and mathematics books from Arabic to Latin (Boyer 1968). African-European trade provided another transmission route. Leonardo of Pisa (Fibonacci) spent years trading and studying mathematics in Algeria. On his return to Italy he used what he had learned in Africa to write influential books of mathematics, adding new material of his own (Gies and Gies 1969).

Finally, the Egyptian value of 3.16 for π remains a great achievement for 1800 B.C. I agree that "Besides the value of 3 for π, the Babylonians occasionally used a better approximation, 3 1/8" (Bunt, Jones, and Bedient 1976).

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Response to Beatrice Lumpkin

WALTER F. ROWE

If Beatrice Lumpkin is offended by the suggestion that she is a purveyor of pseudoscience, she should be more careful in the future. Both she and Hunter Havelin Adams III have published articles in the *Journal of African Civilizations* and in the book *Blacks in Science* (ed. by Ivan van Sertima, New Brunswick: Transaction Books). Adams's articles contain the same sort of pseudoscience as his science essay in the Portland African-American Baseline Essays. I think under the circumstances a reader might be forgiven for assuming that Lumpkin endorses Adams's views (including his belief in the magical powers of melanin).

Lumpkin raises a number of issues in her response to my article. Space does not permit me to reply in detail to all of them. I will restrict my rejoinder to three issues: the interpretation of the Ishango bone, the racial and cultural affinities of the ancient Egyptians, and the extent to which Egypt influenced the development of Greek mathematics.

1. The Interpretation of the Ishango bone: Citing more recent research on the Ishango bone does not mitigate Lumpkin's tendentious use of source materials in her original African-American Baseline Essay. The point of Lumpkin's discussion of the Ishango bone in the African-American Baseline Essays is to lend plausibility to a *non sequitur:* "Since Africa is widely believed to be the birthplace of the human race, it follows that Africa was the birthplace of mathematics and science." The limited nature of the archaeological record does not at this time permit any conclusion about where mathematics originated. It is instructive to compare Lumpkin's discussion of the Ishango bone in her mathematics essay with the discussions of such artifacts in David Nelson's essay "Teaching Mathematics from a Multicultural Standpoint" (Nelson 1993) and in George Gheverghese Joseph's book *The Crest of the Peacock* (1991). Nelson and Joseph (both prominent leaders in the international multicultural mathematics movement) acknowledge the provenance of similar notched bones in both Africa and Europe. In further contrast to Lumpkin, neither of these authors tries to draw from these artifacts any sweeping conclusions as to where mathematics first developed. Joseph ends his discussion of the Ishango bone in *The Crest of the Peacock* with the following warning:

> Finally, in the absence of records, conjectures about the mathematical pursuits of early man have to be examined in the light of their plausibility, the existence of convincing alternative explanations, and the quality of evidence available. A single bone may well collapse under the heavy weight of conjectures piled upon it.

2. The racial and cultural affinities of the ancient Egyptians: I do not see how Bruce Trigger's *historical* essay (Trigger 1983) has any relevance to a discussion of the *scientific* research of Brace et al. (1993), published ten years later. What is even more mystifying is that Trigger's essay contains not a single word about the biological relationship of the ancient Egyptians and sub-Saharan Africans, which is the subject of the article by Brace and his coworkers.

Lumpkin's citation of Trigger's essay raises troubling questions about her research methods. She asserts that ancient Egypt was an African culture.

The second sentence in Trigger's essay reads: "The aim of this chapter is to trace the development of this civilization from the introduction of a southwest Asian-style subsistence economy into the Nile Valley. . . ." Moreover, Trigger's essay details the extensive borrowings of the Egyptians from Southwestern Asia, including all domesticated plants, many domesticated animals, and even aspects of pre-dynastic funerary architecture. Trigger also points out that the Egyptian language is Afro-Asiatic.

3. The alleged influence of ancient Egypt on the development of Greek mathematics: Lumpkin's citation of the statement by Diodorus Siculus is yet another example of her research methods. Diodorus (*Library of History* i. 95) is reporting the tradition among the Egyptian priests that a number of illustrious Greeks studied in Egypt. The historical accuracy of this tradition is questionable. Didorus's list includes not only historical figures such as Pythagoras, Plato, and Eudoxus, but also the mythical figures Orpheus and Daedalus; Diodorus also repeats the highly unlikely claim that Pythagoras derived his doctrine of the transmigration of souls from the Egyptians.

There are better sources that can be consulted on the question of the influence of Egypt on the development of Greek mathematics. Here, I confine my comments to the traditions that Pythagoras, Plato, and Eudoxus studied in Egypt. While the traditions surrounding the life of Pythagoras do have him studying in Egypt, neither Herodotos (*Histories,* iv. 95) nor Isocrates (*Busiris* 28), the very earliest witnesses to the career of Pythagoras, associate him with the study of mathematics. Furthermore, both Diogenes Laertius (*Lives of Eminent Philosophers,* viii. 1) and Iamblichos (*Life of Pythagoras,* iii.-iv.) report that Pythagoras spent a considerable length of time studying in Babylonia among the Magi.

Diogenes Laertius (iii. 6) also mentions Plato's visit to Egypt. According to this account, Plato went first to North Africa to visit the mathematician *Theodorus of Cyrene (a Greek colony* there), then to southern Italy to visit two Pythagorean philosophers, and finally to Egypt where he consulted "those who interpret the wills of the gods."

Readers of Plato's dialogues encounter a number of references to advanced mathematical concepts. They also encounter many references to Egypt. The only references in Plato's dialogues to Egyptian mathematics are in *Phaedrus* and *The Laws.* In *Phaedrus* Plato has Socrates make a passing reference to the tradition that Thoth discovered geometry, arithmetic, astronomy, and the alphabet. In *The Laws* Plato recommends Egyptian pedagogical methods for teaching children basic mathematics. A perceptive reader of Plato cannot escape the impression that by the time of Plato, Egypt held little interest for Greek mathematicians.

Diogenes Laertius (viii. 8) is the principal source for the life of Eudoxus of Cnidus. According to *Lives of Eminent Philosophers,* Eudoxus was taught geometry by Archytas of Tarentum. Subsequently, he traveled to Athens where he studied philosophy. Only then did he travel to Egypt. Strabo (*Geography, xvii.* I. 29) reports a tradition that Eudoxus and Plato went to Egypt together and learned astronomy from the Egyptian priests. There is no ancient tradition that Eudoxus studied mathematics during the sixteen months he was in Egypt.

That the Egyptians contributed in some degree to the development of Greek mathematics is not at issue. The real issue is how much of Greek mathematics was the product of other cultures, especially that of ancient Egypt, and how much represents the original work of Greek mathematicians. The evidence of extant Egyptian and Greek mathematical texts is that the Egyptians contributed very little to Greek mathematics. A survey of the contents of Euclid's *Elements* reveals detailed treatments of a number of areas of mathematics that were foreign to both Egyptian and Babylonian mathematics: the solution of algebraic problems by geometry (Book II); the theory of proportions for commensurable and incommensurable quantities (Books V and VI); number theory, including the concepts of primes and rational and irrational numbers (Books VII through X) and application of the method of exhaustion to circles and spheres (Book XII). All of the propositions in the *Elements* are established by deductive proofs; there is not a single deductive proof in all of the extant Egyptian mathematical writings.

Some scholars have argued that the Egyptians must have been aware of the Pythagorean theorem (Gillings 1972). Even if one were to grant that the Egyptians actually discovered the Pythagorean theorem, the Egyptian contribution to the mathematics in Euclid's *Elements* would still be very small: The Pythagorean theorem is proposition 47 in Book I of the *Elements,* a work containing thirteen books.

Lumpkin calls attention to what she regards as a personnel attack on her credentials. When I was preparing my article I was aware that my comments could be interpreted as an *ad hominem* attack. However, I felt that in light of the claim made in the foreword to the African-American Baseline Essays that the authors were experts on African and African-American history, a critical examination of her credentials and those of Hunter Havelin Adams III was in order.

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