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978-1-108-06576-4 - Inductive Metrology: Or, the Recovery of Ancient Measures
from the Monuments

W. M. Flinders Petrie

Excerpt

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INTRODUCTION.



THE materials for a history of measures have been principally, if not wholly, derived from the statements of ancient authors, and the use of monumental data has been confined to the elucidation and support of these literary remains. The object of this essay is to point out the means by which the independent and complete evidence of ancient monuments may be obtained, apart from any other sources of information. The literary statements on ancient metrology, therefore, obtain less notice here than that which is really due to them in a complete view of the subject, because they have been already so fully examined, and have had so many deductions drawn from them.

“By induction is to be understood the process of collecting general truths from the examination of particular facts.”* Inductive metrology accordingly ascertains the “general truths” of the units of measure in use, from the “particular facts” of those multiples of measures which ancient remains preserve to us.

So far as this method of examination has been worked, the results, though placing many facts in a somewhat new light, have not been opposed to any of the recognised canons of metrology; but are clearly in agreement

* Whewell, *Hist. Induct. Sciences*, I. 6.

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with what may be called the *literary* metrology in all its principal elements.

The historical sciences seem to pass through two stages in the course of their development—the literary and the monumental—the deductive and the inductive. In the first, the science is based on such information as has descended to us by means of literature; and the principal method of advancement is by deductions, combinations of the stated facts, and criticism of the internal evidence. In the second stage, monuments are the principal basis of the science; and literary evidence serves only for filling up such vacancies, and for making such connections, as those remains do not supply. In Egyptian and Assyrian history the Greek historians furnished us with the first stage, but now we look to the monuments as the primary authority. So it has been in ethnology and philology, where the monument of language, whenever available, has supplanted the statements of the ancient authors. So it will probably be in metrology; and when the tale of each monument shall have been read, the vague and often debatable language of the ancients, having served its day, will be justly regarded as more a matter of curiosity than of use.

In such a well-known subject as metrology, that so little requires the results of modern science for its development, it may seem strange that there should still remain any fresh methods of inquiry. But it is with this as with many other branches of knowledge, taking the oft-used simile of the tree of science, the branches have grown forward so vigorously as to leave many buds undeveloped.

Perhaps in this essay rather more credit may be

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given to some of the ancients, with regard to their care and design in building, than is usually allowed to them during the present reaction, caused by the rapid advance of modern science. Our subject, however, has nothing to do with astronomical temples, solar systems of the ancients, or mystic or scientific meanings in ancient remains; but merely recognises that in most ages, when men have to lay out or plan any work that requires to be alike on two sides, if they have a measure they will use it; and they will probably use whole numbers in preference to fractions, and round numbers in preference to uneven ones, merely for convenience in their work. Some nations, such as the Aryan Hindûs, have, moreover, an inherent love of metricality which induces them to pay attention to measures; and others are led to give the same care by their desire to produce regularity of work, or by their attention to recognised canons of proportion. Though this essay is thus based upon postulates that probably few would be found to deny; yet this subject, like many others, might easily be rendered absurd and useless, by encumbering it with an undue regard to every mere coincidence irrespective of sense and method.

When a unit of measure has once been lost to literature, it can never be recovered by the use of the present methods, since the only use hitherto made of monuments has been to corroborate the *known* instead of discovering the unknown; and thus when literature is in any case deficient, metrology is supposed to have never existed. That the most civilised peoples had units of measure, and that the lowest savages have none, is about all that is as yet definitely known; and the boundary of the use of measures is quite undefined, or, worse still, assumed

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without evidence. But that units of measure are used by semi-savage nations is shown by the Tahitians, who were wholly ignorant of any writing or current symbolic marks, and who yet had a recognised unit of measure.* The identity of the dimensions of many North American earthworks has been very reasonably concluded by Squier (who has examined them more than any one else) to prove the existence of a unit of measure; and this is further corroborated by the ten copper bracelets of exactly equal weight (whatever accuracy that indefinite statement may have) which were found in the Scioto valley. An ethnologist† has declared, in the face of these facts, that the mound-builders could not have had a balance or a standard of length, because such instruments are above the culture of that people. This is assuming the very point in question; and, to take the explanation of the equal earthworks that he offers us—namely, that a long cord and a bundle of stakes will suffice to lay out “any earthwork of the mound-builders, and to copy in new places a work already constructed”—this very supposition, that care would be bestowed on exactly reproducing the dimensions of any earthwork, implies such an attention to measure and size as we cannot suppose to exist without producing, or being the product of, the use of a definite standard. That this was not a passing freak, or an accident, is undoubted, from the same length occurring in a dozen or more earthworks mentioned by Squier in Ohio, Indiana, and New York, thus ranging over hundreds of miles of country. Farther evidence on the amount of design shown by the

* Hawkesworth's *Voyages*, II. 228.

† Tylor in 3rd Session International Congress Prehistoric Archæology; Wallace, however, in his address to the British Association, 1876, agrees with Squier.

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mound-builders is adduced where their works are specially examined in the following pages (sect. 148).

In more civilised communities, the importance attached to measures is well known; for instance, in that early Egyptian work, the "Book of the Dead," the soul pleads, "I have not shortened the cubit;" and among the Jews, the Levites were appointed to attend to "all manner of measure and size," referring respectively to liquid measure and linear size, as is clear in the original.

On this question of the existence of standards of measure in the various grades of civilisation, as well as on the origin and distribution of units, it is only sought in this essay to subject assumptions to proof, where such can be obtained; and not to rest satisfied with making suppositions, when the evidences of the subject are at our disposal. Even if the evidence be not in all cases convincing, it, at least, is evidence, and *any* evidence will more than balance *no* evidence.

The "speechless past" which has been so often deplored, has, in its monuments, a voice; to which we may hope that inductive metrology, when developed, will give clear interpretation; and just as comparative philology has revealed to us much of the origin and history of races, so comparative metrology may reveal much of the history and origin of monuments and their builders. When a general network of information shall have been obtained, by ascertaining the units, and their variations, used in different times and places; we may be enabled, by our observations on a structure, to fix its place in ethnology and history. A recent authority on the subject* has ventured still farther in his expectations of the

* Don Vasquez Quiapo.

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future of metrology ; and with a vast amount of research we may hope to see his prognostications fulfilled. But the present state of our knowledge is but elementary, and hitherto only the most authorised units of a small number of countries have been known.

With regard to the following pages of results, it may be asked why some of the stores of measures in many well-known books, have not been worked upon. But it would be the labour of a lifetime to carry this subject to anything like completion, or to any state in which its deficiencies would not be as striking as its results. In this essay the aim has been to select samples for examination from several countries, in order to try the plan of induction thoroughly ; and also by this means to cover as wide a field with tolerably correct results, as was possible in a few years.

All the methods and results have been stated concisely, and in such a form as seemed most useful for further examinations ; a principal object being to give the amount of evidence for each result, and also to enable any one to check the results by referring to the original list of measures, and trying them with the unit obtained from them. To have given all the measures, and the number of units in each length, would have produced a monstrous mass of figures and letterpress such as few would wade through ; the chances of a book being read being probably in inverse proportion to the square of its length ; and it is hoped that the amount of authority for each result arrived at, will be sufficiently clear to those who care to examine it.

Doubts and difficulties have not been slighted or left unnoticed, but in all dubious questions the uncertainty of them is acknowledged and discussed. No attempt

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has been made to try to obtain the acquiescence of others by ignoring uncertainties. It has been well said that “The reader is easily led captive by a writer who has no hesitation;” but this stolen consent is an agreement that snaps with the first shock; whereas, when difficulties and uncertainties have been faced from the beginning, they are not reckoned at more than their true value.

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CHAPTER I.

METHODS OF INDUCTIVE EXAMINATION.

(1) IN all monuments planned by means of a standard of measure, we have a series of unknown multiples of an unknown unit. As the unknown multiples are, however, usually integral numbers (or simple relations of such) in all lengths under about ten or twenty feet, and simple multiples of integral numbers in the longer lengths; we have a limitation, by means of which the unknown multiples and unit of measure may be ascertained.

There are three or four modes of working this question, all nearly related, but each of rather a different nature; and in practice it is best to take a modification of all of them, suited to the case in hand. The direct object, of course, is to obtain the value of the ancient unit in terms of the British inch, or such other standard as the measurements have been stated in by modern travellers or others. All the methods depend on the plan of ascertaining every likely ratio between pairs of the measured lengths; and then comparing these ratios, to find which of them may be combined so as to give a simple number to each length, that shall represent the probable number of the original units by which that length is formed—*i.e.*, the multiples of the unit used by the original designer.

(2) This may be done by noting all likely ratios of

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successive pairs of measures, and observing what ratio will result from them all. For an example, take the following measures of the Cypriote tablet from Dali, in the British Museum :—

Parts measured.	Inches.	Approximate ratios of pairs of the measures.*			Number of units.
		†	†	†	
Height of panel . . .	44·2	7 12 13 22½			60
Width across pilasters	25·49	4 7 7½ 13			35
" " "	25·49		26 17½		35
Height of stylobate . .	2·92		3 2		4
" " "	2·92			2	1
Height of architrave	1·45			1	2
" " "	1·45			2	2
Height of abaci . . .	2·15			3	3
" " "	2·15			2	3
Width of plinths . . .	3·24			3	4½
" " "	3·24			4½ 7	4½
Height of plinths . . .	5·77			8 12½	8

Here 44·2 : 25·49 inches :: 7 : 4, also as 12 : 7, as 13 : 7½, and as 22½ : 13; these are all bracketed together as being alternative ratios. Next 25·49 : 2·92 inches :: 26 : 3, also as 17½ : 2; these are the only likely ratios. Next 2·92 : 1·45 inches :: 2 : 1; and there is no other ratio likely. Similarly the other columns show the ratios existing between the other quantities. The last column is a combination of the preceding ratios; the numbers being those which occur in the preceding ratios, or else doubles or other simple multiples of such; selecting such ratios (marked †) from the bracketed alternatives as agreed best with the other ratios.

* These ratios are quickly obtained by simple inspection of the slide rule.