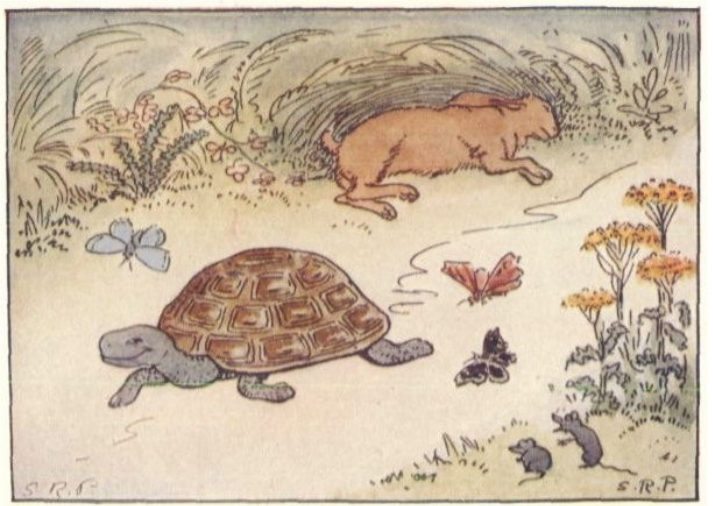
# Distributions and samples

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.*
- One histogram handout *per group*.



THE TORTOISE AND THE HARE

20 min activity

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 1 metre 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) Mark the distance you moved on the *group's* **histogram handout.**
5) First person past the line wins!

04 – 06 : I
07 – 11 : II
12 – 16 :
17 – 21 : II
22 – 24 : I

# Details

- Roll one dice each to decide who goes first. Roll again for ties.
- 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?

https://upload.wikimedia.org/wikipedia/commons/2/2d/D3_Pipped.png

# Distribution on a single dice

1 : IIIIIIII

2 : IIIIIII

3 : IIIIIIIIII

4 : IIIIIII

5 : IIIIIIII

6 : IIIIIIIII

Does your group’s histogram look like this?

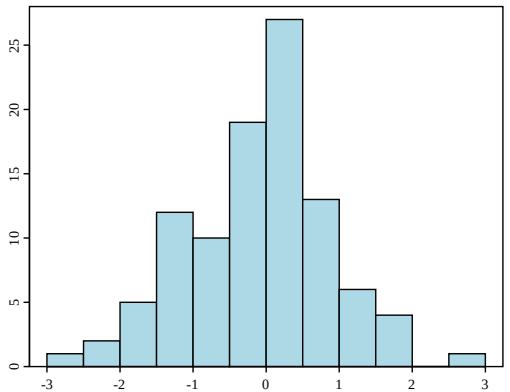
Why / why not?

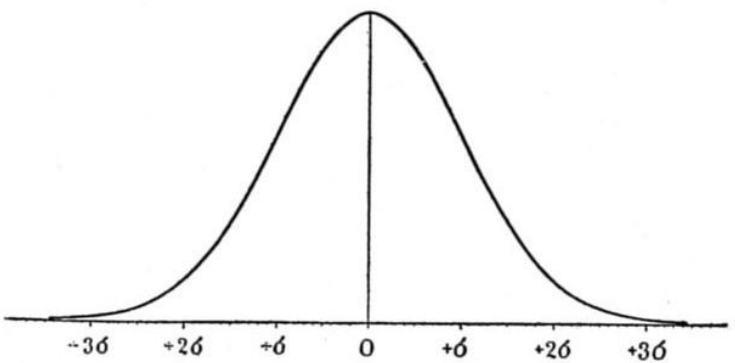
# Central Limit Theorem

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.




https://commons.wikimedia.org/wiki/File:Histogram_example.svg
https://commons.wikimedia.org/wiki/Category:Normal_distribution#/media/File:Critique_of_the_Theory_of_Evolution_Fig_074.jpg

# Exam hall bingo!

- Your group will need:

- One pack of **blue** (or yellow) exam mark cards.
- One pack of **pink** (or green) exam mark cards.
- One “Bingo!” card.
- To divide into two teams, one for each pack of cards.

10 min activity

https://upload.wikimedia.org/wikipedia/commons/thumb/c/c2/Exam_room_at_Stenden_University.jpg/800px-Exam_room_at_Stenden_University.jpg

# Objective

- Work out which group scores higher on exams, on average.
- *Do this as quickly as possible,* BUT
- **Don’t stop until you are sure you have the right answer.**

# How to play

1) One pack of cards per team. Shuffle your pack.
2) On the count of three, both teams turn over their top card.
3) Repeat this until everyone in your group is confident which team scores higher, on average.
4) When you are confident, write down your answer (blue, or red), and the number of cards of each group you have turned over (e.g. if you turned over 4 reds and 4 blues, write down 4). Write this on your **bingo card.**
5) Shout “BINGO!” and hold your card up to be collected.

If you hear another group call “BINGO!”, don’t be distracted. They may or may not have the right answer. Keep going until your group is confident it has the right answer.

# The Results

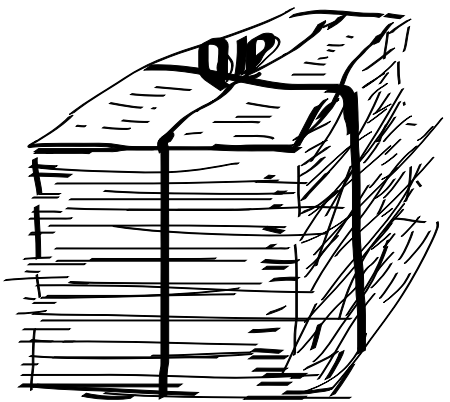
To be revealed in class…

- What each group decided, and how long they took.
- Which team (red or blue) is actually smarter.
- How big the difference between the two teams really is.


https://commons.wikimedia.org/wiki/File:Tokyo_University_Entrance_Exam_Results_8.JPG

# Sample sizes

- This game 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.
- Looking back, how soon do you think you should have stopped?
- 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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