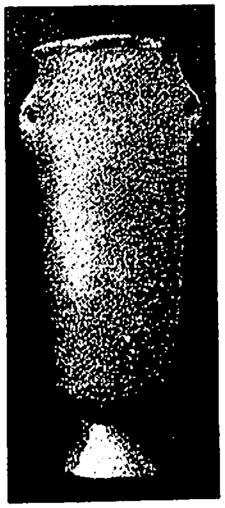

Fig. 16. Basalt vase from 7,000 B.C. with the hieroglyphic inscription "fraction one-half." The inscription shows that the pre-dynastic Nilotic culture possessed hieroglyphics, mathematical notation, and, with the jar itself, a liquid volume measure. (Photo: Petrie)

One of the Egyptians' most intriguing arithmetic operations was their technique of multiplying by doubling, mentioned above. As Gillings describes, the Egyptian, in multiplying two numbers, would make one the multiplier and the other the multiplicand. The multiplicand would be doubled repeatedly until the intermediate multipliers added up to the original; the continually doubled multiplicand then "arrived" at the correct total. The example below illustrates the method; **5** is the multiplier (left side) and **17** is the multiplicand (right side):

1/	**17/**
2	34
4/	68/
5	**85**

On the left hand (multiplier) side, 1 and 4 are marked because they add up to 5; the numbers opposite to them, 17 and 68, respectively, are then added to give the correct answer of 85.

To take another example we might multiply **15** (multiplier) and **9** (multiplicand):

1/	9/
2/	18/
4/	36/
8/	72/
15	135

On the left side, *all* the numbers are marked because, together, they add up to 15, the original multiplier; *all* the right hand numbers, opposite the marked numbers on the left, are added to give the correct answer of 135.

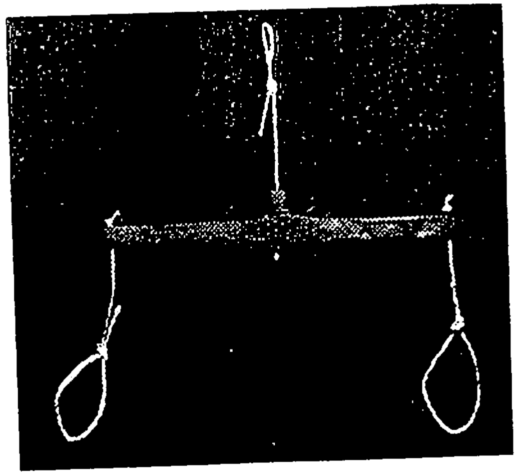

Fig. 17. Pre-dynastic balance-beam made of limestone (Petrie).

As Gillings says,

> These additions were made easier for the scribe by virtue of a special property of the series 1, 2, 4, 8, 16, 32 . . . for any integer can be uniquely expressed as the sum of some of its terms. . . . We do not know whether or not the scribes were explicitly aware of this but they certainly used it, just as do the designers of a modern electronic computer, and this is surely a somewhat sobering thought.[10]

It is worth digressing here to note that this reliance on the 2^n series[11] can be shown to have wider implications that take us to the outer limits of contemporary science. We can appreciate these implications better by examining some of the principles that have emerged from Chaos theory, a domain of science that seems to blend all disciplines.[12] The roots of Chaos theory go back to the work of Edward Lorenz, a meteorologist at the Massachusett[s] Institute of Technology (M.I.T.) who, in 1961, was attempting to mathemati[-] cally model long-range weather forecasting in nonlinear equations. Using [a] computer program that allowed him to "iterate" the equation again and agai[n] for a particular weather system, he found, almost by accident, that very smal[l] differences in inputs resulted in very large differences in forecasts, once th[e] equation was iterated beyond a certain time. For Lorenz, this was an asto[n]ishing, totally unexpected result that flew in the face of the Newtonian o[...]

[10] Ibid., p. 19.

[11] We will call the series 1,2,4,8,16,32, . . . the 2^n series because *all* the numbers in the seri[es] represent powers of 2: $2^0 = 1$, $2^1 = 2$, $2^2 = 4$, $2^3 = 8$, and so on.

[12] The following discussion of Chaos will draw primarily from James Gleick's *Chaos* (Ne[w] York: Penguin Books, 1987) a clear, comprehensive layman's treatment of the subject.