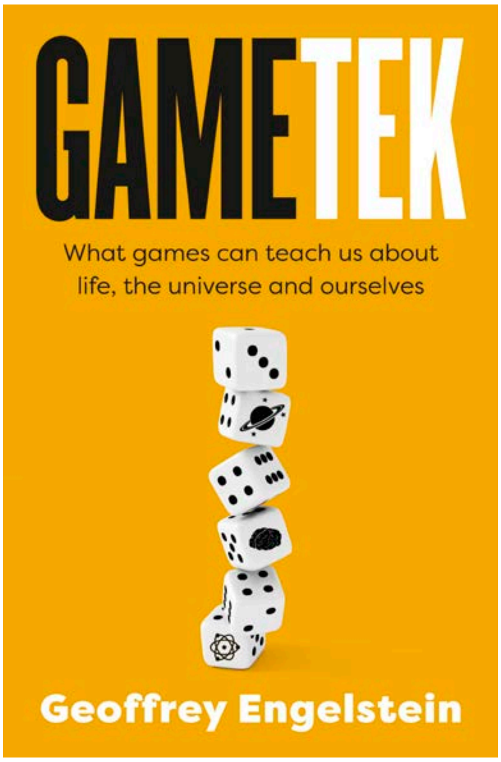

GameTek

By Geoffrey Engelstein

Summary

If you shuffle a deck of cards what are the odds that the sequence is unique? What is the connection between dice, platonic solids and Newton's theory of gravity? What is more random: a dice tower or a number generator? Can you actually employ a strategy for a game as basic as Rock-Paper-Scissors?

These are all questions that are thrown up in games and life. Games involve chance, choice, competition, innovation, randomness, memory, stand-offs and paradoxes – aspects that designers manipulate to make a game interesting, fun and addictive, and players try to master for enjoyment and winning. But they also provide a fascinating way for us to explore our world; to understand how our minds tick, our numbers add up, and our laws of physics work.

This is a book that tackles the big questions of life through the little questions of games.

With short chapters on everything from memory games to the Prisoner's Dilemma, to Goedel's theorems, GameTek is fascinating reading anyone for who wants to explore the world from a new perspective – and a must-read book for serious designers and players.

Key Learning Areas

Mathematics, Science, Psychology

Recommended Ages: 14+

ISBN: 9781460757376

Notes by: Sarah Hill

Date of Publication: November 2019

CLASSROOM ACTIVITIES

Year 10 Mathematics and Science

Chapter 5: Playing on Your Expectations

1. Following the example in the text, estimate how fast the Earth is moving as it orbits the Sun (in kilometres per hour). Page 58 provides hints to help you calculate. Combine your results as a class and graph your results.
   a. Once you have estimated your answer, research the actual speed and add this to the graph.
   b. Was your estimation close to the correct answer or widely different? What extra data would you require to produce a more accurate answer?

2. Using a dice-based game such as Yahtzee, calculate the probability of creating the highest scoring hand for each round. For example, what are the chances of rolling 5 dice and them all being the same number? Does this change if you are trying to get different numbers? (are all 1s easier to get than all 6s?)
   a. How does adding an extra dice change the calculations you can make?

Outcomes: ACMSP246, ACSIS199, ACMSP251

Chapter 8: Falling for Patterns

1. Can you replicate the work of Roger Penrose? Make a replica set of Penrose Tiles (see page 92). What is the largest plane you can cover without the pattern shifting in on itself?

Outcomes: ACMMG244

Year 11 Specialist Mathematics and Physics

Chapter 9: When 'Random' Isn't Random

1. Increase your understanding of entropy by emulating two of the examples from this chapter. As a class, calculate the entropy and logarithm for the number of dice/rolls you are planning to make.
    a. Predict the possible number of 'hits' (rolling a 4, 5, 6).
    b. Roll the dice a minimum of 100 times.
    c. What did you find out about the disorder? How did this match against your prediction?

2. To visualise how entropy works, assemble a small marble run. Test how entropy affects modules by releasing differing batches of marbles into the top of the run and tracking how they dissipate.
    a. Start with 1 marble and then test in increasing batches (3, 5, 7, 9, 11 … up to 52 if possible).
    b. Capture the path of each marbling by using the slow-motion video feature available on most tablet and phone devices.
    c. What effect does adding more marbles have?
    d. Is it possible to predict where each one will end up?

Outcomes: ACSPH009, ACSPH010

Chapter 13: Tic-Tac-Toe and Entangled Pairs

1. Follow the game instructions on page 164 (see page 165 for an example).
    a. How many 'observations' can you create? What strategies can you employ to win the game?

Outcomes: ACSPH053

Chapter 14: When Math Doesn't Have All the Answers

1. Try to solve the Travelling Salesman problem. Working with a map and a set of 15 different cities to visit, try to calculate the most effective route that visits each city once.
    a. What is the most effective solution?
    b. How many different solutions could there be?
    c. What is the criteria for the 'most effective' solution?

Outcomes: ACMSM001

AUSTRALIAN CURRICULUM OUTCOMES COVERED BY *GAMETEK*

Year 10 Mathematics

ACMNA230
ACMMG244
ACMSP246
ACMSP251
ACMNA268
ACMNA270

Year 10 Science

ACSIS198
ACSIS199
ACSIS200
ACSIS203
ACSIS205
ACSHE192
ACSHE194

Year 11 Specialist Mathematics

ACMSM001
ACMSM002
ACMSM003
ACMSM004
ACMSM010
ACMSM011
ACMSM041

Year 11 Physics

ACSPH009
ACSPH010
ACSPH053

ABOUT THE AUTHOR

Geoff Engelstein is an adjunct professor of Board Game Design at the NYU Game Center. He has spoken at a variety of venues, including PAX, GDC, GenCon, Rutgers, and USC. He has degrees in Physics and Electrical Engineering from the Massachusetts Institute of Technology, and is currently the president of Mars International, a design engineering firm. Since 2007 he has been a contributor to *The Dice Tower*, the leading table-top game podcast, with 'GameTek', a series on the math, science, and psychology of games. Since 2011 he has hosted *Ludology*, a weekly podcast. He is also an award-winning tabletop game designer, whose games include *The Ares Project*, *Space Cadets*, *The Fog of War*, and *Survive: Space Attack*, many of which are co-designed with his children, Brian and Sydney.