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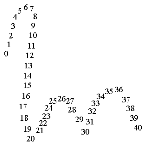
PSYC-1092 Cross-cultural psychology

Numbers and culture

(part 3)



Dr. Anna Samara

Lecture 5, 16/2/2021

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Q & A ON PRE-RECODED LECTURE

- Please go to Menti.com
- The digit code **94 84 69 5**

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So far …

- **Lessons from less "WEIRD" people:** **W**estern, **E**ducated, **I**ndustrialized, **R**ich and **D**emocratic people
- Cross-cultural research with remote, non-industrialized cultures is of paramount importance to infer universal properties of human thought (Henrich et al. 2010)

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Part 2: Learning outcomes

1. Describe a range of methods that can be used to investigate numerical cognition in remote cultures and its interdependencies with language
2. To describe cultural influences on counting preferences and finger counting use
3. To evaluate the claim that “we cannot think about numerical quantities for which we have no words”

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Learning counting in European countries

- **Base-10 system:** Decimal number system, which arranges the digits 0-9 into units, tens and hundreds, and so on.
- Most logical counting systems use words that reflect the structure of this system and have regular, straightforward rules
- Link between fingers and counting
  - E.g. recite the numerical chain, point to objects when counting, keep track of items in mental calculation, and probably also to understand the base-10 system

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Counting systems across the world

- Wide range of counting systems across cultures, varying in line with the environmental needs, both physical and social situations
- Lancy (1978, 1983). Extensive survey of counting systems in New Guinea (**225 languages**)
- **Four types of counting systems**
  - Type 1: Body-part tally system (12-68 body parts)
  - Type 2: Tally system using counters (e.g., sticks). Base number btw 2&5
  - Type 3: Mixed bases of 5 and 20 (e.g., 15 = 2 hands and 1 foot!)
  - Type 4: Base 10 system with several discrete number names

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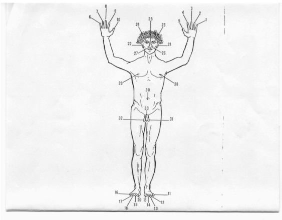
Yupno counting



- **1-5:** left hand
  - 1, 2, 3: distinct number words
  - 4: “2 + 2”
  - 5: “The finger with which one peels bamboo shoots”
- **6-10:** right hand
- **11-20:** feet
- **21-32:** symmetrical body parts designated 2 by 2, intermixed, to mark each group of 5

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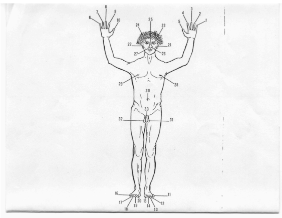
Yupno counting



- Individual variation:
  - < > 33
  - Number of intermediate body parts could vary
- Suggests that counting is done in face-to-face situations where variations can be taken into consideration
- Women: not supposed to count in public (or know the counting system)

Counting is a culturally acquired technique

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On language and arithmetic

Three views

1. Human competence in arithmetic critically depends on language faculty (Chomsky, 1988)
2. Arithmetic independent of language (i.e., evolutionary ancient capacity shared with animals) (Dehaene (1997)
3. “Innately rooted” yet deeply transformed once children acquire a system of number symbols (Wiese, 2003)

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Lessons from three indigenous populations

1. Piraha
   - Gordon (2004)
   - Frank et al. (2008)
2. Munduruku
   - Pica et al. (2004)
3. Tsimane
   - Piantadosi, Jara-Ettinger & Gibson (2014)

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Number cognition without words?

- Pirahã speakers
- Population of less than 200 living in small villages of 10 to 20 people
- Gordon (2004): evidence from three field trips (ranging from 1 week to 2 months), living with the Piraha
- Counting words: hói =1, hoí =2, baágiso = many

Table 1. Use of fingers and number words by Pirahã participant. The arrow (→) indicates a shift from one quantity to the next.

No. of objects	Number word used	No. of fingers
1	hói (= 1)	
2	hoí (= 2)	2
	aibaagi (= many)	
3	hoí (= 2)	3
4	hoí (= 2)	5 → 3
	aibai (= many)	
5	aibaagi (= many)	5
6	aibaagi (= many)	6 → 7
7	hói (= 1)*	1
	aibaagi (= many)	5 → 8
8		5 → 8 → 10
9	aibaagi (= many)	5 → 10
10		5

*This use of "one" might have been a reference to adding one rather than to the whole set of objects.

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Gordon (2004)

- Sample: 7 Piraha villagers
- Matching task: Involves placing tokens in one-to-one correspondence with individuals in group to be counted (i.e., analogous to counting)
  - designed to require some combination of cognitive skills such as the need for memory, speed of encoding, and mental-spatial transformations
- Objects familiar to participants (and available to experimenters!): sticks, nuts, batteries

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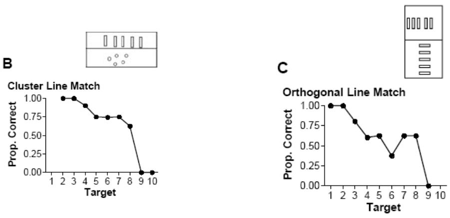
Gordon (2004)

Gordon (2004): Example tasks



Good performance with 1-3 items but 0% for the larger target set sizes in these tasks

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Gordon (2004)

Gordon (2004): Example tasks

Time constraints introduced

“Number comparisons”

Take home: Exact arithmetic on larger numbers that are both outside the small, exact system and outside the language is very hard to do
Raises the possibility that language is a prerequisite for precise numeration

Target

1v2 2v3 3v4 4v5 5v6 6v7
Target

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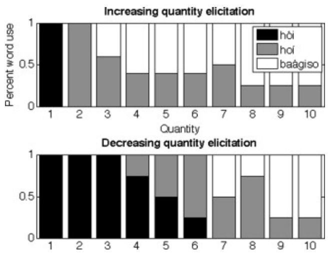
Exp.1

Frank, Everett, Fedorenko, & Gibson (2008)

- sets of spools of thread
- 1, 2, 3, … 10 cond
- 10, 9, 8, ….1 cond
- Proportion of hói, hoí, and baágiso produced by 6 Pirahã speakers



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Frank, Everett, Fedorenko, & Gibson (2008)

- Exp. 1: Words are much more likely to be relative or comparative terms (e.g. “few” or “fewer”) than absolute terms like “one”
- Not likely to be proto-numbers (numerals with approximate quantities, like “roughly one,” as suggested by Gordon, 2004)
  - Using “roughly one” word to refer to 6 seems unlikely given how misleading it is
- Exp. 2: Non replication of the Piraha’s poor on the exact matching task (effects of practice? instructions?)

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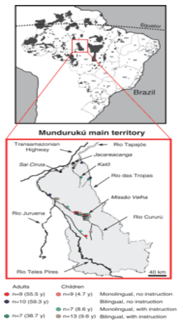
- **Another example of number cognition without words**
- Speakers in Brazil with little exposure to education and measuring devices
- Only exact numbers for 1-5
- 3: eba pug (2+1)
- 4 ebadipdip (2+1+1)
- BUT **eba** ebadipdip meaningless
- 5+ : ‘some’, ‘many’, etc



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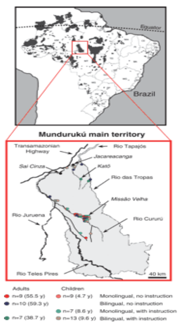
- **Another example of number cognition without words**
- Pica et al. (2004): Is exact vs. approximate calculation possible without numbers above 5?
- Dehaene et al. (2008): Are number-space mappings in the Mundurucu similar or different to those of Western adults?



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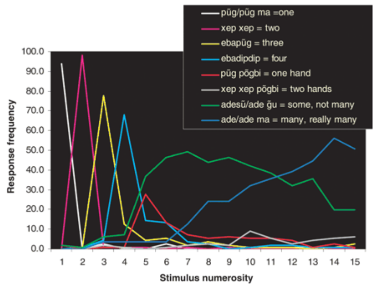
Their responses when shown a particular number of items and asked “how many”



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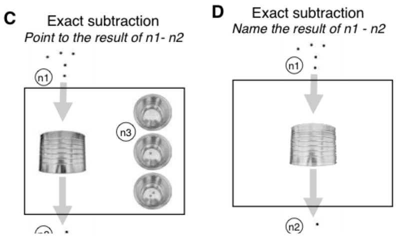
Exact arithmetic performance



worse than speakers who have an exact number system (though still better than chance)

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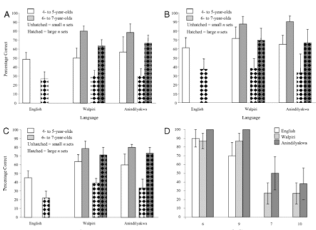
However…

- 2 groups of 4-indigenous Australian children vs. English-speaking controls
- **Tasks:** Memory for number counters; cross-modal matching; nonverbal addition; sharing
- **No evidence of language difference**



(Butterworth, Reeve, Reynolds, & Lloyd, 2008)

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Development of counting. Evidence from Tsimane

- Are children exposed to less counting data going through different stages of number learning?
  - Tsimane number words
    - Own number words for 1-100
    - For 100+, Spanish words used

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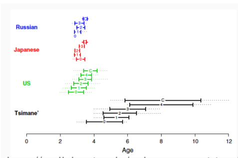
Piantadosi, Jara-Ettinger & Gibson (2014)

- the give-N task (Wynn, 1992)
  - 1-knower: understands 1, not 2
  - 2-knower, understands 2, not 3
  - No 5-knowers, i.e. children who understand 1 - 5, but not 6, 7, 8!



http://tedlab.mit.edu/culture_cognition.html

Same stages of number learning as children in industrialized countries, just delayed a few years

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Summary and conclusions

- **Evidence from less WEIRD people**
- Considerable variety in the amount and usage of words and other procedures that indicate numerical quantities.
- Helps elucidates the relationship between language and arithmetic
  - Effects of vocabulary size: Some evidence points to impaired exact calculations outside one's their number range (reliance on spared representation of large approximate numerosities)
  - But note opposing findings: Important to consider truly ecological validity, sets of instructions, limited *ns* etc.

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Part 2 reading

- Frank, Everett, Fedorenko, & Gibson (2008). Number as a cognitive technology: Evidence from Pirahã language and cognition. Cognition, 108 (3), 819-824
- Pica, P., Lemer, C., Izard, V., & Dehaene, S. (2004). Exact and approximate arithmetic in an Amazonian indigene group. *Science*, *306*(5695), 499-503.
- Wassman, J., & Dasen, P. R. (1994). Yupno number system and counting. *Journal of Cross-Cultural Psychology*, *25*(1), 78-94.

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