A Brief History Of Numbers

Pop Science Symposium



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Did counting have to be invented/discovered?

- Numbers are ubiquitous in our modern lives, prices, distances, measurements, time, etc.
- It can be hard to forget that counting was a skill we all had to learn, not something we always possessed, like reading.
- But where did it come from? Is it a natural thing humans developed? Can animals count or did we alone evolve it/ discover it?

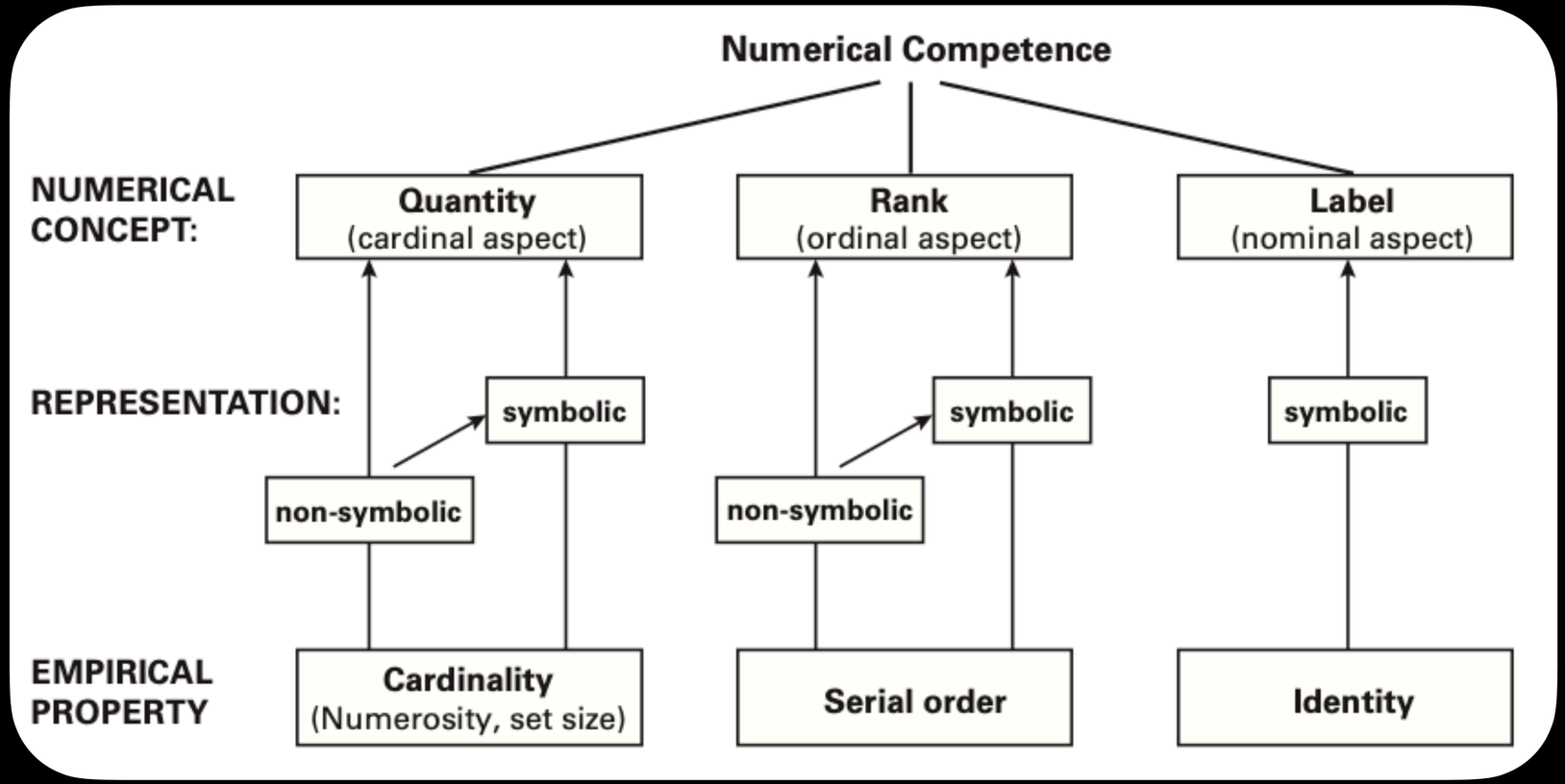




What are numbers?

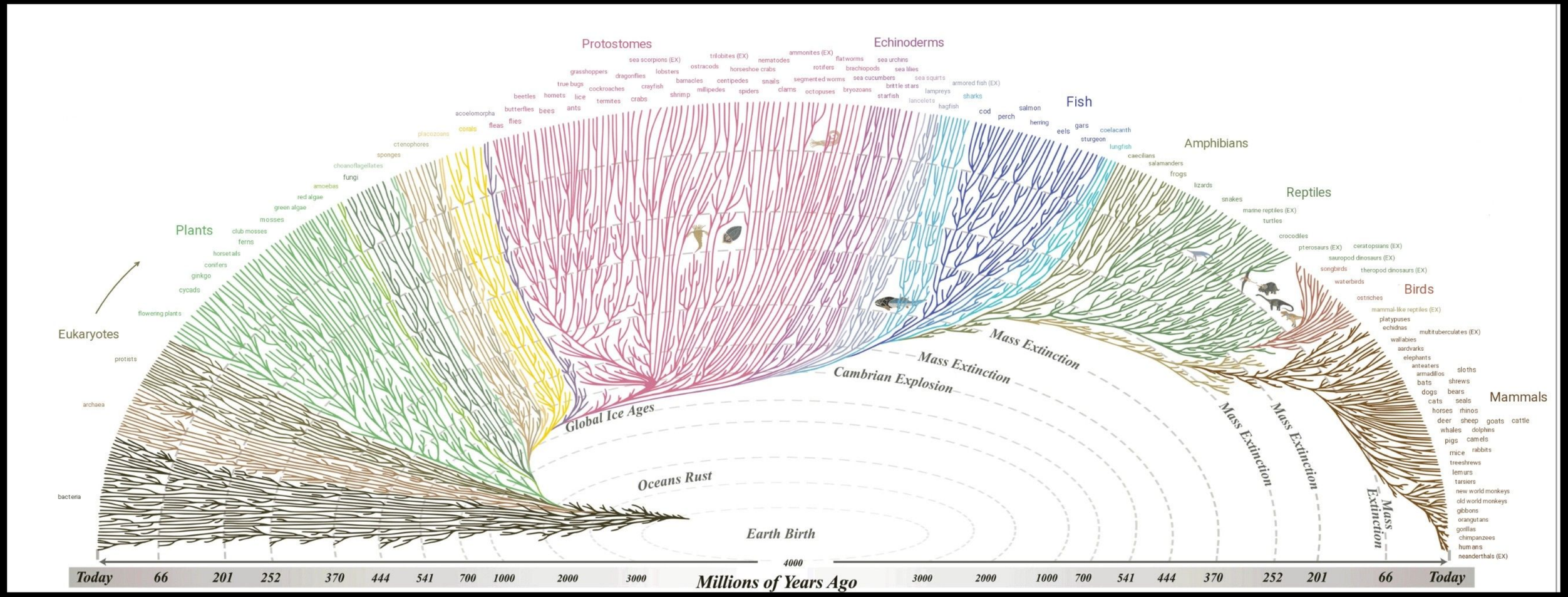
Before we discuss the origin or numbers, we need to define what they are

- It took Bertrand Russell about 200 pages to prove 1+1=2
- We will be using a much simpler definition, and confine ourselves to just the natural numbers
- When we think of numbers, we usually think of the words or the symbols, but they are more than that, the abstract ideas of quantity and rank



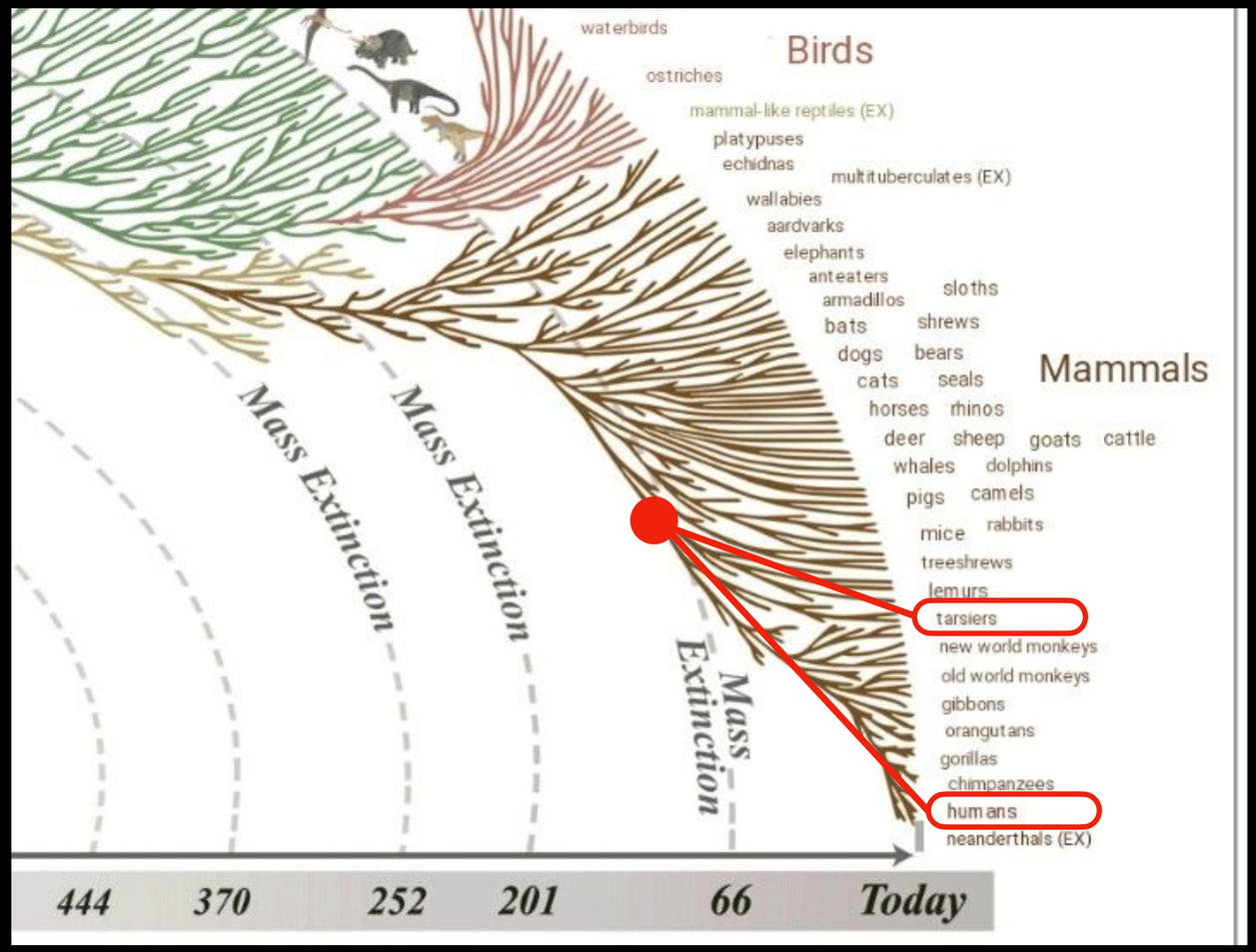
When did counting first evolve?

Evolutionary traits pass forward. If species A and B have a common trait and they are related, its likely a common ancestor was the origin



Where did counting first evolve?

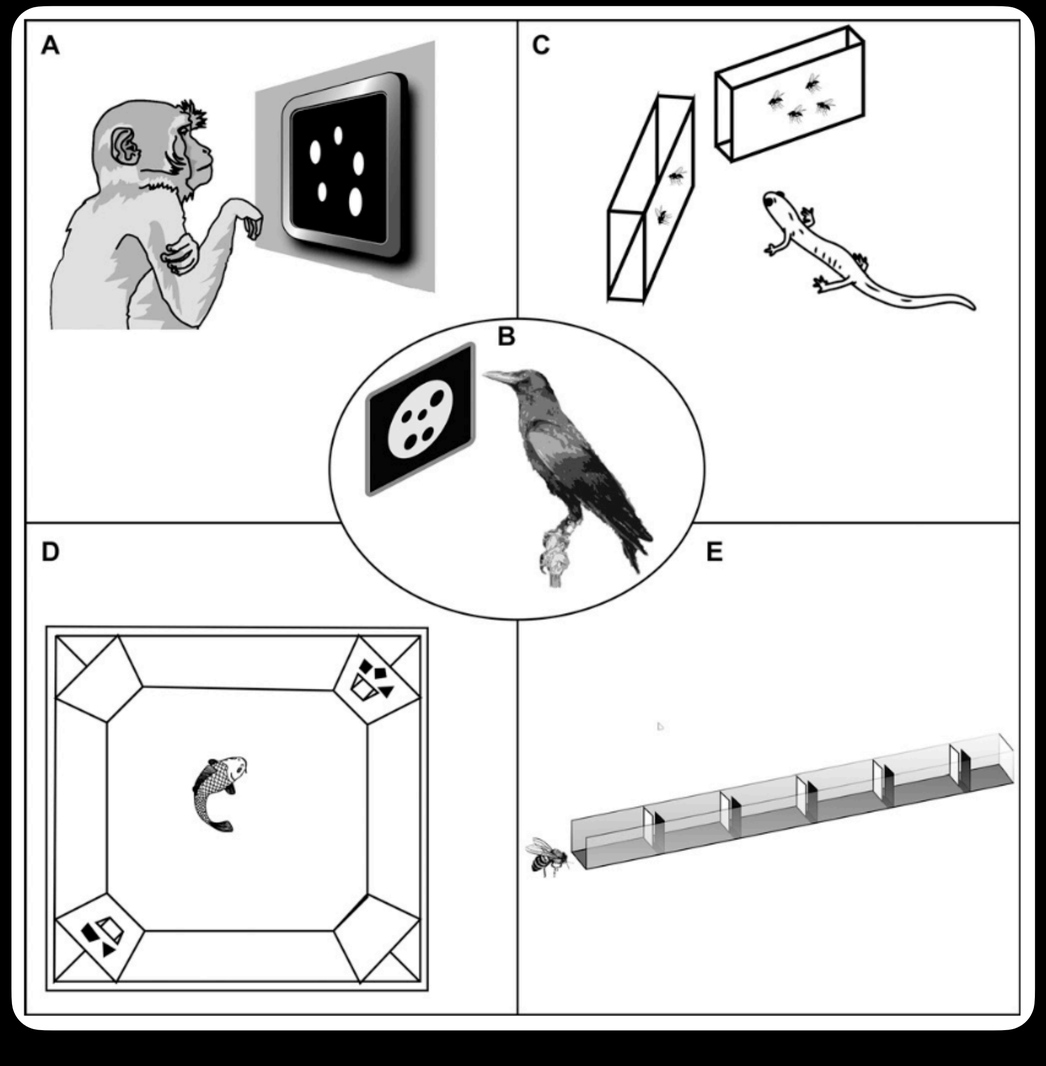
For example, if both treeshrews and humans could count, we could trace the origin of the skill to a common ancestor

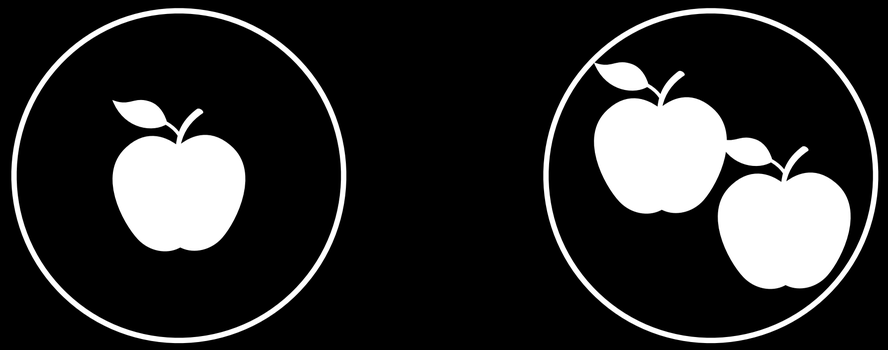


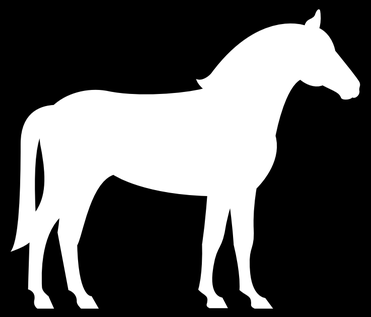
How do you figure out if animals can count?

Hint: you can’t just ask them (I mean you can but don’t except an answer)

- Figuring out if an animal is capable of counting is surprisingly tricky
- You need to place them in situation where the capability makes it self shown
- The common way to do this it the **spontaneous- choice test**







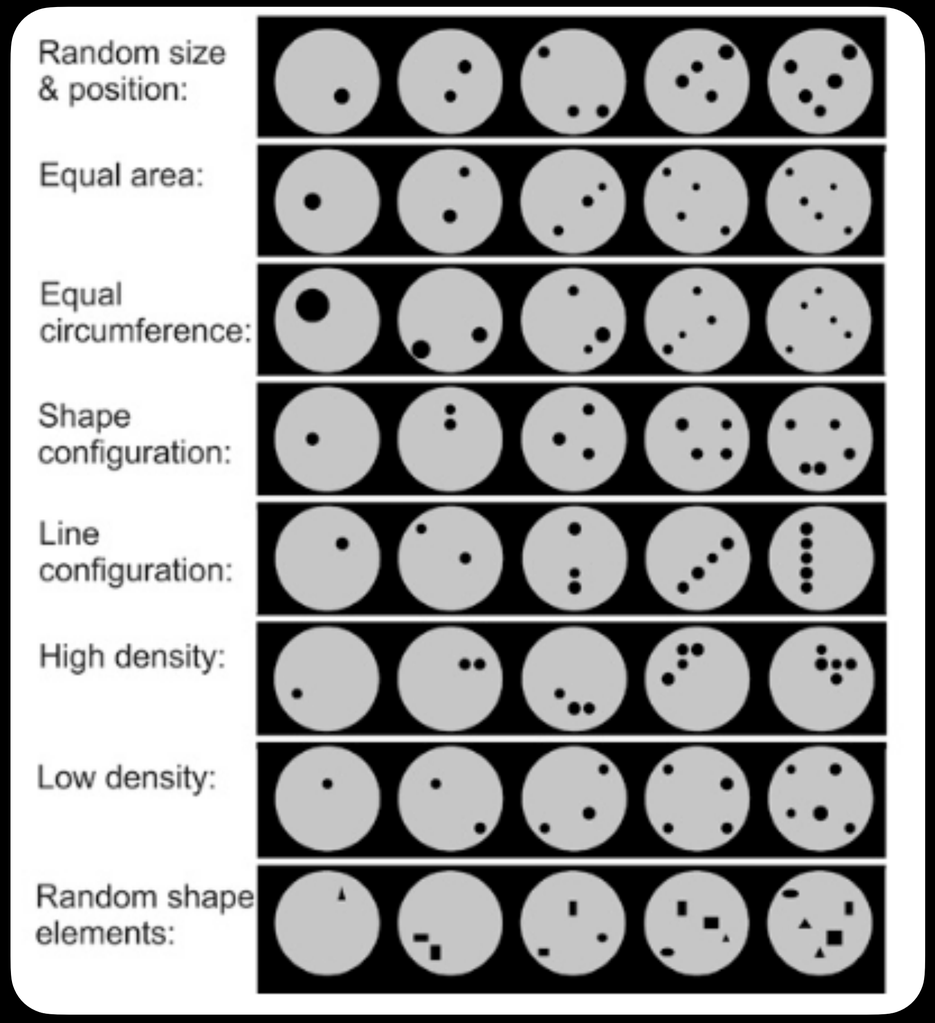
Spontaneous-choice test

Present an animal with a quantity based cho

- For example say you present a horse with two tables, one with one apple, the other with two
- The horse will, if it can count, go to the table with more apples, thus showing it can count
- However there are problems:
  - Maybe 1 apple is bigger than the other 2
  - Maybe the 1 apple is more luscious, smells better, or has some other quality

Controlling for other factors

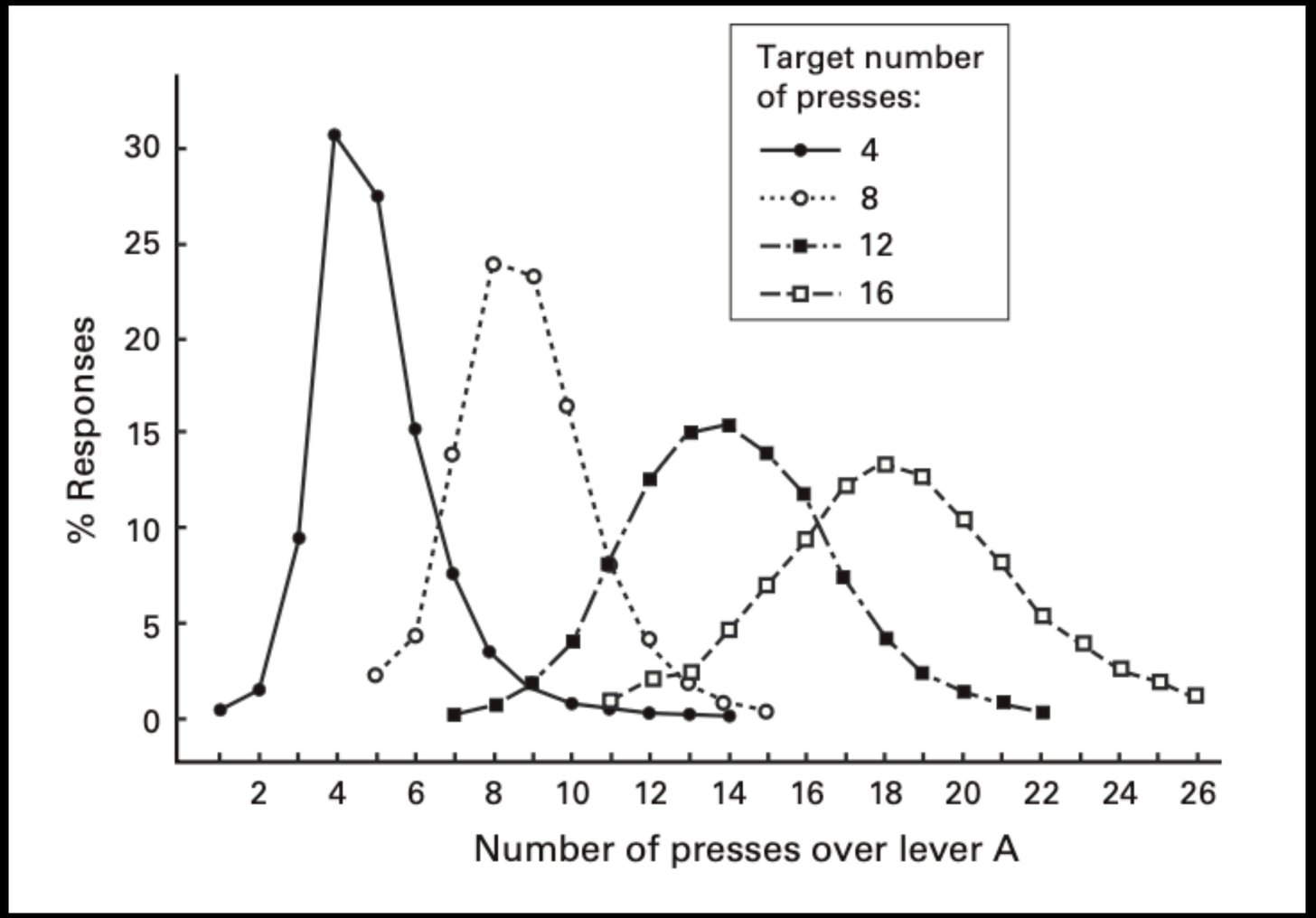
A lot of time and consideration goes into reducing other factors that could effect the result





Number Sense

What are the results of the experiment, can animals count? Well sort of



So animals posses an innate number sense, but what about people?

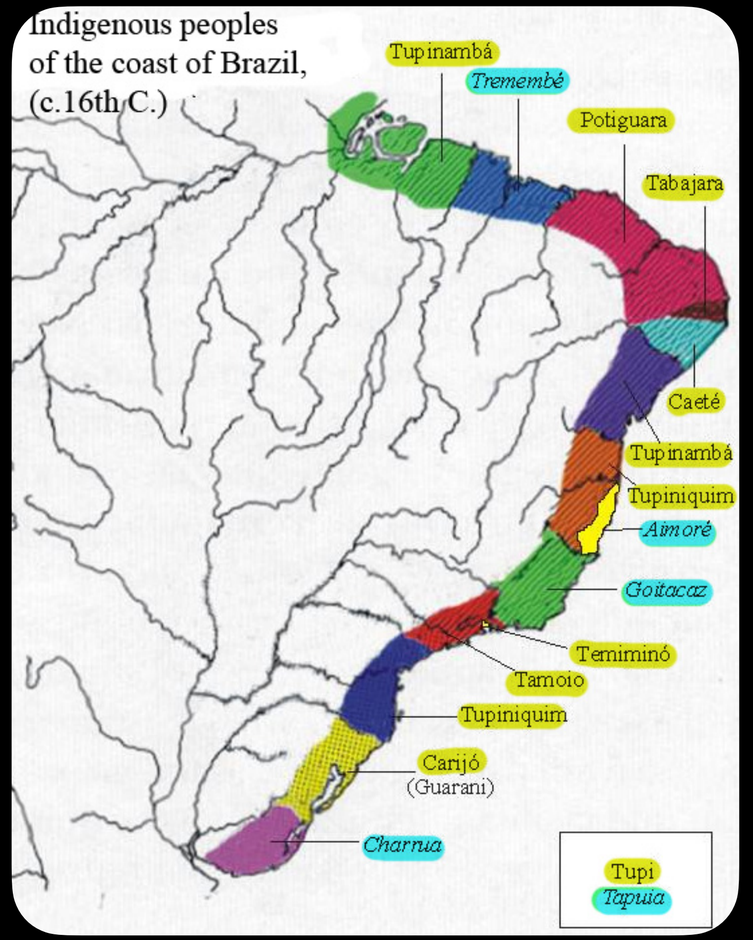
Do we have a better innate sense that lets us count then?

The Munduruku People

An indigenous tribe of Brazil



- They only have words for the number 1-5: “pug,” “xep xep,” “ebapug,” “ebadipdip,” and “pug pogbi,”
- Beyond that the concept of many is used
- This is a common finding of tribes across the world, where they will often have words for one, two and many.
- This pattern would indicate that counting then is not a built in ability to humans’
- But just because they don’t have word for more numbers doesn’t prove they can’t count



One

Two

Many

The Line test

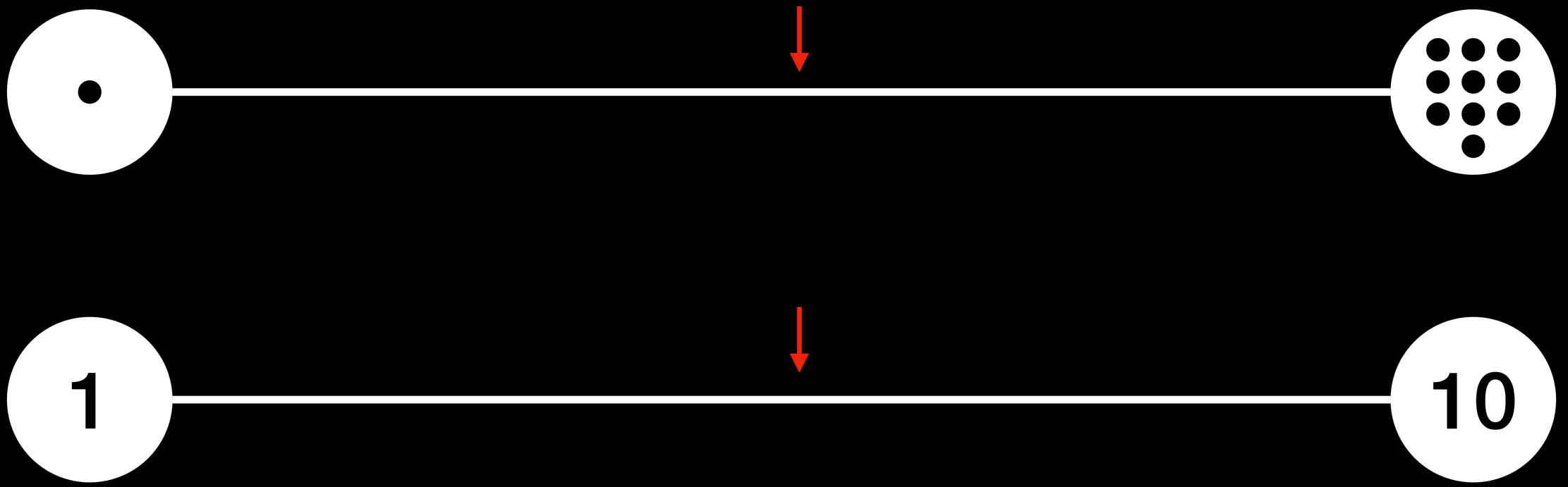
How do you visualise numbers / quantities?

Present a line with two ends with a quality on each end (numbers or dots)



The Line test

Then ask where a value lies on the line. For example, where is 5?

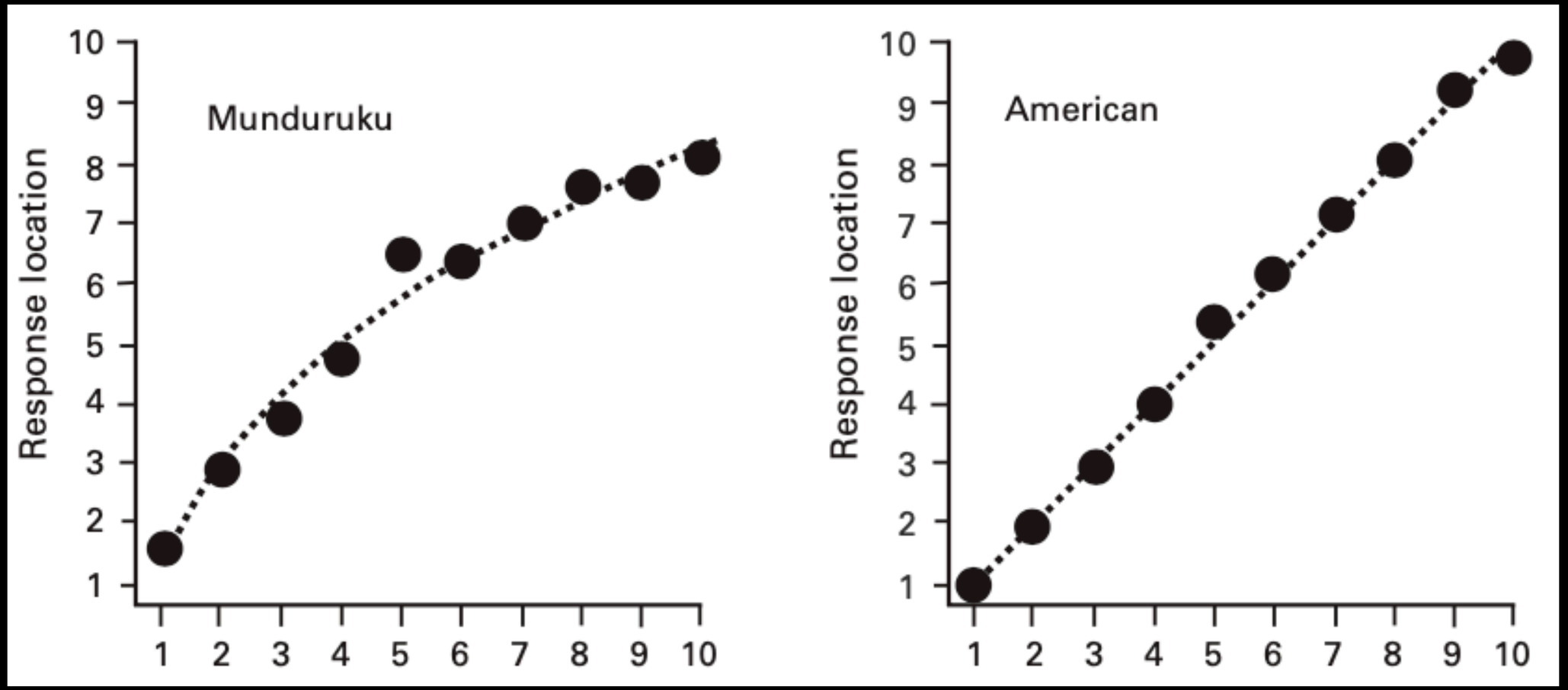


The Line test

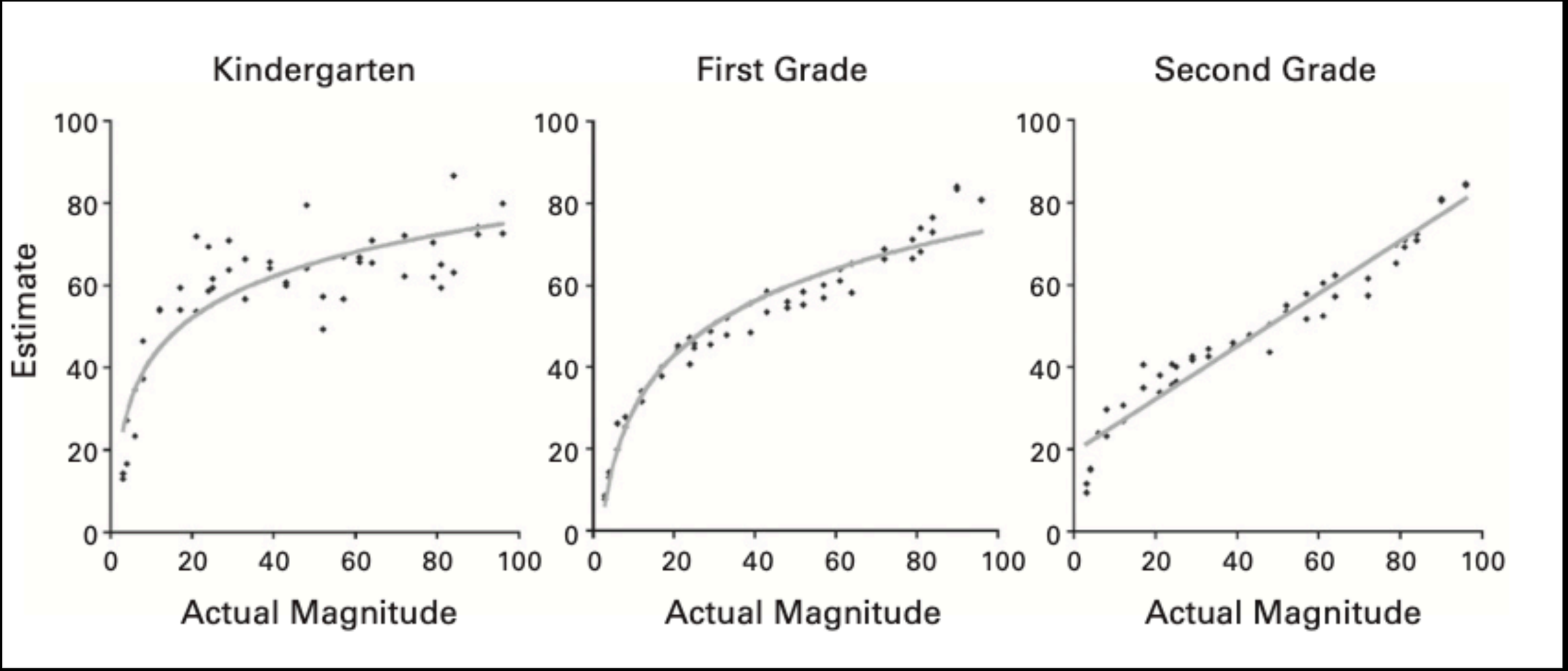
But gets harder the more precise and larger the value. Where is 7.654



The results


Munduruku
Response location
1
2
3
4
5
6
7
8
9
10
American
Response location
1
2
3
4
5
6
7
8
9
10

This has further been found in western countries, with children showing the same behaviour



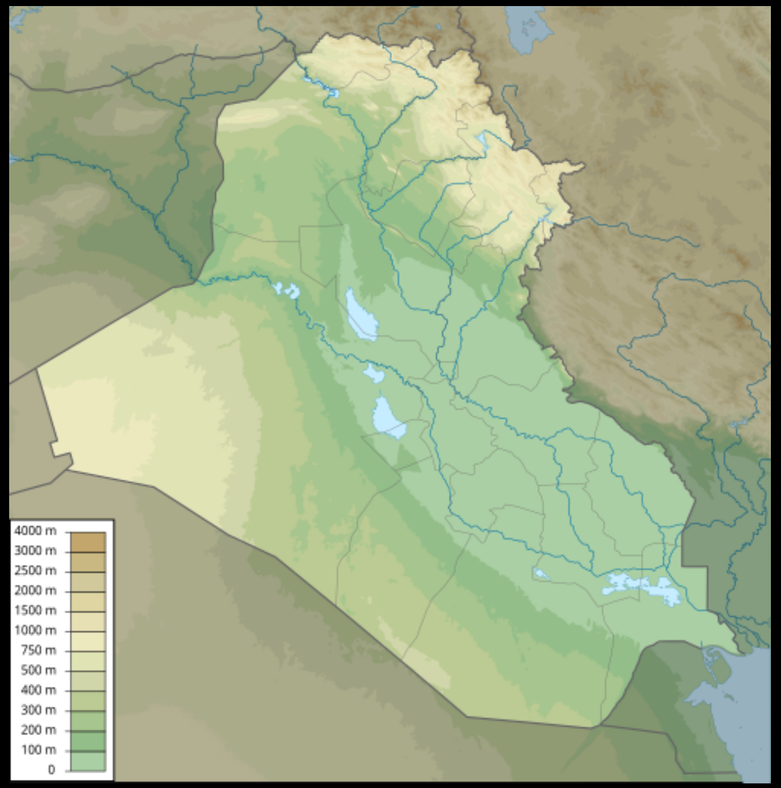
Numbers are not an intuitive thing, but something humans discovered and passed down?
But where was it first discovered?

This in turn is no longer a biology question but a history question.

- We can no longer rely on tests, but instead need to find artefacts and writing which in turn provide evidence
- So then where was writing first invented?
- Writing was indecently discovered all across the world at different time, but Uruk Mesopotamia was first







Abstraction, Writing, and Counting











Extended Reading

- The Universal History of Numbers: From Prehistory to the Invention of the Computer by Georges Ifrah
- A Brain for Numbers: The Biology of the Number Instinct by Andreas Nieder
- Beyond Measure: The Hidden History of Measurement from Cubits to Quantum Constants by James Vincent