Being Conventional on Numbers, Maps and Magnets

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S. Srinivasan ("Chinu"), of the Discovery Science Resource Group, SAHAJ, Baroda, looks at conventions of languages that we all live with. He cites many examples of conventions and representations across cultures, opening our eyes to several possibilities and issues. Will learning be more 'free' if we say there are many ways of doing the same thing? The author can be reached at:sahajbrc@youtele.com

In one of the training programmes with primary school teachers, we were discussing place value and how we put the units' digit on the right, the tens' left of the units, and so on. One teacher shot up to ask why we needed to put the unit digit on the right. After a moment's hesitation, I said that it did not matter how we put it as far as the math was concerned. That is, four hundred and thirty seven could be also written as 734 and not as usual 437 and be read as sevens, thirties and four hundreds.

This led to a bit of ruckus in the class. Teachers said it was unacceptable to write the units' digits at the extreme left. After much debate, one or two teachers grudgingly accepted that I could have a point. And grudgingly is how we all do (certainly I do) when anything unconventional is posed to us for the first time. Understanding and acceptance comes with familiarity and quiet contemplation during a walk or when by ourselves. As it probably did with our teachers who came and told me the next day that maybe I had a point.

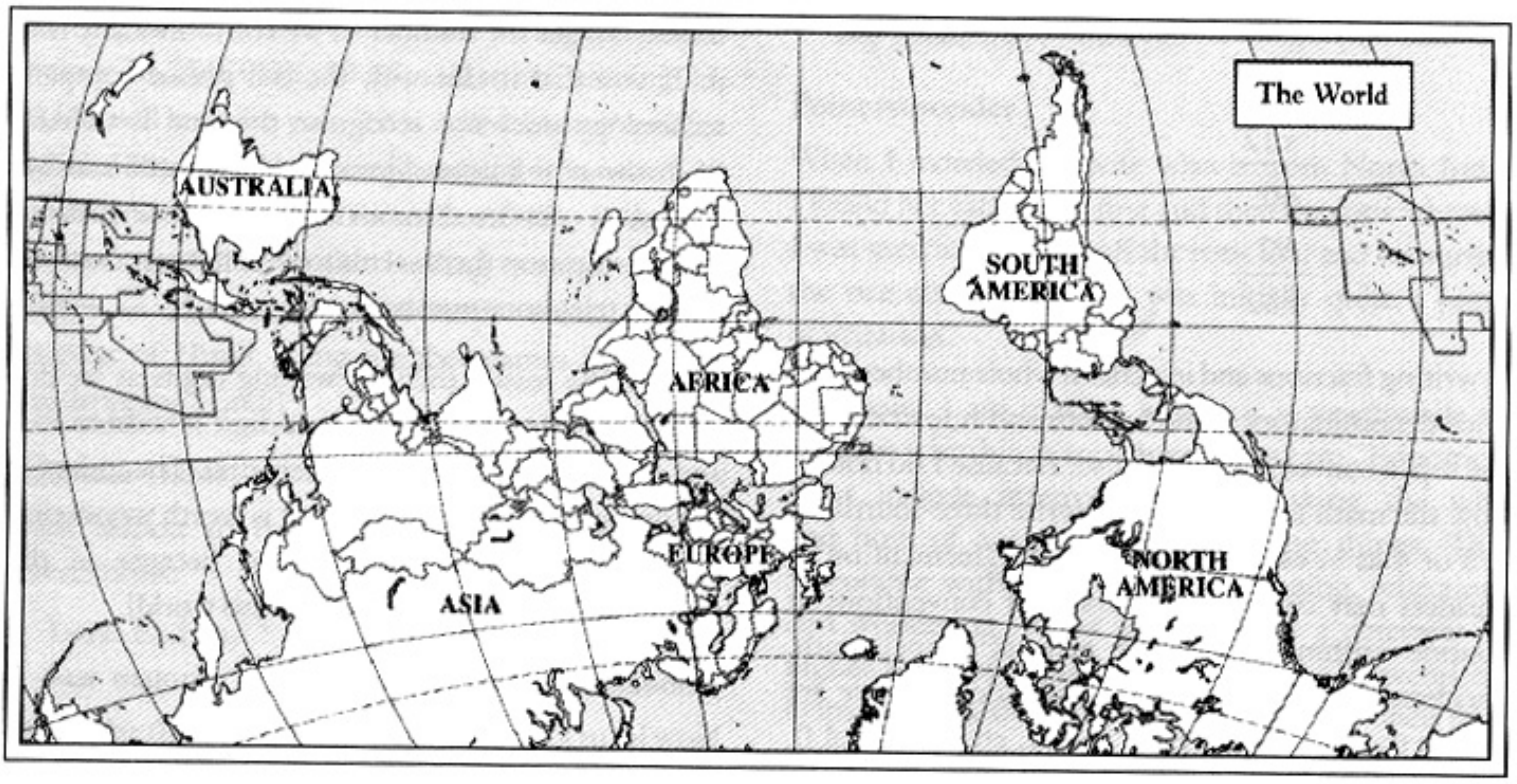
I hope, dear reader, it is clear that as long as everybody follows the same convention, it does not matter whether we write from the left or the right. For example, Hindi and English can be written RTL, from right to left (i.e., tfel ot thgir morf). It is by acceptance of convention that we read certain languages from left to right and some others such as Urdu and Arabic from right to left. Similarly writing units (ones) on the right most is a convention that is accepted.

Conventions in writing and maps

The typical map and globes all indicate north on the top and we all somehow end up believing that the Himalayas are up there and Australia "down under". One can make an "upside down" map* and wait for the reaction from children, teachers and of course the school administration.

Similarly there is a convention for naming the north and south poles of a bar magnet. Most science books tell us that when we freely suspend a bar magnet, the side pointing to the earth's North Pole is labelled as

* Source: http://www.diversophy.com/maps/whatsupsouth.pdf



"N" or north on the magnet. But we wonder, if unlike poles attract, the end marked "N" should have been labelled as "S" or South. It turns out that as a matter of convention we may have chosen the former label at the risk of spreading wrong science and confusing children.

Writing itself has several conventions. LTR (left to right) and top to bottom (TB) are dominant ones. There are other systems (see table) where this is not obvious or natural. Some, like Japanese use both horizontal and vertical systems depending on the context. Naturally the way they represent numbers changes accordingly. The way we write or represent our communication has an influence on our perception and acceptance of reality.

Conventions in arithmetic

There are several other conventions in elementary arithmetic related to negative numbers, decimals, exponents, etc. We write negative numbers on the left side of the number line: we may as well write them on the right side. Decimals are written with the whole number part on the left and the fractional part on the right. Can 1.5 (i.e., one and a half) also be written as 5.1? Can 23 be written as 23, with the index 3 is a subscript instead of a superscript?

Writing Mode	Direction	Common Usage
LTR-TB	LTR	Latin-based, Greek, Cyrillic writing systems (and many others)
RTL-TB	RTL	Arabic, Hebrew, Urdu, Sindhi writing systems
TB-RTL	LTR	Some East Asian writing systems
TB-LTR	RTL	Mongolian writing systems

Table 2: Writing Modes

Source: <http://fantasai.inkedblade.net/style/discuss/vertical-text/>

Several Ways of Writing and Reading

Writing Mode (that is most written orientation)	**Direction of Characters in a line**	**Progression of Lines**	**Examples**	**Remarks**
Horizontal	Left to Right	Top to Bottom	English, Hindi, many Indian languages	Book Binding on left and pages progress from left to right
Horizontal	Right to Left	Top to Bottom	Urdu	Binding on right and pages progress from right to left
Vertical	Top to Bottom	Left to Right	Traditional Mongolian Script and its offshoots like Manchu	
Vertical	Top to Bottom	Right to Left	Traditional Chinese, Japanese, and Korean	Also written horizontally left to right nowadays and lines progressing top to bottom like Hindi or English.[i]
Vertical	Bottom to Top	Left to Right	Ogham (an ancient script named after Irish God Ogma)	Was also written horizontally
Vertical	Bottom to Top	Right to Left	Ancient Berber texts; Orkhon when written vertically, it read from bottom to top and right to left.	In inscriptions, Ancient Berber texts start either at the bottom left or bottom right and run upwards. Monumental inscriptions generally run in horizontal lines from right to left.
Any direction convenient	As per orientation	As per orientation	Ancient Egyptian (Hieroglyphic)	Horizontally from right to left or left to right or vertically from top to bottom

Boustrophedon languages	Written in horizontal lines running alternatively from right to left then left to right.		Hungarian Runes, Linear B, Rongo Rongo Sabaean, Etruscan (Etruscan is also written sometimes from right to left in horizontal lines.)	Boustrophedon, comes from the Greek *βους* (bous) "ox" + *στρεφειν* (strefein) "to turn", because it resembles the path an ox makes when plowing field, turning at the end of each row to return in the opposite direction.
In paired columns zigzagging downwards from left to right			Mayan inscriptions	Any faces on the glyphs generally look towards the beginning of the line, as with Egyptian Hieroglyphs. Elsewhere it was usually written horizontally from left to right

Source: 'Robust Vertical Text Layout' at http://www.unicode.org/notes/tn22/; http://www.omniglot.com/writing/direction.htm; and Wikepedia.

We have not discussed here the issues when vertical scripts are sought to be written horizontally or horizontal scripts are sought to be written vertically. Or how the letters/alphabets/glyphs are oriented in each case. These have become important because now computers have to handle all these and able to recognize and organize 'automatically'. Then there are issues of rtl scripts written in ltr texts and vice versa. We will discuss them in a separate article. But the point we are trying to make is that there are different ways of doing things and especially wrt writing. On needs to understand why different systems have come up in different countries. But like in everything else, ltr writing systems with lines progressing top to bottom seem to be replacing traditional ways of writing.

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[i] Or it was occasionally right to left in horizontal lines. In Taiwan Chinese is often written vertically, while in China and Singapore it is usually written horizontally. Where a text is written in horizontal format, pages are read in the same order as English or Hindi books, with the binding at the left and pages progressing to the right. Vertical books are printed the other way round, with the binding at the right, and pages progressing to the left.

And multiplying like this instead of the usual way:

$$\begin{array}{r} 46 \\ \times\ 12 \\ \hline 46 \\ 92 \\ \hline 552 \end{array}$$

Is writing fractions and in general whole numbers too, with denominators at the bottom and numerators at the top, a convention? I think so. Because I do not see how the math is affected if we write three-fourths as 4/3 or 4 as ¼ especially if we have agreement on it. Readers may cite other instances of conventions in routine arithmetic that we take as gospel truth. Incidentally did any of us ever wonder why we are taught to recite numbers 1, 2, 3, 4, etc? Why not 0, 1,2,3,4...? After all, the zero was discovered in India and yet we start with 1.

Conventions in telephone numbers

Now a related question: when we are asked our telephone number we always start from the left. For example a cell phone number is rattled off as 9998531521, that is, nine, nine ...two, one. Why do we not say one, two, five ... nine, nine, nine? It should not make a difference, especially since cell numbers are not really numbers in the usual sense. In some Arabic speaking countries and in Egypt, telephone numbers (and numbers in arithmetic) are read the usual / dominant way (left to right) but Arabic numbers are traditionally read (i.e. in increasing order, for e.g., 1234 is 'four and thirty and two hundred and one thousand'), though this reading has declined of late*.

Now the above cell phone number can also be written as 1251358999. So if we write and read from right to left, we get the number as we conventionally hear it. If you dial it this way, the cell phone company technology does not recognise this and is unlikely to in the near future. Since all phone networks are nowadays connected to not only other countries but many computers there seems to be some consensus on reading telephone numbers.

What is the reason then for writing digits as we do? Apparently the most significant digit is written first and the less significant digit thereafter. The units fall last in the hierarchy of writing. It is worth wondering how much of this convention is because of the number of right handed people in this world!

Conventions with number names

Now let us look at how the numbers 11- 20 and 21-99 are read in some Indian languages. In Hindi, we know there are special names for the numbers 11 to 19. A novice to the language cannot figure out the name for the number 12, even if they know the name for 11. But Tamil and Telugu, one could figure it out. Eleven and twelve are called *'padinonnu'* and *'padirendu'* in Tamil (ten and one); and (ten and two), but in Hindi *'gyarah'* and *'barah'* are not as obvious. This differentiation can be made when comparing numerals in English and German also. Number sets 21-29 and so on until 99 are decipherable in Tamil, Telugu, English and German but not altogether in Hindi or Gujarati or many other languages**. For e.g., in Hindi, 21 will be read as *'ekees'* (one and twenty) and 44 will be *'chualis'*, (four and forty). Similarly, in Gujarati, also, it takes some practice to discern whether one is referring to 74 or 76 with terms as *'chummoter'* and *'chhoter'*. In Hindi we also have the peculiar practice of heralding the next ten when

*Source: < http://www.101languages.net/arabic/writing_system.html>

**Hindi, Gujrati, German, Tamil, Telugu, and English are languages known to the author. In many languages such as Hindi, Gujrati, the logical naming conventions is not usually known and the etymology is lost in history.

referring to 19, 29, 39, etc. Even if we have mastered naming 20-28, 30-38, 40-48, and so on, naming 29, 39, 49 will surprise you. 29 is called '*untees*' (with a suffix of 30), instead of being predictable '*navvees*'; 39 is called '*unchaalis*' (with a suffix of 40), instead of '*navtees*' etc.'* Due to this baffling number naming system in Hindi, we often come across regular speakers of Hindi, using number names in English and dropping Hindi!

Calendar Dates

With respect to calendar dates, we have various conventions:

- Little-Endian,** dd-mm-yyyy common to the vast majority of the world's countries including India.
- Middle-Endian, mm-dd-yyyy as used in the United States and a few other countries, likely more descriptive with name of the month.
- Big-Endian, yyyy-mm-dd.

Point to ponder

When I married my wife who is from North India I found her eating rice first and then the rotis whereas I was used to finishing off the rotis first and savouring the rice afterwards. This was initially quite a cause of irritation.

The point I am making is that it is worthwhile to examine why things are named as they are. Education must include interrogating and asking the why and how of accepted ways of doing things. This acceptance without pausing, questioning, reflecting, and wondering, serves sometimes as a deterrent in higher levels of education. Questioning conventions helps break hard-set thought patterns and open new windows. I thank the teacher who questioned me. It set me thinking and helped me to cultivate appreciation of other ways of doing things and not take things for granted.

*Incidentally, 89 is also correctly *navasi* instead of *unianve!*

**The terms Endian originally comes from Jonathan Swift's satirical novel *Gulliver's Travels*, where tensions are described in Lilliput and Blefuscu: royal edict in Lilliput requires cracking open one's soft-boiled egg at the small end, inhabitants of the rival kingdom of Blefuscu crack theirs at the big end.