Various Types of Number System form Primitive and Hindu Number System and its Popularity

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Abstract: This paper is intended to present the different types of number systems across the world and their developments along with their notation system. The paper presents the relationship between the number system used in speech and in writing and their usage in the articulation and calculations. Different types of numbering systems are explained from primitive and prehistoric systems to the Hindu number system introduced by Aryabhatta.

Keywords: Primitive and prehistoric number system, the Hindu number system.

I-INTRODUCTION

In a simple manner, number system is a type of technique that we use to express numbers. Though each number is unique in its identity, the value of each number is different. It can be observed that different cultures and civilizations across the world have their own style of symbols to represent these numbers. This numbering system has been in usage for ages and still new style of symbols are coming to represent numbers from different countries. This representation is known as notation. When reasoning about numbers, we need some sort of number base, which is the fundamental number in which all other numbers stand in relation to. In recent times—we're talking perhaps a couple of centuries back in time—we also reason a lot about different sets of numbers that we have been able to create; therefore, the term number system has also been made to mean one of these sets**.** This paper presents the basic structure of various types of number systems across the world and the importance the Hindu number system and it significance.

A. The Relation of Numbers Used in Speech and in Writing

As we use numbers in writing, we use number words to represent the numbers in speech. Usually all the languages have number of words for a finite set of numbers. But most often due to lack of use in practice, many of the large numbers are dead. This paper will present the different types of number systems only if they are of some larger importance or of curious interest but also to speak about their abstract manner in a linguistic survey. Number notation is a type of techniques that is used to form numbers in text. This notation is often tightly linked with the language being used in particular area as there is often a connection between the way words are formed in speech and in the way they are formed in writing. This is, however, not always the case. The notation system is constantly changing over time as the scope of the number system and its usage is expanding. It has been observed that many of the researchers speak about various types of notation systems used by different societies through history. The reasons for much attention in this area are first it is our curiosity to understand the number systems of past times as there is no availability of record of the system used. Second, this continuous thirst for learning helps to understand the mathematical advancement of the civilization. Third, notation is such an inspirational thing and many readers want the written word but not the content. Therefore the study on the number system is increasing day by day.

Generally, a number base is a number in which other numbers stand in relation to. Numbers are expressed in a certain number base and calculations are performed using the values of a number given its base. Throughout the ages there have been an exceedingly large number of radices—a somewhat more scientific term with the same meaning as number base—by which mathematicians have performed their calculations. Perhaps surprisingly, and we are jumping the conclusions somewhat, our decimal—base 10 —number base, where all numbers are expressed as multiples of ten, is not the oldest, nor the one most often used. The number base is of

grave importance to the possibility of further advancement of a number system and the mathematics utilizing it. As we will see, a number base can stagnate a whole civilizations mathematical progression, and we will therefore give it an important role in our discussion.

II-TYPES OF NUMBER SYSTEMS AND THEIR DEVELOPMENTS

A.   Primitive and Prehistoric Number Systems

Primitive and Prehistoric number systems are number systems that have been developed when there has been some need to express magnitudes. Examples of these are what is known as body count, the "bundle-of-sticks" method, tally sticks, 2-count, and neo-2-count. Although exceedingly primitive and limited in applicability, these systems have been the beginning of counting in almost every civilization, and many are still used by many of the primitive—in the sense of development, not ability to reason— cultures on Earth today. We will make a quick survey of these number systems and discuss their uses and their limitations.

B.   The "bundle-of-sticks" Method

This method—for it is hardly a number system in its own right—is a way to represent magnitudes. It works by mapping a set of unmanageable items, say coconuts, unto something more manageable, say sticks. So, for each coconut we select a stick. When we have gone through all our coconuts, we will have the total number of coconuts represented by a bundle of sticks. This may not be counting in any real sense of the word, but at least we have arrived at a magnitude that is easier to deal with. The "bundle-of-sticks" method cannot be used to express anything but quantities, and can perhaps not even be considered a way to count. Nevertheless, it has been a method often employed for applications like the one described in the previous paragraph.

C.   2-Count

2-count is what could perhaps be called a counting system, as it provides a way to count, yet provides no means to perform computations. It works as follows: There are number words for numbers 1 and 2, and sometimes an additional for expressing "many", i.e., an uncountable magnitude. These are then combined to express larger quantaties. This is, however, limited to small multiples of 2, as beyond a certain limit, counting the number of times that the word for 2 has been repeated would require a more advanced system in itself! This method of counting is seen across the globe even today, among primitive cultures, and many conjecture that it is so old that it has been with us since the first human civilizations began arising before people spread out on Mother Earth. This type of system is wide popular among the Bushmen in South Africa. As already stated, two-count is rather limited in applicability. Beyond a certain limit, it cannot be used anymore, as the number of repetitions become too large to keep track of. They have, however, played an important role in developing more usable systems and is the ancestor of the neo-2-count system discussed in the next section.

D.   Neo-2-Count

Neo-2-count is an extension to 2-count, where words for 3 and 4 have been added, and larger multiples of 2 are expressed as multiplications of 2 with 3 or 4. The Toba in Paraguay use the system outlined in There are several variations to this scheme, but all amount to a simplification of expressing larger numbers. Of most interest, perhaps, is a system where groups of 4 is used, instead of 2. Still, these systems all share the same limitations as basic 2-count, in that they have an inherit limit in expressiveness.

E.   Body Counting

Body Counting is another method for describing magnitudes. Body parts are associated with a given quantity and by touching them, the given quantity is inferred. It can be as limited to the ten fingers or as advanced as upwards of forty different parts of the body. Again, this system is constrained to a fixed limit, yet is an advancement over both types of 2- count. Body counting only occurs in areas prone to 2-count.

F. Tally Tricks

Not only limited to notches on sticks, tallies are most likely the oldest means of recording quantaties in human history. It is also the one that has stuck with us the longest, even being used for accounting well into the 1800th century. A tally stick is simply a piece of wood in which notches have been made, representing some quantity. More advanced forms have different notches, e.g., deeper grooves or crossed notches, to represent larger quantities. For recording some transfer of goods, talies where sometimes made and split in two along the tally so that later the transfer could be validated by both parties. When used for recording debts, tally sticks where often made shorter as parts of the debt were payed, removing notches corresponding to the returned amount. Not much more than a way to record transactions and quantities, tally sticks nonetheless have played an important role in many civilizations, as the need for such records have become apparent. Many are truly a beautiful piece of history, as their importance often warranted great care in their creation.

G. The Hindu Number System

The Hindu number system as we know it today—for it is more or less the one we (as in us Westerners) use today as well—can be attributed to two men: the great hindu astronomer Âryabhaṭa and his pupil Bhâskara I, during the period 499-522 B.C.E. Âryabhaṭa invented a system that was based on using syllables and combining them to form greater numbers. Bhâskara I simplified the system somewhat and made it decimal place-value system. The Hindus had used a decimal system for a long time and even had the zero before this time, but it was not until these two astronomers came up with their system for forming numbers that the system was more or less complete. As all Hindu literature was written on verse form, they also had to come up with a system to form numbers that fit well in verse. Thus, they substituted different words for numbers. Examples are "moon" for one, as there is only one moon, "eyes" for two, as we have two arms, and so on. 201 would then be paksa-kha-eka, or eyes-hole-one. The zero was very important in the development of the Hindu number system, as it allowed for the introduction of a place-value decimal system using only nine other symbols. This made calculations much simpler than any previous system could have provided. The zero later reached the Arabs, who were not very fond of it. Even the great al-Khowârîzmî-who has given name to the word "algorithm"—considered there to be only nine numerals, even though he made use of the zero. Even though, that Devanagari is only one of a multitude of different scripts in the Hindu region and is merely an example of Hindu numerals.

REFERENCES

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