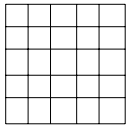
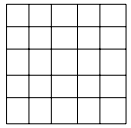
randomness

- just how random is the world?
- raindrops and horse races



a story



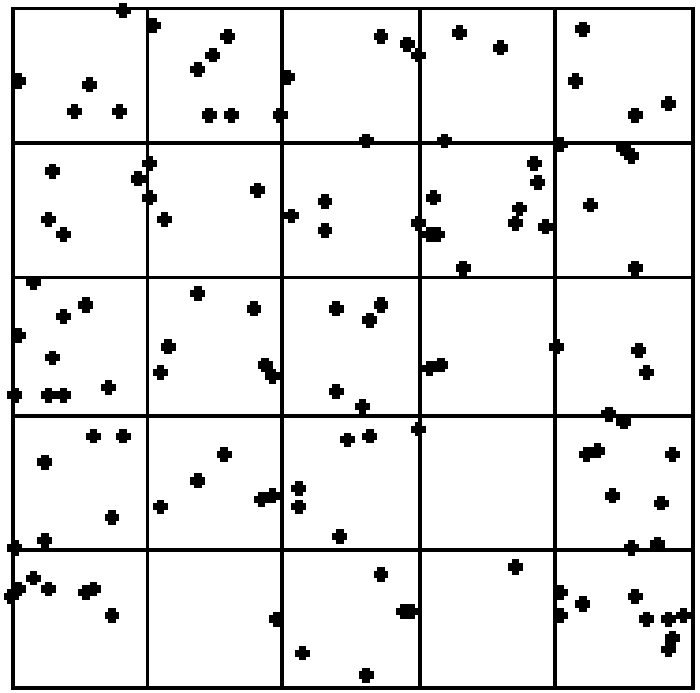
In the far off land of Gheisra there lies the plain of Nali. For one hundred miles in each direction it spreads, featureless and flat, no vegetation, no habitation; except, at its very centre, a pavement of 25 tiles of stone, each perfectly level with the others and with the surrounding land.

The origins of this pavement are unknown – whether it was set there by some ancient race for its own purposes, or whether it was there from the beginning of the world.

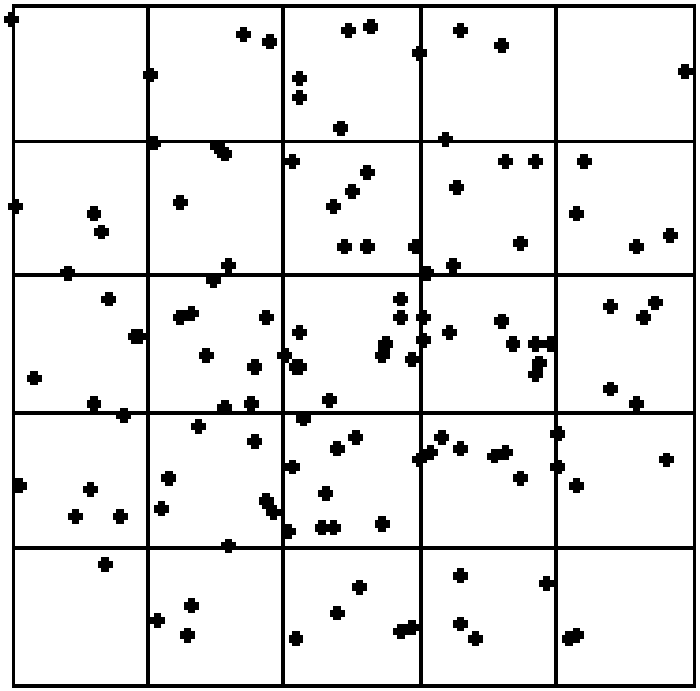
Rain falls but rarely on that barren plain, but when clouds are seen gathering over the plain of Nali, the monks of Gheisra journey on pilgrimage to this shrine of the ancients, to watch for the patterns of the raindrops on the tiles. Oftentimes the rain falls by chance, but sometimes the raindrops form patterns, giving omens of events afar off.

Some of the patterns recorded by the monks are shown on the following pages. Which are mere chance and which foretell great omens?

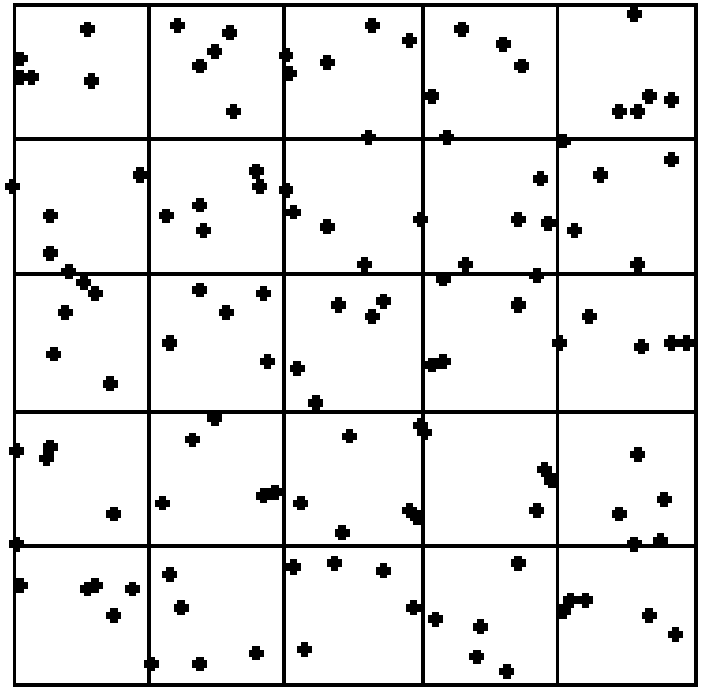
day 1



day 2

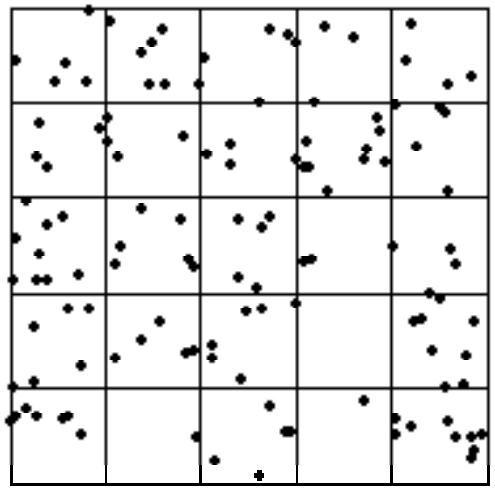


day 3

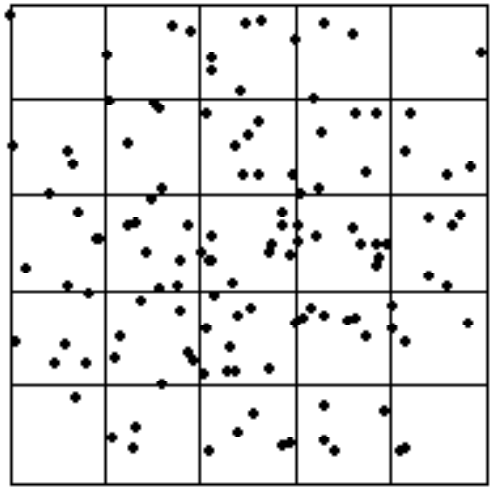


your choice?

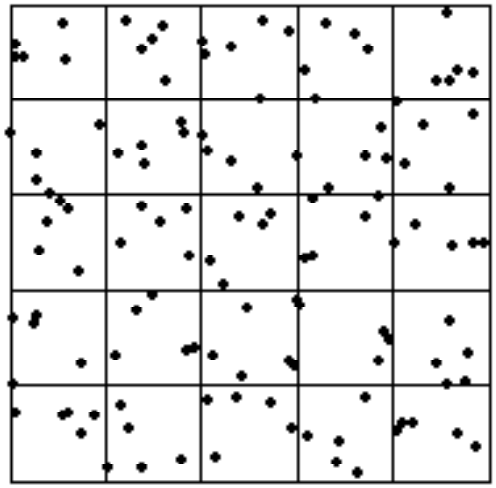
day 1



day 2



day 3



which are by chance ...

and which are unusual?

why?

- .....
- .....
- .....

two horse races

- toss 20 coins
- add the heads to one row
  the tails to a second
- the winner is the first row to 10
- before you start – what will happen?

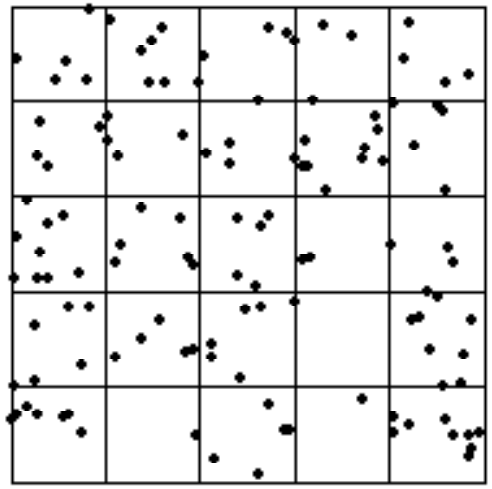
- did you get a clear winner?
- or was it neck and neck?

the world is very random

$$\text{probability head} = 0.5$$

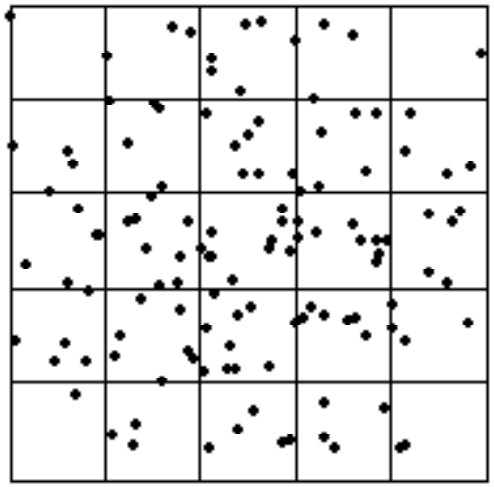
$$\text{number of heads} \neq \frac{\text{number of tosses}}{2}$$

really random



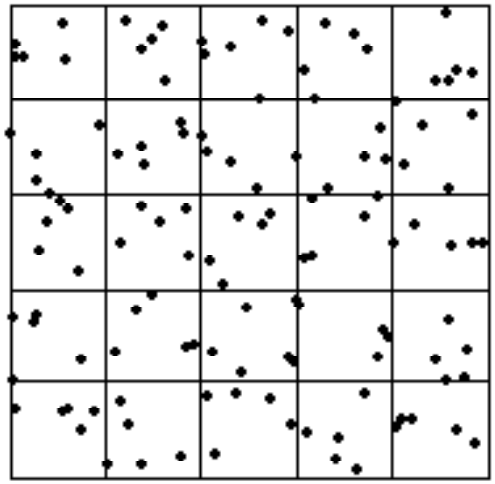
empty squares & overfull squares

random but not uniform



clumped towards the middle

too uniform



every square has 5 rain drops

too good to be true!

lessons

- apparent differences may be chance
- real data has some bad values

e.g. Mendel's sweet peas and electron discovery were too good!