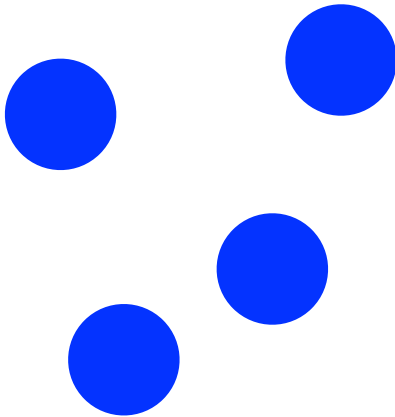


Folk mathematics

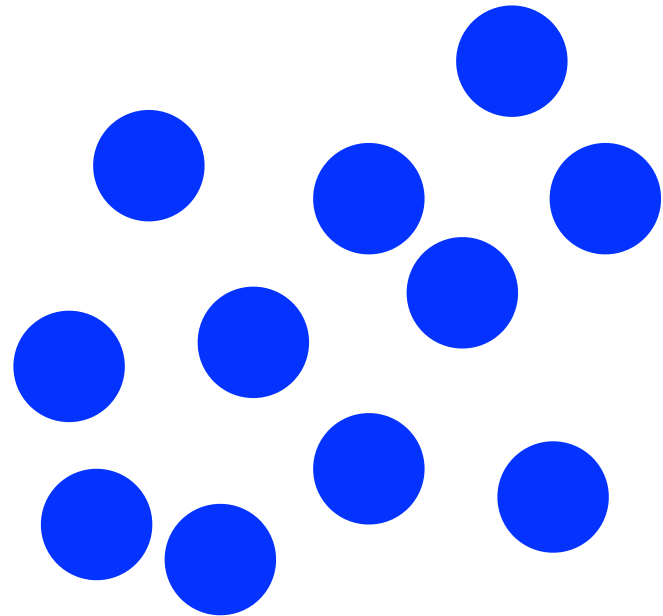
- “*God created the integers, all else is the work of man.*” - Leopold Kroeneker
- Quantity, comparison (greater/lesser)
- Number vs. continuous quantity
- Counting principles
 - Counting words: one, two, three, ...
 - Principle of isomorphism: a one-to-one correspondence between numbers and items to be counted
 - Cardinality principle: #items is last word in counting sequence
 - Recursion / no largest number

Subitizing

- How many dots?



4



11

Subitizing vs. counting

- Some studies of enumeration performance suggest a **qualitative change** in enumeration procedures at about $n=4$

- Below $n=4$, enumeration appears to be **perceptual**: you can “see the 4-ness”

This is called **subitizing**

In some accounts it is attributed to the **allocation of attentional indices**

- Above $n=4$, enumeration depends on **counting**, and both number of errors and RT increases with n .

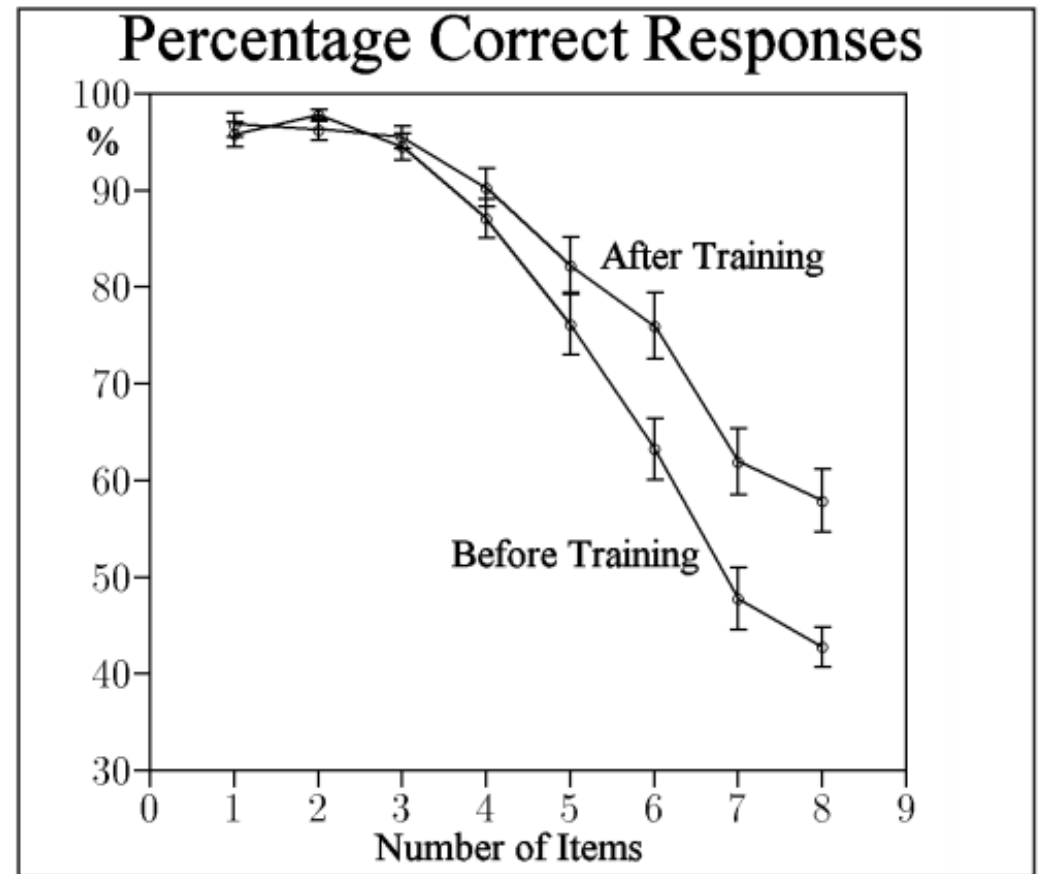


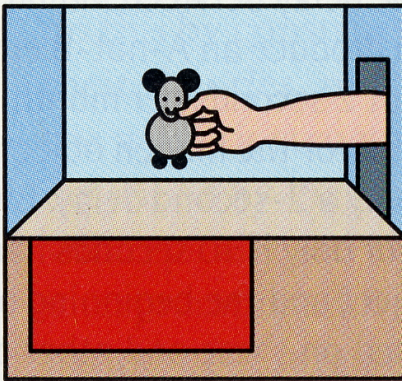
Figure 1: Percentage of correct responses as a function of the number of items before and after the training. Data from age group 2. Here and in the following figures the vertical bars represent standard errors.

Exact vs approximate number systems

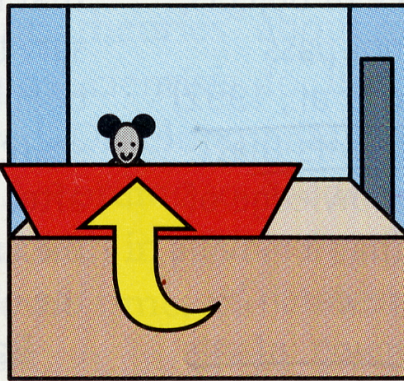
- There may be two distinct systems for understanding quantities:
 - An **approximate number system**, suitable for guessing rough quantities
 - An **exact number system** based on **counting**
- The exact number system is acquired much later by children

Do infants understand addition?

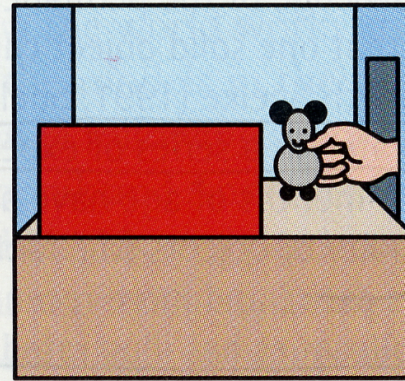
1. Object placed in case



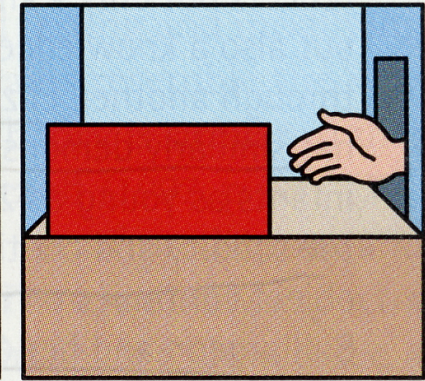
2. Screen comes up



3. Second object added

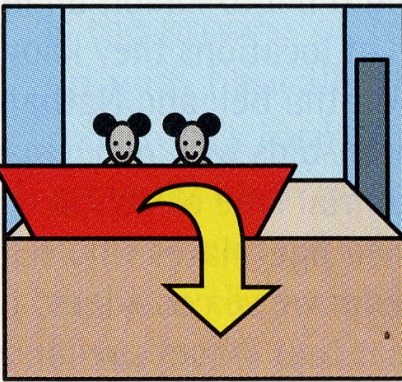


4. Hand leaves empty

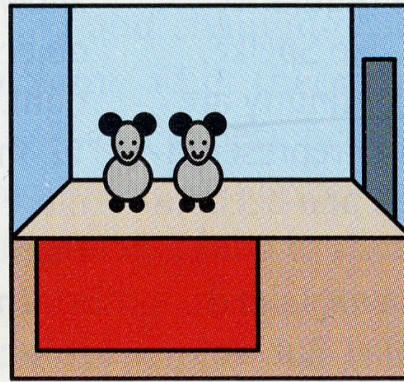


Then either: possible outcome

5. Screen drops...

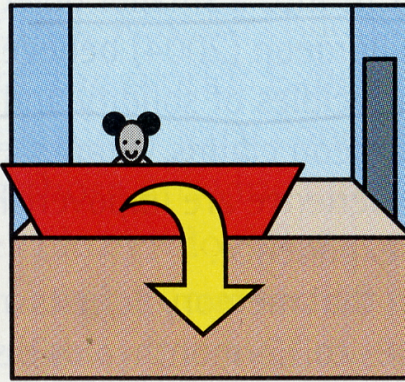


... revealing 2 objects

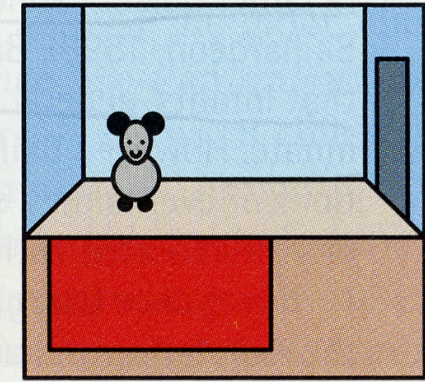


or: impossible outcome

5. Screen drops...



... revealing 1 object



Wynn, 1992

What about monkeys?

- Monkeys (macaques) were taught the numeric meaning of number symbols
 - They learned to choose the symbol indicating the quantity of reward
- Then they were taught an addition symbol
 - Subsequent choices indicate they partly understood it, e.g

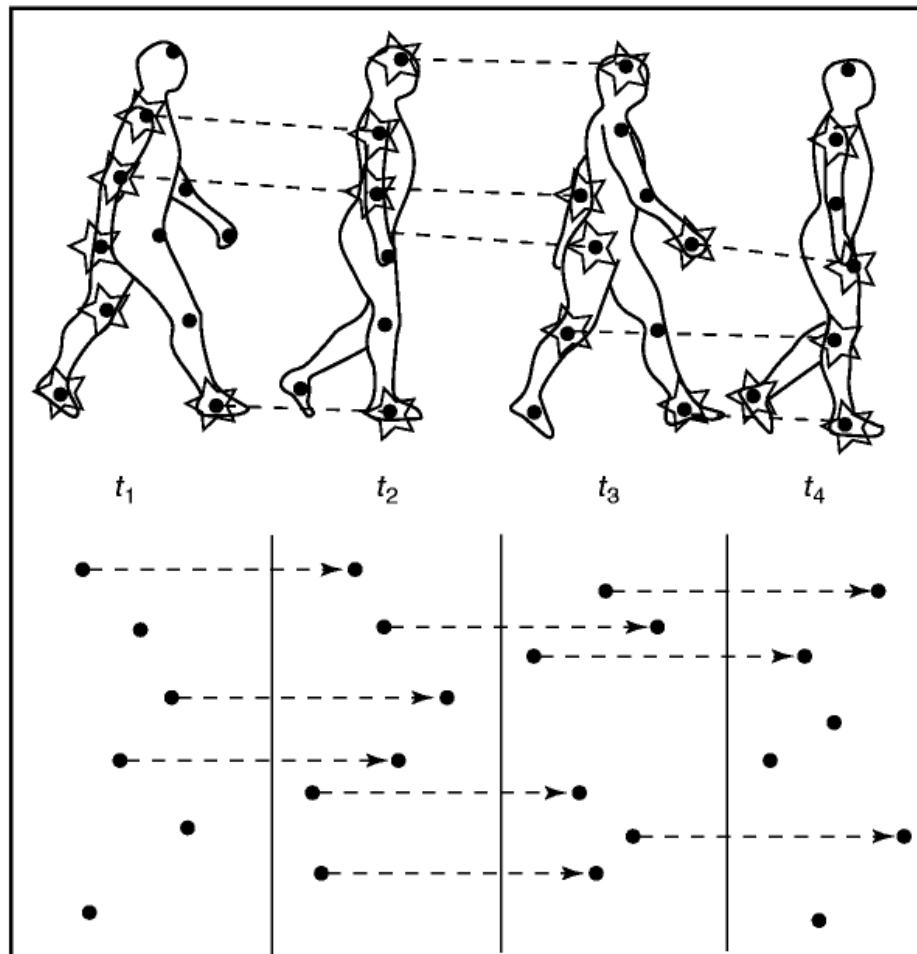
$$7 + 3 > 5 + 4 \text{ but } 8 + 4 > 7 + 6$$

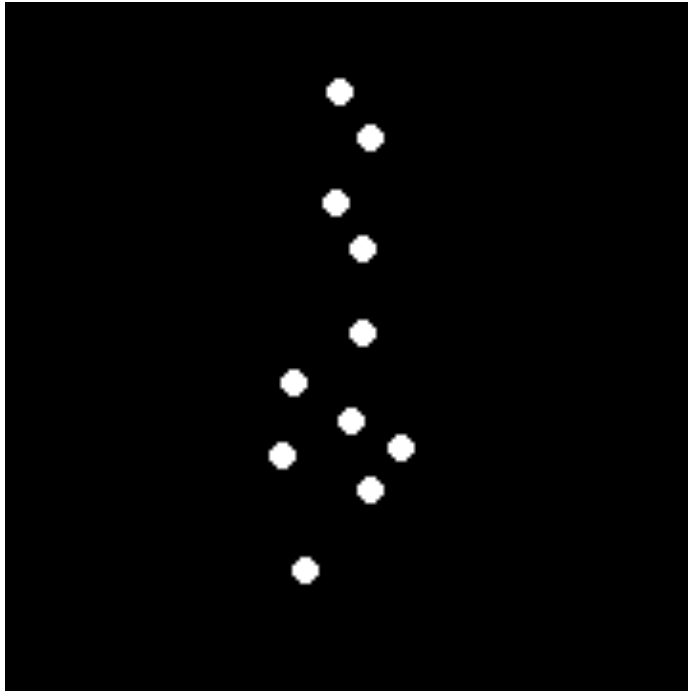
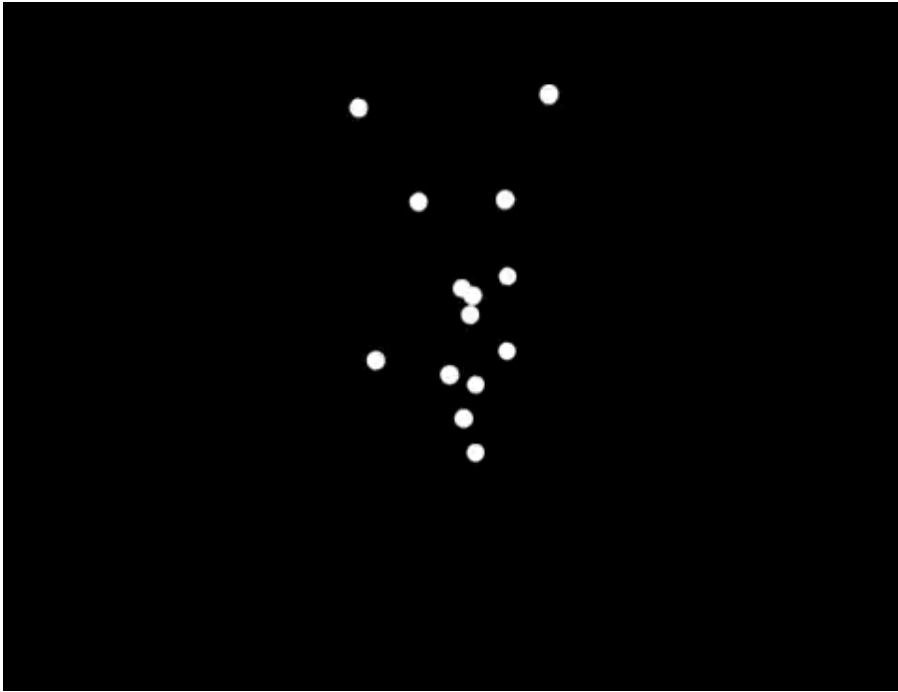
- The implication is that quantity estimation is partly innate

Folk biology

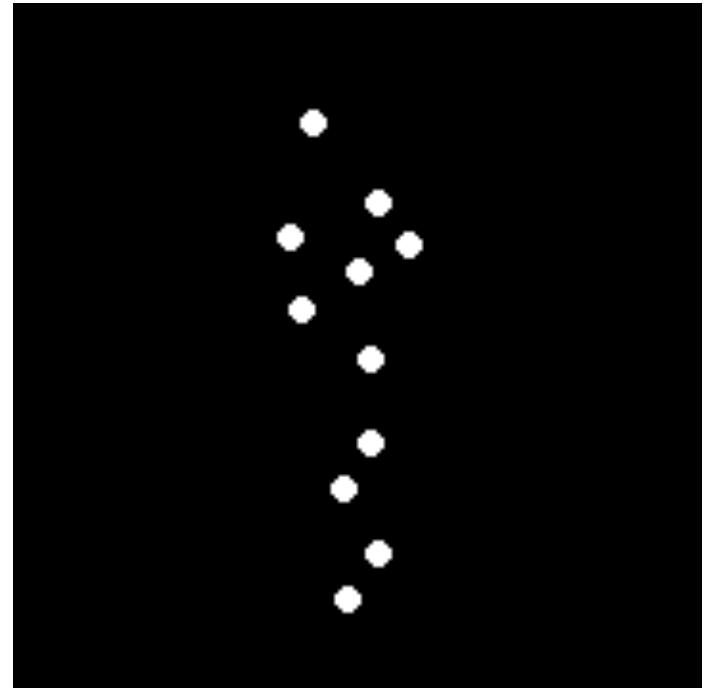
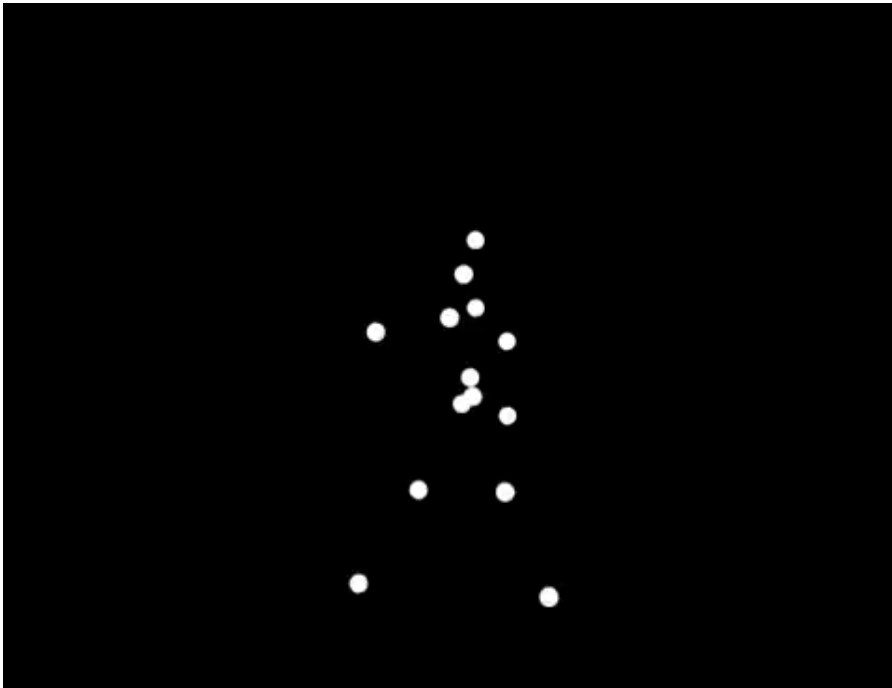
- Life vs non-life - **vitalism**, **essentialism**
- Life cycle - infancy/adulthood/death
- Animacy
 - Some patterns of motion are perceived as indicating “life”
- Biological motion

Biological motion (Johansson, 1973)





Biological motion



People have an innate (?) ability to parse joint motion as human movement

Folk psychology

- The intentional stance (Dennett)
- Theory of Mind (ToM)
 - Other animate agents have beliefs, goals, mental states, subjective experience
 - Their beliefs may differ from mine, and from the truth
- False-belief tasks (“Sally-Anne task”)