

Typology of numeral systems in Papuan languages. A cognitive account.

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Papuan languages exhibit a variety of number systems. The main opposition is between *tally*-systems and number systems proper (although they may co-exist in a language). The genuine number systems are organized according to the bases 2, 4, 5, 10, and 20. Usually one language combines several bases. Rather frequent is the combination 2, 5, 10, 20 followed by 4, 5, 10, 20. By contrast, systems starting with base 5 seem to be considerably less frequent. Thus it is evident that the lowest base is either 2 or 4, leading to a general split between binary and quaternary systems. The systems have an obvious anthropomorphic foundation: the binary systems are motivated by the highly dual organization of the human body; the quaternary systems, by the four extremities of the human body; the quinary systems, by the five fingers of a hand. This strategy of embodiment becomes lexically apparent in the higher bases 5, 10 and 20. 5 is almost regularly expressed by a term meaning 'hand, fist' – notably with the exception of base 5 systems – often expanded by an additional term meaning 'whole', 'all', 'finish' or else 'half' if the two hands are conceived as a whole. The base 10 is normally composed of 5 + 5 'two hands'; it serves as the conceptual base for the numbers 11 to 19. Yet there is a possibility to rely on the feet instead of the hands, especially for numbers 15 to 19. The most common means to express 20 is a term meaning 'person' or 'human'. Like 5 it can be expanded by 'whole', but interestingly, there also are other modifiers attested, like 'tree', 'long' or 'dead', which focus on a standing or a lying human figure. With the correlation of 20 and 'person' the binary as well as the quaternary orientation of numbering is conceptually present: hands or feet (quaternary), or a pair of hands and a pair of feet (binary). Accordingly, 20 can also be expressed by composite terms meaning '2 hand, 2 feet'. The embodiment structure of numeral systems can be summarized in the following hierarchies:

- (i) base 2 > base 4 > base 5 > base 10 (rare: West Papuan)
- (ii) hand > foot > person
- (iii) speaker > addressee > third person

The last hierarchical order becomes relevant for numbers higher than 20.

As a general result concerning the embodiment structure of numeral systems one can state the following: the more bases a numeral system combines, the more vivid is embodiment as a conceptual strategy; the less bases a numeral system is made of, the less overt is embodiment as a conceptual strategy. *Tally*-systems show the highest degree of embodiment.

The internal syntactic structure of complex numerical expressions follows different principles of organization: (i) the single numerical expressions are simply juxtaposed; (ii) the numerical expressions are related by special words or morphemes such as 'and', 'with place', 'plus', 'plus more', 'leg plus', 'jump down leg', DEFINITE, INDEFINITE, PERF+do+PRES. Some languages use these means to distinguish between 'addition of' and 'multiple of'.

In at least one West Papuan language a classifier occurs between the head noun and the numerical expression.

The data are based on fieldwork by the author (Kilmeri, Papua New Guinea); for the other 24 languages grammars were consulted and interpreted.