Literature as a Gateway to Numeracy

Conference presentation

Canberra Mathematical Association

August 2015

Happy Birthday, Alice!

- This year marks the 150th anniversary of the publication of **Alice in Wonderland**, by Lewis Carroll.

- Lewis Carroll was actually Charles Lutwidge Dodgson (1832 – 1898) - mathematician, writer and Anglican deacon.

- Note the psychoanalytical Freudian analysis of the 1930s, the psychedelic interpretation of the 1960s, and the moral panic of paedophilia of the 1990s.

- *Lewis Carroll in Numberland*
         Robin Wilson (2008)

The hidden mathematics of
Alice in Wonderland

- **Keith Devlin –** a summary of the work of Melanie Bayley (University of Oxford), 2009…**Alice's Adventures in algebra: Wonderland solved** (published New Scientist, 16 December 2009).

- The proposal is that Dodgson, a tutor in mathematics (rather than a researcher)and writer, was a "stubbornly conservative mathematician", dismayed by what he saw as declining standards of rigour. Much of the material in the books – the Cheshire Cat, the hookah-smoking caterpillar, the Duchess and baby which turns into a piglet – are satirical responses to the development of abstract (non-symbolic) algebra, non-Euclidian geometries, and the growing acceptance of "imaginary numbers".

- It is this "fierce satire" that produced the wit and nonsense!

Do we need to know all of this?
...Probably not!

So, what can we take from this for our Maths classroom?

- A consideration of the publication statistics?

The British copyright on "Alice's Adventures in Wonderland" expired in 1907. After the Bible, Koran and Shakespeare, "Alice's Adventures in Wonderland" is the most frequently quoted and best known in the world. The story has been translated into over 125 different languages, including Korean, Japanese, Egyptian and Arabic. Hundreds of editions have been published ever since.

- **Using *Alice in Wonderland* to Teach Multiplication of Fractions** (Taber, 2007)

'An interdisciplinary language arts and maths unit, for students in Grades 4 – 8' ('shrinking and enlarging')

- **Some very sophisticated approaches**
http://www.slideshare.net/dr.f/math-in-wonderland   A commentary and activities based on the hidden mathematics

http://www.theguardian.com/books/2015/mar/20/lewis-carroll-alice-in-wonderland-adventures-150-years   An overview of the Alice legacy

"Reeling and Writhing of course, to begin with", the Mock Turtle replied, "and the different branches of arithmetic - ambition, distraction, uglification, and derision."

The Magic of Mitsumasa Anno
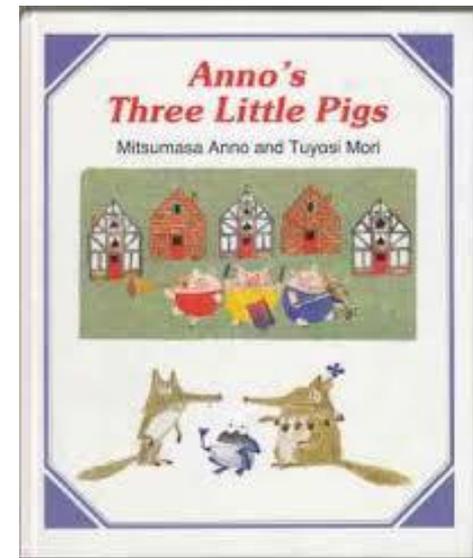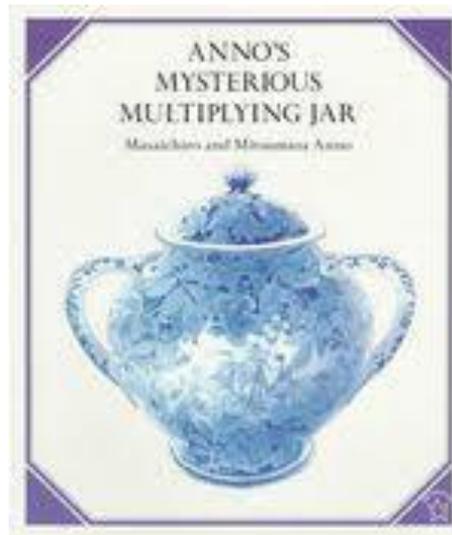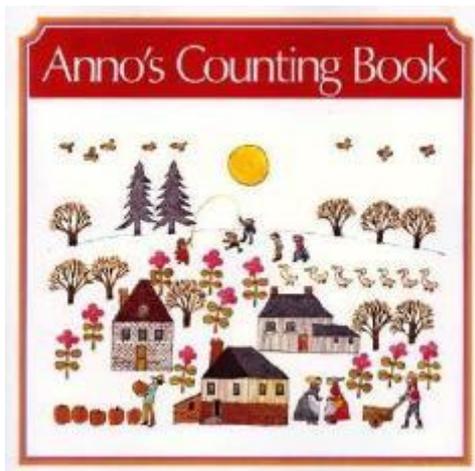
Anno's Counting Book

With a growing column of cubes on the left side of the page, and a large number on the right, Anno shows the development of a small village. On each successive page, spread throughout the year, the village increases by one child, one building, and one tree.

Each picture is full of small stories such as building a railroad, photographing a wedding, or fishing, as well as many examples of the number. There are opportunities for **adding**, such as when three of the geese on the number 4 page lag far behind the other one, and for thinking about **sets,** and other concepts.

Though it is a counting book, it is also much more.

Anno's Mysterious Multiplying Jar

Inside the jar there was water, and there seemed to be just enough wind to set the water rippling…and suddenly we are inside the jar, on a sea, sailing toward 1 island. On it there are 2 countries. Fascinating pictures tell the story of **factorials** in the first half of the book, and Anno explains them explicitly in the second half.

Anno's Three Little Pigs

Socrates the wolf is trying to locate one of the three little pigs. He explores **combinations and permutations** in the process. Again the mathematics is explicitly explained.

# The Curious Incident of the Dog in the Night-time
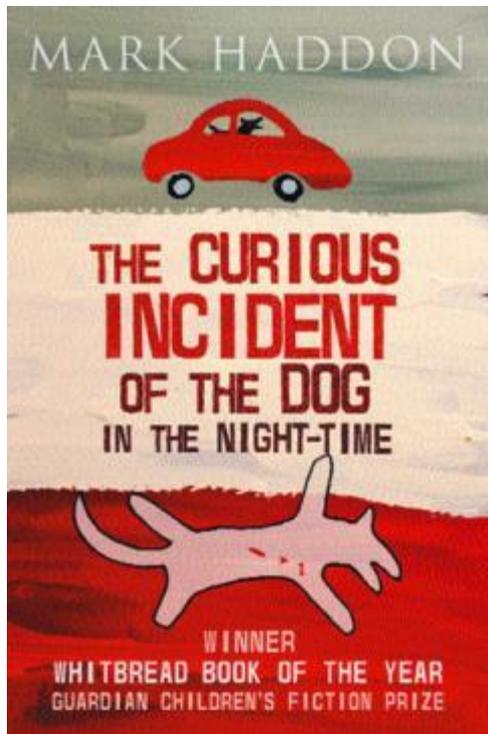
- Prime numbers and encryption – note the chapter numbering…)
- The Monty Hall problem
- Occam's Razor
- A lot of fairly sophisticated mathematics
- More language arts and maths/science

- http://www.maa.org/press/maa-reviews/the-curious-incident-of-the-dog-in-the-night-time

  a review by a mathematician
  (but probably too challenging for our classroom needs…)

The Parrot's Theorem

A magical fantasy about a talking parrot bought at a flea market in France who, with the help of the personal library of a reclusive mathematical genius, teaches some children (and the reader) about 2000 years of the history of mathematics. It was written originally written in French.

The author, a professor of the history of science, specialises in the use of fiction to develop scientific literacy.

The clever plot device of having a non-mathematical bibliophile forced to look carefully through a collection of mathematics books may succeed in interesting a general audience in the history of mathematics.
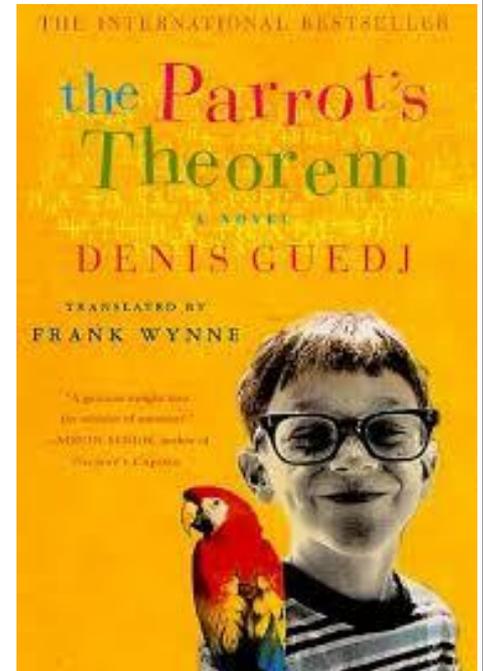
Frank and Fermi

- *Real-life, everyday problems*
- *I wonder how many/what if…*
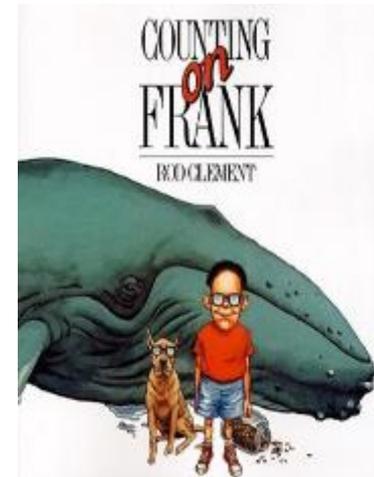
Fermi questions receive their name from **Enrico Fermi,** an Italian physicist known for his participation in the Los Alamos atomic bomb project and the development of quantum theory.

Fermi questions emphasize **estimation, numerical reasoning, communicating in mathematics**, and **questioning skills**.

Students often believe that "word problems" have one exact answer and that the answer is derived in a unique manner.

Fermi questions encourage multiple approaches, emphasize process rather than "the answer", and promote non-traditional problem solving strategies.
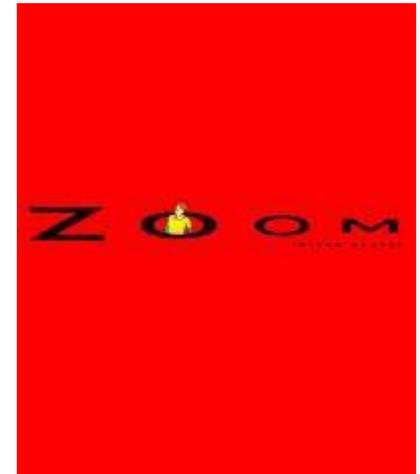
Zoom…ReZoom

The world of wordless books
(transformation geometry)

- https://www.youtube.com/watch?v=JMhUujrN4iU

- https://www.youtube.com/watch?v=_qLMUkSc1WA

- Do you know the *Powers of Ten* movie?
  https://www.youtube.com/watch?v=0fKBhvDjuy0

  And an interesting variation (made for Imax)

- https://www.youtube.com/watch?v=bhofN1xX6u0

Hello, Harry

This is a way to make interconnections between mathematics and popular children's fiction:

- The monetary system – Galleons, Sickles and Knuts – **conversions**
- **Functions and linear modelling** (using computers and graphics calculators)
- The Sorting Ceremony **– probability**

Harry Potter and the Magic of Mathematics
(McShea, Vogel & Yarnevich, 2005)

- Some story problems, using the context
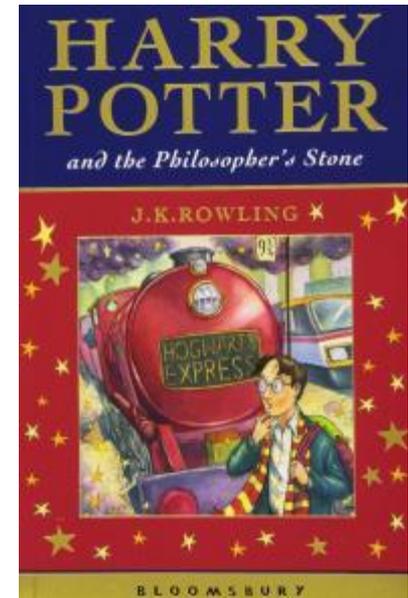
Fractured Fairytales

Traditional fairy tales and nursery rhymes have been used – with an 'interpretation' – to develop mathematical concepts.

Loafing About – *The Little Red Hen*

Calculations with **time, fractions**, **percentages** and **conversions between decimals and fractions.**

Flatland…
and even **Flatterland**?

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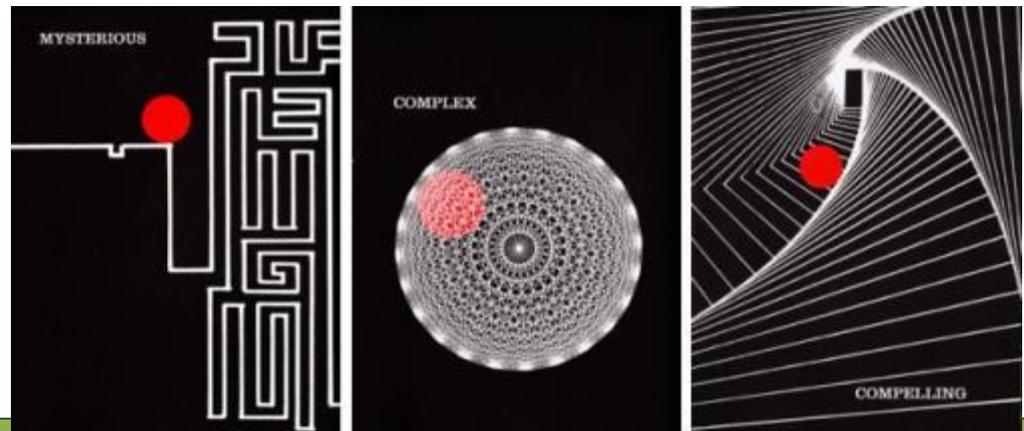 The film version – a little more accessible, perhaps?

- **Flatland** (Edwin A. Abbott) – first published in 1884. Another satire, this time of Abbott's Victorian contemporaries, it opens our imaginations to the **possibility of a fourth and higher dimensions**. This is a foray into **geometry.**

- **Flatterland** (Ian Stewart, 2001)… "like Flatland, only more so", is a derivative work, a type of sequel, set in the late 21st century.

The Dot and the Line
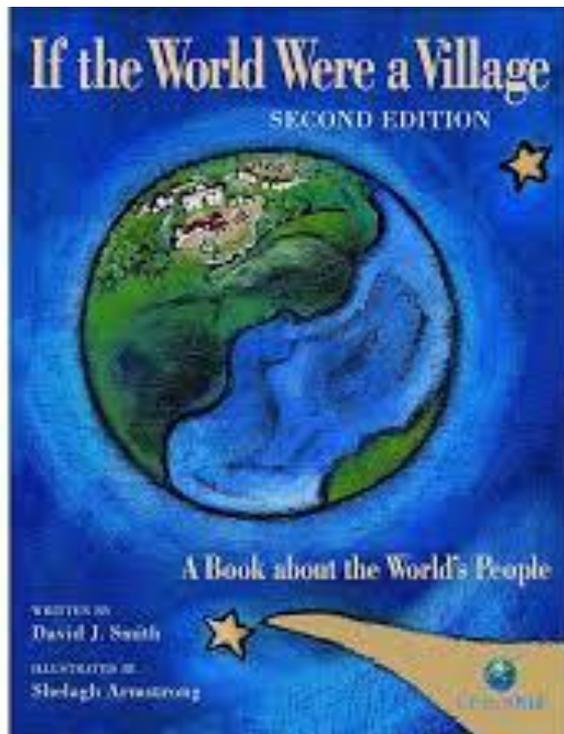
- https://www.youtube.com/watch?v=OmSbdvzbOzY

A 'distraught straight line falls in love with a frivolous dot…'

More **geometry**

If the World Were a Village

Statistics

Think globally...

...act locally

Useful references

http://nzmaths.co.nz/picture-books-mathematical-content

http://research.acer.edu.au/cgi/viewcontent.cgi?article=1006&context=digest

http://www.slj.com/2010/05/collection-development/as-easy-as-pi-picture-books-are-perfect-for-teaching-math/

http://kasmana.people.cofc.edu/MATHFICT/all.php
A list of mathematical fiction.

Ward, R.A.(2009). *Literature-Based Activities for Integrating Mathematics with other Content Areas (Grades 3-5)*. Pearson