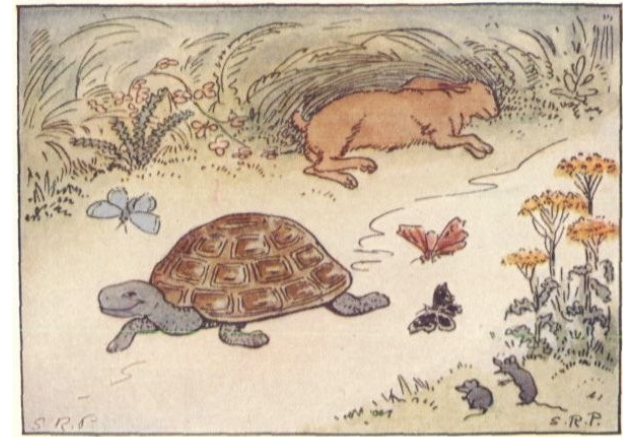# Distributions and samples

Andy Wills

Animal racing!

Your group will need:

- One toy animal *each.*
- Four dice *per group.*
- One 30cm rule *per group.*
- One "start" and one "end" marker *per group.*

THE TORTOISE AND THE HARE

https://commons.wikimedia.org/wiki/File:The_Tortoise_and_the_Hare_-_Project_Gutenberg_etext_19993.jpg

How to play

1) Put the **start marker** at one end of the table.

2) Measure 45cm from that and place your **end marker**.

3) Put your toy animals on the starting line.

4) On your turn:

   1) Roll four dice, add up the score.

   2) Move your animal forward that many centimetres.

   3) Record you score **on Mentimeter.**

5) First person past the line wins!

Details, details...

- Put the front of the animal at the front of the start line.
- Measure your distance from the front of the animal.
- If your animal accidentally gets knocked, put it back.

Question

Is any number on one dice more likely than any other?

Distribution on a single dice

1 : IIIIIIII

2 : IIIIIII

3 : IIIIIIIIII

4 : IIIIIII

5 : IIIIIIII

6 : IIIIIIIII

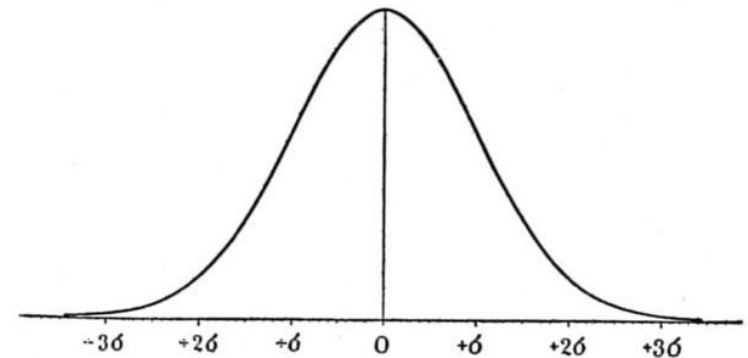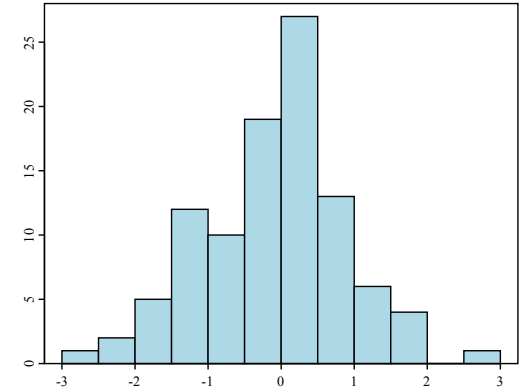Does the **mentimeter** distribution look like this?

Why / why not?

Central Limit Theorem

If a total score is the sum of a bunch of different scores, it will have approximately the same distribution **whatever the distribution of the individual scores.**

A *theorem,* not a *theory*.

Known as a *normal* or *Gaussian* distribution.

Exam hall bingo!

- Two groups of the students, the **blues** and the **pinks,** take an exam.

- I'll show you one exam score at a time.

- Without a calculator and without pen and paper, try to work out which group scores higher on exams, on average, **and enter your answer into Mentimeter**.

- *Do this as quickly as possible,* BUT

- **Don't stop until you are sure you have the right answer.**
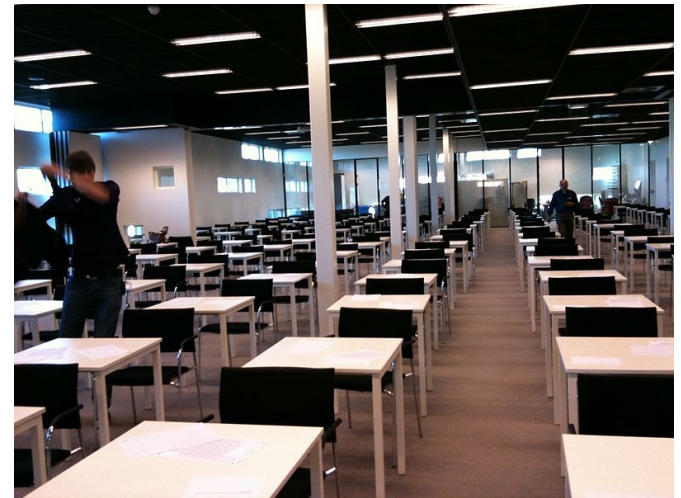
The Results

To be revealed in class…

Sample sizes

- This demonstration is much like a psychology experiment:
  - You collect some data about two groups.
  - You collect enough of it to be confident that you know whether the groups differ.
- To be revealed in class…
  - What the minimum sample size a psychologist should accept for these two groups is.
- To be revealed next *year*:
  - How I worked out the minimum sample size.

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