

Mundurucu terms with arithmetical, geometrical and spatial content

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The following list of words (revised September 2015), established with the help of several informants who are native speakers of Mundurucu, updates the list published as Supplementary Online Materials in Dehaene, Izard, Pica, & Spelke (2006), Core knowledge of geometry in an Amazonian indigene group, *Science*, 311(5759), 381-384.¹

1. Arithmetical terms

1.1. Number words²

pũg ma one-FOC	One (literally: “exactly one”)
xep-xep xep-REDUP	Two
e-ba-pũg your- arm-one	Three (literally: “your (two) arms + one”)
e-badip-dip your-companion-REDUP	Four
pũg-põgbi one-handful	Five (literally: “one handful”)
xep-xep põgbi xep-REDUP handful	Ten (literally: “two handfuls”)
e-ba-pũg põgbi your- arm-one handful	Fifteen (literally: “three handfuls”)

1.2. Quantifiers and other expressions of quantity

¹ This work was done using the Topological Relation Pictures Series of Bowerman and Pederson (1992) supplemented by Socratic dialogs (cf; Véronique Izard, Pierre Pica, Elizabeth Spelke & Stanislas Dehaene’s (2011) supplementary material and psychophysics experiments (see Stanislas Dehaene, Véronique Izard, Pierre Pica & Elizabeth Spelke (2006), among others).

We thank Johan Rooryck and Jairo Saw for extensive discussions and insightful comments on the analysis of these terms. We will use the following abbreviations. ADV: adverbial, CAUS: causative, DEM: demonstrative, DIR: directional relative marker, DIST: distal, FOCUS: Focus, FUT: future marker, INDEF: indefinite, NEG: negation, PROX: proximate, REDUP: reduplication of the last syllable or a part of the last syllable, REFL: reflexive, REL relative marker.

² Previous research (3) has established that all terms refer to an approximate range of numerosities, with the possible exception of the first three number words, and that large number words (≥ 10) are rarely used.

pũg-pũg pũg-REDUP	Some
xêp-xêp xêp-REDUP ³	A little
a-de a-grate	Much
ade sũ a-grate rather	Rather much
ade ma a-grate FOC	Really much
ade jijã a-grate very	Very much
ade-de a-grate-REDUP	Very much
ade ģu a-grate-NEG	Few (literally: "not a lot")
ade'-ũm a-grate-NEG	Few (literally: "not a lot")
so-an so-REL	Everything
so-at so-REL	All, Every
bit Piece-Focus (literally: "as opposed to")	Amount
bit-ku amount-DEM	That size
pe-bit at-piece	Which size, quantity
Bu-ģũn line-similar	Extent, size, distance, time... (typically accompanied by two-hand gesture defining a certain extent)

³ There are two types of reduplication. Many lexical elements are obligatorily reduplicated, such as *xep-xep* 'two' or *je-je* 'above'. In such cases, reduplication expresses number and approximation. To this type of reduplication a second reduplication can be added to express multiplicity: *pũg pũg pũg* "a multiplicity of individuals", *xep xep xep* "a large number of equivalent pairs", etc.

pe-buḡũn at-line-similar- size/distance/time	Which size/distance/time
(i)-bũrũ INDEF-quantity	(Small) quantity (of), by extension ⁴ "some". ⁵
pe-bũrũ at-quantity	How much, by extension "how many"
xe-re near-re	More or less
xi-ri mother-fold	Very (high degree of something, by extension "much")
biḡ-(ma) pressure-FOC	Again, one more time, more
i-mu-wẽḡun INDEF-CAUS-equal.quantity	To put (the same quantity) on both sides (by extension: "to count to measure (something)")
i-mu-ade-de-m INDEF-CAUS-much-REDUP-Adv	To increase, intensify (something) (literally: "to make become many") (by extension: "to multiply (something)")
i-mu-’ẽ-’ẽ-ẽ-m INDEF-CAUS-time-REDUP-REDUP-Adv	To split, distribute (something) (literally: "to make become many times") (by extension: "to divide (something)")

1.3. Ideophones used in narrative contexts (uttered with a gesture indicating a variable extent)

Kiiih or Kih Kih Kih	Ideophone of variable duration, indicating a large quantity (numerosity, duration, or spatial extent). The duration of the syllable refers to the quantity depicted
Kuuuh or Kuh Kuh Kuh	Ideophone of variable duration, indicating duration or spatial extent. The duration of the syllable refers to the quantity depicted.

⁴ Whenever a meaning is provided ‘by extension’ in this section, it is important to underline that these meaning do not have any lexical counterparts in Mundurucu, where they correspond to lexical gaps. It is unclear at this point whether these extended meanings exist as distinct concepts for the Mundurucu.

⁵ The meaning of *bũrũ* as "quantity" is related to its other meaning "outcome of a story, denouement, ending". In other words, the notion of quantity is related to notion of sequence. The end of a sequence is viewed as expressing the range of a quantity.

Töööööö Ideophone of variable duration, indicating a small quantity (numerosity, duration, spatial extent). The duration of the syllable refers to the density of the stimulus.

1.4. Ordinal words

ko-ap indivisible-for	First
w-ap w-for	Before, ahead (literally “the one (who comes) ahead”)
no-mu-ju from-caus-go	After, behind (literally “the one (who comes) after”)
ãm-ap end-for	Last (Literally “the one (who comes) at the end”)

1.5. Comparatives

bo-di DEM-water	More (on the other side) (literally: “over there by the water”) (by extension: “more”)
i-buxi-m INDEF-doubt-Adv	Close to (something) (literally: “related to”)
i-jo’i INDEF-see-similar	Similar to (someone) (by extension: “equal”)
i-waru INDEF-different	Different
wegũn my-near	Same quantity, number, or distance than (literally: “on each side”) (by extension: “middle”)

2. Geometrical terms

2.1 Topology

dağ/tağ d-observe/d-observe	by, through
kuğ	In contact with
toğ	Through, by means of
teğ	Near, through

wûy Far

Directional

kay to, in the direction of

xe Close to, by the side of, in the presence of

2.2 Geometry

Geometrical figures

i-roy-ruy-'at
INDEF-flat-REDUP-REL Spherical object (by extension "circle"
(as a 2D projection of a spherical object))

i-waket-kut-'at
INDEF-circular-REDUP-REL Imperfect rounded object
(by extension: "circular shape or curved square" (as a 2D projection
of an imperfect rounded object))

Points, lines, angles

ko-ap Beginning (by extension : "start")
ko-DIR

cũg Straight (ahead)

i-bu-cũg Curve, line (literally "his straight finger")
INDEF-finger-straight

etako Side

ka-di Border, side
border-water (literally "bank (of a river)")

yabi Corner, top
head (literally: "head")

yabi-ta-rûg Sharp corner; (by extension: "angle")
head-seed-rûg

yarõg inside corner

yanõg outside corner

ta-rŭg-at
seed-rŭg-REL Sharp point, tip; (by extension: “angle”)

2.3. Metric Properties

Proportions

wedip	entire, complete
i'in i-son-FUT	small bit (of something) in a sequence, piece, (by extension “part”) (this meaning "small bit" is directly related to the other meaning of <i>i'in</i> , which is "the next, future, child of a woman": both meanings presuppose a sequence of pieces/ parts).
ipi-d-ase earth-d-above	Middle, half (literally “above the earth/ground”) (by extension: "(immutable) center", and "center of a circular shape")
ipi-d-ase-su earth-d-on-more.or.less	more or less in the middle
bi-d-ase mouth-d-above	Middle

2.4. Gradients (defined in relation to a Vertical and Horizontal axis)

Kaxi-je-m-ap sun/moon-REFL-for	Sun/moonrise (literally: “the place from which the sun/moon rises”)
kaxi-ac-ap sun/moon-ac-for	Sun/moonset (literally: “the place at which the sun/moon declines”), setting.
kaxi-cŭg sun/moon-straight	The vertical axis that can be drawn from the sun/moon to the ground, with the sun/moon viewed as a body ⁶ held upright (by extension, “zenith”)
kaxi-jodek sun/moon-bent	The slanted axis that can be drawn from the sun/moon to the ground, with the sun/moon viewed as a body in a slightly bent position as compared to its upright posture.
kaxi-cere-re sun/moon-bent-REDUP	The slanted axis that can be drawn from the sun/moon to the ground before setting or after rising, with the sun/moon viewed as a body in a bent position close to the ground.
kaxi-pi-teḡ	The horizontal axis that can be drawn from the sun/moon to the

⁶ The different positions of the body can be viewed as an abstract temporal sequence.

sun/moon-ground-close	ground, with the sun/moon viewed as a body lying on the ground, (by extension “moon/sunset, moon/sunrise”).
yabi-cūg head-straight	The vertical axis that that corresponds to a person or an object analyzed as a body standing straight.
yabi-jodek head-bent	The slanted axis that corresponds to a body or an object analyzed as a body that is slightly bent as compared to its straight position.
yabi-cere-re head-bent-REDUP	The slanted axis that corresponds to a body or an object analyzed as a body bent close to the ground.
we-ta-bi-ju my-eyes-mouth-in.contact	Horizon, vision (lit. 'at my eyes', at eye level)

2.5. Polar Sense & Direction (as defined with respect to a Depth axis)

To/from

be	In, at, towards
(be)-wi (from)-to	From (literally: “from (to)”)

Far/Not far

bo-di DEM-water	Outside, on the (other) side, par ext, far
i-jo-di INDEF-look-WATER	On this (my) side, par ext, near

Opposite lateral sides

i-ba-’at INDEF-arm-REL	Literally: “at the main (i.e. right) arm of a body or object analysed as a body” (by extension “on the right”)
i-ba-’at kadi INDEF-arm-REL side	Literally: “on the side of the main (i.e. right) of a body or object analysed as a body” (by extension “on the right side”)
i-ba-’at ũg INDEF-arm-REL NEG	Literally: “not at the main (i.e. right) arm of a body or object analysed as a body” (by extension “on the left”)
i-ba-’at ũg kadi INDEF-arm-REL NEG side	Literally: “not on the side of the main (i.e. right) arm of a body or object analysed as a body” (by extension “on the left side”)

Front/Back

dopa be face at	in front of (literally: “at his/its face”)
yakpida be nape at	behind, at the back of
yanõg pita be corner- anus-at	Behind, at the back of (literally: “to the anus corner”)

Above/Below

je-je above-REDUP	All above, on the top of
ase	Above
um	Above, high
di-ot(pe) water ot (at)	Below, under (literally: ‘to the place of the water)
ya-ka-be Cl –temples(at)	at his/its side (literally :to his/its temple)
di-ot-(pe) water ot (at)	Below, under (literally: “to the place of the water”)
ya-kaba-(be) Cl-temples (at)	at his/its side (literally: “to his/its temples”)

Upstream/Downstream

ti-a-kay water-a-to	Upstream (literally: “to the water”)
de-im de-your foot	Downstream (literally: “the place from which the water comes”)

2.6. Opposite sides (as defined in relation to a vertical axis)

i-be-ren ind-at-desire	High (from the point of view of the speaker), elongated (object)
a-pin a-desire	Low (from the point of view of the speaker), (short) non-elongated (object)

kabi kadi sky side	On the upper side (literally: “on the side of the sky”)
ipi kadi ground side	On the lower side (literally: “on the side of the ground”)

2.7. Adverbs and deictic (as defined in relation to an Horizontal/Vertical/Depth axis)

2.7.1. Directional adverbs

Distal

i-bo-ce INDEF-DIST-PRON	Away from location of speaker, thither (literally: “that place there”)
(i)-bo-di INDEF-DIST-water	Over there on that (other) side, through there (literally: “that place there by the water”)
i-bo-ma INDEF-DIST-FOC	In that direction

Proximate

i-jo-ce INDEF-PROX-PRON	Towards location of speaker, hither (literally: “on this side”)
i-jo-di INDEF-PROX-water	Towards this place here, hither (literally: “this place over here by the water”)

dup
dot

In flexible flat object form
In a natural conjunct form