



|    |  |         |      |
|----|--|---------|------|
|    | yì-bǎi yī  | 1-100 1 | 101– |
| 6. | Supyire (Gur, Niger-Fongo; Mali)                     |         |      |
|    | ḡkwuu sicyeeré 'ná bée-tàànrè ná ké 'ná báár-ìcyèèrè |         |      |
|    | 80 4 and 20-3 and 10 and 5-4                         |         |      |
|    | (80 x 4) + (20 x 3) + 10 + 5 + 4 = 399               |         |      |

## II. Consistently smaller addend before larger addend

|    |  |                       |       |
|----|--|-----------------------|-------|
| 7. | Malagasy (Austronesian; Madagascar)              |                       |       |
|    | iraika ambin'ny folo ... sivy ambin'ny folo      | 1 + 10 ... 9 + 10     | 11–19 |
|    | iraika ambin'ny roa-polo ... sivy amby sivi-folo | 1 + 2-10 ... 9 + 9-10 | 21–99 |
|    | iraika amby zato                                 | 1 + 100               | 101–  |
|    | telo amby roa-njato sy roa arivo                 |                       |       |
|    | 3 + 2-100 + 2 1000                               |                       |       |
|    | 3 + 200 + 2000 = 2203                            |                       |       |

(Rajaonarimanana, Narivelo. 1995. *Grammaire moderne de la langue malgache. Méthode de malgache*, volume 1. Paris: L'Asiathèque, p.67; sy 'and', amby 'excess', ambin'ny 'excess of, plus'.)

|    |   |                       |             |
|----|---|-----------------------|-------------|
| 8. | Arabic (Classical, one variant) (Semitic, Afroasiatic; Middle East, North Africa) |                       |             |
|    | 'aḡada 'ašara ... tis'ata 'ašara  | 1 10 ... 9 10         | 11–19       |
|    | 'aḡad(un) wa-'išruun(a) ... tis'(un) wa-tis'uun(a)                                | 1 and-20 ... 9 and-90 | 21–99       |
|    | 'aḡad(un) wa-mi'a(tun)  | 1 and-100             | 101–        |
|    | 'aḡad(un) wa-'išruun(a) wa-sib'(u)-mi'a(tin)                                      | wa-thalaathat(u)      | 'aalaaf(in) |
|    | 1 and-20 and-7-100 and-3  | 1000                  |             |
|    | 1 + 20 + 700 + 3000 = 3721 ٣٧٢١   |                       |             |

(Wright, W. 1896. *A grammar of the Arabic language*, third edition, volume 1. Cambridge: Cambridge University Press, p.259)

## III. Smaller numbers have smaller addend before larger addend, larger numbers have larger addend before smaller addend.

|     |   |                     |       |
|-----|---|---------------------|-------|
| 9.  | English (Germanic, Indo-European; England, USA, etc.) |                     |       |
|     | (eleven, twelve) thir-teen ... nine-teen              | 3-10 ... 9-10       | 13–19 |
|     | twenty-one ... ninety-nine                            | 20-1 ... 90-9       | 21–99 |
|     | a/one hundred (and) one                               | 1 100 (and) 1       | 101–  |
|     | (Cut-off point is between 19 and 21.)                 |                     |       |
| 10. | Russian (Slavic, Indo-European; Russia)               |                     |       |
|     | odin-na-dcat' ... devjat-na-dcat'                     | 1-on-10 ... 9-on-10 | 11–19 |
|     | dvadcat' odin ... devjanosto devjat'                  | 20 1 ... 90 9       | 21–99 |

|  |   |  |                                 |
|--|---|--|---------------------------------|
|  | sto odin<br>(Cut-off point is between 19 and 21.)   | 100 1  | 101–                            |
| 11.  | German (Germanic, Indo-European; Germany, etc.)<br>(elf, zwölf) drei-zehn ... neun-zehn<br>ein-und-zwanzig ... neun-und-neunzig<br>(ein-)hundert-(und-)eins<br>(Cut-off point is between 99 and 101.)   | 3-10 ... 9-10<br>1-and-20 ... 9-and-90<br>(1)-100-(and)-1                    | 13–19<br>21–99<br>101–          |
|  | [[zwei-hundert-sechs-und-fünfzig-]tausend-drei-hundert-zehn]<br>[[2-100-6-and-50-]1000-3-100-10] = 256,310  |  |                                 |
| 12.  | Arabic (Classical, another variant, and Modern Standard)<br>as above for Classical Arabic but:<br>mi'a(tun) wa-'ahad(un) 100 and-1<br>(Cut-off point is between 99 and 101.)  | 100 and-1  | 101–                            |
| 13.  | Italian (Italic, Indo-European; Italy)<br>un-dici ... se-dici<br>dicias-sette ... dician-nove<br>vent-uno ... novanta-nove<br>cent-uno<br>(Cut-off point is between 16 and 17.)   | 1-10 ... 6-10<br>10-7 ... 10-9<br>20-1 ... 90-9<br>100-1                     | 11–16<br>17–19<br>21–99<br>101– |
| 14.  | Portuguese (Italic, Indo-European; Portugal, Brazil)<br>on-ze ... quin-ze<br>dez-e-seis ... dez-e-nove<br>vinte e um ... noventa e nove<br>cento e um<br>(Cut-off point is between 15 and 16.)  | 1-10 ... 5-10<br>10-and-6 ... 10-and-9<br>20 and 1 ... 90 and 9<br>100 and 1 | 11–15<br>16–19<br>21–99<br>101– |
| IV. Lower numbers have smaller addend before larger addend, higher numbers have larger addend before smaller addend, with an intermediate range allowing both possibilities (e.g. (15)); either the smaller–larger (e.g. (16)) or the larger–smaller (e.g. (17)) range may be missing. |   |  |                                 |
| 15.  | Latin (Italic, Indo-European; formerly Rome)<br>un-decim — septen-decim<br>viginti unus ... nonaginta novem /<br>unus et viginti ... novem et nonaginta<br>centum et unus<br>(Cut-off points are between 17 and 21, and between 99 and 101. Note that 18–19 are formed by subtraction from 20, though at least octo-decim 18 is attested) | 1-10 ... 7-10<br>20 1 ... 90 9 /<br>1 and 20 ... 9 and 90<br>100 and 1       | 11–17<br><br>21–99<br>101–      |
| 16.  | Tsez (Asakh dialect) (East Caucasian; North Caucasus)<br>sij-oc'i ... biλ-oc'i /  | 1-10 ... 8-10 /  |                                 |

|                                      |                    |       |
|--------------------------------------|--------------------|-------|
| oc'ino sis ... oc'ino biļno          | 10 1 ... 10-8      | 11–18 |
| eč'-oc'i / oc'ino oč'ino             | 9-10 / 10 9        | 19    |
| quno sis ... uyno quno oc'ino oč'ino | 20 1 ... 4 20 10 9 | 21–99 |
| bišonno sis                          | 100 1              | 101–  |

(Cut-off point between variation and larger–smaller is between 19 and 21. The form oc'ino oč'ino is dispreferred to eč'-oc'i, outside larger combinations, probably because of the near-repetition; for 99 uyno quno eč'-oc'i 4 20 9-10 is also possible.)

17. Welsh (Biblical) (Celtic, Indo-European; Wales)
- |                                      |                       |       |
|--------------------------------------|-----------------------|-------|
| un ar ddeg ... pedwar ar bym-theg    | 1 on 10 ... 1 on 5-10 | 1–19  |
| un ar hugain ...                     | 1 on 20 ...           |       |
| pedwar ar bym-theg a deu-gain        | 4 on 5-10 and 2-20    | 21–59 |
| un a thri ugain ...                  | 1 and 3 20            |       |
| pedwar ar bym-theg a phedwar ugain / | 4 on 5-10 and 4-20 /  |       |
| tri ugain ac un ...                  | 3 20 and 1            |       |
| pedwar ugain a phedwar ar bym-theg   | 4 20 and 4 on 5-10    | 61–99 |
| cant ac un / un a chan               | 100 and 1 / 1 and 100 | 101–  |
- (Cut-off point between smaller–larger and variation is between 59 and 61. Based on Hurford, James R. 1975. *The linguistic theory of numerals*. Cambridge: Cambridge University Press, pp. 211–232, who also comments “inversion [i.e. smaller–larger — BC] applies less frequently in expressions for higher numbers”, p.156).

C. A possible counterexample?: Trumai (isolate; Mato Grosso, Brazil)

18. “I have found just one exception to the generalizations about cut-off numbers, namely Trumai, an Equatorial language (Steinen 1894: 542) in which ‘three’ is (2 + 1) but ‘six’ through ‘nine’ and ‘eleven’ through ‘fourteen’ are (1 + 5) ... (4 + 5) and (1 + 10) ... (4 + 10). The highest numeral given is ‘twenty.’ However, the expression for ‘one’ in (2 + 1) is suppletive.” (Greenberg, p.273)

[Note: There are crucial typos in the original, with (5 + 1) etc. instead of (1 + 5) etc. However, the corrections are clear not only from Von den Steinen’s data (see (19) but also from the context: If Trumai did have (5 + 1), etc., then it would not be an exception.]

19. Trumai numerals according to Karl von den Steinen. 1894. *Unter den Naturvölkern Zentral-Brasiliens: Reiseschilderung und Ergebnisse der Zweiten Schingú-Expedition 1887–1888*. Berlin: Dietrich Reimer, pp. 541–542. Reprinted New York & London, 1968: Johnson Reprint Co. The second column reproduces Von den Steinen’s forms. The two columns to the right give the analysis proposed by Greenberg (and others before him) with commentary.

|   |       |
|---|-------|
| 1 | mihin |
| 2 | hurš  |

|    |                     |           |  |
|----|---------------------|-----------|--|
| 3  | hurstame            | 2 1       | form for 1 suppletive (Greenberg)                |
| 4  | kumatak             |           |  |
| 5  | katkel, nekatkelan  |           |  |
| 6  | mihin-po(k)péskun   | 1 5       | form for 5 in 6–9 would have to be suppletive    |
| 7  | hurš-apokpéskun     | 2 5       |  |
| 8  | hurstam-apokpéskun  | 3 5       |  |
| 9  | kumatak-apokpéskun  | 4 5       |  |
| 10 | yepun-pokpéskun     | [? 5]     | not discussed by Greenberg                       |
| 11 | mihin-pitsa         | 1 10      | form for 10 in 11–14 would have to be suppletive |
| 12 | hurš-apitsa         | 2 10      |  |
| 13 | hurstam-apitsa      | 3 10      |  |
| 14 | kumatakuanpitsa     | 4 10      |  |
| 15 | katkel musrákkuake  | [5 10]    | not discussed by Greenberg                       |
| 16 | pitsuranapáke       | [10 ?]    | not discussed by Greenberg                       |
| 20 | pitskel; nekatkelan | [10 ?; ?] | not discussed by Greenberg                       |

## 20. Contemporary Trumai numeral system

Only the numerals 1–5 are used regularly in conversation and texts, and are not subject to variation. The numerals 6–10 are offered in elicitation, and different (but quite similar) forms are given by different speakers, but in practice these numbers are identified by showing the appropriate number of fingers. The numerals 11–20 are never used, and some speakers do not even know them.

|    |   |
|----|---|
| 1  | mihin   |
| 2  | huš   |
| 3  | huštahme  |
| 4  | pine pinekte len                                      |
| 5  | ine k'ad kelan  |
| 6  | mihin apa wakpeškun<br>k'ad kel wakpeškun             |
| 7  | huš apa wakpeškun<br>huš k'ad kel wakpeškun           |
| 8  | huštahme apa wakpeškun<br>huštahme k'ad kel wakpeškun |
| 9  | pine pinekte len apa wakpeškun                        |
| 10 | k'ad kel wanlekan<br>ine k'ad kelan apa wakpeškun     |
| 11 | huš k'ad kel wanlekan, mihin apa wakpeškun            |
| 12 | huš k'ad kel wanlekan, huš apa wakpeškun              |
| 13 | huš k'ad kel wanlekan, huštahme apa wakpeškun         |
| 14 | huš k'ad kel wanlekan, pine pinekte len apa wakpeškun |
| 15 | mihin, ine k'ad kelan                                 |
| 16 | mihin, pits' kel wakpeškun                            |

- 17 mihin, huš pits' kel wakpeškun  
 20 pits' kel wanlekan

21. Commentary on relevant Trumai forms

In interpreting these forms, note that both kel and apa designate both fingers and toes. The word kel, which always occurs in conjunction with k'ad 'hand' or pits' 'foot', seems to designate 'finger/toe' but also evoke the rest of the hand or foot, while apa just designates 'finger/toe' (and can thus be used, for instance, in the case of a detached finger/toe).

- 3 The form is not synchronically analyzable, although the first component is surely at least diachronically huš 2. The second component is not interpreted by speakers as a variant of 1, nor is there any evidence that it ever had this meaning. It does not occur elsewhere in the language, and any speculations about its original meaning are just speculations. Maybe it originally meant something like 'big, a bigger X'; cf. perhaps the relation between malatsitsik 'armadillo' and malatsitsik ruyaw 'giant armadillo' (a species of armadillo), where ruyaw is not the regular word for big (which is: iye), but a modifier indicating that the entity in question is a big version of another entity. In any case, there is no reason to suppose that the formation involves addition.
- 4 The form cited by Von den Steinen is not known to us. The form currently found is analyzed as follows, i.e. 'group of friends':

|        |            |       |
|--------|------------|-------|
| pine   | pine-kte   | len   |
| friend | friend-GEN | group |

Note: pine means 'friend, partner' (i.e. the person that is usually with you, as in a twosome). Its use here probably means 'two friends' + 'two friends' (pine + pine) = 4.

- 5 The forms given by Von den Steinen, especially the second one, are close to the current form, which can be analyzed as follows, i.e. '(in) the fingers of one hand':

|     |      |             |
|-----|------|-------------|
| ine | k'ad | kel-an      |
| DEM | hand | finger-?LOC |

- 6 The form given by Von den Steinen is close to one current form, which is analyzable as follows, i.e. 'one finger crossed [to the other hand]', i.e. one has finished counting the fingers of one hand and crosses over to the second hand, on which this is finger number one:

|       |        |           |
|-------|--------|-----------|
| mihin | apa    | wakpeškun |
| one   | finger | cross     |

The second current form is analyzable as follows: ‘[one] finger of the hand crossed [to the other hand]’:

k’ad kel wakpeškun  
hand finger cross

The same analysis applies, *mutatis mutandis*, to the forms 7–9. Note that none of these forms involves a morpheme 5, or more specifically an addend 5.

- 10 The form given by Von den Steinen, though not found in current usage, can be interpreted as follows, i.e. ‘all the fingers crossed [to the other hand]’:

yupun apa wakpeškun  
all finger cross

The first of the contemporary forms is analyzable as follows, i.e. ‘it finished the fingers of the hands’:

k’ad kel wanle-kan  
hand finger finish-?CAUS

The second follows the pattern of 6–9.

- 11 The form given by Von den Steinen contains as its first morpheme 1, and its second morpheme apparently the word pits’ ‘foot’, i.e. the sense is ‘one finger of the foot’. There is no morpheme meaning 10, nor is addition used. Von den Steinen’s forms for 12–14 follow the same pattern as his form for 11.

The contemporary form for 11 (and similarly for 12–14) is longer and is analyzable as follows: ‘it finished the fingers of the two hands, one finger crossed [to the foot]’:

huš k’ad kel wanle-kan, mihin apa wakpeškun  
two hand finger finish-?CAUS one finger cross

Given that k’ad kel wanlekan is attested in the meaning 10, one might analyze this as an instance of addition (10 + 1), but if so the order is larger–smaller.

- 15 The form given by Von den Steinen is unknown to us, as is its analysis, other than that the first word is the same as one form given by Von den Steinen for 5. The current form is analyzable as follows, i.e. ‘one [foot], five fingers’. (Recall that in k’ad kelan is the expression for 5.)

mihin, ine k’ad kelan  
one DEM hand finger-?LOC

16 The form given by Von den Steinen is unknown to us, as is its analysis, other than that the first part pits- is pits' 'foot'. The current form is analyzable as follows, i.e. '[having finished the fingers of the hands and] one [foot], [one] finger crossed [to the other foot]':

mihin, pits' kel wakpeškun  
one foot finger cross

The current form for 17 has the same structure, but with addition of the word for 'two', i.e. '[having finished the fingers of the hands and] one [foot], two fingers crossed [to the other foot]'.

20 Von den Steinen's form is made up of the morphemes 'foot' and 'finger'; the contemporary form is somewhat longer, viz. 'it finished the fingers of the foot':

pits' kel wanle-kan  
foot finger finish-?CAUS

The form nekatkelan for 20 seems to be an error; the same form is also (correctly) given by Von den Steinen for 5.

Given that the form for 3 does not involve addition, Von den Steinen's forms are not in fact a counterexample to Greenberg's generalization 27 (see (3) above).

Neither Von den Steinen's nor the modern forms for 6–9 involve a morpheme identifiable as 5, and so do not involve addition. However, the element wakpeškun 'cross' in reference to the hands (i.e. in the absence of a specific reference to the feet) does get interpreted as an instruction to add the specified numeral to 5, and thus in terms of Greenberg's cognitive explanation (see (4) above), it is the case that one has to wait for this element in order to gain an approximate idea of the magnitude of the number designated (in the range 6–9, or in the range 1–4), i.e. these formations have the effect of the smaller–larger order. But since no smaller numerals, in particular 3, have the order larger–smaller, Trumai remains consistent with Greenberg's generalization 27 (= (3)).

Essentially the same applies to Von den Steinen's forms for 11–14, which do not contain a numeral 10, although the use of pits' 'foot' is effectively interpreted as an instruction to add the specified numeral to 10, and the effective order would then be smaller–larger, but without violating generalization 27. The contemporary form for 11 seems interpretable as an instruction to take both hands (i.e. 10) and then add 1 to this, with the specification of the instructions in this order, i.e. effectively larger–smaller; this would thus be the lowest numeral with the order larger–smaller, and indeed, in keeping with generalization 27, no higher numeral has the order smaller–larger. The contemporary numeral for 16 receives a similar

interpretation, viz. an instruction to complete one foot (which implies prior completion of the hands, i.e. 15) and to add 1 to this.

D. Some other *potential* counterexamples

22. Malagasy (Sakalava dialect; western Madagascar)  
 lima-mpolo roe amby, amby telo-njato  
 5-10          2    +        +        3-100  
 50 + 2 + 300 = 352

(Dahl, Otto Chr. 1968. *Contes malgaches en dialecte sakalava. Textes, traduction, grammaire et lexique*. Oslo: Universitetsforlaget, p.14; “in pronouncing a number greater than ten, one begins with the tens, putting *amby* after the units but before the hundreds” [my translation — BC]; i.e. tens before units, but tens and units before hundreds)

23. Toba (of 16th century; Guaicuruan; Argentina)  
 a) nivoca    nalotapegat    nathedac  
      2           4                   1  
      (2 x 4) + 1 = 9  
 b) cacayni    nivoca    nalotapegat  
      2           2           4  
      2 + (2 x 4) = 10

(Forms as given by Alonso Bárcena, *Arte de la lengua toba* (16th century, reprinted La Plata, 1893: Talleres de Publicaciones del Museo de La Plata), as cited in J.W. McGee, 1900, Primitive numbers, in: *Smithsonian Institution, Bureau of American Ethnology, 19th Annual Report, Part 2*, Washington DC, 821–851, p.838. 9 has order larger–smaller, 10 has order smaller–larger. No other source for Toba seems to cite indigenous numerals above 6; the speakers that Harriet Klein (p.c.) worked with do not know indigenous numbers above 4. We have not yet been able to consult Bárcena, so it is not clear whether alternative orders were also possible.)

24. Tsez (Asakh dialect)  
 See (16) above; avoidance of order larger–smaller with 19 seems to have a phonological basis, though this does lead potentially to a system where 11–18 allow both orders, 19 allows only smaller–larger, numbers 21 and above allow only larger–smaller, i.e. the relation between 11–18 and 19 would be a counterexample.
25. Welsh (traditional 1)  
 teens    un ar ddeg, deu-ddeg, tri ar ddeg, pedwar ar ddeg, pym-theg, un ar bym-theg (i.e. 1 on 5-10), dau ar bym-theg, deu-naw (i.e. 2-9), pedwar ar bym-theg  
 20s      un ar hugain 21, dau ar hugain 22

- 30s deg ar hugain 30
- 40s un a deu-gain 41
- 50s deg a deu-gain (also: hanner cant ‘half 100’) 50, un ar ddeg a deu-gain 51, pym-theg a deu-gain 55
- 60s un a thri-gain 61, tri-gain a phump / pump a thri-gain 65
- 70s tri-gain a deg / deg a thri-gain 70
- 80s pedwar ugain a phump 85
- 90s deg a phedwar ugain / pedwar ugain a deg 90, pedwar ugain a phym-theg 95
- 100s cant ac un 100 and 1

(All relevant forms given in Bowen, John T. and T.J. Rhys Jones. 1960. *Teach yourself Welsh*. London: The English Universities Press, p. 109. Greenberg, op.cit, p.272: “in Welsh, as described by Bowen and Rhys (1960), for numbers up to and including 59, the smaller precedes the larger. From 61 to 99 both orders occur, while over 100 the larger precedes the smaller”. In fact, Bowen and Rhys Jones give both orders for 65, 70, and 90, but only the order smaller–larger for 61, and only the order larger–smaller for 85 and 95.)

26. Welsh (traditional 2)
- teens as under (25)
  - 20s un ar hugain ... naw ar hugain
  - 30s deg ar hugain ... pedwar ar bym-theg ar hugain
  - 40s dau a deu-gain / deu-gain a daw ... naw a deu-gain / deu-gain a naw [the form for 41 is not given]
  - 50s hanner cant / *lit[erary]* *occ[asionally]* deg a deu-gain / deu-gain a deg, dau a hanner cant / hanner cant a dau ... naw a hanner cant / hanner cant a naw [the form for 51 is not given; only forms using hanner cant are used for 51–59]
  - 60s un a thri-gain / tri-gain ac un ... naw a thri-gain / tri-gain a naw [the form for 66 is not given; for 63 and 65, only tri a thri-gain and pump a thri-gain respectively are given]
  - 70s deg a thri-gain ... pedwar ar bym-theg a thri-gain
  - 80s un a phedwar ugain / pedwar ugain ac un, ... naw a phedwar ugain / pedwar ugain naw [for 88, and only for 88, the variant pedwar ugain ac wyth is labeled “occasionally”]
  - 90s deg a phedwar ugain ... pedwar ar bym-theg a phedwar ugain
  - 100s cant a hanner 150 [this, lit. ‘100 and half’, is the only combination given]

(All relevant forms from Griffiths, Bruce and Dafydd Glyn Jones. 1995. *The Welsh Academy English-Welsh dictionary*. Cardiff: University of Wales Press. In summary, only the order smaller–larger is given for the 20s, 30s, 70s, and 90s; both orders are given for the 40s, 50s, 60s — with two unexplained exceptions having only smaller–larger — and 80s.)