# Sociable Cards

## Activity Summary:

This activity uses a “magic trick” to demonstrate that statistical thinking can help to identify patterns in situations which may otherwise be considered unpredictable.

It is highly interactive and requires minimal resources.

## Activity Learning Outcomes:

- Appreciate that probability can be used to identify patterns in a range of situations.
- Understand that skills in probability and statistics are highly transferrable.
- Appreciate the usefulness of this “trick” in real life applications.

## Suggested Resources:

- One pack of playing cards (the larger the better!)
- Floor space (or table top) to lay out the cards.
- Between four and eight participants.
- Counters e.g. small bean bags (optional).

## How to run the activity:

- Shuffle the cards and lay them in a path across the floor (or table top for small cards), snaking back and forth as necessary.
- Clearly identify the start and finish points of the path.
- Encourage the participants to stand at the start of the path. Each person should stand, or place a counter, on one card. With four players, each of the first four cards on the path will have one person/counter on them. Five people, the first five cards, and so on.
- At the facilitator’s command, each player then moves forward the number shown on the card that they have started on. Aces count as 1; Jack, Queen and King all count as 5.
- Each player continues to move forward unprompted according to the value of the card they land on.
- Each player continues moving forward until they cannot move any further without travelling beyond the end of the path of cards.

## Exploring the activity:

- Where do the players end up?
- What happens if the end of the path becomes the start?
- What happens if the cards are shuffled and a new path is laid out?
- What happens if the values of the picture cards are changed (increased or decreased)?
What's going on?

- Most of the time, all participants will finish on the same card.
- Even if the end of the path becomes the start, and/or the pack is reshuffled and laid out in a new path, most of the time all participants will still finish on the same card.
- The intuitive explanation is that, at some point, most (usually all) participants 'land' on the same card on the path – from then on, these participants will make the same moves forward, and so end up on the same card at the end of the path.
- This is a variant on a magic trick known as “Kruskal’s Count”, invented by Martin Kruskal, an American mathematician and physicist.
- If necessary the trick can be demonstrated by asking the group of participants to step through the game slowly, one move forward for each player in turn, at a time.

- The probability of all players landing on the same card depends on the number of players and the number of moves associated with the Jack, Queen and King picture cards.
  - The higher the number of participants the (slightly) lower the chance that all of them will end the game on the same card.
  - The higher the number of moves associated with the picture cards the (slightly) lower the chance that all participants will end the game on the same card.

- This has a real-life application in Pollard's Kangaroo method which is an efficient means of breaking certain codes and digital signature schemes.

Video demonstration:
A video demonstrating this activity is available on the RSS website at [www.rss.org.uk/hands-on](http://www.rss.org.uk/hands-on)

Risk assessment:
Laminated playing cards can be slippery, particularly on carpet. Be mindful of slip hazards. Counters can be used as a lower risk alternative to participants standing on the cards.

Additional information and taking it further:
NRICH Sociable Cards (desktop version) with video: [http://nrich.maths.org/7219](http://nrich.maths.org/7219)
James Grime performing the trick on YouTube: [https://www.youtube.com/watch?v=uRI4XtnJxXo](https://www.youtube.com/watch?v=uRI4XtnJxXo)
Demonstration of Pollard’s Kangaroo method: [http://faculty.uml.edu/rmontenegro/research/kruskal_count/kangaroo.html](http://faculty.uml.edu/rmontenegro/research/kruskal_count/kangaroo.html)

Credits:
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