India’s Unique Place in the World of Numbers and Numerals

Indi	0	1	2	3	4	5	6	7	8	9
Devnagiri	०	१	२	३	४	५	६	७	८	९
Bengali	০	১	২	৩	৪	৫	৬	৭	৮	৯
Gujarati	૦	૧	૨	૩	૪	૫	૬	૭	૮	૯
Gurmukhi	੦	੧	੨	੩	੪	੫	੬	੭	੮	੯
Odia	୦	୧	୨	୩	୪	୫	୬	୭	୮	୯
Telugu	౦	౧	౨	౩	౪	౫	౬	౭	౮	౯
Kannada	೦	೧	೨	೩	೪	೫	೬	೭	೮	೯
Tamil	௦	க	உ	ங	ச	டு	கூ	எ	அ	கை
Malayalam	൦	ഫ	ഛ	ന	ൽ	ൾ	ന	ഭ	വ	ൻ

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SECTION - 1

Numbers and numerals form an important, even a vital, part of life. This point is too elementary to waste time here in elaborating why it is so. The fact is that India occupies a unique place in the whole world in the field of numbers and numerals, and the purpose of this article is to place these unique features on record:

1. The Concept of Numbers.
2. The Written Numeral System.
3. Indo-Aryan Numbers.

1. THE CONCEPT OF NUMBERS

The very idea of numbers is something which seems very natural to us. But is it really so? Incredible though it may appear to us, there are some very primitive or simple languages in the world which do not even have concepts or names for numbers up to **ten** (the number of fingers on a human pair of hands, which would seem to be the natural base for counting). This is mainly so among the Australian aboriginal languages. The following examples of some Australian aboriginal language numbers will make this clear:

Nunggubugu:

1. anyabugij.
2. wulawa.

3. wulanybaj.
4. wulal wulal.

There are no number words beyond four.

Kamilaroi:

1. mal.
2. bular.
3. guliba.
4. bular bular.
5. bular guliba.
6. guliba guliba.

There are specific number words for numbers up to three, and the same words are combined to produce numbers from four to six, at least.

Gumulga:

1. urapon.
2. ukasar.

3. ukasar urapon.
4. ukasar ukasar.
5. ukasar ukasar urapon.
6. ukasar ukasar ukasar.

This language has specific number words for one and two, and these are combined to produce numbers from three to six.

A related language **Mabuiag** has similar words from one to six:

1. urapun.
2. okosa.
3. okosa urapun.
4. okosa okosa.
5. okosa okosa urapun.
6. okosa okosa okosa.

And then there is a number word for seven and any other number after 7:

7 or 7+. ras.

There are apparently a few rare languages in the extreme isolated portions of areas within Papua-New Guinea, interior Africa and Patagonia (the southern half of South America) which have similar structures in which the numbers do not go beyond six or ten and are based on words from one to three.

But **India represents the world in microcosm**: here we have the simplest and most primitive number system in the world even as late as the twentieth-twenty-first century CE, *as well as* the most developed and elaborate number system in the world even as early as during the Vedic period (extending back beyond 3000 BCE, or, even as per the

now discredited AIT version of Vedic history, to 1200 BCE).

The simplest and most primitive number system in the world (the word "primitive", it must be emphasized here, is not a deprecatory word) is found in the Andaman islands in India. Formerly (as per older colonial records, and I have myself quoted them in an earlier article) it was believed in fact that the Andamanese languages had numbers only for one and two. However, it appears this is not so.

The following are the number words in the **Aka-bea-da** (**Greater Andamanese**) language, which only has words from one to five:

1: obatul.

2: ikpaurda.

3: edarobai.

4: eijipagi.

5: arduru.

But an even simpler and more primitive form of number system, the simplest and most primitive form in the world, is found in the **Onge** language, which has numbers only from one to three, and any number above that is represented by a word **ilake** which does not mean “four” but specifically means “many”:

1: yuwaiya.

2: inaga.

3: irejidda.

On the other hand, as early as the Vedic Samhitas, we had words in India for very high numbers. The Yajurveda, for example, in the course of a hymn (**Yaj**. **17**.2), casually lists the following words for numbers from **ten** (10^1 or 10) to **one trillion** (10^{12} or 1, 000, 000, 000, 000):

10^1: daśa.

10^2: śata.

10^3: sahasra.

10^4: ayuta.

10^5: niyuta.

10^6: prayuta.

10^7: arbuda.

10^8: nyarbuda.

10^9: samudra.

10^{10}: madhya.

10^{11}: anta.

10^{12}: parārdha.

It is obvious that while, for ritual purposes, the enumeration in this hymn stops at 10^{12}, logically there is clearly an understanding of the infinite nature of this mathematical series and of the idea that these are just the first steps in an infinite series of numbers each being a multiple of the previous number by ten. This becomes apparent from countless references and number words in the ancient Vedic and Sanskrit texts, but most particularly in certain texts which play with mathematical ideas. For example, the **Lalitavistara**, a Buddhist text, actually describes an even more

elaborate system (where some of the above words from the Yajurveda are now replaced by other words, and all the names are given in multiples of hundred. Here in fact some of the above words, like **ayuta** and **niyuta**, are given higher values):

10^3: sahasra.

10^5: lakṣa.

10^7: koṭi.

10^9: ayuta.

10^{11}: niyuta.

10^{13}: kaṅkara.

10^{15}: vivara.

10^{17}: akṣobhya.

10^{19}: vivāha.

10^{21}: utsāṅga.

10^{23}: bahula.

10^{25}: nāgabala.

10^{27}: tiṭilambha.

10^{29}: vyavasthānaprajñāpti.

10^{31}: hetuhila.

10^{33}: karaphū.

10^{35}: hetvindriya.

10^{37}: samāptalambha.

10^{39}: gaṇanāgati.

10^{41}: niravadya.

10^{43}: mudrābala.

10^{45}: sarvabala.

10^{47}: visaṁjñāgati.

10^{49}: sarvasaṁjña.

10^{51}: vibhūtaṅgamā.

10^{53}. tallakṣaṇa.

The text does not stop there: it points out that this is just the first of a series of nine counting systems that can be expanded geometrically, and then goes on to mention the names of the culmination points of each of the nine systems (starting with the number 10^{53} above, as tallakṣaṇa, dhvajāgravatī, dhvajāgraniśāmaṇī, vāhanaprajñapti, iṅgā, kuruṭu, kuruṭāvi, sarvanikṣepa and agrasārā), culminating in a large number, 10^{421}, or one followed by 421 zeroes! This text, and many other Sanskrit texts, go even further in indulging in flights of fantasy involving even higher numbers.

The point is not whether such incredibly high numbers could possibly serve any practical purpose: obviously they could not! The point is that the ancient Indian theoretical concept of numbers had a vision which was limitless.

India therefore occupies a unique position in the world: on the one hand, it has *even in the twenty-first century* the Onge language with no number words of its own beyond three (i.e. the simplest number system in the world), and on the other, it had *even in ancient times*:

1. a) number words for numbers as high as 10^{53}, and, in theory, even as high as 10^{421}, and in further theory, going into unimaginably and fantastically high numbers beyond even that;

2. b) the concepts of zero, finite numbers and infinity (and, in Jain texts, even different categories of what are now called transfinite numbers);
3. c) the concept of fractions (found even in the Rigveda, in the **Puruṣa sūkta**, Rig. **X**.**90**.3, 4);
4. d) the concept of negative numbers.

All this is apart from the highly developed state of almost every branch of Mathematics in ancient India.

SECTION – 2

Numbers (at least till three) are found in every language in the world. A written numeral system is something different from the mere concept of numbers. The numeral system used all over the world today is the system invented in India. In popular parlance, this is often described as follows: "**India invented/contributed the zero**". But this is an extremely haphazard statement, at least when it comes to the importance of India in the history of numerals: the zero was also (at much later dates) independently invented in ancient

Mesopotamia and Mexico (the Mayans). Also, it is quite a silly way of putting it. It sounds like some old-time fable: all the ancient civilizations of the Old World got together and decided "**let us invent/contribute numbers**". **China** announced that it was contributing the numbers **one**, **four** and **six**. **Egypt** announced it was contributing **two**, **three** and **nine**. Mesopotamia announced it was contributing **five**, **seven** and **eight**. **India**, a little slow off the mark, was left with nothing to contribute. Then, the Indian representative had a brilliant idea: he immediately invented the **zero**, and announced "**we contribute zero**"!

The fact is, zero is just one essential part of the whole of the present day **decimal** numeral system which is used all over

the world and which was invented/contributed by **India** and which is also the basis for the **binary** system which is used in computers (with a change of base from ten to two) . Numeral systems were ***independently*** invented by every highly developed civilization in the world: Egypt, Mesopotamia, China, Mexico and India. Most of the other civilizations of West Asia and Mediterranean Europe derived or developed their own numeral systems based on the Egyptian system. The numeral system of each civilization provides an indication of the stage of development of mathematical logic in each civilization, as we will see, and the Indian system represents the highest stage of development: the **Egyptian** system represents the **first systematic**

stage of development, the **Chinese** system represents the **second systematic stage** of development, and the **Indian** system represents the **third and final systematic stage** of development.

The very idea of numbers contains the first seeds of any numeral system. We can imagine different societies from the most primitive times which had numbers (at least up to three in the simplest and most primitive system) but did not have any method of recording numbers in the form of a written numeral system.

The first primitive stage of recording numbers must have started in a pictorial form. In a primitive society, a man possessing, for example, 12 cows and 5 sheep thought of recording the fact by drawing 12 pictures of a cow and 5

pictures of a sheep. The very concept of representing numbers in writing (albeit pictorial) is the characteristic of this first stage.

In the second primitive stage, as society became larger and more complicated, the concept of numbers must have evolved from the concrete to the abstract. Thus, finding it tiresome to draw 12 pictures of a cow and 5 pictures of a sheep, the man in a society at a more developed stage conceived the idea of representing each unit by an abstract picture (most logically a simple vertical or horizontal line): thus 12 lines followed by the picture of a cow, and 5 lines followed by the picture of a sheep. The concept of abstract numbers, as opposed to numbers as an intrinsic

aspect of some concrete material unit, is the characteristic of this second stage.

In the third primitive stage, as the number of units became much larger and more cumbersome, it would be tiresome to keep track of the number of individual pictures. Draw a series of 152 vertical lines in a row and try to count them again, to see how clumsy it would be and how susceptible to counting errors! This must have led to the evolution of numbers from the individual unit to the collective unit. This can be seen even today in a system of keeping scores which is still quite commonly used: after four vertical strokes to indicate four scores, the fifth stroke is a horizontal stroke drawn across the earlier four strokes, indicating **five** or a full **hand**.

After that the sixth score is recorded by another vertical stroke at a little distance from the first **hand**. The concept of an abstract unit consisting of a collection of a certain fixed number of individual abstract units is the characteristic of this third stage.

[This fixed number was different in different primitive societies: the most common, natural and logical number was **ten** in most societies since human beings have ten fingers on the hands for counting, but it could also be (and *was* so in some societies) **five** (one full hand) or **twenty** (the total number of fingers on both hands and feet). If human beings had had **twelve** fingers instead of **ten**, the natural numeral system would have been mathematically even more effective,

since twelve is divisible by two, three, four and six, while ten is divisible only by two and five. And it would also have fit in with some other aspects of nature, such as the twelve months in a natural year, the twelve tones in a natural octave, etc.].

From this point start the **three systematic stages** of development of the numeral system:

1. The **Egyptian** numeral system represents the **first stage** of development. This stage involves the invention of a **continuous recurring base**. The base (as in most cultures) is **ten.** The main problem in any numeral system that was solved by the Egyptian system was the repetition of symbols *beyond* nine times. The Egyptian system

had one symbol for **one**, another for **ten**, another for **hundred**, and so on, for subsequent multiples of ten (see chart). Each symbol could be repeated as many as nine times to represent the next number in the series. Thus to write **4596**, first the symbol for **thousand** was repeated **four** times, then the symbol for **hundred five** times, then the symbol for **ten nine** times, and finally the symbol for **one six** times:
The symbols for 1 (10^0), 10 (10^1), 100 (10^2), 1, 000 (10^3), 10, 000 (10^4), 100, 000 (10^5), and 1, 000, 000 (10^6), respectively are as follows:

1 (10^0)

10 (10^1)

100 (10^2)

1,000 (10^3)

10,000 (10^4)

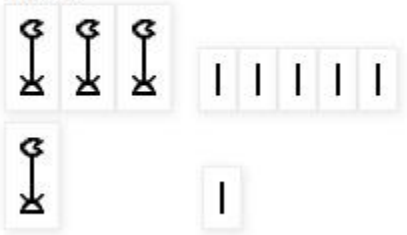
100,000 (10^5)

1,000,000 (10^6)

4596:

4096:

4006:



2. The **Chinese** numeral system represents the **second stage** of development. Like the Egyptian system, it has symbols to represent the numbers **one**, **ten** and multiples of **ten**. But it eliminated the need to repeat these symbols from **two** times to **nine** times to

represent multiples of the symbols. The logic used was the same as the logic involved in replacing the twelve pictures of a cow (in the primitive stage explained earlier) with twelve abstract symbols for **one** (usually a vertical line) followed by the picture of a cow. Here the repetitions of the symbol were replaced by new symbols representing the number of repetitions. That is, any symbol (**one**, **ten**, **hundred**) required to be repeated only in **eight** ways: twice, three times, four times, five times, six times, seven times, eight times *or* nine times. The Chinese system therefore also invented **eight** new symbols to represent the abstract numbers **two** to **nine**, and merely placed the new symbols before the original symbols (**ten**, **hundred**, etc.) as required in representing any number.

Thus to write **4596**, the Chinese would place the following symbols in the following order: **four**, **thousand**, **five**, **hundred**, **nine**, **ten**, **six**. The following chart shows some of the Chinese numerals (a sixth century book gives these symbols from 10^2 to 10^{14}, see below, but in practice, the Chinese followed, and still follow, in cases where the traditional numbers are still used, different systems of combinations of symbols to express large numbers. In this, many of the symbols given below have much larger values in modern usage):

1-9: 一 二 三 四 五 六 七 八 九

10^1: 十

10^2: 百

10^{3}: 千

10^{4}: 萬

10^{5}: 億

10^{6}: 兆

10^{7}: 京

10^{8}: 垓

10^{9}: 秭

10^{10}: 穰

10^{11}: 溝

10^{12}: 澗

10^{13}: 正

10^{14}: 載</strong

Thus:

4596: 四 千 五 百 九 十 六

4096: 四 千 九 十 六

4006: 四 千 六

3. The **Indian** numeral system represents the **third and final stage** of development. The Chinese system had eliminated the need for repeating symbols from **two** to **nine** times to represent the next number in any series, but the system still required a fresh symbol to represent each next multiple of ten (i.e. $\mathbf{10^2}$, $\mathbf{10^3}$, $\mathbf{10^4}$…). The Indian system, by using a fixed positional system and a symbol for zero, eliminated this need to invent an endless number of symbols and made it possible to represent any finite number without any limit by a

simple system of ten symbols (**1-9** and **0**).

. १
. २
. ३
. ४
. ५
. ६
. ७
. ८
. ९
. 0

The shapes of the actual symbols used do not matter: the numeral symbols are different in different Indian languages, and even the “Devanagari” numeral symbols in Hindi and Marathi, for

example, have noticeably different shapes. The Indian numeral system was borrowed by the Arabs, who gave the symbols different shapes again, and later by the Europeans from the Arabs with other similar changes in the shapes. It may be noted, moreover, that some of the Devanagari (Sanskrit) numerals, which were the ultimate basis for the shapes of the symbols in all the other systems, clearly bear some resemblance to the initial letters of the respective Sanskrit number words: १ (ए), ३ (त्र), ५ (प), ६ (ष).

The binary system used in computers is a direct derivative of the Indian decimal system, with a change of base from **ten** to **two**: so, while the Indian decimal system has **ten** symbols (**nine** number symbols and a **zero**), the binary system

has two symbols (**one** and **zero**), and the place values from the right to the left are not 1, 10, 100, 1000…. as in the decimal system, but 1, 2, 4, 8, 16…. .

Thus, in the binary system:

4596: 1, 000, 111, 110, 100.

4096: 1, 000, 000, 000, 000.

4006: 111, 110, 100, 110.

Clearly, while the binary system is useful in the world of computers, the decimal system is more practical for the daily use of human beings.

Now, if the **Egyptian**, **Chinese** and **Indian** systems represented the three logical stages in the development of a logical and practical numeral system, what did the numeral systems of the

other civilizations represent? They represented deviations from the logical line of thinking, which is why their systems ultimately failed to acquire the universality of the Indian system.

1. **The Babylonian numeral system**:
The Babylonian (Mesopotamian/Cuneiform) numeral system, to begin with, had symbols for **one** and **ten**, and derived the numbers in between accordingly by repetitions:

The numbers for 1-10 are as follows:

The symbols for the **tens** numbers were also formed by repeating the symbol for **ten**.

The numbers for 20, 30, 40, 50 and 60:

And here was the catch: although the Babylonians had symbols for one and ten, their numeral system was not a **decimal** system (i.e. with a base of ten): it was a unique **sexagesimal** system (i.e. with a base of **sixty**)! Therefore their place values from the right to the left were not 1, 10, 100, 1000…. as in the decimal system, but 1, 60, 3600, 72000…. . Therefore, the symbol for **one** also served as the symbol for **sixty**, **three thousand six hundred**, **seventy-two thousand**, etc., depending on its position from the right in a composite numeral. The Babylonian system had three main faults:

1. Just as the **binary** system (howsoever vital to computers and cyber technology) is too small for

normal human usage, a **sexagesimal** system was too large and unwieldy for human usage and computation.

2. To be effective even as a **sexagesimal** system, it should have had **sixty** symbols (for the numbers from **one** to **fifty-nine**, and one for **zero**), but it only had symbols for **one** and **ten**. Of course, the symbols, as we can see above, were joined together, but that did not really improve matters. And, even if there had been sixty different symbols, it would still have been too large and unwieldy for common human use.
3. It did not have a symbol for **zero**. Therefore, it was not clear whether the symbol for **one**, all by itself and without being a part of a larger composite numeral, represented **one**

or **sixty** or **three thousand six hundred** or **seventy-two thousand** or something bigger. In the Indian system, you can distinguish not only between 1, 10, 100, 1000, etc. because of the **zeroes**, but also between 40006, 40060, 40600, 46000, 4006, 4060, 4600, 406, 460 and 46. In the Egyptian and Chinese systems, even without the zero, all these numbers could be distinguished because the "position" of each individual number in the composite numeral was distinguished by a different symbol (for **ten**, **hundred**, **thousand**, etc.). The Babylonian system, although it was effectively used by the Babylonians for their different purposes, was a very faulty system in which, for example, not only could

the same symbol represent 1, 60, 3600, 72000, etc., but the same combination of symbols could represent, to take the simplest example, 3601, 3660 and 61.

[Later in time, a zero symbol was invented, but it was not really properly understood, and was used only at the end of a composite numeral].

To continue the same examples of the numbers already seen in the other systems, the Babylonian system would write them as follows:

4596: (1 x 3600, 16 x 60, 36 x 1):

4096: (1 x 3600, 8 x 60, 16 x 1):

4006: (1 x 3600, 6 x 60, 46 x 1):

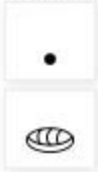
2. **<u>The Mayan numeral system</u>**:
Like the Babylonian numeral system, the Mayan (Mexican) numeral system also was not a **decimal** system (i.e. with a base of ten): it was a **vigesimal** system (i.e. with a base of **twenty**). Basically it had only three symbols, for **one**, **five** and **zero**, and the other numbers between **one** and **twenty** were written by repetitions of symbols. The Mayans also, thus, had discovered the principle of using a **zero**

symbol. The place values in this system, (written not from the right to the left as in other systems, but from the bottom to the top), were not 1, 10, 100, 1000…. as in the **decimal** system, but 1, 20, 400, 8000…. (<u>at least we must assume this theoretically here for the moment</u> for our study of the numeral system, but this was not strictly accurate as we will see presently). The symbols from one to nineteen were as follows:

The numbers 1-10:

The numbers 11-19:

The number 20:



The Mayan system was basically a marvelous one: it had a **strict positional system** as well as a **fully-developed zero concept and symbol**; but it suffered from certain faults:

1. To be fully effective as a **vigesimal** system, it should have had **twenty** symbols (for the numbers from **one** to **nineteen**, and one for **zero**), but it only had symbols for **one, five** and **zero**. The numbers in between **one** and **twenty** were written by repetitions of the symbols for **one** and **five**.
2. For religious reasons, to fit in with the (roughly) **360** days in the calendar, the Mayans tweaked the base of the **vigesimal** system, so that instead of the place values in this

system (written from the bottom to the top) being 1, 20, 400, 8000, 160000…. as in a regular **vigesimal** system, they were 1, 20, 360, 7200, 144000…. . In short, there was a break in the regularity of the recurring base at the very second multiple, so that the third place from the bottom represented **360** instead of **400**, and after that all the subsequent bases continued at multiples of **twenty**: The numbers for 1, 20, 360, 7200, 144, 000, and 2, 880, 000 are as follows:

1.

20.

360:

7,200:

144,000:

2,880,000:

We have already seen certain numbers written in all the numeral systems discussed so far. The following are their forms in the **Mayan** numeral system:

4956: (13 x 360) + (13 x 20) + (16 x 1)

4906: (13 x 360) + (11 x 20) + (6 x1):

4006: (11 x 360) + (2 x 20) + (6 x 1):

3. The Egyptian-derived Mediterranean and West Asian Numeral Systems

The **Egyptian** numeral system that we have already examined (called the **Hieroglyphic** numeral system) was

adopted by the **Greeks**, and from the **Greeks** by the **Romans**, with modifications. The **Egyptian Hieroglyphic** numeral system, as we have seen, was at the **first stage** of development of a logical and complete system of numerals. But unfortunately, instead of developing it in the right direction and reaching at least the **second stage** of development, as for example represented in the **Chinese** numeral system, the **Greeks** and the **Romans** went off at a tangent from the logical line of development in trying to simplify and "develop" the **Hieroglyphic** numeral system.

At the same time, the Egyptians themselves "developed" *another* system of numerals, distinct from the earlier

system, called the **Hieratic** numeral system. This system was adopted by the **Greeks** (and called the Greek **Ionian** numeral system in opposition to the earlier Greek **Attic** numeral system derived from the Egyptian **Hieroglyphic** numeral system) and by all the other prominent civilizations and cultures of the Mediterranean area and West Asia (including the **Israelites** and the **Arabs**) except the **Romans**. This represented another "development" at a tangent from the logical line of development:

a. **The Attic Greek numeral system**: The Greeks adopted the Egyptian Hieroglyphic numeral system, replacing the Hieroglyphic symbols with Greek letters (being the first letters of the

respective Greek numbers), as follows:
The numbers 1, 10, 100, 1000, 10000:

I Δ H X M

The first ten numbers **1-10** should naturally have been written as follows:

I II III IIII IIIII IIIIII IIIIIII IIII IIIII IIIIIIII IIIIIIIII Δ

However, the Greeks decided to simplify or “develop” the numeral system to reduce the number of repetitions of a symbol within a compound numeral. Their solution was to invent mid-way symbols between 1, 10, 100, 100, 10000, etc., as follows:

The numbers 5, 50, 500, 5000, 50000:

Therefore, the Greek

symbols for the first ten numbers **1-10** were as follows:

The three numbers that we saw in the different systems already described would appear as follows in the Greek system:

b. **<u>The Roman numeral system</u>**: The Romans adopted the Attic Greek numeral system, providing their own symbols for the Greek ones:
1, 5, 10, 50, 100, 500, 1000, 5000, 10000, 50000, 100, 000:

I V X L C D M <u>V</u> <u>X</u> <u>L</u> <u>C</u>

[The numbers 5, 000 onwards have a horizontal line above the symbol, but due to lack of such a font, the symbols here have been underlined]

However, the Romans decided to "develop" the system further. They found even four repetitions of a symbol within a compound number (as in **IIII** for **four** and **VIIII** for **nine**) too much, and decided to reduce the fourth repetition by introducing a minus-principle: instead of having the bigger number followed by the smaller number four times, they decided to place one symbol of the concerned smaller number **before** the bigger number to indicate "minus one". Thus:

1-10:

I II III IV V VI VII VIII IX X

Tens 10-100:

X XX XXX LX L LX LXX LXXX XC C

Hundreds 100-1000:

C CC CCC CD D DC DCC DCCC CM M

1000:

M

And so on. The three numbers already shown in the other systems would appear as follows in the Roman numeral system:

4596: **M$\underline{V}$DXCVI**

4096: **M$\underline{V}$XCVI**

4006: **M$\underline{V}$VI**

c. **The Hieratic numeral system**: The Egyptians themselves invented another new numeral system, a sort of shorthand numeral system, where they had nine symbols for the numbers **1-9**, nine symbols for the numbers **10-90**, nine symbols for the numbers **100-900**, and so on, based on the letters of the **Hieratic** script. This numeral system was then adopted by the **Ionian Greeks**, using the symbols of their alphabets to represent the numbers. The **Hieratic** numerals and the **Ionian Greek** numerals are shown in the charts below:

	Units	Tens	Hundreds
1	α alpha	ι iota	ρ rho
2	β beta	κ kappa	σ sigma
3	γ gamma	λ lambda	τ tau
4	δ delta	μ mu	υ upsilon
5	ε epsilon	ν nu	ϕ phi
6	ϝ digamma	ξ xi	χ chi
7	ζ zeta	ο omicron	ψ psi
8	η eta	π pi	ω omega
9	θ theta	ϟ koppa	ϡ sampi

The same system was also adopted by almost all the cultures and civilizations of the Mediterranean area and West Asia (except the Romans), including the Arabs and the Israelites, using the symbols of their respective alphabets.

This exposition of the numeral systems of the world makes it clear why the Indian numeral system was universally

adopted all over the world, and all the other numeral systems fell into disuse (although still used as secondary symbols in scholarly works or for other particular and restricted purposes, as for example the Roman numeral system in western academic and religious works or a much-modified Chinese numeral system in China).

SECTION – 3

C. INDO-ARYAN NUMBERS

One aspect of Indian numbers which is not generally recognized is that the numbers in the Indo-Aryan languages of North India have one feature (though not exactly a positive feature) which makes them unique among all the languages of the world: they are probably the only languages in the world where anyone learning the language (any North Indian Indo-Aryan language) necessarily finds that he has to individually learn or

memorize every single number from **one** to **hundred**.

To understand this fully, one must first understand the methods by which the different world languages form their numbers **1-100**. We will examine the subject under the following heads:

C-I. Sexagesimal systems (with a base of 60).

C-II. Quindecimal systems (with a base of 15).

C-III. Vigesimal systems (with a base of 20).

C-IV. Decimal systems (with a base of 10) with words for 1-10 and 100.

C-V. Decimal systems (with a base of 10) with words for units 1-9 and tens 10-100.

C-VI. Decimal systems (with a base of 10) with words for numbers 1-19 and tens 20-100.

C-VII. Decimal systems (with a base of 10) with words for numbers 1-100.

C-VIII. Historical Implications of the Indo-Aryan number system.

C-I. SEXAGESIMAL SYSTEMS (WITH A BASE OF 60):

The **sexagesimal** system (with a base of **60**, although with a subset of **10**) is *very rare*, and we will look at it before moving on to the two main systems. I can personally think of only one language

today with such a system (probably also found in some related neighboring languages), though the ancient Mesopotamians (Sumerians/Akkadians/Assyrians, etc., who were the only ones to use a **sexagesimal** numeral system) may have had **sexagesimals** in the spoken number system as well. This rare language is **the Masai language**, belonging to the **NiloSaharan/Sudanic** language family, and spoken in southern Kenya and northern Tanzania in east Africa. The numbers are as follows:

1-9: **nabu**, **ari**, **üni**, **ungwun**, **miet**, **elle**, **nabishäna**, **issiet**, **nawdu**

10, 20, 30, 40, 50, 60: **tomon**, **tigitum**, **ossom**, **arrtam**, **orrnom**, **ïp**

70, 80, 90, 100, 110: **ïp–tomon**, **ïp–tigitum**, **ïp–ossom**, **ïp–arrtam**, **ïp–orrnom**

Other numbers in between **10-60** are formed by the **tens** word followed by the following *secondary* forms of **1-9**: **obbo**, **are**, **ogüni**, **ungwun**, **oimiet**, **oīille**, **nabishäna**, **oissiet**, **nawdo**

sexagesimals 60, 120, 180, 240, etc: **ïp**, **ari-ïp**, **üni-ïp**, **ungwun-ïp**, etc. (60, 2×60, 3×60, 4×60, etc.)

Other numbers above 60: **sexagesimal** (60, 120, etc) followed by **1-59**. Thus:

11 is **tomon-obbo** (10+1), 99 is **ïp ossom-nawdo** (60+30+9), 179 is **ari-ïp orrnom-nawdo** (60×2+50+9).

C-II. QUINDECIMAL SYSTEMS (WITH A BASE OF 15):

Unlikely though it seems, there is even a language with a **quindecimal** system, i.e. with a base of **15** (and it does not even have a subset of **10**)! This is **the Huli language** of Papua New Guinea, belonging to the **Papuan** language family. The possible origin of such a system (as also the above **sexagesimal** system) is hard to pinpoint: perhaps it is based on the number of days in a lunar fortnight.

The numbers are as follows:

1-14: **mbira**, **kira**, **tebira**, **maria**, **duria**, **waragaria**, **karia**, **halira**, **dira**, **pira**, **bearia**, **hombearia**, **haleria**, **deria**

15, 30, 45, 60, 75, 90, 105 (and so on): **ngui-ra**, **ngui-ki**, **ngui-tebo**, **ngui-ma**, **ngui-dau**, **ngui-waraga**, **ngui-ka** (and so on, i.e. 15×1, 15×2, 15×3, etc.).

16-29: **nguira-ni-mbira**….**nguira-ni-deria** (i.e. 15+1 to 15+14)

Other numbers between the **quindecimals** are counting according to the serial position: e.g. the numbers **31-44** belong to the "third series of 15" culminating in **45**, the numbers **46-59** belong to the "fourth series of 15" culminating in **60**, etc. The names of the series (covering the numbers upto 100) are as follows:

third series 31-45: **ngui-tebone-gonaga** (45: **ngui-tebo**)

fourth series 46-60: **ngui-mane-gonaga** (60: **ngui-ma**)

fifth series 61-75: **ngui-dauni-gonaga** (75: **ngui-dau**)

sixth series 76-90: **ngui-waragane-gonaga** (90: **ngui-waraga**)

seventh series 91-105: **ngui-kane-gonaga** (105: **ngui-ka**)

Other numbers (between the quindecimals) 31 onwards: previous quindecimal + new series (to which the following unit belongs) + unit number. Thus 31: **ngui-ki ngui-tebone-gonaga mbira**. (i.e. 30+third-series+1)

99: **ngui-waraga ngui-kane-gonaga dira** (i.e. 90+seventh-series+9).

The **Huli** numbers are complicated because of two things:

1. The odd (to everyone else in the world, except the speakers of **Huli**) base of 15.
2. The illogical addition of the series name (based actually on the name of the *following* **quindecimal**) between the previous **quindecimal** and the **unit**: thus, 31 could well have simply been **ngui-ki mbira** (30+1) and 99 could have been **ngui-waraga dira** (90+9).

However, the first complication is part of this rare system, and the second one can be eliminated as shown above, and (even if it isn't eliminated, still) we get a very *regular* **quindecimal** system.

C-III. VIGESIMAL SYSTEMS (WITH A BASE OF 20):

Vigesimal number systems are those which are based on **20**, although they usually have a subset of **10**. To learn the numbers, one necessarily has to memorize the numbers **1-19**, the **vigesmals/tens** numbers from **20-100**, and the *regular procedure* for forming the other in-between numbers.

The two characteristics of these languages are:

1. The **vigesimal** numbers **40**, **60**, **80**, and sometimes **100**, are based on the word for **20**.
2. The other numbers are formed by adding the numbers **1-19** to the vigesimals.

In a few languages, the numbers **1-19** are based on an internal subset not of **ten** but of **five**. The most perfect example of this is the **Turi** language from the **Austric** (**Austro-Asiatic**) family, spoken in the adjoining parts of Jharkhand-W. Bengal-Orissa in India, which shows this subset of **five** very clearly, with the words for **5**, **10** and **15** literally meaning “one hand”, “two hands” and “three hands” respectively. Another example is the **Nahuatl**/**Aztec** language of Mexico:

Turi (Austric-KolMunda):

1-5: **miad**, **baria**, **pea**, **punia**, **miadti**

6-10: **miadti-miad**, **miadti-baria**, **miadti-pea**, **miadti-punia**, **baranti**

11-15: **baranti-miad**, **baranti-baria**, **baranti-pea**, **baranti-punia**, **peati**

16-19: **peati-miad**, **peati-baria**, **peati-pea**, **peati-punia**

20, 40, 60, 80, 100: **lekacaba**, **bar-lekacaba**, **pea-lekacaba**, **punia-lekacaba**, **miadti-lekacaba**

Other numbers: **vigesimal** numbers **20**, **40**, **60** or **80** followed by **1-19**. Thus:

21: **lekacaba miad** (20+1), 99: **punia-lekacaba peati-punia** (4×20+19).

[**Khmer (Cambodian)**, which also belongs to the **Austric** family, also originally had this subset of **five**, but the language now uses numbers borrowed from the unrelated **Thai** language for numbers beyond **10**. The Khmer numbers 1-10 are:

muəy, **pii**, **bəy**, **buən**, **pram**, **pram-muəy**, **pram-pii**, **pram-bəy**, **pram-buən**, **dap**].

<u>Nahuatl/Aztec (Amerindian)</u>:

1-5: **ce**, **ome**, **yey**, **naui**, **macuilli**

6-10: **chica-ce**, **chic-ome**, **chicu-ey**, **chic-naui**, **matlactli**

11-15: **matlactli-on-ce**, **matlactli-on-ome**, **matlactli-on-yey**, **matlactli-on-naui**, **caxtulli**

16-19: **caxtulli-on-ce**, **caxtulli-on-ome**, **caxtulli-on-yey**, **caxtulli-on-naui**

20, 40, 60, 80, 100: **cem-poualli**, **ome-poualli**, **yey-poualli**, **naui-poualli**, **macuil-poualli**

Other numbers: **vigesimal** numbers followed by (the word) **on** and the numbers **1-19**. Thus:

21: **cem-poualli on ce** (20+**on**+1), and 99: **naui-poualli on caxtulli-on-naui** (80+**on**+19).

[**on-ce** can be shortened to **oce**].

The majority of **vigesimal** systems, however, have a sub-set of **10**. These number systems are found in every continent (except perhaps Australia). Some examples from the Caucasian, Basque, Burushaski, Ainu, Niger-Congo, Austric/Austro-Asiatic, Sino-Tibetan and the Ameridian-superfamily language-families:

Georgian (Caucasian):

1-10: **erti**, **ori**, **sami**, **otxi**, **xuti**, **ekwsi**, **šwidi**, **rwa**, **çxra**, **ati**

11-19: **tertmeṯi**, **tormeṯi**, **çameṯi**, **totxmeṯi**, **txutmeṯi**, **tekwsmeṯi**, **cwidmeṯi**, **twrameṯi**, **çxrameṯi**

20, 40, 60, 80, 100: **oçi**, **ormoçi**, **samoçi**, **otxmoçi**, **asi**

Other numbers: **vigesimal** + **1-19** with the ending **oçi** of the first word becoming **oçda**. Thus:

21: **oçda erti** (20+1), 99: **otxmoçda çxrameṯi** (80+19).

[Note: **x** is pronounced “kh”].

Euskara/Basque (Basque):

1-10: **bat**, **biga**, **hirur**, **laur**, **bortz**, **sei**, **zazpi**, **zortzi**, **bederatzi**, **hamar**

11-19: **hameka**, **hamabi**, **hamahirur**, **hamalaur**, **hamabortz**, **hamasei**, **hamazazpi**, **hamazortzi**, **hemeretzi**

20, 40, 60, 80, 100: **hogei**, **berrogei**, **hiruetanogei**, **lauetanogei**, **ehun**

Other numbers: **vigesimal** + **ta** + **1-19**. Thus:

21: **hogei ta bat** (20+**ta**+1), 99: **lauetanogei ta hemeretzi** (80+**ta**+19).

Burushaski (Burushaski):

1-10: **hən**, **ālto**, **ůsko**, **wālto**, **tsůndo**, **mıšīndo**, **təlo**, **āltəmbo**, **hůnčo**, **tōrůmo**

11-19 **tůrma** + 1-9.

20, 40, 60, 80, 100: **āltər**, **ālto-āltər**, **īski-āltər**, **wālti-āltər**, **thā**

Other numbers: **vigesimal** + **1-19** (but before the words **tōrůmo** and **tůrma** preceded by the word **ga**). Thus:

21: **āltər hən** (20+1), 90: **wālti-āltər ga tōrůmo**, (80+**ga**+10), 99: **wālti-āltər ga tůrma hůnčo** (80+**ga**+19).

Ainu (Ainu):

1-10: **shine**, **tu**, **re**, **ine**, **ashikne**, **iwan**, **arwan**, **tupesan**, **shinepesan**, **wan**

20, 40, 60, 80, 100: **hotne**, **tu-hotne**, **re-hotne**, **ine-hotne**, **ashikne-hotne**

30, 50, 70, 90: **wane-tu-hotne**, **wane-re-hotne**, **wane-ine-hotne**, **wane-ashikne-hotne**

(literally, **30** is “ten-*less*-than-forty”, etc).

Other numbers (including 11-19): **unit** + **ishama** + **tens**. Thus:

11: **shine ishama wan** (1+ **ishama**+10),
21: **shine ishama hotne** (1+**ishama**+20),
99: **shinepesan ishama wane-ashikne-hotne** (9+**ishama**+90).

Mende (NigerCongo):

1-10: **yira**, **fere**, **sawa**, **nani**, **lolu**, **woita**, **wofela**, **wayakpa**, **tau**, **pu**

11-19: **pu-mahũ-yira** (10-**mahũ**-1) etc.

20, 40, 60, 80, 100: **nu-yira-gboyongo**, **nu-fere-gboyongo**, **nu-sawa-gboyongo**, **nu-nani-gboyongo**, **nu-lolu-gboyongo**

Other numbers: **vigesimal** + **1-19**. Thus:

21: **nu-yira-gboyongo mahũ yira** (20-**mahũ**-1), 99: **nu-nani-gboyongo mahũ pu-mahũ-tau** (80-**mahũ**-19).

Savara/Saora (Austric-KolMunda):

1-10: **bo**, **bagu**, **yagi**, **uñji**, **molloi**, **tuḍru**, **gulji**, **tamji**, **tiñji**, **galji**

11: **galmui**, 12: **miggal**, 13-19: **miggal-aboi** (13: 12+1), etc.

20, 40, 60, 80, 100: **bo-koḍi**, **bagu-koḍi**, **yagi-koḍi**, **uñji-koḍi**, **molloi-koḍi**

Other numbers: **vigesimal** + **1-19**. Thus:

21: **bo-koḍi bo** (20+1), 99: **uñji-koḍi miggal-gulji** (80+12+7).

[A special word is **aboi** instead of **bo** for **1** in the number **13**]

<u>Shompeng (Austric-Nicobarese)</u>:

1-10: **heng**, **au**, **luge**, **fuat**, **taing**, **lagau**, **aing**, **towe**, **lungi**, **teya**

11-19: **heng-mahaukoa-teya** (1+**mahaukoa**+10), etc.

20, 40, 60, 80, 100: **heng-inai**, **au-inai**, **luge-inai**, **fuat-inai**, **taing-inai**

Other numbers: **vigesimal** + **1-19**. Thus:

21: **heng-inai heng** (20+1), 99: **fuat-inai lungi-mahaukoa-teya** (80+**mahaukoa**+19).

Lepcha/Rōng/Sikkimese (SinoTibetan-Tibetic):

1-10: **kāt**, **ñat**, **sām**, **falī**, **fango**, **tarak**, **kakyak**, **kaku**, **kakyōt**, **katī**

11-19: **katī kāt-thāp** (10+1+**thāp**), etc.

20, 40, 60, 80, 100: **khā-kāt**, **khā-ñat**, **khā-sām**, **khā-falī**, **gyo-kāt** (20×1, 20×2, 20×3, 20×4, 100×1)

Other numbers: **vigesimal** + **sa** + **1-19**. Thus:

21: **khā-kāt sa kāt-thāp** (20×1+**sa**+1+**thāp**), 99: **khā-falī sa kakyōt-thāp** (20×4+**sa**+9+**thāp**).

[Note: The word **thāp** is dropped after **katī**, 10. Thus 30 is **khā-kāt sa katī**].

<u>Garo (SinoTibetan-Tibetic)</u>:

1-9: **sa**, **gini**, **gittam**, **bri**, **boṅga**, **dok**, **sini**, **cet**, **sku**

10, 20, 30: **ci**, **korgrik**, **koraci**

Other numbers 11-39: tens+unit. Thus 11, 21, 31, etc.: **ci-sa**, **korgrik-sa**, **koraci-sa**, etc.

40, 60, 80, 100: **korcaṅ-gini**, **korcaṅ-gittam**, **korcaṅ-bri**, **ritca-sa**

Other numbers 41-99: **vigesimal** + **1-19**. Thus:

41: **korcaṅ-gini sa**, 99: **korcaṅ-bri ci-sku**

<u>Welsh (IndoEuropean-Celtic)</u>:

1-10: **un**, **dau**, **tri**, **pedwar**, **pump**, **chwech**, **saith**, **wyth**, **naw**, **deg**

11-15 **un-ar-ddeg**, **deuddeg**, **tri-ar-ddeg**, **pedwar-ar-ddeg**, **pymtheg**

16-19 **un-ar-bymtheg**, **dau-ar-bymtheg**, **tri-ar-bymtheg**, **pedwar-ar-bymtheg**

20, 40, 60, 80, 100: **hugain**, **deugain**, **triugain**, **pedwarugain**, **cant**

The numbers from **21-99** are *regularly* formed by the numbers **1-19** + **ar** + **vigesimal** (here the units come first. Note, in Old English also, the units came

first, as in the nursery rhyme "**four-and-twenty blackbirds**"). Thus:

21: **un ar hugain** (1+**ar**+20) and 99: **pedwar-ar-bymtheg ar pedwarugain** (19+**ar**+80).

Irish (IndoEuropean-Celtic):

1-10: **aon**, **dō**, **trī**, **keathair**, **kūig**, **sē**, **seakht**, **okht**, **naoi**, **deikh**

11-19: **aon-dēag** (1+10), etc.

20, 40, 60, 80, 100: **fikhe**, **dā-fhikhid**, **trī-fhikhid**, **kheithre-fhikhid**, **kēad**

Other numbers: the numbers **1-19** + **is** + **vigesimal** (here also the units come first). Thus:

21: **aon is fikhe**, 99: **naoi-deag is kheithre-fhikhid** (19+**is**+80).

[But the language also alternatively retains the original Indo-European **tens** numbers:

10, 20, 30, etc: **deikh**, **fikhe**, **trīokha**, **daikhead**, **kaoga**, **seaska**, **seakhtō**, **okhtō**, **nōkha**, **kēad**].

French (IndoEuropean-Italic) [but only partially]:

1-10: **un**, **deux**, **trois**, **quatre**, **cinq**, **six**, **sept**, **huit**, **neuf**, **dix**

11-19: **onze**, **douze**, **treize**, **quatorze**, **quinze**, **seize**, **dix-sept**, **dix-huit**, **dix-neuf**

20-100: **vingt**, **trente**, **quarante**, **cinquante**, **soixante**, **soixante-dix**, **quatre-vingts**, **quatre-vingt-dix**, **cent**

The numbers from **21-99** are generally formed as follows, e.g. **20**: **vingt**, **1**: **un**, **21**: **vingt et un**

The **et** (“and”) only comes before **un**, otherwise **22 vingt-deux**, etc.

But note the words for **70**, **80** and **90** mean “60+10”, “4×20” and “4×20+10” respectively. So the numbers **71-79** are **soixante et onze**, **soixante-douze**, (60+11, 60+12) etc., and the numbers **91-99** are **quatre-vingt-onze**, **quatre-vingt-douze**, (4×20+11, 4×20+12) etc. (**81-89** are the normal **quatre-vingt-un**, **quatre-vingt-deux**, etc.).

It is very likely that this sub-system of **20**, found in the Indo-European family only in **French** and in the **Celtic**

languages may be due to the influence of **Basque**.

<u>Yucatec/Mayan (Amerindian)</u>:

1-10: **hun**, **ca**, **ox**, **can**, **ho**, **uac**, **uc**, **uaxac**, **bolon**, **lahun**

11-19: **buluc**, **lahca**, **ox-lahun**, **can-lahun**, **ho-lahun**, **uac-lahun**, **uuc-lahun**, **uaxac-lahun**, **bolon-lahun**

20, 40, 60, 80, 100: **kal/hun-kal**, **ca-kal**, **ox-kal**, **can-kal**, **ho-kal**

30, 50, 70, 90: **lahu-ca-kal**, **lahu-ox-kal**, **lahu-cankal**, **lahu-hokal** (10 less than 40, etc.).

Other numbers:

21-39 (except 30): **1-19** + **tu kal**. Thus: **21** is **hun tu kal** (1+**tu**+20).

Other numbers (after 40, except the actual non-vigesimal **tens** numbers 50, 70, 90, etc., where the word **tu** is dropped): **1-19** + **tu** and the *following* **vigesimal**. Thus:

41 is **hun tu ox-kal** (1 below 60), 99 is **bolon-lahun tu ho-kal** (19 below 100).

[Some additional, but not *necessary*, euphonic variations in speech are:

1. a) 15, **ho-lahun**, is sometimes contracted to **ho-lhun**
2. b) a **y** is sometimes inserted between a word ending in **u** and a following **ox** or **ho**. Thus: **lahu-oxkal** and **lahu-hokal** (50 and 90) become **lahu-y-oxkal** and **lahu-y-hokal**, and similarly **hun tu ox-kal**, 41, becomes **hun tu y-ox-kal**]

3. c) **l** of **lahun** is dropped before **tu**. Thus **bolon-lahun tu kal**, 39, becomes **bolon-lahu tu kal**]

[Note: This is important since the Mayans were the only people to invent a **vigesimal** *numeral* system. Hence also, perhaps, the system of forming the other numbers (**21-99**) is slightly less regular or more complicated (but still explicable by certain rules]

[Note: the **x** is pronounced "sh" and the **c** as well as **k** as "k"].

<u>Yupik (EskimoAleut)</u>:

1-10: **atauciq**, **malruk**, **pingayun**, **cetaman**, **talliman**, **arving-legen**, **malrung-legen**, **pingayun-legen**, **qulngunritaraan**, **qula**.

11-19: **qula-atauciq**, **qula-malruk**, **qula-pingayun**, **akimiarunrita’ar**, **akimiaq**, **akimiaq-ataucik**, **akimiaq-malruk**, **akimiaq-pingayun**, **yuinaunrita’ar**

vigesimals 20, 40, 60, 80, 100: **yuinaq**, **yuinaak-malruk**, **yuinaat-pingayun**, **yuinaat-cetaman**, **yuinaat-talliman**

Other numbers: **vigesimal** + **1-19**. Thus:

21: **yuinaq atauciq**, 99: **yuinaat-cetaman yuinaunrita’ar**

C-IV. DECIMAL SYSTEMS (WITH A BASE OF 10) WITH WORDS FOR 1-10 AND 100

Decimal number systems are those which are based on **10**. The simplest types of **decimal** systems are those

where, to learn the numbers, one necessarily has to memorize the numbers **1-10**, and the number **100**, and the *regular procedure* for forming the other in-between numbers.

Typical examples of these numbers are found in the major languages of the **Sino-Tibetan** family [The sign after each word shows the tone: low, rising, falling, etc.]:

Chinese Mandarin (SinoTibetan-Sinitic):

1-10: **yi_** , **erh** , **sān¯**, **szə** , **wu** , **liu**, **ch'i_** , **pā_** , **chiu** , **shih_**

tens 20-90: **erh** **shih_** , etc. 100: **bai**

Other numbers: tens+unit. Thus 11: **shih_ yi_** , 21: **erh shih_ yi_** , 99: **chiu shih_ chiu**

Thai/Siamese (SinoTibetan-Sinitic):

1-10: **hnïng_** , **sɔng** , **sām** , **sī_** , **hā** , **hok_** , **chet_** , **bpɛt_** , **kɔ** , **sip_**

tens 20-90: **sɔng sip_** , etc. 100: **hnïng_ rɔy**

Other numbers: tens+unit.

Thus 11: **sip_ hnïng_**, 21: **sɔng sip_ hnïng_**, 99: **kɔ sip_ kɔ**

Tibetan (SinoTibetan-Tibetic):

1-10: **gchig**, **gnyis**, **gsum**, **bzhi**, **lnga**, **drug**, **bdun**, **brgyad**, **dgu**, **bchu**

tens 20-90: **gnyis bchu**, etc. 100: **brgya**

Other numbers: tens+unit. Thus 11: **bchu bchig**, 21: **gnyis bchu gchig**, 99: **dgu bchu dgu**

[Note: the initial letter in **lnga** is small **L**, not capital **i**]

Burmese (SinoTibetan-Tibetic):

1-10: **tit**, **hnit**, **sũ**, **le**, **ngā**, **cowk**, **khuhnit**, **shit**, **kɔ**, **ta-cheh**

tens 20-90: **hnit-cheh**, etc. 100: **ta-yā**

Other numbers: tens+**hnin**+unit.

Thus 11: **ta-cheh hnin tit**, 21: **hnit-cheh hnin tit**, 99: **kɔ-cheh hnin kɔ**

Abor-Miri (SinoTibetan-Tibetic):

1-10: **ā**, **ānyī**, **āūm**, **āpī**, **ānga**, **ākheng**, **kīnit**, **pinyī**, **kanāng**, **ēing**

tens 20-90: **ēing-ānyī**, etc. 100: **ling**

Other numbers: tens+**lāng**+unit. Thus 11: **ēing lāng ā**, 21: **ēing-ānyī lāng ā**, 99: **ēing- kanāng lāng kanāng**

[Note: the suffix **-ko** is attached at the *end* of every composite number. Thus: 1: **ā-ko**, 10: **ēing-ko**, 11: **ēing lāng ā-ko**, 20: **ēing-ānyī-ko** , 21: **ēing-ānyī lāng ā-ko**, 99: **ēing-kanāng lāng kanāng-ko**]

Some languages of the **Austric** family:

Santali (Austric-KolMunda):

1-10: **mit’**, **bar**, **pɛ**, **pon**, **mɔrɛ**, **turūi**, **ēāe**, **irəl**, **arɛ**, **gɛl**

tens 20-90: **bar-gɛl**, etc. 100: **mit-sae**

Other numbers: tens+**khān**+unit.

Thus: 11: **gɛl khān mit’**, 21: **bar-gɛl khān mit’**, 99: **arɛ-gɛl khān arɛ**

[Alternately, the other numbers can be formed without inserting the word **khān**]

<u>Vietnamese (Austric-MonKhmer)</u>:

1-10: **mot _ , hai, ba, bôn , năm, sau , bay , tam , chin , muoi**

tens 20-90: **hai muoi** , etc. 100: **mot _ trăm**

Other numbers: tens+unit.

Thus 11: **muoi mot _** , 21: **hai muoi mot _** , 99: **chin muoi chin**

<u>Khasi (Austric-MonKhmer)</u>:

1-10: **ši, ār, lāi, sāw, sàn, hinrīw, hinniew, p'rā, k'ündāi, ši-p'ew**

tens 20-90: **ār-p'ew**, etc. 100: **ši-spå**

Other numbers: tens+unit: Thus 21: **ār-p'ew ši**, 99: **k'ündāi-p'ew k'ündāi**

Some languages of the **Austronesian** family:

Hawaiian (Austronesian):

1-10: **akahi**, **alua**, **akolu**, **aha**, **alima**, **aono**, **ahiku**, **awalu**, **aiwa**, **umi**

20: **iwak-alua**, 30-90: **kan-akolu**, etc. 100: **haneli**

Other numbers: tens+**kumam**+unit.

Thus: 11: **umi kumam-akahi** 21: **iwak-alua kumam**–**akahi**, 99: **kan-aiwa kumam-aiwa**

Some languages from African families:

Hausa (SemitoHamitic-Hamitic):

1-10: **daia**, **biu**, **uku**, **fudu**, **biar**, **shidda**, **bakoi**, **takos**, **tara**, **goma**

tens 20-90: **gomia-biu**, etc. 100: **dari**

Other numbers: 11-17, etc.: tens+**sha**+unit. Thus 11: **goma sha daia**, 21: **gomia-biu sha daia**

18-19: *following* tens+**gaira**+biu/daia (i.e. following tens-minus-2/1). Thus:

18: **gomia**–**biu gaira biu** (20-minus-2), 99: **dari gaira daia** (100-minus-1).

Wolof (NigerCongo):

1-10: **ben**, **nīar**, **nīat**, **nīanit**, **jiūrum**, **jiūrumrumben**, **jiūrum-nīar**, **jiūrum-nīat**, **jiūrum-nīanit**, **fūk**

tens 20-90: **nīar-fūk**, etc. 100: **tēmēr**

Other numbers: tens+a+unit. Thus 11: **fūk a ben**, 21: **nīar-fūk a ben**, 99: **jiūrum-nīanit-fūk a jiūrum-nīanit**

Fulani (NigerCongo):

1-10: **goo**, **zizi**, **tati**, **nayi**, **joyi**, **jeegom**, **jeezizi**, **jetati**, **jenayi**, **sappo**

20: **noogas**, tens 30-90: **capanze-tati**, etc. 100: **temedere**

Other numbers: tens+**e**+unit.

Thus 11: **sappo e goo**, 21: **noogas e goo**, 99: **capanze-jenayi e jenayi**

Namagua-Hottentot (Khoisan):

1-10: **ckui**, **ckam**, **qnona**, **haka**, **kore**, **qnani**, **hû**, **xkhaisi**, **goisi**, **disi**

tens 20-100: **ckam-disi**, etc. [even 100: **disi-disi**]

Other numbers: tens+unit+**ckha**.

Thus: 11: **disi ckui-ckha**, 21: **ckam-disi ckui-ckha**, 99: **goisi-disi goisi-ckha**

[the four letters **c**, **v**, **q**, and **x** represent four different types of clicking sounds. Clicking sounds as part of the language are unique in the whole world to the Khoisan languages, though some non-Khoisan neighboring languages like Zulu have also borrowed this feature from them]

Some languages from the **Amerindian** super-family of languages from America:

Quechua/Inca (Amerindian):

1-10: **huk**, **iskay**, **kimsa**, **tawa**, **pisqa**, **suqta**, **qanchis**, **pusaq**, **iskun**, **chunka**

tens 20-90: **iskay**–**chunka**, etc. 100: **pachak**

Other numbers: tens+unit+**yuq**/**niyuq** [-**yuq** after vowel, –**niyuq** after consonant. final **y** in **2** is consonant]. Thus:

11: **chunka**–**huk**–**niyuq**, 13: **chunka kimsa**–**yuq**, 99: **iskun**–**chunka iskun**–**niyuq**

Guarani (Amerindian):

1-10: **peteĩ**, **mokoĩ**, **mbohapy**, **irundy**, **po**, **poteĩ**, **pokoĩ**, **poapy**, **porundy**, **pa**

tens 20-90: **mokoĩ-pa**, etc. 100: **sa**

Other numbers: tens+unit. Thus 11: **pa peteĩ**, 21: **mokoĩ-pa peteĩ**, 99: **porundy-pa porundy**

Tarahumara (Amerindian):

1-10: **bire**, **oka**, **beka**, **nawo**, **mari**, **usani**, **kichao**, **osanawo**, **kimakoi**, **makoi**

tens 20-90: **oka-makoi**, etc. 100: **makoi-makoi**

Other numbers: tens+**wamina**+unit. Thus:

11: **makoi wamina bire**, 21: **oka-makoi wamina bire**, 99: **kimakoi-makoi wamina kimakoi**

<u>Tonkawa (Amerindian)</u>:

1-10: **wē'isbax**, **gedai**, **med'is**, **sigid**, **gasgwa**, **sikwālau**, **sigidyē'es**, **sikwē'isxw'ēl'a**, **sikbax**

tens 20-90: **sikbax-'āla-gedai**, etc. 100: **sendo-wē'isbax** (borrowed from Spanish)

Other numbers: tens+**'en**+unit+**'en**. Thus 11: **sikbax-'en wē'isbax-'en**,

21: **sikbax-‘āla-gedai-‘en wē’isbax-‘en**, 99: **sikbax-‘āla-sikwē’isxw’ēl’a-‘en sikwē’isxw’ēl’a-‘en**

<u>Zuñi (Amerindian)</u>:

1-10: **t’opa**, **kwili**, **ha’i**, **awiten**, **apte**, **t’opaleqä**, **kwilileqä**, **ha’eleqä**, **tenaleqä**, **astemła**

tens 20-90: **kwili-qän-astemła**, etc. 100: **asi-astemlä**

Other numbers: tens+unit+**yälto**. Thus 11: **astemła t’opa-yälto**, 21: **kwili-qän-astemła t’opa- yälto**, 99: **tenaleqä-qän-astemła tenaleqä-yälto**

C-V. DECIMAL SYSTEMS (WITH A BASE OF 10) WITH WORDS FOR UNITS 1-9 AND TENS 10-100:

These are the **decimal** systems where, to learn the numbers, one necessarily has to memorize the numbers **1-10**, and the tens numbers **20-100**, and the *regular procedure* for forming the other in-between numbers.

Typical examples of these numbers are found in the major languages of the **Uralo-Altaic** family:

Mongolian (UraloAltaic-Altaic):

1-10: **nigen**, **khoyar**, **gorban**, **dörben**, **tabun**, **jirgugan**, **dologan**, **naiman**, **yisun**, **arban**,

Tens 20-100: **khorin**, **gochin**, **döchin**, **tabin**, **jiran**, **dalan**, **nayan**, **yeren**, **jagon**

Other numbers: tens+unit, e.g. 11 is **arban nigen** (10+1), etc.

Turkish (UraloAltaic-Altaic):

1-10: **bir**, **iki**, **üç**, **dört**, **beş**, **altï**, **yedi**, **sekiz**, **dokuz**, **on**

Tens 20-100: **yirmi**, **otuz**, **kïrk**, **elli**, **altmïş**, **yetmiş**, **seksen**, **doksan**, **yüz**

Other numbers: tens+unit, e.g. 11 is **on bir** (10+1), etc.

Manchu (UraloAltaic-Altaic):

1-10: **emu**, **juwe**, **ilan**, **duin**, **sunja**, **ninggun**, **nadan**, **jakūn**, **uyun**, **juwan**

Tens 20-100: **orin**, **gusin**, **dehi**, **susai**, **ninju**, **nadanju**, **jakūnju**, **uyunju**, **tanggū**

Other numbers: tens+unit, e.g. 11 is **juwan emu** (10+1), etc.

[The only special form is 15, **tofohun**].

Korean (UraloAltaic-KoreoJapanese):

1-10: **hana**, **tul**, **set**, **net**, **tasət**, **yəsət**, **ilgop**, **yədəlp**, **ahop**, **yəl**

tens 20-100: **simïl**, **səlïn**, **mahïn**, **sühïn**, **yecun**, **ilhïn**, **yədïn**, **ahïn**, **pɛk**

Other numbers: tens+unit. Thus 11: **yəl hana**, 21: **simïl hana**, 99: **ahïn ahop**

[usually a –**ii** is inserted after the final word. Thus 1: **hanaii**, 20: **simïlii**, 21: **simïl hanaii**, etc.]

Japanese (UraloAltaic-KoreoJapanese):

1-10: **hitotsu**, **futatsu**, **mittsu**, **yottsu**, **itsutsu**, **muttsu**, **nanatasu**, **yattsu**, **kokonotsu**, **tō**

tens 20-100: **hatachi**, **miso**, **yoso**, **iso**, **muso**, **nanaso**, **yaso**, **kokonoso**, **momo**

[Note: **miso**, **yoso**, etc. can alternately be **misoji**, **yosoji**, etc]

Other numbers: tens+**amari**+unit

Thus 11: **tō amari hitotsu**, 21: **hatachi amari hitotsu**, 99: **kokonoso amari kokonotsu**

[Modern Japanese, however, uses numbers basically borrowed from Chinese]

Hungarian (UraloAltaic-Uralic):

1-10: **egy**, **kettő**, **három**, **négy**, **öt**, **hat**, **hét**, **nyolcz**, **kilencz**, **tíz**

tens 20-100: **húsz**, **harmincz**, **negyven**, **ötven**, **hatvan**, **hetven**, **nyolczvan**, **kilenczven**, **száz**

Other numbers: tens+unit [But here, in line with the –**n** endings, 10: **tizen**, 20: **huszon**]. Thus:

11: **tizen-egy**, 99: **kilenczven-kilencz**

Also, sometimes in some other languages in Asia and Africa:

Tengima Naga (SinoTibetan-Tibetic):

1-10: **po**, **kenna**, **sê**, **dā**, **pangu**, **suru**, **thenā**, **thethā**, **tekwü**, **kerr**

tens 20-100: **kerr**, **mekwü**, **serr**, **lhidā**, **lhisuru**, **lhithenā**, **lhithethā**, **lhitekwü**, **krā**

Other numbers: 11-13, etc. *previous* **tens**+**o**+1-3 [Here, 1 has the special form **pokrō**],

14-19, etc. *following* **tens**+**pemo**+7-9.

e.g. 11 is **kerr o pokrō** (10+**o**+1), 21 is **mekwü o pokrō**, (20+**o**+1), 99 is **krā pemo tekwü** (100+**pemo**+9)

Amharic/Ethiopian (SemitoHamitic-Semitic):

1-10: **and**, **hulat**, **sost**, **arāt**, **am'st**, **sad'st**, **sabāt**, **sam'nt**, **zaṭañ**, **ašr**

tens 20-100: **hāyā**, **šalāsā**, **arbā**, **amsā**, **salsā**, **sabā** , **samānyā**, **zaṭanā**, **mato**

Other numbers: tens+unit, e.g. 11: **ašrā and**, 21: **hāyā and**, 99: **zaṭanā zaṭañ**

[The only special form is the first **tens** number in combining with units: **ašr** becomes **ašrā**].

Swahili (NigerCongo):

1-9: **mosi**, **pili**, **tatu**, **'nne**, **tano**, **sita**, **saba**, **nane**, **kenda**

Tens 10-100: **kumi**, **makumi-mawili**, **makumi-matatu**, **makumi-ma’nne**, **makumi-matano**, **makumi-sita**, **makumi-saba**, **makumi-manane**, **makumi-kenda**, **mia**

(The word for 100 is borrowed from Arabic)

Other numbers: tens+**na**+unit 1-9 [Here, 1 and 2 have special forms: **moja**, **mbili**], e.g. 11 is **kumi na moja** (10+**na**+1).

Languages of this category are found in the **Amerindian** superfamily of America as well. One example:

Sahaptin (Amerindian):

1-10: **naxc**, **nipt**, **mətad**, **pinipt**, **paxad**, **ptəxninc**, **tusxas**, **paxatumad**, **t’sməst**, **putəmd**

tens 20-100: **nibtid**, **mətabtid**, **pinibtid**, **paxabtid**, **ptəxninseibtid**, **tusxaseibtid**, **paxatumadeibtid**, **tsmaseibtid**, **naxcputabdid**

Other numbers: tens+unit or tens+**wiya**+unit. Thus:

11: **putəmd wiya naxc**, 21: **nibtid wiya naxc**, 99: **tsmaseibtid wiya t'sməst**

C-VI. DECIMAL SYSTEMS (WITH A BASE OF 10) WITH WORDS FOR NUMBERS 1-19 and TENS 20-100:

These are the **decimal** systems where, to learn the numbers, one necessarily has to memorize the numbers **1-10** and the tens numbers **20-100** and the *regular procedure* for forming the other numbers in-between **21-99**, but (due perhaps to the influence of some **vigesimal** number

systems in the vicinity) also the separate numbers or the regular procedure for forming the numbers **11-19**.

Many languages form the numbers *differently* for **11-19** than for the other later numbers **21-29**, **31-39**, etc., but by a *regular procedure* rather than with different words. Thus we have the following languages from the **Uralo-Altaic** family:

Finnish (Uralo-Altaic-Finno-Ugrian):

1-10: **yksi**, **kaksi**, **kolme**, **neljä**, **viisi**, **kuusi**, **seitsemän**, **kahdeksan**, **yhdeksän**, **kymmenen**

11-19: **yksi-toista**, etc.

tens 20-90: **kaksi-kymmentä**, etc. 100: **sata**

Other numbers: tens+unit. Thus 21: **kaksi-kymmentä yksi**, 99: **yhdeksän-kymmentä yhdeksän**

Estonian (Uralo-Altaic-Finno-Ugrian):

1-10: **üks**, **kaks**, **kolm**, **neli**, **viis**, **kuus**, **seitse**, **kaheksa**, **üheksa**, **kümme**

11-19: **üks-teist**, etc.

tens 20-100: **kaks-kümmend**, etc. 100: **sada**

Other numbers: tens+unit. Thus 21: **kaks-kümmend üks**, **üheksa-kümmend üheksa**

Some languages of the **Austronesian** family:

Malay (Austronesian):

1-10: **satu**, **dua**, **tiga**, **empat**, **lima**, **enam**, **tujuh**, **lapan**, **sembilan**, **se-puluh**

11-19: **se-belas**, **dua-belas**, etc.

tens 20-90: **dua-puluh**, etc., 100: **se-ratus**

Other numbers: tens+unit. Thus: 21: **dua-puluh satu**, 99: **sembilan-pulu sembilan**

Tagalog (Austronesian):

1-10: **isá**, **dalawá**, **tatló**, **apat**, **limá**, **anim**, **pitó**, **waló**, **siyam**, **sang-pouó**

11-19: **labing-isá**, etc.

tens 20-100: **dalawá-ngpouó**, **tatló-ngpouó**, **apat-napouó**, **limá-ngpouó**, **anim-napouó**, **pitó-ngpouó**, **waló-ngpouó**, **siyam-napouó** [ie. –**ngpouó** after vowel, –**napouó** after consonant]

100: **sangdáan**

Other numbers: tens+**‘t**+unit. Thus 21: **dalawá-ngpouó-‘t isá**, 99: **siyam-napouó-‘t siyam**

Then we have the languages where the numbers **11-19** are formed with distinct words or by a process of fusion and inflection, but the later in-between numbers (**21-29**, **31-39**, etc.) are formed in a very regular way.

Some languages of Africa:

Kanuri (NiloSaharan/Sudanic):

1-10: **tilo**, **ndi**, **yasgə**, **degə**, **ugu**, **arasgə**, **tulur**, **wusgə**, **ləgar**, **megu**

tens 20-90: **pindi**, **piyasgə**, **pidegə**, **piugu**, **pirasgə**, **pitulur**, **pitusgu**, **piləgar**

11-19: **ləgari**, **nduri**, **yasgən**, **deri**, **uri**, **arasgən**, **tulurri**, **wusgən**, **ləgarri**

Other numbers: tens+unit, or tens+**tata**+unit [units ending in vowels add a –**n**, and units ending in consonants add a –**nyin** in the compound words].

Thus: 21: **pindi tata tilon**, 99: **piləgar tata ləgarnyin**

Some languages from the **Amerindian** language super-family of America:

Cherokee (Amerindian-):

1-10: **sowo**, **tali**, **tsoi**, **nvgi**, **hisgi**, **sudali**, **galiquogi**, **tsunela**, **sonela**, **sgohi**

11-19: **sadu**, **talidu**, **tsogadu**, **nigadu**, **hisgadu**, **daladu**, **galiquadu**, **neladu**, **soneladu**

tens 20-100: **tali-sgohi**, **tsoi-gohi**, **nvg-sgohi**, **hisgi-sgohi**, **sudali-sgohi**, **galiqua-sgohi**, **tsunela-sgohi**, **sonela-sgohi**, **sgohitsiqua**

Other numbers: tens (minus –**hi**)+unit. Thus 21: **tali-sgo sowo**, 99: **sonela-sgo sonela**

Navaho (Amerindian):

1-10: **dałai**, **nak'i**, **txā**, **dī**, **ashdla**, **hastxá**, **tsosts'ed**, **tsebi**, **naast'ai**, **naezná**

11-19: **ładzáda**, **nak'idzada**, **txádzáda**, **didzáda**, **ashdlaáda**, **xastxaáda**, **tsosts'edzáda**, **tsebidzáda**, **naas'aidzáda**

tens 20-100: **nadīn**, **txadīn**, **dísdīn**, **ashdládīn**, **hastą́dīn**, **tsosts’idīn**, **tseebídīn**, **náhást’édīn**, **naennádīn**

Other numbers: tens+**ła**+unit. Thus 21: **nadīn ła dałai**, 99: **náhást’édīn ła naezná**

Some of the **Semitic** languages (which also have dual forms in **1-19** because of grammatical gender):

Arabic (SemitoHamitic-Semitic):

1-10 masc.: **wāḥidun**, **iṯnāni**, **ṯalaṯatun**, **‘arba’atun**, **khamsatun**, **sittatun**, **sab’atun**, **ṯamāniyatun**, **tis’atun**, **‘asharatun**

1-10 fem.: **wāḥidatun**, **iṯnatāni**, **ṯalaṯun**, **‘arba’un**, **khamsun**, **sittun**, **sab’un**, **ṯamānin**, **tis’un**, **‘ashrun**

11-12 masc.: **‘aḥada-‘ashar**, **iṯnā-‘ashar**. 11-12 fem.: **‘iḥdai-‘ashrat**, **iṯnatā-‘ashrat**

13-19 masc.: **ṯalaṯata-‘ashar**, etc. (**-tun** becomes **-ta**).

13-19 fem.: **ṯalaṯa-‘ashar**, etc. (**-un** becomes **-a**). [Note: 18 is **ṯamāniya–‘ashar**]

Tens 20-100: **i’shrūna**, **ṯalaṯūna**, **‘arba’ūna**, **khamsūna**, **sittūna**, **sab’ūna**, **ṯamānūna**, **tis’ūna**

Other numbers 21-99: unit (m/f) followed by (the word) **wa** and the **tens**. Thus:

21(masc.): **wāḥidun-wa-i’shrūna**, 99 (masc.): **tis’atun-wa-tis’ūna**.

Hebrew (SemitoHamitic-Semitic):

1-10 masc.: **ɛḥɔd**, **shnayim**, **shloshɔh**, **arbɔ’ɔh**, **ḥªmishɔh**, **shishɔh**, **shiv’ɔh**, **shmōnɔh**, **tish’ɔh**, **‘ɛsɔrɔh**

1-10 fem.: **aḥad**, **shtayim**, **shlosh**, **arba**, **ḥɔmesh**, **shesh**, **shɛva’**, **shmōnɛh**, **tesha’**, **‘ɛsɛr**

11-12 masc.: **‘aḥad-‘ɔsɔr**, **shnem-‘ɔsɔr**.
11-12 fem.: **‘aḥad-‘ɛsreh**, **shtem-‘ɛsreh**.

13-19 masc: **shloshɔh-‘ɔsɔr**, etc. (3+**‘ɔsɔr**). 13-19 fem.: **shlosh–‘ɛsreh**, etc. (3+**‘ɛsreh**).

Tens 20-100: **‘ɛsrīm**, **shloshīm**, **arbɔ’īm**, **ḥªmishīm**, **shishīm**, **shiv’īm**, **shmōnīm**, **tish’īm**, **meɔh**

Other numbers 21-99: unit (m/f) followed by (the word) **w** and the **tens**. Thus:

21(masc.): **ɛḥɔd-w-‘ɛsrīm**, 99 (masc.): **tish’ɔh-w-tish’īm**

Maltese (SemitoHamitic-Semitic):

1-10: **wieħed**, **tnejn**, **tlieta**, **erbgħa**, **ħamsa**, **sitta**, **sebgħa**, **tmienja**, **disgħa**, **għaxra**

11-19: **ħdax**, **tnax**, **tlettax**, **erbatax**, **ħmistax**, **sittax**, **sbattax**, **tmintax**, **dsatax**

tens 20-100: **għoxrin**, **tletin**, **erbgħin**, **ħamsin**, **sittin**, **sebgħin**, **tmenin**, **disgħin**

Other numbers: unit+**u**+tens. Thus 21: **wieħed u għoxrin**, 99: **disgħa u disgħin**

But the **Dravidian** family of languages of India as a whole falls in this category, with clear fusion or inflection in **11-19**.

Tamil (Dravidian):

1-10: **onṛu**, **iraṇḍu**, **mūnṛu**, **nāngu**, **aindu**, **āṛu**, **ēl̲u**, **eṭṭu**, **onbadu**, **pattu**

11-19: **padinonṛu**, **panniraṇḍu**, **padimūnṛu**, **padināngu**, **padinaindu**, **padināṛu**, **padinēl̲u**, **padineṭṭu**, **pattonbadu**

tens 20-100: **irubadu**, **muppadu**, **nāṛbadu**, **aimbadu**, **aṛubadu**, **el̲ubadu**, **eṇbadu**, **toṇṇūṛu**, **nūṛu**

Other numbers: tens+unit [The final –**du** and –**ṛu** of the tens become –**tt** and –**ṭṛ** before vowels and –**ttu** and –**ṭṛu** before consonants]. Thus:

21: **irubatt-onṛu**, 23: **irubattu-mūnṛu**, 93: **toṇṇūṭṛu-mūnṛu**, 99: **toṇṇūṭṛ-onbadu**

[In Dravidian languages, initial **e**, **ē**, **o**, **ō** are pronounced **ye**, **yē**, **wo**, **wō**. In Tamil, a final **u** is pronounce **ï**]

<u>Malayalam (Dravidian)</u>:

1-10: **onn**, **raṇṭ**, **mūnn**, **nāl**, **añc**, **āṟ**, **ēḻ**, **eṭṭ**, **onpat**, **patt**

11-19: **patinonn**, **panṟaṇṭ**, **patimmūnn**, **patināl**, **patinañc**, **patināṟ**, **patinēḻ**, **patineṭṭ**, **pattonpat**

tens 20-100: **irupat**, **muppat**, **nālpat**, **anpat**, **aṟupat**, **eḻupat**, **eṇpat**, **toṇṇūṟ**, **nūṟ**

Other numbers: tens+unit [The final –**at** of the tens becomes –**att** before vowels and –**atti** before consonants. The final **ūṟ** of 90 becomes **ūṭṟi** alternately pronounced **ūṭi**, before the units]. Thus

21: **irupatt-onn**, 23: **irupatti-mūnn**, 99: **toṇṇūṭṛi-onpat**

Kannada (Dravidian):

1-10: **ondu**, **erḍu**, **mūru**, **nalku**, **aidu**, **āru**, **ēḷu**, **eṇṭu**, **ombattu**, **hattu**

11-19: **hannondu**, **hannerḍu**, **hadimūru**, **hadinālku**, **hadinaidu**, **hadināru**, **hadinēḷu**, **hadineṇṭu**, **hattombattu**

tens 20-100: **ippattu**, **mūvattu**, **nālvattu**, **aivattu**, **ārvattu**, **eppattu**, **embattu**, **tombattu**, **nūru**

Other numbers: tens+unit. [The final –**ttu** of the tens become –**tt** before vowels].

Thus 21: **ippatt-ondu**, 99: **tombatt-ombattu**

Telugu (Dravidian):

1-10: **okaṭi**, **reṇḍu**, **mūḍu**, **nālugu**, **ayidu**, **āru**, **ēḍu**, **enimidi**, **tommidi**, **padi**

11-19: **padakoṇḍu**, **panneṇḍu**, **padamūḍu**, **padanālugu**, **padihēni**, **padahāru**, **padihēḍu**, **paddenimidi**, **pandommidi**

tens 20-100: **iruvai**, **muppai**, **nalubhai**, **yābhai**, **aravai**, **ḍebbhai**, **enabhai**, **tombhai**, **vandala**

Other numbers: tens+unit. Thus 21: **iruvai okaṭi**, 99: **tombhai tommidi**

And so do the languages from all the other branches of **Indo-European** languages outside India:

Persian (IndoEuropean-Iranian):

1-10: **yak**, **dū**, **si**, **cahār**, **pañj**, **shish**, **haft**, **hasht**, **nuh**, **dah**

11-19: **yāzdah**, **davāzdah**, **sīzdah**, **chahārdah**, **pānzdah**, **shānzdah**, **hīvdah**, **hījdah**, **nūzdah**

tens 20-100: **bīst**, **sī**, **chihil**, **pañjāh**, **shast**, **haftād**, **hashtād**, **navad**, **sad**

Other numbers: tens+**u**+unit. Thus 21: **bīst u yak**, 99: **navad u nuh**

Armenian (IndoEuropean-ThracoPhrygian):

1-10: **mēk**, **erkou**, **erekh**, **chors**, **hing**, **veçh**, **eòthə**, **outhə**, **inə**, **tas**

11-19: **tasnmēk**, **tasnerkou**, **tasnerekh**, **tasnchors**, **tasnhing**, **tasnveçh**, **tasneòthə**, **tasnouthə**, **tasninə**

tens 20-100: **khsan**, **eresoun**, **kharrasoun**, **yisoun**, **vathsoun**,

eòthanasoun, **outhsoun**, **innsoun**, **hariur**

Other numbers: tens+unit. Thus: 21: **khsan mēk**, 99: **innsoun inə**

Ancient Greek (IndoEuropean-Hellenic):

1-10: **heîs/mía/hen** (m/f/n), **dúo**, **treîs**, **téssares**, **pénte**, **héks**, **heptá**, **oktṓ**, **ennéa**, **déka**

11-19: **héndeka**, **dṓdeka**, **treîs-kaì-déka**, **téssares-kaì-déka**, **pentekaídeka**, **hekkaídeka**, **heptakaídeka**, **oktokaídeka**, **enneakaídeka**

tens 20-100: **eíkosi**, **triákonta**, **tessarákonta**, **pentḗkonta**, **heksḗkonta**, **hebdomḗkonta**, **ogdoḗkonta**, **enenḗkonta**, **hekatón**

Other numbers: tens+**kaì**+unit or unit+**kaì**+tens. Either form can be used. Thus:

21: **eíkosi kaì heîs** or **heîs kaì eíkosi**, 99: **enenḗkonta kaì ennéa**, or **ennéa kaì enenḗkonta**

[Note: Greek vowels have a tonal accent, which is marked. A special form for neuter 4: **téssara**]

<u>Modern Greek (IndoEuropean-Hellenic)</u>:

1-10: **henas**, **duo**, **treis**, **tessereis**, **pente**, **eksi**, **hephta**, **okhtō**, **ennia**, **deka**

11-12: **hendeka**, **dōdeka**, 13-19: **deka-treis**, etc.

tens 20-100: **eikosi**, **trianta**, **saranta**, **penēnta**, **heksēnta**, **hebdomēnta**, **ogdonta**, **enenēnta**, **hekato**

Other numbers: tens+unit. Thus: 21: **eikosi-henas**, 99: **enenēnta-ennia**

[Modern Greek has no tonal accent, hence accent not marked here].

<u>Albanian (IndoEuropean-Illyrian)</u>:

1-10: **një**, **dy**, **tre**, **katër**, **pesë**, **gjashtë**, **shtatë**, **tetë**, **nënd**, **dhjëte**

1-18: **një-mbë-dhjëte**, etc. 19: **nëntë-mbë-dhjëte**

tens 20-100: **njëzet**, **tridhjet**, **dyzet**, **pesë-dhjet**, **gjashtë-dhjet**, **shtatë-dhjet**, **tetë-dhjet**, **nënd-dhjet**, **një-qind**

Other numbers: tens+**e**+unit. Thus 21: **njëzet e një**, 99: **nënd-dhjet e nënd**

[Note: 20 and 40 seem to be formed on a principle of 1×20, 2×20].

Polish (IndoEuropean-Slavic):

1-10: **jeden**, **dwa**, **trzy**, **cztery**, **pięć**, **sześć**, **siedem**, **osiem**, **dziewięć**, **dziesięć**

11-19: **jeden-naście**, **dwa-naście**, **trzy-naście**, **czter-naście**, **pięt-naście**, **szes-naście**, **siedem-naście**, **osiem-naście**, **dziewięt-naście**

tens 20-100: **dwa-dzieścia**, **trzy-dzieści**, **cztery-dzieści**, **pięć-dziesiąt**, **sześć-dziesiąt**, **siedem-dziesiąt**, **osiem-dziesiąt**, **dziewięć-dziesiąt**, **sto**

Other numbers: tens+unit. Thus 21: **dwa-dzieścia jeden**, 99: **dziewięć–dziesiąt dziewięć**

Russian (IndoEuropean-Slavic):

1-10: **odin**, **dva**, **tri**, **cyetyrye**, **pyat’**, **shyest’**, **syem’**, **vosyem’**, **dyevyat’**, **dyesyat’**

11-19: **odi-nadçat’**, **dvye-nadçat’**, **tri-nadçat’**, **cyetyr-nadçat’**, **pyat-nadçat’**, **shyest-nadçat’**, **syem-nadçat’**, **vosyem-nadçat’**, **dyevyatnadçat’**

tens 20-100: **dvadçat’**, **tridçat’**, **sorok**, **pyat’-dyesyat**, **shyest’-dyesyat**, **syem’-dyesyat**, **vosyem’-dyesyat**, **dyevyanosto**, **sto**

Other numbers: tens+unit: Thus 21: **dvadçat’ odin**, 99: **dyevyanosto dyevyat’**

<u>Lithuanian (IndoEuropean-Baltic)</u>:

1-10: **vienas**, **du**, **trys**, **keturi**, **penki**, **šeši**, **septyni**, **aštuoni**, **devyni**, **dešimtis**

11-19: **vienuolika**, **dvylika**, **trylika**, **keturiolika**, **penkiolika**, **šešiolika**, **septyniolika**, **aštuoniolika**, **devyniolika**

tens 20-100: **dvidešimt**, **trisdešimt**, **keturiasdešimt**, **penkiasdešimt**, **šešiasdešimt**, **septyniasdešimt**, **aštuoniasdešimt**, **devyniasdešimt**, **šimtas**

Other numbers: tens+unit. Thus 21: **dvidešimt vienas**, 99: **devyniasdešimt devyni**

<u>Latvian (IndoEuropean-Baltic)</u>:

1-10: **viens**, **divi**, **tris**, **četri**, **pieci**, **seši**, **septiņi**, **astoņi**, **deviņi**, **desmits**

11-19: **vienspadsmit**, **divspadsmit**, **trispadsmit**, **četrpadsmit**, **piecpadsmit**,

sešpadsmit, **septiņpadsmit**, **astoņpadsmit**, **deviņpadsmit**

tens 20-100: **divdesmit**, **trisdesmit**, **četrdesmit**, **piecdesmit**, **sešdesmit**, **septiņdesmit**, **astoņdesmit**, **deviņdesmit**, **simts**

Other numbers: tens+unit. Thus 21: **divdesmit viens**, 99: **deviņdesmit deviņi**

Danish (IndoEuropean-Germanic):

1-10: **en/et**, **to**, **tre**, **fire**, **fem**, **seks**, **syv**, **otte**, **ni**, **ti**

11-19: **elleve**, **tolv**, **tretten**, **fjorten**, **femten**, **seksten**, **sytten**, **atten**, **nitten**

tens 20-100: **tyve**, **tredive**, **fyrre**, **halvtreds**, **tres**, **halvfjerds**, **firs**, **halvfems**, **hundrede**

Other numbers: unit+**og**+tens. Thus: 21: **en-og-tyve**, 99: **ni-og-halvfems**.

Norwegian (IndoEuropean-Germanic):

1-10: **en/et**, **to**, **tre**, **fire**, **fem**, **seks**, **sju**, **åtte**, **ni**, **ti**

11-19: **elleve**, **tolv**, **tretten**, **fjorten**, **femten**, **seksten**, **sytten**, **atten**, **nitten**

tens 20-100: **tjue**, **tretti**, **førti**, **femti**, **seksti**, **sytti**, **åtti**, **nitti**, **hundre**

Other numbers: unit+**og**+tens. Thus: 21: **en-og-tjue**, 99: **ni-og-nitti**.

Swedish (Indo-European-Germanic):

1-10: **en/ett**, **två**, **tre**, **fyra**, **fem**, **sex**, **sju**, **åtta**, **nio**, **tio**

11-19: **tio**, **elva**, **tolv**, **tretton**, **fjorton**, **femton**, **sexton**, **sjutton**, **aderton**, **nitton**

tens 20-100: **tjugo**, **trettio**, **fyrtio**, **femtio**, **sextio**, **sjuttio**, **åttio**, **nittio**, **hundra**

Other numbers: tens+unit. Thus 21: **tjugo-en**, 99: **nittio-nio**

Icelandic (IndoEuropean-Germanic):

1-10: **einn**, **tveir**, **þrīr**, **fjórir**, **fimm**, **sex**, **sjö**, **átta**, **níu**, **tíu**

11-19: **ellefu**, **tólf**, **þrettán**, **fjórtán**, **fimmtán**, **sextán**, **seytján**, **átján**, **nítjan**

tens 20-100: **tuttugu**, **þrjátíu**, **fjörutíu**, **fimmtíu**, **sextíu**, **sjötíu**, **áttatíu**, **níutíu**, **hundrað**

Other numbers: tens+**og**+unit. Thus 21: **tuttugu og einn**, 99: **níutíu og níu**

German (IndoEuropean-Germanic):

1-10: **eins**, **zwei**, **drei**, **vier**, **fünf**, **sechs**, **sieben**, **acht**, **neun**, **zehn**

11-19: **elf**, **zwölf**, **dreizehn**, **vierzehn**, **fünfzehn**, **sechzehn**, **siebzehn**, **achtzehn**, **neunzehn**

tens 20-100: **zwanzig**, **dreissig**, **vierzig**, **fünfzig**, **sechzig**, **siebzig**, **achtzig**, **neunzig**, **hundert**

Other numbers: unit+**und**+tens (as one word, but **eins** becomes **ein**). Thus:

21: **einundzwanzig**, 99: **neunundneunzig**

Dutch (IndoEuropean-Germanic):

1-10: **een**, **twee**, **drie**, **vier**, **vijf**, **zes**, **zeven**, **acht**, **negen**, **tien**

11-19: **elf**, **twaalf**, **dertien**, **veertien**, **vijftien**, **zestien**, **zeventien**, **achttien**, **negentien**

tens 20-100: **twintig**, **dertig**, **veertig**, **vijftig**, **zestig**, **zeventig**, **tachtig**, **negentig**, **honderd**

Other numbers: unit+**en**+tens. Thus 21: **een en twintig**, 99: **negen en negentig**

Old English (IndoEuropean-Germanic):

1-10: **ān**, **twēgen**, **þrīe**, **fēower**, **fīf**, **siex**, **seofon**, **eahta**, **nigon**, **tīen**

11-19: **endleofan**, **twelf**, **þrēotīene**, **fēowertīene**, **fīftīene**, **siextīene**, **seofontīene**, **eahtatīene**, **nigontīene**

tens 20-100: **twentig**, **þrītig**, **fēowertig**, **fīftig**, **siextig**, **hundseofontig**,

hundeahtatig, **hundnigontig**, **hundtēontig**

Other numbers: unit+**and**+tens. Thus 21: **ān and twentig**, 99: **nigon and hundnigontig**

[**ƥ** is pronounced “th”]

<u>English (IndoEuropean-Germanic)</u>:

1-10: **one**, **two**, **three**, **four**, **five**, **six**, **seven**, **eight**, **nine**, **ten**

11-19: **eleven**, **twelve**, **thirteen**, **fourteen**, **fifteen**, **sixteen**, **seventeen**, **eighteen**, **nineteen**

tens 20-100: **twenty**, **thirty**, **forty**, **fifty**, **sixty**, **seventy**, **eighty**, **ninety**, **hundred**

Other numbers: tens+unit. Thus: 21: **twenty-one**, 99: **ninety-nine**

Latin (IndoEuropean-Italic):

1-10: **unus**, **duo**, **tres**, **quattuor**, **quinque**, **sex**, **septem**, **octo**, **novem**, **decem**

11-19: **undecim**, **duodecim**, **tredecim**, **quattuordecim**, **quindecim**, **sedecim**, **septemdecim**, **duode-viginti**, **unde-viginti**

tens 20-100: **viginti**, **triginta**, **quadraginta**, **quinquaginta**, **sexaginta**, **septuaginta**, **octoginta**, **ninaginta**, **centum**

Other numbers: tens+unit (1-7) or unit (1-7)+**et**+tens. Either form can be used.

Tens (including 100)+unit (8-9): **duode**/**unde**+*following*-tens (i.e. 2-less-

then, 1-less-then the following tens). Thus:

21: **viginti-unus** or **unus et viginti**, 99: **undecentum**

Spanish (IndoEuropean-Italic):

1-10: **uno/una**, **dos**, **tres**, **cuatro**, **cinco**, **séis**, **siete**, **ocho**, **nueve**, **diez**

11-19: **once, doce**, **trece**, **catorce**, **quince**, **dieciséis**, **diecisiete**, **dieciocho**, **diecinueve**

tens 20-100: **veinte**, **treinta**, **cuarenta**, **cincuenta**, **sesenta**, **setenta**, **ochenta**, **noventa**, **ciento**

Other numbers: 21-29: **vienti**–**uno**, etc. Others: tens+**y**+unit. Thus:

31: **treinta y uno**, 99: **noventa y nueve**

Portuguese (IndoEuropean-Italic):

1-10: **um/uma**, **dois**, **três**, **quatro**, **cinco**, **seis**, **sete**, **oito**, **nove**, **dez**

11-19: **onze**, **doze**, **treze**, **catorze**, **quinze**, **dezasseis**, **dezassete**, **dezoito**, **dezanove**

tens 20-100: **vinte**, **trinta**, **quarenta**, **sessenta**, **setenta**, **oitenta**, **noventa**, **cento**

Other numbers: tens+**e**+unit. Thus 21: **vinte e um**, 99: **noventa e nove**

Romanian (IndoEuropean-Italic):

1-10: **unu**, **doi**, **trei**, **patru**, **cinci**, **şase**, **şapte**, **opt**, **nouă**, **zece**

11-19: **unsprezece**, **doisprezece**, **treisprezece**, **paisprezece**, **cincisprezece**, **şaisprezece**,

şaptesprezece, **optsprezece**, **nouăsprezece**

tens 20-100: **douăzeci**, **treizeci**, **paizeci**, **cincizeci**, **şaizeci**, **şaptezeci**, **optzeci**, **nouăzeci**, **o sută**

Other numbers: tens+**şi**+unit. Thus 21: **douăzeci şi unu**, 99: **nouăzeci şi nouă**

Italian (IndoEuropean-Italic):

1-10: **uno**, **due**, **tré**, **quattro**, **cinque**, **sei**, **sette**, **otto**, **nove**, **dieci**

11-19: **undici**, **dodici**, **tredici**, **quattordici**, **quindici**, **sedici**, **diciassette**, **diciotto**, **diciannove**

tens 20-100: **venti**, **trenta**, **quaranta**, **cinquanta**, **sessanta**, **settanta**, **ottanta**, **novanta**, **cento**

Other numbers: tens+unit [last vowel of tens dropped before vowels in **uno**, **otto**]. Thus:

21: **vent-uno**, 99: **novanta-nove**

C-VII. DECIMAL SYSTEMS (WITH A BASE OF 10) WITH WORDS FOR NUMBERS 1-100:

Finally, we come to the most complex decimal system of all, where there is such complete fusion and inflection between the **tens** and **unit** numbers that it becomes necessary to learn individually the exact form of every number from **1-100**, above the usual necessity of learning the **unit** words **1-9** and **tens** words **10-100**.

Basically, one has to first learn the numbers from **1-10**, **11-19** and the tens

20-100. The other numbers **21-99** are naturally formed by a combination of the **tens** and **unit** words.

But these words are fused together in such a way that it becomes necessary to individually learn every number from **1-100**. [In addition, the words 19, 29, 39, etc. are formed on the principle "**one** less than the *following* **tens**" (usually except 89 and 99)].

The only languages in the world which have a number system of this kind are the **Indo-Aryan** languages of North India. We will take the example of just three of these languages: **Hindi**, **Marathi** and **Gujarati**. Compare the difference in the forms in both the languages:

Hindi:

1-9: **ek**, **do**, **tīn**, **cār**, **pāñc**, **chah**, **sāt**, **āṭh**, **nau**

11-19: **gyārah**, **bārah**, **terah**, **caudah**, **pandrah**, **solah**, **satārah**, **aṭhārah**, **unnīs**

tens 10-100: **das**, **bīs**, **tīs**, **cālīs**, **pacās**, **sāṭh**, **sattar**, **assī**, **nabbe**, **sau**

The other numbers are formed by unit-form+tens-form, e.g. 21: **ek**+**bīs** = **ikk-īs**.

The different changes taking place in the **tens** forms as well as the **units** form in the numbers **21-99** must be noted:

Tens forms:

20 **bīs**: –**īs** (21, 22, 23, 25, 27, 28), –**bīs** (24, 26).

30 **tīs**: –**tīs** (29, 31, 32, 33, 34, 35, 36, 37, 38).

40 **cālīs**: –**tālīs** (39, 41, 43, 45, 47, 48), –**yālīs** (42, 46), –**vālīs** (44).

50 **pacās**: –**cās** (49), –**van** (51, 52, 54, 57, 58), –**pan** (53, 55, 56).

60 **sāṭh**: –**saṭh** (59, 61, 62, 63, 64, 65, 66, 67, 68).

70 **sattar**: –**hattar** (69, 71, 72, 73, 74, 75, 76, 77, 78).

80 **assī**: –**āsī** (79, 81, 82, 83, 84, 85, 86, 87, 88, 89).

90 **nabbe**: –**nave** (91, 92, 93, 94, 95, 96, 97, 98, 99).

Unit forms:

1 **ek**: **ikk-** (21), **ikat-** (31), **ik-** (41, 61, 71), **iky-** (81), **ikyā-** (51, 91).

2 **do**: **bā-** (22, 52, 62, 92), **bat-** (32), **ba-** (42, 72), **bay-** (82).

3 **tīn**: **te-** (23), **ten-** (33, 43), **tir-** (53, 63, 83), **ti-** (73), **tirā-** (93).

4 **cār**: **cau-** (24, 54, 74), **ca-** (44), **caun-** (34, 64), **caur-** (84), **caurā-** (94).

5 **pāñc**: **pacc-** (25), **paĩ–** (35, 45, 65), **pac-** (55, 75, 85), **pañcā-** (95).

6 **che**: **chab-** (26), **chat-** (36), **chi-** (46, 76), **chap-** (56), **chiyā-** (66, 96), **chiy-** (86).

7 **sāt**: **sattā-** (27, 57, 97), **saĩ–** (37, 47), **saḍ-** (67), **sat-** (77), **satt-** (87).

8 **āṭh**: **aṭṭhā-** (28, 58, 98), **aḍ-** (38, 48, 68), **aṭh-** (78, 88).

9 **nau**: **un-** (29, 39, 59, 69, 79), **unan-** (49), **nav-** (89), **ninyā-** (99).

Marathi:

1-9: **ek**, **don**, **tīn**, **cār**, **pāç**, **sahā**, **sāt**, **āṭh**, **naū**

11-19: **akrā**, **bārā**, **terā**, **çaudā**, **pandhrā**, **soḷā**, **satrā**, **aṭhrā**, **ekoṇīs**

tens 10-100: **dahā**, **vīs**, **tīs**, **cāḷīs**, **pannās**, **sāṭh**, **sattar**, **aĩśī**, **navvad**, **śambhar**

The other numbers are formed by unit-form+tens-form, e.g. 21: **ek**+**vīs** = **ek-vīs**.

The different changes taking place in the **tens** forms as well as the **units** form in the numbers **21-99** must be noted:

Tens forms:

20 **vīs**: –**vīs** (21, 22, 23, 24, 25, 26, 27, 28).

30 **tīs**: –**tīs** (29, 31, 32, 33, 34, 35, 36, 37, 38).

40 **cāḷīs**: –**cāḷīs** (39, 41, 42, 43, 44, 45, 46, 47, 48).

50 **pannās**: –**pannās** (49), –**vanna** (51, 52, 55, 57, 58), –**panna** (53, 54, 56).

60 **sāṭh**: – **sāṭh** (59), –**saṣṭa** (61, 62, 63, 64, 65, 66, 67, 68).

70 **sattar**: –**sattar** (69), –**hattar** (71, 72, 73, 74, 75, 76, 77, 78).

80 **aĩśī**: –**aĩśī** (79, 81, 82, 83, 84, 85, 86, 87, 88).

90 **navvad**: –**navvad** (89), –**ṇṇav** (91, 92, 93, 94, 95, 96, 97, 98, 99).

Unit forms:

1 **ek**: **ek-** (21, 31, 61), **ekke-** (41), **ekkyā-** (81, 91), **ekkā-** (51, 71).

2 **don**: **bā-** (22, 52, 62, 72), **bat-** (32), **be-** (42), **byā-** (82, 92).

3 **tīn**: **te-** (23), **teha-** (33), **tre-** (43, 53, 63), **tryā-** (73, 83, 93).

4 **cār**: **co-** (24), **çau-** (34, 54, 64), **çavve-** (44), **çauryā-** (74, 84, 94).

5 **pāç**: **pañc-** (25), **pas-** (35), **pañce-** (45), **pañçā-** (55), **pā-** (65), **pañcyā** (75, 85, 95) .

6 **sahā**: **sav-** (26), **chat-** (36), **sehe-** (46), **chap-** (56), **sahā-** (66), **śahā-** (76, 86, 96).

7 **sāt**: **sattā-** (27, 57), **sada-** (37), **satte-** (47), **sadu-** (67), **sattyā-** (77, 87, 97).

8 **āṭh**: **aṭṭhā-** (28, 58), **aḍ-** (38), **aṭṭhe-** (48), **aḍu-** (68), **aṭṭhyā-** (78, 88, 98).

9 **naū**: **ekoṇ-** (29, 39, 49, 59, 69, 79, 89), **navvyā-** (99).

Gujarati:

1-9: **ek**, **be**, **traṇ**, **cār**, **pāñc**, **cha**, **sāt**, **āṭh**, **nav**

11-19: **agyār**, **bār**, **ter**, **caud**, **pandar**, **soḷ**, **sattar**, **aḍhār**, **ogṇis**

tens 10-100: **das**, **vīs**, **trīs**, **cālīs**, **pacās**, **sāīṭh**, **sitter**, **ẽsī**, **nevũ**, **so**

The other numbers are formed by unit-form+tens-form, e.g. 21: **ek**+**vīs** = **ek-vīs**.

The different changes taking place in the **tens** forms as well as the **units** form in the numbers **21-99** must be noted:

Tens forms:

20 **vīs**: –**īs** (25), –**vīs** (21, 22, 23, 24, 26, 27, 28).

30 **trīs**: –**trīs** (29, 31, 32, 33, 34, 35, 36, 37, 38).

40 **cālīs**: –**tālīs** (41, 42, 43, 45, 46, 47, 48), –**cālīs** (39), –**ālīs** (44).

50 **pacās**: –**pacās** (49), –**van** (51, 52, 55, 57, 58), –**pan** (53, 54, 56).

60 **sāīṭh**: –**sāṭh** (59), **saṭh** (61, 62, 63, 64, 65, 66, 67, 68).

70 **sitter**: **sitter** (69), –**oter** (71, 72, 73, 74, 75, 76, 77, 78).

80 **ẽsī**: **ẽsī** (79), –**āsī** (81, 82, 83, 84, 85, 86, 87, 88, 89).

90 **nevũ**: –**ṇu** (91, 92, 93, 94, 95, 97, 98, 99), –**nnu** (96).

Unit forms:

1 **ek**: **ek-** (21, 41, 61, 71), **eka-** (31), **ekā-** (51, 91), **eky-** (81).

2 **be**: **bā-** (22, 52, 62, 92), **ba-** (32), **be-** (42), **b-** (72), **by**– (82).

3 **traṇ**: **te-** (23, 33), **tre-** (43, 53, 63), **ty-** (83), **t-** (73), **trā-** (93).

4 **cār**: **co-** (24, 34, 54, 64), **cum-** (44, 74), **cory-** (84), **corā-** (94).

5 **pāñc**: **pacc-** (25), **pāã–** (35, 65), **pis**– (45), **pañc-** (75, 85), **pañcā-** (55, 95).

6 **cha**: **cha-** (26, 36.96), **che-** (46), **chap-** (56), **chā-** (66), **chay-** (86), **ch**– (76).

7 **sāt**: **sattā-** (27, 57, 97), **saḍa-** (37), **suḍ**– (47), **saḍ-** (67), **sity-** (77, 87).

8 **āṭh**: **aṭṭhā-** (28, 58, 98), **aḍ-** (48, 68), **aḍa**– (38), **iṭhy-** (78, 88).

9 **nav**: **ogaṇ-** (29, 39, 49, 59), **agṇo-** (69), **ogṇā-** (79), **nevy-** (89), **navvā**– (99).

The same irregularity or inflectional complexity can be seen in the formation of the numbers between **21** and **99** in **all the Indo-Aryan languages of North India** (right up to Kashmiri in the extreme north, and going so far westwards as to influence the Pashto language in the northwest which, although it belongs to the **Iranian** branch, has also been influenced by the **Indo-Aryan** cerebral sounds), **but is found nowhere else outside the sphere**

of North India . Note that the irregularity of the fusion of the forms in one Indo-Aryan language do not correspond to those in another Indo-Aryan language. Thus, **ek** (1) has one form (**ek-**) in Marathi in 21, 31 and 61, but Hindi has three different forms **ikk-** (in 21), **ikat-** (in 31) and **ik-** (in 61), and Gujarati has two forms **ek**– (in 21, 61) and **eka**– (in 31). Or **pāñc** (5) has one form (**paĩ–**) in Hindi in 35, 45 and 65, and Gujarati has two forms **pāã**– (in 35, 65) and **pis**– (in 45), but Marathi **pāç** (5) has three different forms **pas-** (in 35), **pañce-** (in 45) and **pā-** (in 65).

We have shown the numbers **21-99** in these three Indo-Aryan languages in classified table form, but obviously it is simpler to learn each individual number

by rote than with the help of these classification tables.

This is in sharp contrast with all the other languages in the world other than the Indo-Aryan languages of North India. In **all** the other languages, it is necessary to learn by heart at the most the numbers from **1-10**, or from **1-19**, and the **tens** forms (**20**, **30**, **40**, **50**, **60**, **70**, **80**, **90**). All the numbers between **21** and **99** are formed from these numbers by *some* sort of *regular* process which does not require all these individual numbers to be learnt by heart. This is the case with **all** other languages, including all the other **non-Indo-European Indian languages** (Dravidian, Austric, Sino-Tibetan, Burushaski. The Andamanese languages, as already pointed out, do not have

numbers beyond **3** or **5**) as well as all the **non-Indian Indo-European languages** (spoken outside India), including even the Indo-Aryan **Sinhalese** language spoken to the south of India.

This feature of the Indo-Aryan numbers has very definite practical disadvantages:

1. The first and most obvious disadvantage is that it makes it more difficult for the learner to learn the exact forms of the numbers **1-100** in an Indo-Aryan language than in any other language, even if the learner is himself a speaker of another Indo-Aryan language (though in *that* case, of course, he is likely to *recognize* the numbers when spoken by someone else more easily than the learner who

is a speaker of a non-Indo-Aryan language).

2. The second disadvantage is that, like all the other many languages (including, for example, Old English and German) which have a similar word-order for the numbers **21-99**, the word-order of the **tens** and **unit** words is irrational and unordered since the **unit** word comes before the **tens** word. Thus, the number **45, 396** (**four**, **five**, **three**, **nine**, **six**) in English, for example, would be "**for**ty-**five** thousand, **three** hundred and **nine**ty-**six**" (in the order **four**, **five**, **three**, **nine**, **six**), which is rational and ordered, but in Hindi would be "**pain**–**tāl**īs hazār **tīn**-sau

chiyā-**nav**e" (in the order **five, four, three, six, nine**).

This is somewhat like the irrational and unordered American style of writing the date as compared to the British style: **4th January 2018** is written **1/4/2018** in the American style and **4/1/2018** in the British style. Logically, the **month** should come between the **day** and the **year**, and the only reason the irrational and unordered American style is gaining ground in modern usage is because of the political and economic clout of the U.S.A and its monopoly over computer technology.

The unordered nature of the Indo-Aryan numbers **21-99**, compounded with the irregular and inflected forms, adds to the difficulty of the numbers. On a personal

note, I myself regularly fumble for the right words (although I *know* them well) when suddenly called upon to say, for example, **67**, when I automatically say **sain**–**saṭh** (or even **chiya-**…) instead of **saḍ**–**saṭh**, and then pause and correct myself.

But the nature of the Indo-Aryan numbers is very important from the cultural and **historical** view-point. As the Muslim saying goes, "**mulla ki dor masjid tak**": I find in the nature of the Indo-Aryan number system one more clear piece of evidence for the OIT (the **Out-of-India Theory** of **Indo-European** original).

SECTION – 4

An analysis of the development of number systems in the world presents us with an interesting point about the origin and spread of the Indo-European languages from their original homeland, pointing towards the geographical location of that homeland.

C-VIII. HISTORICAL IMPLICATIONS OF THE INDO-ARYAN NUMBER SYSTEM:

The number systems as found in the different languages in India show a great

range and variety. We do *not* find the most uncommon types like the **sexagesimal** (based on **60**, found in the **Masai** language in Africa), and the **quindecimal** (based on **15**, found in the **Huli** language of Papua), but within the more common systems, the **vigesimal** (based on **20**), and **decimal** (based on **10**), we have every possible variety: see the difference above between the number systems in the *closely related* **Santali** and **Turi** languages where, after the initial four numbers **1-4**, there is nothing in common, and **Santali** has a purely **decimal** system while **Turi** has a purely **vigesimal** system with a subset of **five**.

The interesting thing is that an analysis of the development of number systems in the world presents us with an interesting

point about the origin and spread of the **Indo-European languages** from their original homeland, pointing towards the geographical location of that homeland. For the purpose of the discussion to follow, which is about the development of the **Indo-European** number system, we will leave out the language families of the New World and some isolated language families in the Old World (i.e. the **Australian**, **Papuan**, **Amerindian**, and also **Andamanese**, as well as the interior families of Africa: **Khoisan**, **Niger-Congo** and **Nilo-Saharan**, and also **Eskimo-Aleut**, which straddles the northernmost parts of both the Old and New Worlds, from Greenland to Alaska and the easternmost tips of Siberia), since they are not relevant to this question.

It will be seen that the **decimal** system dominates in the most widely spoken and distributed language families in the Old World (**Indo-European**, **Semito-Hamitic**, **Sino-Tibetan**, **Uralo-Altaic**, **Austronesian**, **Dravidian**), and the **vigesimal** system is found in the more isolated families (in the three language-isolate families, **Basque**, **Burushaski** and **Ainu**, and in **Caucasian**).

It is also likely that the **vigesimal** system was the original system in the **Austric** family: we have the system in **Turi** (in its earliest form, with a clear subset of **5**), and in **Savara** and **Nicobarese** and perhaps originally in **Khmer** as well (among the languages examined by us here). The **Vietnamese** language was clearly influenced by its **Sino-Tibetan**

family neighbours in developing a **decimal** system: note that it also has a tonal-system and monosyllabled words like most of its major **Sino-Tibetan** neighbour languages. **Santali** was also probably influenced by its **Indo-Aryan** and **Dravidian** neighbours, and **Khasi** by its **Sino-Tibetan** and **Indo-Aryan** neighbours, in developing a **decimal** system. It may be noted that **Turi** (**mead**, **pea**, **punia**), **Santali** (**mit'**, **pɛ**, **pon**), **Khmer** (**muəy**, **bəy**, **buən**) and **Vietnamese** (**mot _** , **ba**, **bôn**) have a close correspondence in the numbers for 1, 2 and 4, but not beyond that, and **Turi** has basic unit number words only upto 4 (all of which *could* be pointing to an original subset of **5**). A reverse influence is seen in the originally **Austric**-speaking areas of eastern India, where neighboring

Sino-Tibetan languages like **Sikkimese** and **Garo** have developed **vigesimal** systems. We also saw how the (**Indo-European**) **Celtic** languages like **Welsh** and **Irish** developed **vigesimal** systems in what probably was originally the ancient area of the **Basque** family (although **Irish** also retained parallel **decimal** word-names for the tens), while **French** was influenced enough to develop words like **quatre-vingts** for 80 and **soixante-onze** etc. for 71 etc..

The point here is that the **Indo-European** languages must certainly have developed the feature of forming the numbers **11-19** in a different way from the other sets of numbers (**21-29**, **31-39**, **41-49**, etc.) due to the influence of neighboring languages with **vigesimal**

systems: we will call this the **vigesimal-effect**. This could be a clue to the location of the Original IE Homeland in India, since the eastern half of India is riddled with languages having **vigesimal** systems (from **Sikkimese** in the north through **Savara** and **Turi** in the central parts to **Nicobarese** in the eastern islands), and we also have **Burushaski** in the north-northwest – but then of course we also have the **Caucasian** languages in the area of the Caucasus mountains and **Basque** in western Europe, which (with possibly related now-extinct languages spread out in the intervening areas) could likewise have influenced **proto-IE** in other suggested Homeland-theories.

But the **Indo-European** number system nevertheless does point towards an

Indian Homeland and Out-of-India theory. This can be examined from two angles:
1. The stage-wise development of Indo-European numerals.

2. The spread of the vigesimal-affected decimal number-system.

1. **The Stage-wise Development of Indo-European numerals**:
The first stage of the **Indo-European** number system is represented by the **Sanskrit** numbers, which are as follows:
1-9: **eka**, **dvi**, **tri**, **catur**, **pañca**, **ṣaṭ**, **sapta**, **aṣṭa**, **nava**
tens 10-90: **daśa**, **viṁśati**, **triṁśat**, **catvāriṁśat**, **pañcāśat**, **ṣaṣṭi**, **saptati**, **aśīti**, **navati**, **śatam**
Other numbers: unit-form+tens.
[The **tens** do not undergo any change in

combination, with the sole exception of the word for **16**, where –**daśa** becomes –**ḍaśa** in combination with **ṣaḍ-**. And, by the regular Sanskrit phonetic rules of *sandhi* or word-combination, in the unit-form+tens combinations for **80-**, **a-**+**-a** becomes **ā**, and **i-**+**-a** becomes **ya**, so 81: **ekāśīti**, 82: **dvyaśīti**, etc].

Units forms:
1 **eka**: **ekā-** (11), **eka-** (21, 31, 41, 51, 61, 71, 81, 91).
2 **dvi**: **dvā-** (11, 22, 32), **dvi-** (42, 52, 62, 72, 82, 92).
3 **tri**: **trayo-** (13, 23, 33), **tri-** (43, 53, 63, 73, 83, 93).
4 **catur**: **catur-** (14, 24, 84, 94), **catus-** (34), **catuś-** (44) **catuḥ-** (54, 64, 74).
5 **pañca**: **pañca-** (15, 25, 35, 45, 55, 65, 75, 85, 95).

6 **ṣaṭ**: **ṣo-** (16), **ṣaḍ-** (26, 86), **ṣaṭ-** (36, 46, 56, 66, 76), **ṣaṇ-** (96).
7 **sapta**: **sapta-** (17, 27, 37, 47, 57, 67, 77, 87, 97).
8 **aṣṭa**: **aṣṭā-** (18, 28, 38, 48, 58, 68, 78, 88, 98).
9 **nava**: **ūna-** (19, 29, 39, 49, 59, 69, 79, 89), **nava**– (99).

Compared to the modern **Indo-Aryan** forms:
a) The **Sanskrit** numbers with –**5**, –**7**, –**8** and even –**9** are remarkably regular (compare with the forms already shown in **Hindi**, **Marathi** and **Gujarati**, for example).

b) The variety of forms for –**4** and –**6** are fully explained (except perhaps the **ṣo-** in **16**) by the regular phonetic rules of Sanskrit *sandhi*: **r-** becomes **ḥ-** before **-p**

(**54**), **-ṣ** (**64**) and **-s** (**74**), **s-** before **-t** (**34**), and **ś-** before **-c** (**44**). Likewise, **ṭ-** becomes **ḍ-** before voiced consonants and vowels (**26**, **86**) and **-ṇ** before nasal consonants (**96**). These are all variations based only on the general phonetic rules of *sandhi* in Sanskrit (which apply to all Sanskrit words).

c) So we are left with with a *few* (*far fewer* as compared to the modern **Indo-Aryan** languages) variable forms for –**1**, –**2** and –**3** (apart from the irregular form for **16** already mentioned), and hardly any fusion and irregular inflection beyond the rules of regular *sandhi*.

Certain noteworthy features of the **Sanskrit** numbers, which have lingered on in **modern Indo-Aryan**, are:
1. The **units** come before the **tens** in <u>all</u>

the numbers: this feature continues in the **modern Indo-Aryan** languages, and in some of the **Indo-European** languages outside India (**Pashto** under the influence of neighboring **Indo-Aryan**, and the **Germanic** branch languages **German-Dutch-OldEnglish-Norwegian-Danish**), but is reversed in all the other modern languages (including the **Germanic** branch languages **English-Swedish-Icelandic**) in the numbers after 20. In **Ancient Greek** and **Latin**, both ways were allowed after 20.

2. A minus principle (**ūna-** "less-than" or alternately **ekona-** "one-less-than") is used for the **-9** numbers: **19**: **ūna-viṁśati** (or **ekona-viṁśati**) etc., except for **99**: **nava-navati**. This feature continues in the **modern Indo-Aryan** languages and

in **Latin**, which takes the step further (note the **Latin** tendency to innovate with a minus-principle, as when adopting the **Attic Greek** numeral system) by having **duode-viginti** and **unde-viginti** (**18** and **19**) etc., and even **duode-centum** and **unde-centum** (**98** and **99**).[Note: **Dravidian** has this etymology for the number **9**: e.g. Tamil **on-badu** ("one-less than-ten"). Here the prefix **on-** represents the **Tamil** word **onṛu** "one", but also resembles the Sanskrit **ūna** "less" and Latin **unus** "one"!].

But, about two other main significant features:
1. While **all** the branches of Indo-European languages show the **vigesimal-effect**, where **1-19** are formed differently from subsequent sets like **21-29**, etc. (not

counting the **Celtic** branch with its **vigesimal** system borrowed from **Basque**), the sole exception is **Sanskrit**.In **Sanskrit**, 11, 12, etc. (**ekā-daśan**, **dvā-daśan**, etc.) are exactly similar formations to 21, 22, etc. (**eka-viṁśati**, **dvā-viṁśati**, etc.), although grammatically the **Sanskrit** numbers **1-19** are supposed to be adjectives, while the numbers above that are supposed to be nouns. The **Sanskrit** numbers, therefore, clearly represent a frozen form of the earliest **Indo-European** purely **decimal** number-system *before* the **vigesimal-effect** took place.

2. Although **Sanskrit** is a very highly inflectional language, and the **modern Indo-Aryan** languages by and large have a very-much-diluted inflectional nature, the case is the opposite in the case of the

numbers, where all the **modern Indo-Aryan** languages have a strong degree of inflection as compared to **Sanskrit** in the numbers **21-99**. All this shows a state of affairs which leads to the second stage [Note: The numbers from **1-4** are highly inflected in themselves in Sanskrit and have many forms, e.g. **2**: **dva-**, **dvau-**, **dvi-**, **dve-**, etc. and **3**: **tri-**, **trayaḥ-**, **trīṇi**, etc. But that is not relevant to the discussion on hand]:

The second stage of development of the **Indo-European** number system is represented by all the **Indo-European** languages outside North India, where we see the **vigesimal-effect** in full force. In addition, the original order of the forms is **unit+tens**, and there is *inflection* in the formation of the numbers **11-19**:

1. The **vigesimal-effect**, with the numbers **11-19** formed differently from subsequent sets like **21-29**, etc., is found in all the branches of **Indo-European** languages outside India.

2. The **unit**+**tens** order for the numbers **11-19** is retained in the **Iranian**, **Albanian**, **Germanic**, **Baltic**, **Slavic** and **Italic** branches, and partially in the **Greek** branch (fully in **Ancient Greek**, and partially, only for **11-12**, in **Modern Greek**), although, among these, most of them reverse the order in the numbers after **20**.

3. The distinct inflection in the numbers **1-19** (but, whether having a **unit**+**tens** order or a **tens**+**unit** order thereafter, *not* found in the numbers beyond **20**) is found in the **Iranian**, **Italic**, **Germanic**

and **Greek** (in **Ancient Greek**, and for **11-12** in **Modern Greek**, as pointed out above) branches.

Strangely, "**all the Indo-European languages outside North India**" **includes even the Indo-Aryan Sinhalese language to the south of India which shares these features**:

Sinhalese (IndoEuropean-IndoAryan):
1-9: **eka**, **deka**, **tuna**, **hatara**, **pasa**, **haya**, **hata**, **aṭa**, **navaya**, **dahaya**
1-9 unit stems: **ek-**, **de-**, **tun-**, **hatara-**, **pas-**, **ha-**, **hat-**, **aṭa-**, **nava**–
11-19: **ekoḷaha**, **doḷaha**, **teḷaha**, **tudaha**, **pahaḷoha**, **soḷaha**, **hataḷoha**, **aṭaḷoha**, **ekun-vissa**
tens 10-100: **dahaya**, **vissa**, **tisa**, **hatalisa**, **panasa**, **hɛṭa**, **hɛttɛva**, **asūva**, **anūva**, **siyaya**

Other numbers: unit-stem+tens. Thus the word-order for *all* the numbers is unit+tens.
[And, like **Sanskrit** and **Latin** (and the other **modern Indo-Aryan** languages which retain this feature), the number -9 is expressed by a minus-principle, where **ekun**– is used with the *following* **tens**-form (except, as in **Sanskrit** and most other **modern Indo-Aryan** languages, for 99)].
Thus: 21: **ek-vissa**, 89: **ekun-anūva**. Only 99 is **nava-anūva**. There is no minus-principle].

[Modern colloquial Sinhalese has simplified the system, or can it be that colloquial **Sinhalese** in fact represents an archaic remnant of the first stage, where there was a purely **decimal** system

without the **vigesimal-effect**?
In colloquial speech the word-order for *all* the numbers is tens+unit. Even the numbers **11-19** are similarly formed in the form of tens-stem+unit, as **daha-eka**, **daha-deka**, etc.
The tens 10-100 stems: **daha-**, **visi-**, **tis-**, **hatalis-**, **panas-**, **hɛṭa-**, **hɛttɛɛ-**, **asū-**, **anū-**, **siya**–
Thus 21: **visi-eka**, 99: **anū-navaya**, etc.]

Thus, **Sinhalese** texts provide us with evidence missing in North India itself. **Sinhalese** is doubtless a treasure-house of clues to the most archaic stages of **Indo-European**, often giving us clues to even older stages than **Sanskrit** (e.g. the word **watura** for "water", as in Germanic **English water** and **Hittite watar**). These clues are not recognized because of the

blinkers of the AIT, which treats all "**Indo-Aryan**" languages (i.e. **Indo-European** languages native to India) as belonging to one branch which entered India in its earliest form as the **Vedic Sanskrit** language. Orthodox opponents of the AIT, who also want to accord primacy to the **Vedic** language, also adopt these blinkers.

In this second stage, therefore, it is clear that there was a **vigesimal-effect** where only the numbers **11-19** acquired distinctly inflected forms but not the other in-between numbers from **21-99**. This second stage of development of the **Indo-European** number system is not found recorded in any text or document in North India because the older **Sanskrit** numbers of the first stage had

become frozen in form and the **Prakrits** are recorded from a *much later* post-Buddhist period in the second half of the 1st millennium BCE, long after the departure of the other branches of **Indo-European** languages westwards from India, and after the diffusion of the **Vedic Sanskrit** culture to the **Dravidian** South, all of which must have taken place at a point of time when the **Indo-Aryan** languages of the North still had a numeral system at the second stage of development.

The third stage of development of the **Indo-European** number system, where the number system *continued* to become more and more subject to inflection and fusion between the **tens-**forms and the **unit-**forms, and the inflection in the

formation of compound numbers spread to all the numbers from **11-99**, is found in its earliest forms in most of the **Prakrits** and much more so in the **modern Indo-Aryan** languages of North India. In this stage, *all* the compound numbers between **10** and **100** acquired distinct forms with fusion and inflection between the **tens** and **units** words. The numbers **11-19**, which had *already* become distinctly inflected in the second stage, therefore got a *double* dose of inflection:

1. In the first stage, we see that there is barely any inflection, where the numbers **11-19** are formed just like the subsequent sets: thus **11**: **eka**+**daśa** = **ekā-daśa**, **12**: **dvi**+**daśa** = **dvā-daśa**, etc. Compare with **21**: **eka**+**viṁśati** = **eka-viṁśati**, **22**: **dvi**+**viṁśati** = **dvā-viṁśati**, etc.

2. In the second stage, which as we saw is unrecorded in India, there must have clearly been greater fusion and inflection in **11-19**, but not in the later sets **21-29**, etc.

3. In the third stage, we find strong inflection in all the numbers, but:

a) In the numbers after **20**, the **tens**-forms and **unit**-forms are still recognizable: Hindi **21**: **ek**+**bīs** = **ikk-īs**, 22: **do**+**bīs** = **bā-īs** (both **do-** and **bā-** are recognizable as forms of an original **dva-**).

b) In the numbers **11-19**, there is a clear case of *further* fusion and inflection: Hindi **11**: **ek**+**das** = **gyārah**, 22: **do**+**das** + **bārah**, etc., where the **tens** and **unit** elements are even more fused, inflected

and changed as to make recognition of the original elements more difficult: the –**r**– element in modern Indo-Aryan numbers from **11-19** is difficult to recognize as a development from the word for **10**. [A similar process of *further* inflection seems to have taken place in the westernmost IE branch **Germanic**, where **11** and maybe **12**, at least, seem to have continued to become more inflected later, making recognition of the elements difficult: English **11**: **one**+**ten** = **eleven**, German **eins**+**zehn** = **elf** (German), etc. Note also: **Germanic** languages are also the only modern languages outside India retaining the original **unit**+**tens** order in their compound numbers after **20**].

[**Note on Sanskrit vis-à-vis Prakrits vis-à-vis modern Indo-Aryan**:

The *earliest* beginnings of the third stage can be seen in most of the recorded **Prakrits**. But the **literary Prakrits** were actually highly **Sanskritized** or **Sanskrit-imitating** approximations of the spoken forms of **Indo-Aryan** speech of the time, and so they do not reflect the actual state of the spoken speech of the time. Thus, for example:
a) For the number **22**, **Pali** texts alternately use both **dvāvīsati** (imitating Sanskrit **dvāviṁśati**) and **bāvīsa** (similar to **modern Indo-Aryan** form **bāvīs**, etc.).

b) The **Pali** word, **paññāsa**/**paṇṇāsa** for **50**, is closer in form to the **modern Indo-Aryan** word **pannās** for **50** than to the **Sanskrit** word **pañcāśat** for **50**.But its uniform use in that form (**-paññāsa**/-

paṇṇāsa) in all the compound **unit+tens** numbers (i.e. in **49** and **51-58**) reflects imitation of the similar use of the word – **pañcāśat** in **Sanskrit** rather than the use of multiple forms in **modern Indo-Aryan** languages:
Hindi: –**cās** (49), –**van** (51, 52, 54, 57, 58), –**pan** (53, 55, 56).
Marathi: –**pannās** (49), –**vanna** (51, 52, 55, 57, 58), –**panna** (53, 54, 56).
Gujarati: –**pacās** (49), –**van** (51, 52, 55, 57, 58), –**pan** (53, 54, 56).
Similiarly, its uniform use of the form **pañca**– (5) in all the compound **unit+tens** numbers (25, 35, 45, etc.) reflects imitation of the similar use of the same word **pañca-** in **Sanskrit** rather than the use of multiple forms in **modern Indo-Aryan** languages:
Hindi: **pacc-** (25), **paĩ–** (35, 45, 65), **pac-**

(55, 75, 85), **pañcā-** (95),
Marathi**: pañc-** (25), **pas-** (35), **pañce-** (45), **pañçā-** (55), **pā-** (65), **pañcyā** (75, 85, 95)
Gujarati: **pacc-** (25), **pāã–** (35, 65), **pis**– (45), **pañc-** (75, 85), **pañcā-** (55, 95)].

Therefore, the area of North India was home to the first stage of development of the **Indo-European** number system (as represented by **Vedic and Classical Sanskrit**, and perhaps **colloquial Sinhalese**?), as well as to the third stage, both of which are found *only* in North India, while *all* the other branches of **Indo-European** languages *outside North India* (include **literary Sinhalese**) represent the second stage. This clearly indicates that the Original Homeland of all these languages was in North India,

and they migrated from India during a period when the **Indo-Aryan** languages of the North were at the second stage, and shared a similar **vigesimal-affected decimal** system.

The Spread of the Vigesimal-Affected Decimal Number-System:

As we saw, the first and third stages of development of the **Indo-European** decimal number system, as shown by what we have called the **vigesimal-effect** (i.e. where the numbers **11-19** are formed in a distinctly different way from the later sets like **21-29**, **31-39**, etc.), are found only in North India, and the second stage is found in all the branches outside North India (and therefore must have logically existed in North India in an intervening period, even if not

recorded), shows that the Original Homeland of all these **Indo-European** languages was in North India.

And an examination of the areas and languages which have this "**vigesimal-affected decimal number-system**" leads to the same conclusion:

There are many stray languages among the thousands of native American (**Amerindian**) languages with **decimal** systems, which have distinctly *different* formations for the numbers **11-19** on the one hand and subsequent sets like **21-29**, **31-39**, etc. on the other. We saw the examples of **Cherokee** and **Navaho**, and there must be many more. The explanation for this can be the effect of neighboring languages with **vigesimal** systems, and there are many of them in

America: we saw the examples of the **Nahuatl** (Aztec), **Yucatec** (Mayan) and **Yupik** languages. Likewise, we saw the example of the **Kanuri** language in the interior of Africa which also clearly has a **vigesimal–affected decimal system**, and, again, there may be many more such languages in Africa. But obviously, these remote languages of America and Africa cannot have a place in the history of the origin and spread of the **Indo-European** languages or number systems.

The other languages which have **vigesimal–affected decimal systems** are: some **Uralo-Altaic** languages (e.g. **Finnish**, **Estonian**), some **Semito-Hamitic** languages (e.g. **Arabic**, **Hebrew**, **Maltese**), some **Austronesian** languages (e.g. **Malay**, **Tagalog**), and the

Dravidian languages of South India. However, barring the **Dravidian** languages, the following points may be noted about the other languages:

1. The **vigesimal–affected decimal** feature is **not** found in the families as a whole: thus, the other relatives of **Finnish** and **Estonian** do not have this **vigesimal–affected decimal system** (check **Hungarian**, **Turkish**, **Mongolian**, etc. earlier in this article). Nor do the other relatives of **Arabic**, **Hebrew** and **Maltese** (check the ancient and modern **Hamitic** languages, **Amharic** earlier in this article, and the available data on the ancient **Semitic** languages). And nor do the other relatives of **Malay** and **Tagalog** (check **Hawaiian** earlier).

2. Except perhaps **Arabic** and **Hebrew**, the other languages are clearly or arguably influenced by **Indo-European** languages. Check what the Wikipedia entry has to say about **Maltese**:”**Maltese has evolved independently of Literary Arabic and its varieties into a standardized language over the past 800 years in a gradual process of Latinisation.**[5][6] **Maltese is therefore considered an exceptional descendant of Arabic that has no diglossic relationship with Standard Arabic or Classical Arabic,** [7] **and is classified separately from the Arabic macrolanguage.**[8] **Maltese is also unique among Semitic languages since its morphology has been deeply influenced by Romance languages, namely Italian and Sicilian**“.

The **Malay** and **Tagalog** languages may have been influenced by Indian languages: S.E. Asia was under the influence of Indian culture since almost two millennia.
Finnish (and the very closely related **Estonian**) are known to have a large number of **Indo-European** (even specifically **Indo-Aryan** and **Iranian**) borrowings. Also, the word for "hundred" in **Finnish** is **sata**, and in **Estonian** is **sada**.

3. The numbers **11-19** are certainly formed differently from the later numbers in all the above languages, but in every single one of them, the **tens** and **unit** forms are not fused together (except in **Maltese**, which, as seen above is a **dialect** of Arabic highly influenced in its

morphology by **Indo-European** languages), and so the numbers **11-19** do not require to be individually learned since they are formed by simple juxtaposition: check the numbers in all these languages detailed earlier in this article.

In sharp contrast to this, in the **Dravidian** languages:

All the languages have this **vigesimal–affected decimal system**. The **tens** and **unit** words in **11-19** are fused together by inflection.

So the **Indo-European** languages outside North India, and the **Dravidian** languages in South India, are the only families of languages in the world which share this **vigesimal–affected decimal** feature as a whole and in almost the same way (inflection found only in **11-19** but

not after **20**). Obviously this cannot be a coincidence.
[The only difference is that the **Dravidian** numbers **1-19** have the word-order **tens**+**unit**. This shows two things: that **Dravidian** was influenced by **Indo-Aryan** in this **vigesimal-effect**, but also that it did not change its original *more* logical word-order for the *less* logical **Indo-Aryan** one].

Generally, we find common elements between the **Indo-Aryan** and the **Dravidian** languages which are not found in the other **Indo-European languages** outside India (e.g. the cerebralretroflex consonants, many grammatical features and words, etc. or even words for specifically Indian flora and fauna). These are usually attributed

(in most cases probably correctly) to **Dravidian** influence on the **Indo-Aryan** languages. But then a conclusion sought to be drawn from these common features is that it proves that the **Indo-European** homeland *cannot* be in India, since in that case these features should have been found in some **Indo-European** languages outside India as well, and so this proves the AIT (Aryan Invasion Theory) and disproves the OIT (Out-of-India Theory). But this logic is extremely faulty for two reasons:

1. The *other* branches of **Indo-European** languages, in the OIT scenario, were situated well to the *west* of the **Indo-Aryan** languages and away from any influence from the **Dravidian** languages of South India, and, in any case, they had started migrating out northwestwards in a

very early period, around 3000 BCE. So they obviously did not participate in any common **Indo-Aryan-Dravidian** linguistic innovations in the interior of India, or get affected by any **Dravidian** features.

2. The example of the purely **Indo-Aryan Romany** (Gypsy) language of Europe – which undisputedly migrated from India just over a thousand years ago, but did not take with it either the retroflex consonants, *or* Dravidian words, *or* words for specifically Indian flora and fauna – shows the faultiness of this logic.

But in this case, we find the common element is between the **Dravidian** languages of South India and the **Indo-European** languages outside India, and it

is *not* found in either **Sanskrit** or the **modern Indo-Aryan** languages of North India!

We get a clear picture of a **decimal** number system developing in a core area in North India, occupied by the **Indo-European** languages which were spread out in a sprawling area between the **Austric** languages in the east and **Burushaski** in the north-northwest:
1. In the first stage, the number system which developed was a purely **decimal** system, which became frozen or fossilized in the **Vedic** language and in later **Sanskrit**.

2. In the second stage, this system continued to evolve and was influenced in its further evolution to a small extent by the surrounding **vigesimal** number

systems, and developed into a **vigesimal-affected decimal system**, where the unitary nature of the numbers **1-10** was extended to the next set of ten numbers by fusing and inflecting the **unit**-word and **tens**-word numbers for **11-19** into single unitary words. This system spread out southwards to influence the formation of the number system in the **Dravidian** languages to the South, and spread out westwards and outwards from India with the expansion and migration of the other (then non-**Pūru** or "non-Indo-Aryan") **Indo-European** dialects from India, which later spread out to Central Asia, West Asia and Europe. This system prevailed on the ground in the core area in North India, but the fossilized system of the first stage alone

continued to be recorded in the Vedic and Classical Sanskrit texts.

3. In the third stage, *after* the migration of the other **Indo-European** dialects and the standardization of the number system in the **Dravidian** languages of the South, at some time in the late second or the early first millennium BCE, the system on the ground in the core area of North India continued to evolve, i.e. to become more and more unitary, with the unitary nature of the numbers **1-20** now extended to all the numbers **1-99**, by fusing and inflecting the **unit**-word and **tens**-word numbers for **21-99** into single unitary words. This system came to be recorded in its earliest form in the **Prakrit** texts, and in more fully developed only in the last thousand years or so after the

modern Indo-Aryan languages developed into literary languages.

All this constitutes one more piece of very strong evidence for the OIT and one more nail in the coffin of the AIT.