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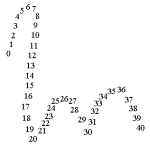
PSYC-1092 Cross-cultural psychology

Numbers and culture

(part 1)



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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Roadmap of today's lecture

- Numbers and how they are represented in the cognitive system
- Numerical experiences are shaped by culture
  - Reading habits
  - Educational systems
  - Intensity of training/learning strategies (extra study slide)
  - Spoken language differences
  - Written language differences

Cognitive psychology perspective

Ethno-mathematics

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Part 1: Learning outcomes

1. Define the term numerosity
2. Present evidence in support of the view that numbers are represented on a mental number line
3. Evaluate how reading habits may influence numerical cognition
4. To describe cultural influences on arithmetic task-induced changes in brain **(extra study slide)**

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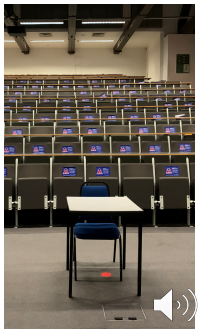
An everyday essential....

- Doublechecking what room I am teaching in
- Ordering one coffee and paying the exact price
- Getting the right bus number
- Printing the correct number of handouts
- Checking what the time to have a 15 minute break



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We use numbers to...

- Label things

- Order things

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Numerosity

- **'How many things in a set'**
- Understanding this concept involves understanding:
  - Sets of things (not necessarily visible) have numerosities
  - Numerosities can be altered by combining/removing subsets etc
  - One-to-one principle: Two sets have the same numerosity if and only if members of each can be put in 1-to-1 correspondence with none left over
  - Magnitudes are different to numerical orders ("he came first") and semantic labels (call "999")

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- The study of how humans (and nonhumans) perceive, represent and compute **quantities**
- An impressive human achievement
- A fairy recent human achievement (Ifrah, 1998)

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How are numbers represented?

- Key characteristics of our mental representations of numerosity (e.g., extracted from arrays of visually presented objects)
- Insights from relevant methodologies

1. Counting experiments
2. Comparison experiments

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Count the dots shown on the page as quickly as possible

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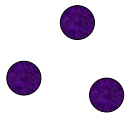

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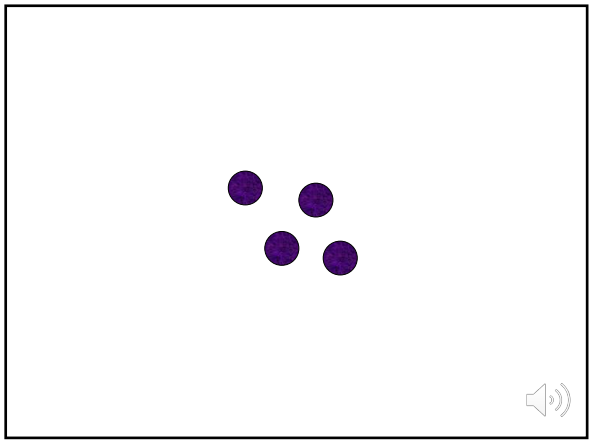

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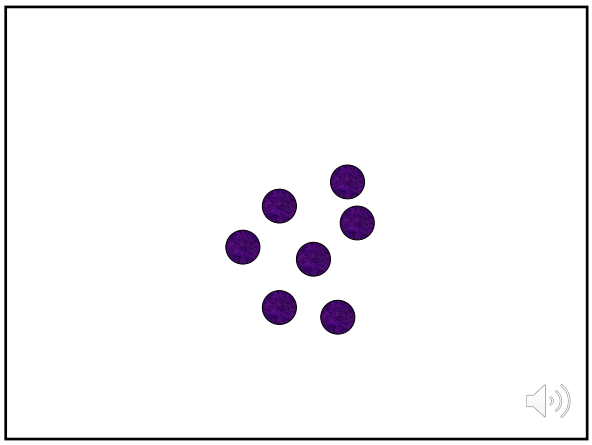

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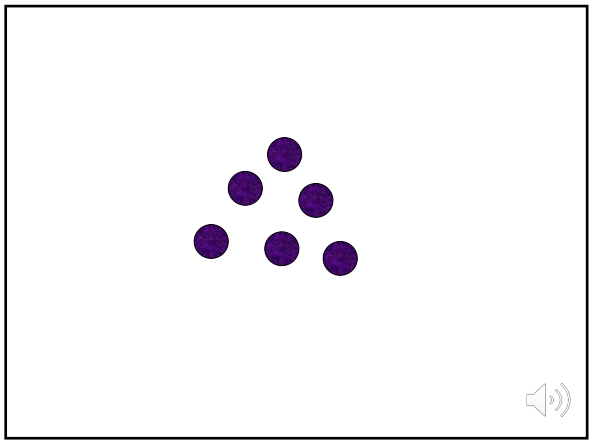

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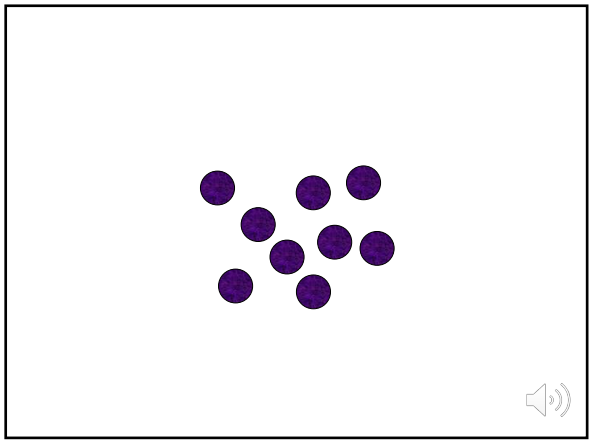

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- Easy!
- But gets harder after 4…
- Differences in numerical abilities for numbers within the **subitizing range** (up to 4) and numbers above the special number 4 (**counting range)**

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Which side has more?

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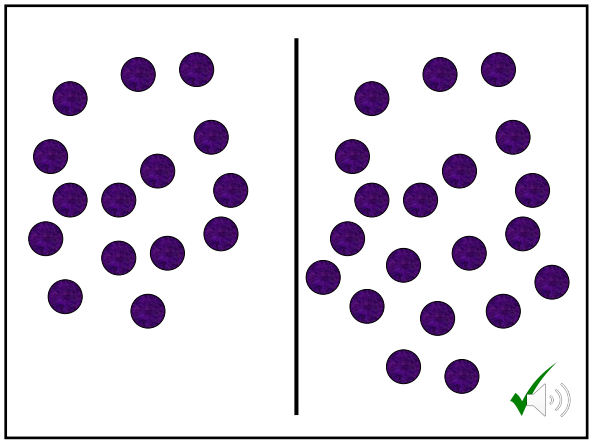

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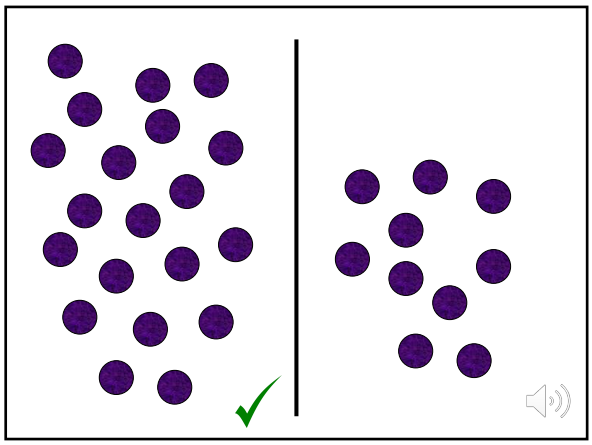

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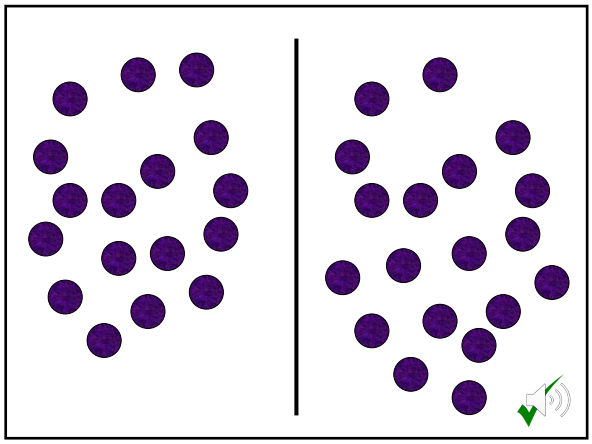

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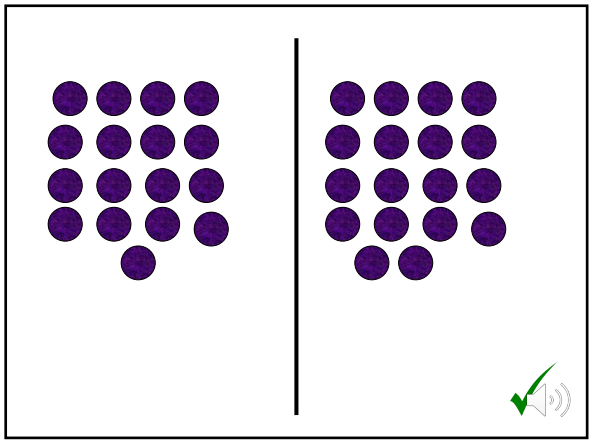

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- Possible to get it right without needing to actually count the dots
- Response speed depends on a) whether numerosity is correlated with other continuous quantities (e.g. how much space the dots take on a screen)
- Response speed depends on a) the ratio of the difference (e.g. 1:4 harder than 1:10 ratio)
- This is called “Weber’s law”

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To sum up….

- We are able to extract both exact and approximate numerosities using two different cognitive systems (e.g. dissociated in patients with acalculia)

1. Exact system
   - Subitizing range: fixed upper limit (‘4’)
   - Numbers above 4 are counted at a processing time cost that is linearly related to the set size
2. Approximate system (has no size limit) but represents numbers only approximately
   - Subject to Weber’s law: our sensitivity to changes in numerosity depends on the discriminability ratio

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A third system?

- Underlying the use of quantifiers, number words, and verbal counting
  - Link with language (thus, most likely to be affected by culture)
  - Arabic numerals: "Which one is bigger, 8 or 5?"
- Much evidence to suggest that the cognitive interpretation of number symbols links back to the quantities they represent.
  - E.g., shorter time needed to compare numbers 'further apart' (8 vs 1 relative to 8 vs 7) (distance effect). **This has been taken to suggest that we represent numbers spatially in a number line**

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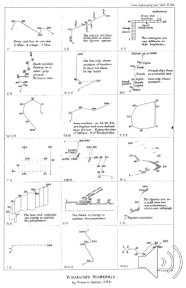
The Mental Number Line (MNL)

- Close your eyes and imagine the number the numerical sequence 1-30. What do you see?
- When asked to think about numbers, people often activate a mental number line (MNL), ***oriented left to right***
- Early illustrations of number lines date back at least to the late 17th century (Galton, 1881; *The Visions of Sane Persons*)



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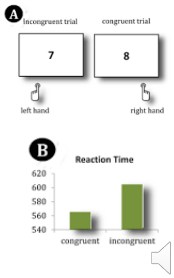
MNL: experimental evidence

- **Spatial Numeric Association Response Code Effect (SNARC):** Western adults asked to perform an odd/even judgment task, respond faster to small numbers with their left hand and large numbers with their right hand (Dehaene et al., 1993)
- Similar findings when people are asked to producing random numbers during left vs. right head turning (Loetscher et al., 2008)



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Is this mental number line characteristic shared universally across cultures?

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