip E. B. Jourdain states that:³³

The Egyptians' geometrical knowledge was of a wholly practical nature. For example, the Egyptians were very particular about the exact orientation of their temples.

Jourdain explains how the regular flooding of the Nile continually washed away or concealed land marks and boundary lines, so that re-surveying was an annual chore. This led early to the development of rapid means for drawing right angles, etc., and indeed led to the word 'Geometry (i.e., land-measuring) which the Greeks gave to the mathematics they took over from the Egyptians. But unlike the Greek mathematics, Egyptian mathematics was purely a practical affair. As Jourdain put it:

³⁴

32. Newman, James, R, "The Rhind Papyrus," in *The World of Mathematics*, of which he was the editor, New York, NY, Simon and Schuster, 1956, vol.1, p.170.

33. Jourdain, Philip, E.B., "The Nature of Mathematics," in *The World of Mathematics*, edited by J.R.Newman, Simon and Schuster, 1956, vol.1, p.11.

34. Jourdain, Philip.E.B., *ibid.*, p.12.

The Rhind Papyrus contains a fairly complete applied mathematics, in which measurement of figures and solids plays the principal part; there are no theorems properly so called; everything is stated in the form of problems, not in general terms, but in distinct numbers.

How completely different was the product which Thales derived out of this heritage. It was, as Jourdain says a 'transformation'; he no longer presented his conclusions as a mere induction from a large number of special instances, as probably was the case with the Egyptian geometrician. But rather: ³⁵

The deductive character which he gave to the Science is his chief claim to distinction. Pythagoras (born about 580 B. C.) changed geometry into a form of abstract science, regarding its principles in a purely abstract manner, and investigated its theorems from the immaterial and intellectual point of view.

This, then, in the field of mathematics: in medicine the same picture is presented. Ileen Stewart, in dealing with one particular aspect of early medical practice, says this: ³⁶

Much of the medical lore of the Egyptian became the heritage of the Greeks as they fashioned their civilization in the last few centuries B. C., at the eastern fringe of the Mediterranean.

The knowledge they inherited was essentially factual, the accumulation of Egyptian observations and experience. The Greeks attempted to put these facts together and derive a systematic pattern in nature. Many of their interpretations are still tinged with mysticism, but were philosophical and logical as the Egyptians had never been.

The Ebers Papyrus, dated about 1500 B. C., purchased in Luxor in 1872 from an Arab by a German Egyptologist after whom it is named, shows how extensive the knowledge of the Egyptians was. Their medicine was by no means a mere jumble of magic formulae and otherwise useless substances whose only value was as a kind of placebo.

The Ebers Papyrus alone mentions over 700 drugs and lists numerous prescriptions for specific illnesses. Most of these are polypharmaceutical and contain up to 35 ingredients. Some are still valid today. Among

35. Jourdain, Philip E.B., *ibid.*, p.14.

36. Stewart, Ileen, "Helminths in History, *Scientific Monthly*, vol.72(6), June, 1951, p.348.

the drugs prescribed are castor oil, opium, squill, honey, copper sulfate, and sodium bicarbonate, as well as magnesia, iron, and lead, peppermint, anise, saffron, juniper berries, gentian, colchicum, and Epsom salts. It contains some 811 such

prescriptions.

Our knowledge of their achievements is quite extensive in this area. We have a number of other papyri, such as the Edwin Smith Papyrus, 1600 B. C., dealing with surgery; the Lesser Berlin Papyrus, 1600 B. C., dealing with magic; and the Kahum Papyrus, 2000 B.C., dealing with gynecology and animal medicine.

Speaking of their astronomy, Jourdain says it was "altogether concrete and empirical" - undertaken for purely practical reasons.

James Baikie, in a well-known early textbook on Egyptian life and times, speaking of their so-called 'philosophers' such as Ptah-hotep, said: ³⁷

All the evidence goes to show that the Egyptian was one of the most severely practical of men, who sought learning not for any joy in the attainment of truth for its own sake, but simply as a means to an end.... The wisdom of Ptah-hotep and Kagemni is in general of a canny, practical nature, concerning itself with the ordinary details of life and conduct, and inculcating prudence which, however praiseworthy, reaches no high ideals but is based mainly on self-interest.

This is in no way to belittle the extraordinary achievements of the Egyptians in every field of Technology. The daily lives of their upper classes must have been as comfortable as one can imagine, their physical needs supplied with elegance and good taste in marked contrast to the Greeks who initiated Science in Europe but whose lives were evidently lived in rather comfortless austerity. Clive Bell has pointed out that the disinterestedness of the latter in their pursuit of truth has been made a reproach to them. As he put it, "they sought truth for its own sake . . . not as a means to power and comfort... The Athenians wished to live richly rather than to be rich." ³⁸ The life of a well-to-do Greek in classical times, so rich and complete in thought and feeling, was in most material blessings "indecently deficient" as he puts it.

37. Baikie, James, *Tire Story of the Pharaohs*, London, UK, Black, 1908, p.59.

38. Bell, Clive, *Civilization*, Harmondsworth, UK, Penguin Books, 1938, p.63.

Theory vs. practice

Yet one should not suppose that either the Egyptians or the Sumerians or the Babylonians were illogical or lacked precision in their Technology. R J. Forbes, speaking more particularly of their metallurgy, is careful to make it quite clear that the very opposite was the case. He says: ³⁹

It is certainly not true that pre-classical Science [i.e., Technology, ACC] is nothing but a mass and a medley of fantasy and detective observations. The more we get to know of it, the better we observe that it was a model of precision and practical classification as far as the means of those days went. Pre-classical Science was a-logical; it did not *want* to explore or to understand structures and mechanisms. [Emphasis mine]

What has been said of Egypt applies to all the ancient Middle East Cultures. The Mesopotamian Cultures produced a highly complex mathematical knowledge as we have seen. Yet here again, all their tables are presented to us much as statistical tables tend to be - 'findings' resulting from actual cumulative experience. There *is* no theory. As Benjamin Farrington put it, ⁴⁰

We are in the presence of abundant evidence of Babylonian mathematical ability, but their tables (of roots, cube roots, squares, and cubes, etc.) are offered to us like our own practical tables for calculating interest and so forth, *without proof or theory*. So that as far as the evidence goes, Babylonian arithmetic is under the suspicion of being largely empirical.

In both Babylonia and Egypt we therefore have evidence of an extensive manipulation of figures, yet in neither case did it ever disengage itself from practical applications, nor become organized as a logical series of deductions from a few self-evident principles capable of extension by abstract reasoning 'into a true Science. There was no Babylonian or Egyptian Euclid.

39. Forbes, R.J., *Metallurgy in Antiquity*, Leiden, NL, Brill, 1950, p.46.

40. Farrington, Benjamin, *Science in Antiquity* Oxford, UK, Home University Library, 1947, p.24.

Classification: step towards philosophy

Alfred North Whitehead, speaking of how the Arabs transmitted to Europe the mathematics thus derived from the Middle East, argues that it was in their 'classification' ability through which they made their most important contribution. He holds that classification is a halfway house between the immediate concreteness of the individual thing and the complete abstraction of the mathematical notions. ⁴¹ He then points out: ⁴²

The Arabic notation had equipped the Science [of Mathematics] with almost perfect technical efficiency in the manipulation of numbers. This relief from a struggle with authentic details (as instanced, for example, in the Egyptian Arithmetic of B.C. 1600) gave room for a development which had already been faintly anticipated in later Greek mathematics.

Though it is anticipating somewhat, Whitehead's subsequent observation shows how the Indo-European contribution in the end redounded to the benefit of Technology as well. Thus he wrote: ⁴³

Nothing is more impressive than the fact that as mathematics withdrew increasingly into the upper regions of ever greater extremes of abstract thought, it returned back to earth with a corresponding growth of importance for the analysis of concrete fact.



As we shall endeavor to show, Science developed by the play of philosophical minds upon the data of Technology - and of course, using the skills of the latter in

the manufacture of instruments of measurement

41. Whitehead, Alfred, N., "Mathematics as an Element in the History of Thought," in *The World of Mathematics*, edited by J. R. Newman, New York, NY, Simon and Schuster, 1956, vol.1, p.409.

42. Whitehead, A.N. *ibid.*, p.410.

43. Whitehead, A.N. *ibid.*, p.412.

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