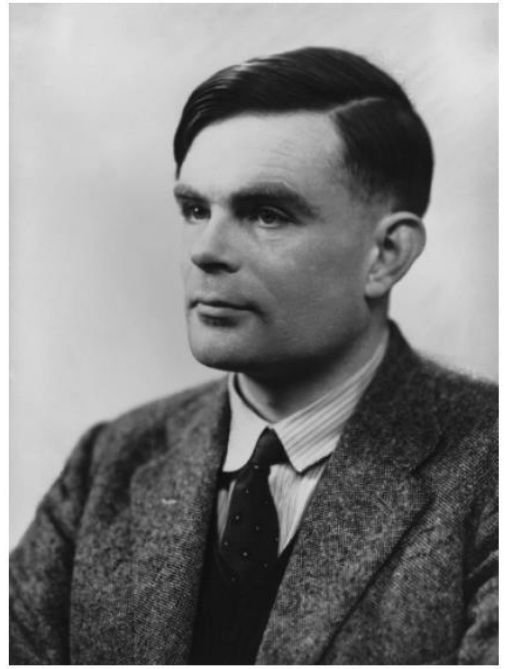
# WHAT IS A MODEL?



“This model will be a **simplification** and an **idealization**, and consequently a **falsification**. It is to be **hoped** that the features retained for discussion are those of **greatest** importance in the present state of knowledge.” Turing, 1952

A.M. Turing, The chemical basis of morphogenesis, Phil. Trans. R. Soc. B, 237, 37-72 (1952)

“All models are wrong, but some are useful” (George Box)

Modelling is an art rather than a science

# Lewis Carroll's Paradox of the complete map

**'That's another thing we've learned from *your* Nation," said Mein Herr, "map-making. But we've carried it much further than you. What do you consider the *largest* map that would be really useful?"**

**"About six inches to the mile."**

**"Only *six inches*!" exclaimed Mein Herr. "We very soon got to six *yards* to the mile. Then we tried a *hundred* yards to the mile. And then came the grandest idea of all! We actually made a map of the country, on the scale of *a mile to the mile*!"**

**"Have you used it much?" I enquired.**

**"It has never been spread out, yet," said Mein Herr: "the farmers objected: they said it would cover the whole country, and shut out the sunlight! So we now use the country itself, as its own map, and I assure you it does nearly as well."**

***Sylvie and Bruno Concluded*, by Lewis Carroll, 1893**

# The Virtuous Cycle

## Predict-test-refine-predict

# Why bother?

- We test our intuition
- We validate/invalidate hypotheses
- We generate new hypotheses
- Where mathematical modelling comes into its own is when the underlying processes (or hypotheses) appear to be in contradiction to the observations.

# End of Lecture 4