ROYAL STATISTICAL SOCIETY

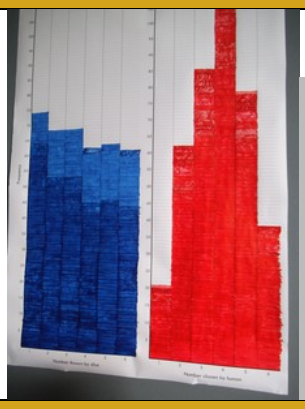
DATA | EVIDENCE | DECISIONS

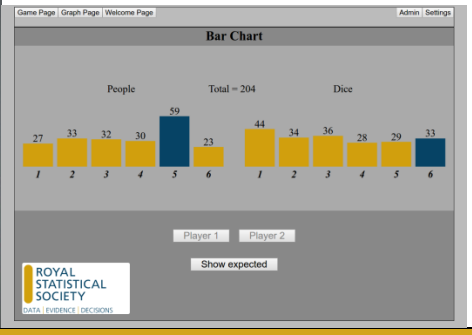
How random are you?

Activity Summary:

This activity introduces people to the concept of randomness.

People often believe they can be random. However, activities like this demonstrate a failure for many people to be random.



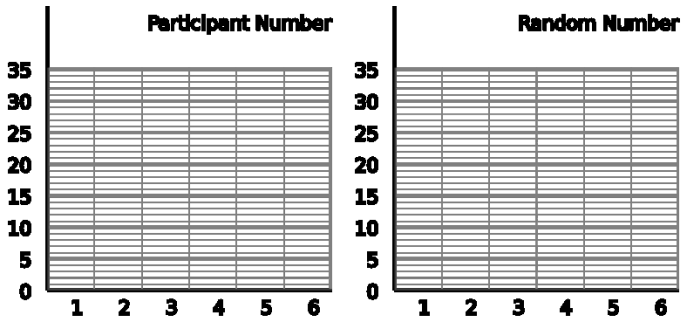


Activity Learning Outcomes:	Suggested Resources:
• Understand randomness • Understand bar charts • Understand why we need to be random	• A six-sided die • Method to record participant numbers and rolled numbers (paper and pen to fill in graphs, above left) (computer/tablet app to record activity, above right)

How to run the activity:

- It is important to pre-load the outcome graphs before any participant's engagement. Starting with blank graphs will mean the first 50-100 participants will not see the effect.

- Ensure the participants **do not** see the graphs before the activity – this may affect their choice.
- This activity can be run for a range of group sizes, as long as individuals pick independently.
- The activity:
    a. Get each participant to **secretly** pick at random number between one (1) and six (6)
    b. Get the participant(s) to generate a truly random number between one and six – either by rolling a six-sided die or using a computer-aided generator
    c. Reveal all the participant-generated and randomly-generated numbers and add them to a bar chart



Exploring the activity:

- Once a participant has done the activity, it is difficult to re-test them in a short space of time, they will be "on guard" against being asked to pick something at random.
  This can be linked to problems with repeated testing or repeated questionnaires
- To what extent does the form of the original question, "pick a number between one and six at random" affect the outcome? Is there a difference if asking participants to state their choice verbally or point/click from among a written set? What about if we don't mention the requirement to be random?

What's going on?

- The six-sided die (or computer-aided generator) will generate approximately random numbers. Each of the six outcomes will have equal probability, a so-called uniform distribution. Hence the bar chart of die rolls should be flat.
- It will not be perfectly flat due to random variation, over time it will get closer. Use this to explain how we construct the **bar charts** and what they represent.
- People believe they can be random. However, it will quickly become apparent that the participant generated bar chart is not flat. There are several explanations for this, all of which can impact the shape of the bar chart
  - So-called *priming* is when the form of the question affects the answer. In this case, since the numbers one and six are mentioned in the question, some people may be averse to saying these numbers. This may lead to fewer 1's and 6's.
  - Single verses multiple draws, each participant is only asked for a single random number, this can lead people to prefer the middle numbers – but knowing they "should" be random, going a bit off-centre. This may lead to an excess of 3's and 5's
  - If participants make their choices publically, the first to say a number may impact the remaining participants – by not wanting to pick the same number.
- There are many situations where we need randomness. For example, in clinical trials of new treatments we need to randomly assign patients to treatments to compare them. If a human made the assignments, they may introduce a bias in who gets which treatment.

Video demonstration:

Demonstration videos of the low-tech (pen and paper) and high-tech (computer app) implementations of this activity are available on the RSS website at www.rss.org.uk/hands-on

Risk assessment:

There are minimal risks associated with this activity if using age-appropriate materials (e.g. small dice are a choking hazard for very young children).

Additional information and taking it further:

An online web-based app is available for recording outcomes, for use on a computer or tablet.

Credits:

Idea, graphics and web-based app by Dr Simon R White (Medical Research Council Biostatistics Unit, University of Cambridge). Bar chart photograph by Dr Laura Bonnett (University of Liverpool).