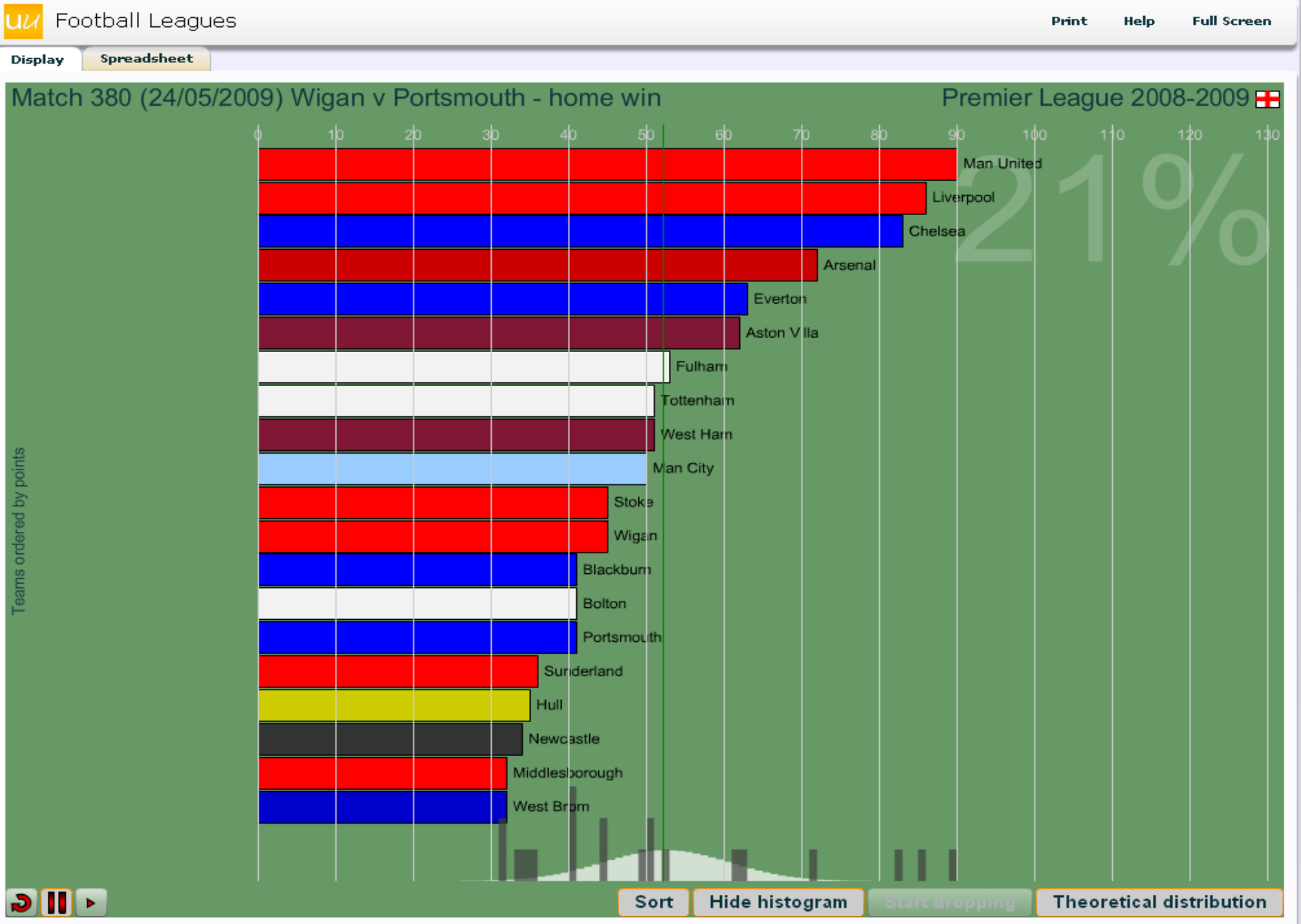


Football animation: www.understandinguncertainty.org/node/228

Representations of risk and uncertainty

David Spiegelhalter

winton professor of the public understanding of risk, university of cambridge

Cambridge Risk, October 2009

With thanks to Mike Pearson, Ian Short , Hauke Riesch, Owen Smith, Arciris Garay, etc etc

Derren Brown leaves more questions than answers as he explains lottery trick

Derren Brown, the illusionist, left viewers with more questions than answers after the programme in which he promised to disclose how he predicted the winning National Lottery numbers.

By Lucy Cockcroft
Published: 7:00AM BST 12 Sep 2009

Derren Brown predicted the National Lottery numbers. Photo: CH

Indeed, this method was rubbished by mathematicians.

David Spiegelhalter, professor of public understanding of risk at Cambridge University, said: "There is a difference between guessing between the weight of an ox and guessing lottery balls, which is unguessable.

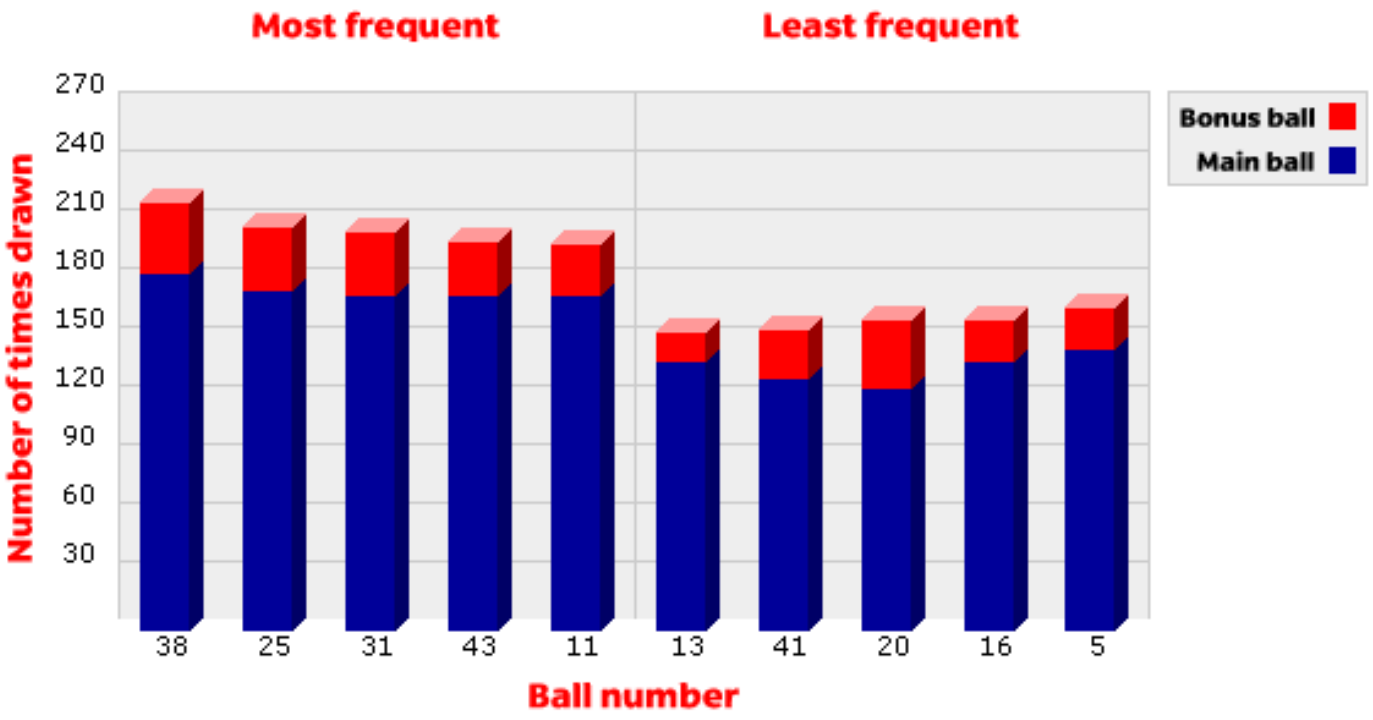
"this is just a clear wind-up and complete nonsense."

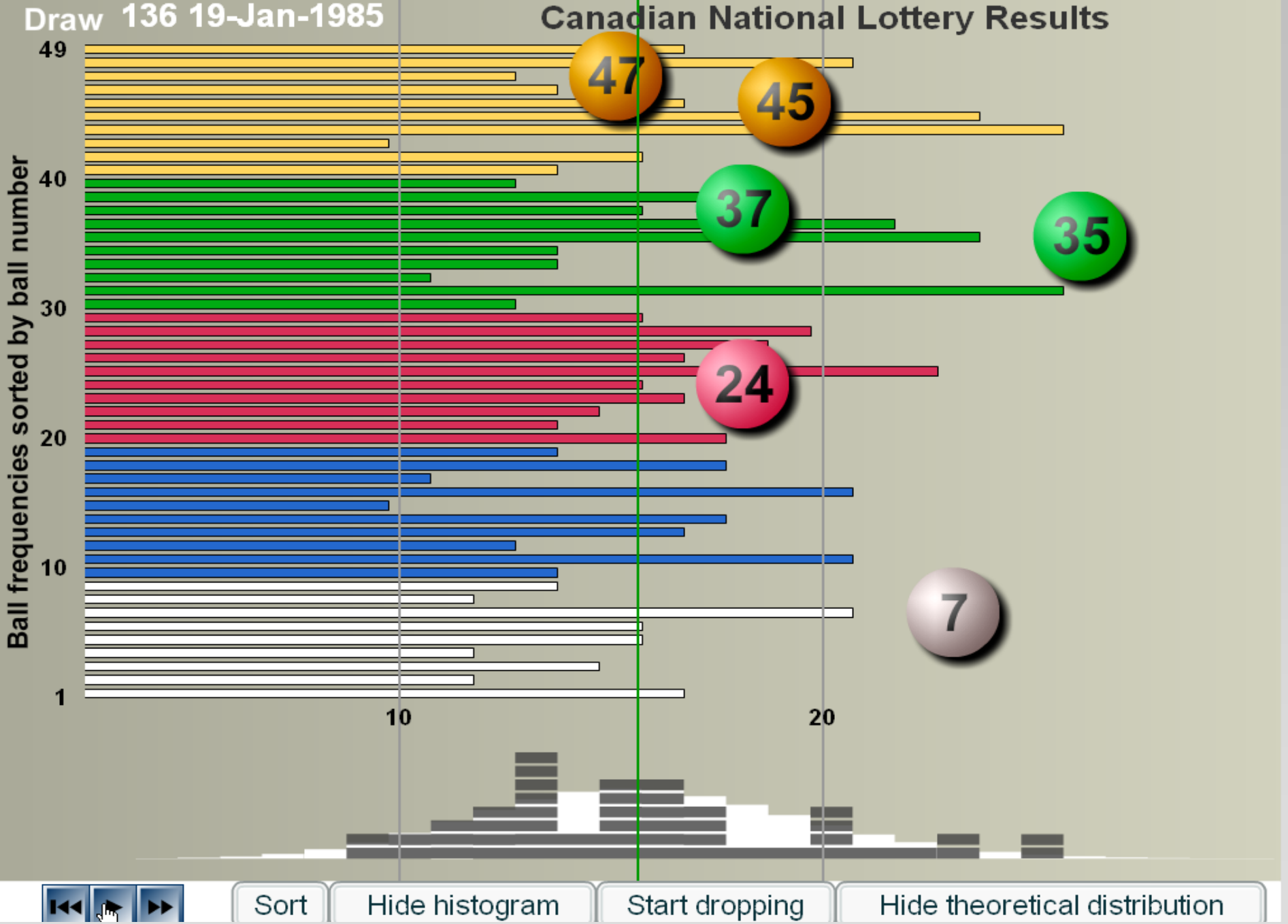
Find out which numbers have been drawn the most frequently, and which have been drawn the least. Despite the draws being totally random, some numbers have a habit of cropping up more than others, while others hardly appear at all! Please note, these results include the Lotto Bonus Draws held on 18th May 2002, 1st June 2002, 6th November 2004, and the £5 million jackpot-only draw held on 29th April 2006.

All numbers | Individual number

Game: Lotto | Time period: To Date | GO

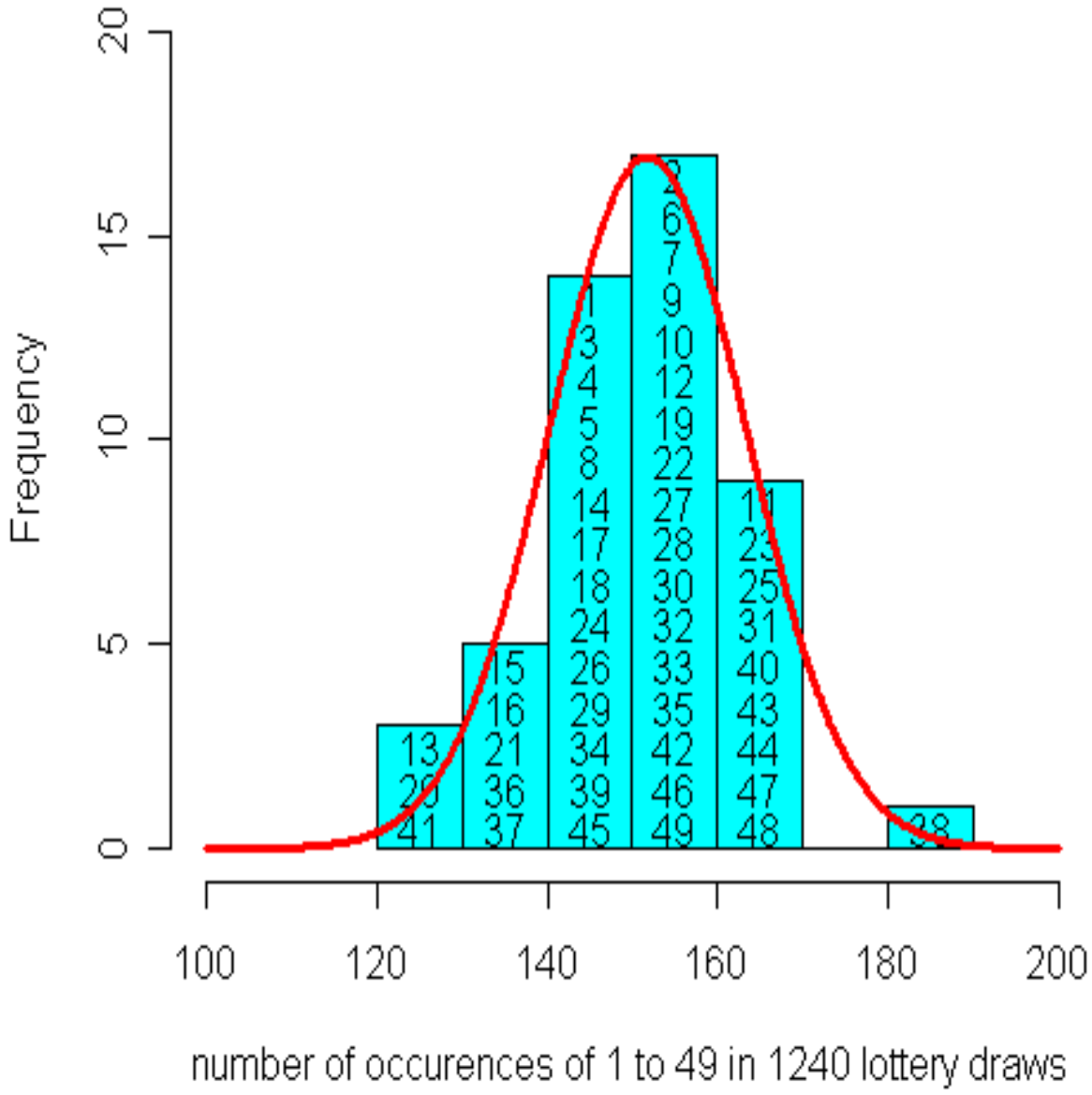
lotto Five most and least frequently drawn balls





Lottery animation: www.understandinguncertainty.org/node/39

Counts obey the rules of probability



What is the Winton programme trying to do?

Improve the public handling of quantitative aspects of risk and uncertainty, through

- Educational lectures, workshops
- The ‘Risk Roadshow’
- Website
- Engagement with media
- Working with people who want to communicate risk
- Inter-disciplinary research

www.understandinguncertainty.org

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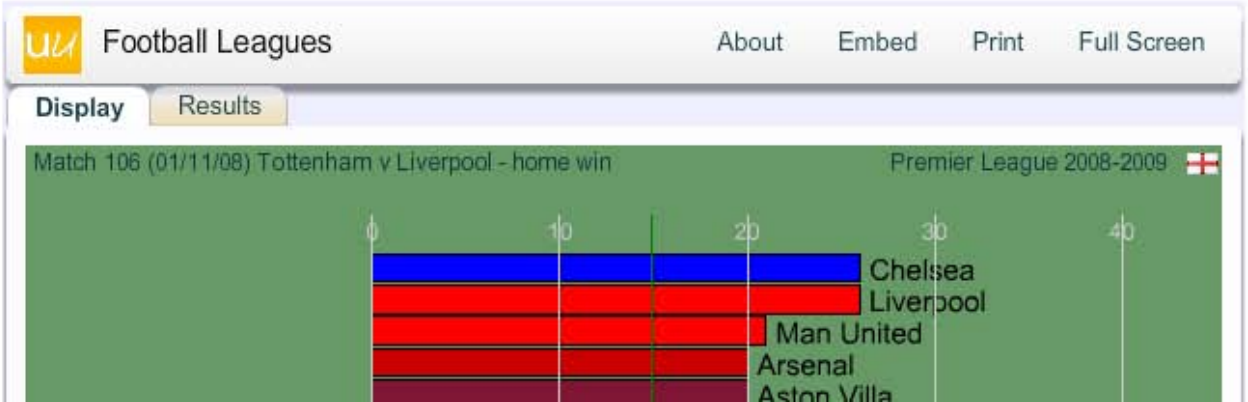
Home :: Featured Content

European Football - How much is chance?

Posted August 6th, 2009 by gmp26 in level 1, sport football

Is football just a matter of luck? Just because a team ends up top of the league, does it really mean it is the best team? We have taken most of the major league football games played in Europe since 1993 and created an animation that shows what happened in each league and how much of the apparent difference between the teams was due to chance alone.



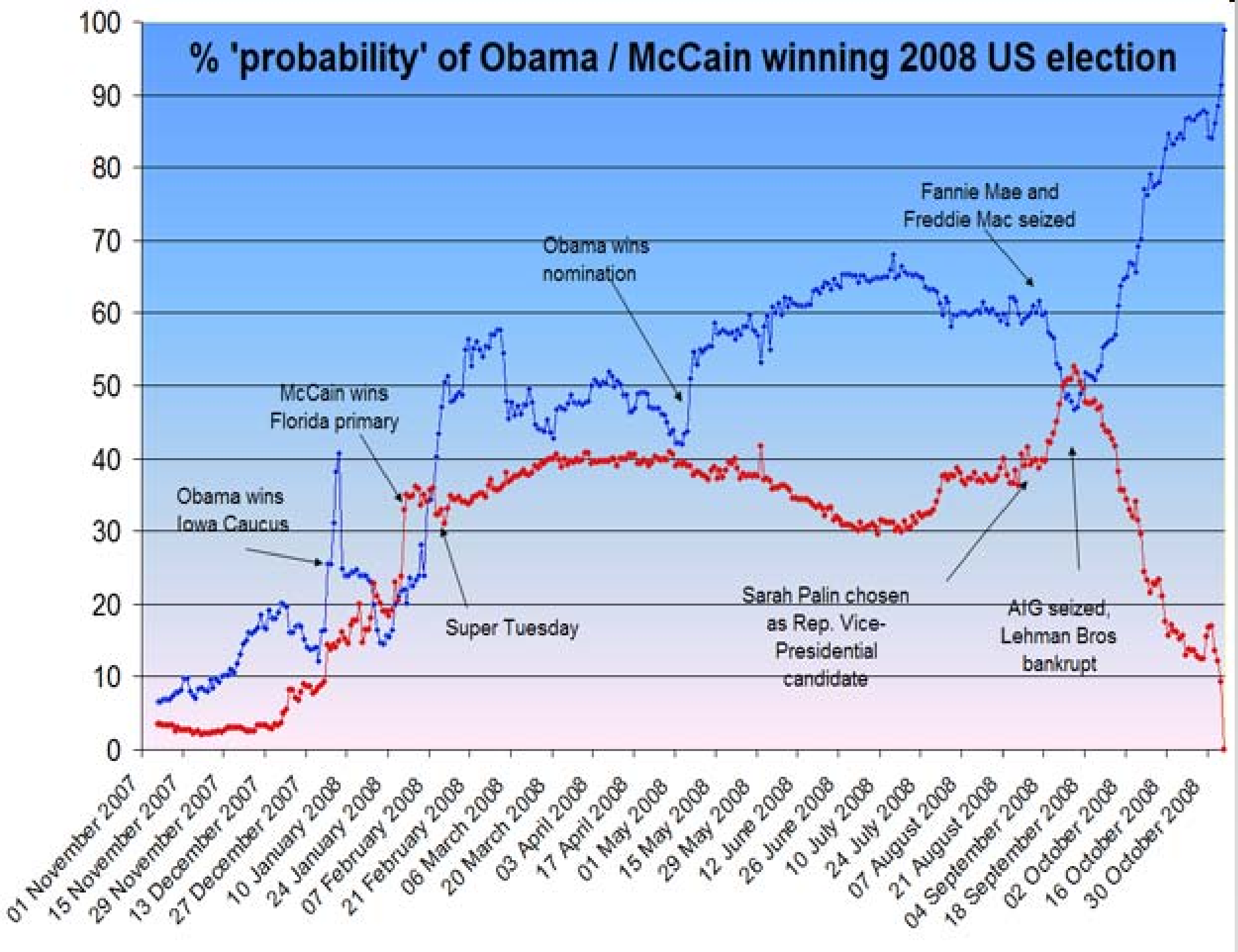
Featured Content

- European Football - How much is chance?
- Screening for disease and dishonesty
- 2845 ways to spin the Risk
- A predictable pattern of murder?
- Nightingale's 'Coxcombs'
- What was the probability that Barack Obama would win the US election?
- Coincidences
- Football Leagues
- National Lottery
- What is Probability?
- Risk in the media
- How long are you going to live?

RSS News Feed

‘Personalist’ approach to risk and uncertainty

- ‘*Probability does not exist*’ (objectively)
- Constructed based on current knowledge
- Is always contingent
- Assessed, not measured
- Best thought of as betting odds
- Allowed to use probability for epistemic uncertainty
- Calibrate by thinking of ‘chance’ situation that would be equally preferable to bet on


% 'probability' of Obama / McCain winning 2008 US election
100
90
80
70
60
50
40
30
20
10
0
Obama wins Iowa Caucus
McCain wins Florida primary
Super Tuesday
Obama wins nomination
Sarah Palin chosen as Rep. Vice-Presidential candidate
Fannie Mae and Freddie Mac seized
AIG seized, Lehman Bros bankrupt
01 November 2007
15 November 2007
29 November 2007
13 December 2007
27 December 2007
10 January 2008
24 January 2008
07 February 2008
21 February 2008
06 March 2008
20 March 2008
03 April 2008
17 April 2008
01 May 2008
15 May 2008
29 May 2008
12 June 2008
26 June 2008
10 July 2008
24 July 2008
07 August 2008
21 August 2008
04 September 2008
18 September 2008
02 October 2008
16 October 2008
30 October 2008

Want to bet? (January 2008)

Formats for communicating ‘known’ risks

Text? Numbers? Graphics? Animations?

We may be concerned with what people –

- like
- understand / can reproduce
- are influenced by

But

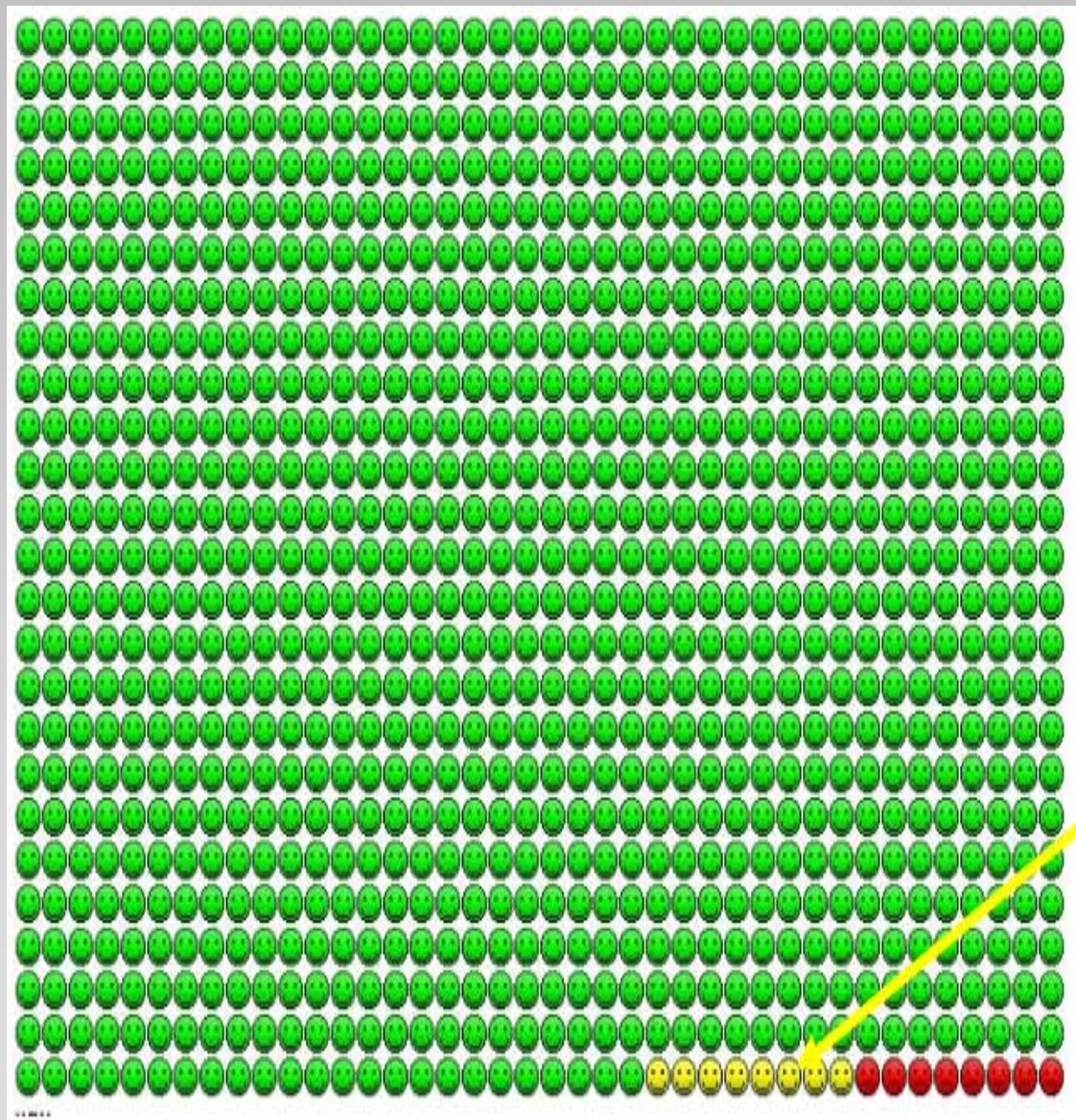
- These are not necessarily the same formats!
- Formats are influential (framing)
- People vary hugely in their preferences and understanding

Real story:

1 in 10 people carry a low-risk gene

Benefits of Tamiflu

(National Prescribing Centre)



These 984 people are not admitted to hospital, whether or not they take oseltamivir

These 8 people avoid being admitted to hospital because they take oseltamivir

These 8 people are admitted to hospital even though they take oseltamivir

- Recently I went to see my family doctor …

Online Clinical Calculator

Coronary Heart Disease Risk Calculator

Risk Factor	Your Answer	Points	Relative Risk
Sex:	◉ Male ○ Female		
Age:	54 years	3	
Smoker:	○ Yes ◉ No	0	Low
Diabetes:	○ Yes ◉ No	0	Low
Blood Pressure:	148 / 94 mm Hg	2	High
Total Cholesterol	224 mg/dl	1	Moderate
HDL Cholesterol:	54 mg/dl	0	Low

Calculate, with Incomplete Values | Calculate

Total Points: 6 = 10 **% risk of heart disease in 10 years**

Average 10-year risk = 14 **%** *(for others in your age group)*

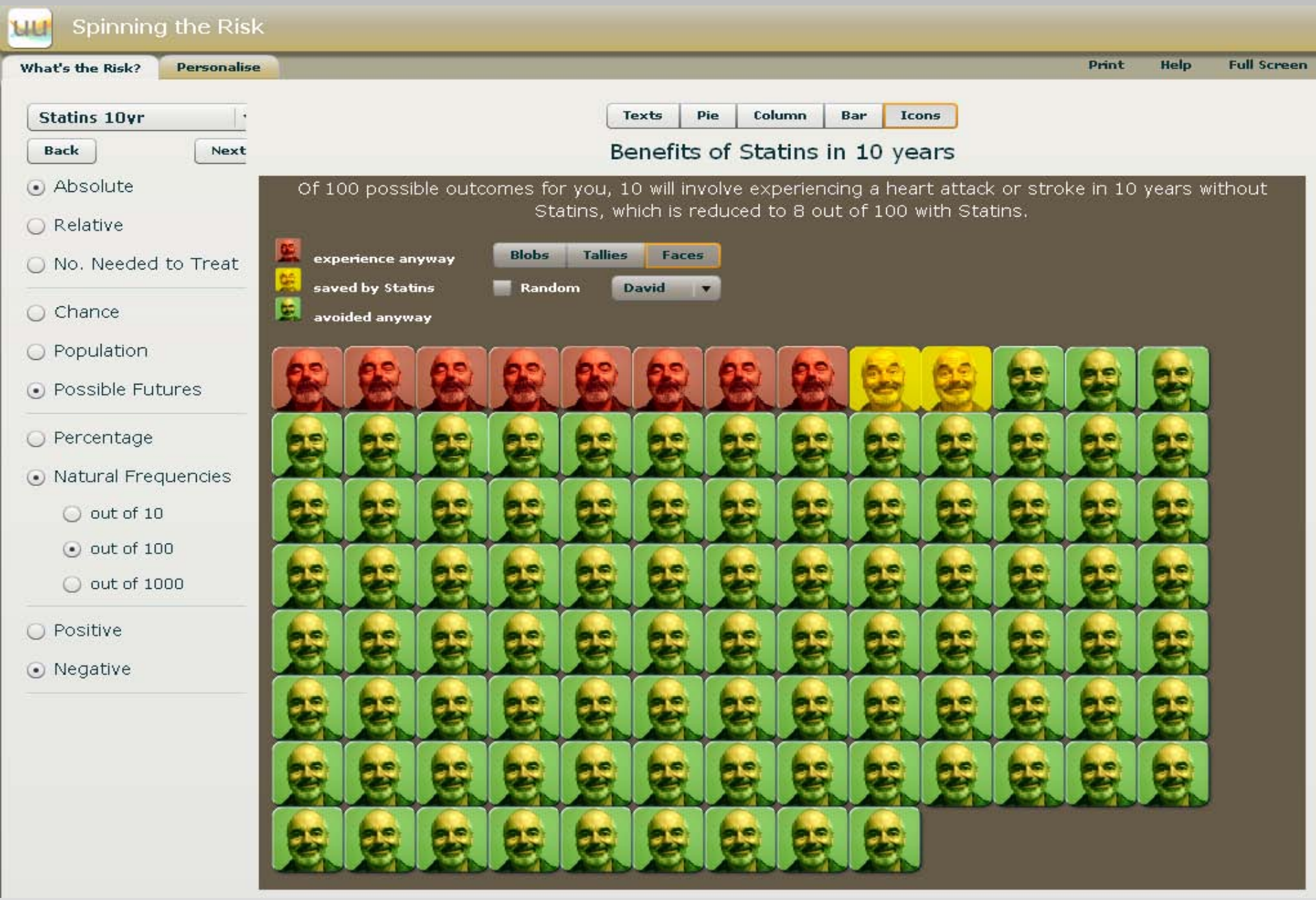
Low 10-year risk = 6 **%** *(for others in your age group)*

Information for this Coronary Heart Disease Risk Calculator comes from the Framingham Heart Study. The results are applicable *only* for the ages of 30 t
Please refer to:

Wilson, PW, *et. al*. **Prediction of Coronary Heart Disease Using Risk Factor Categories**. *Circulation* 1998 97 (18): 1837-1847.

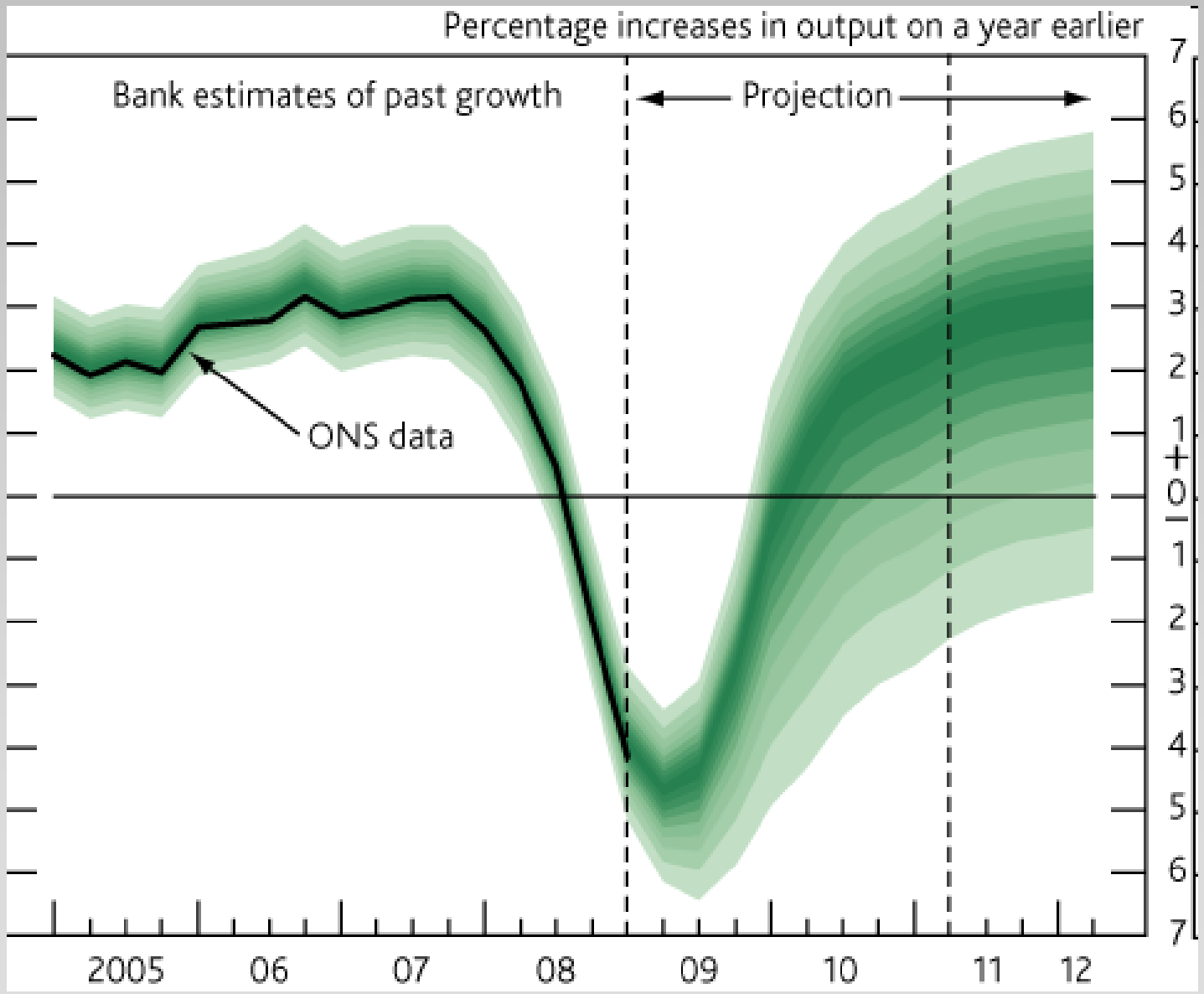
My doctor quoted me a 10% risk of heart attack or stroke in 10 years

– should I take statins?



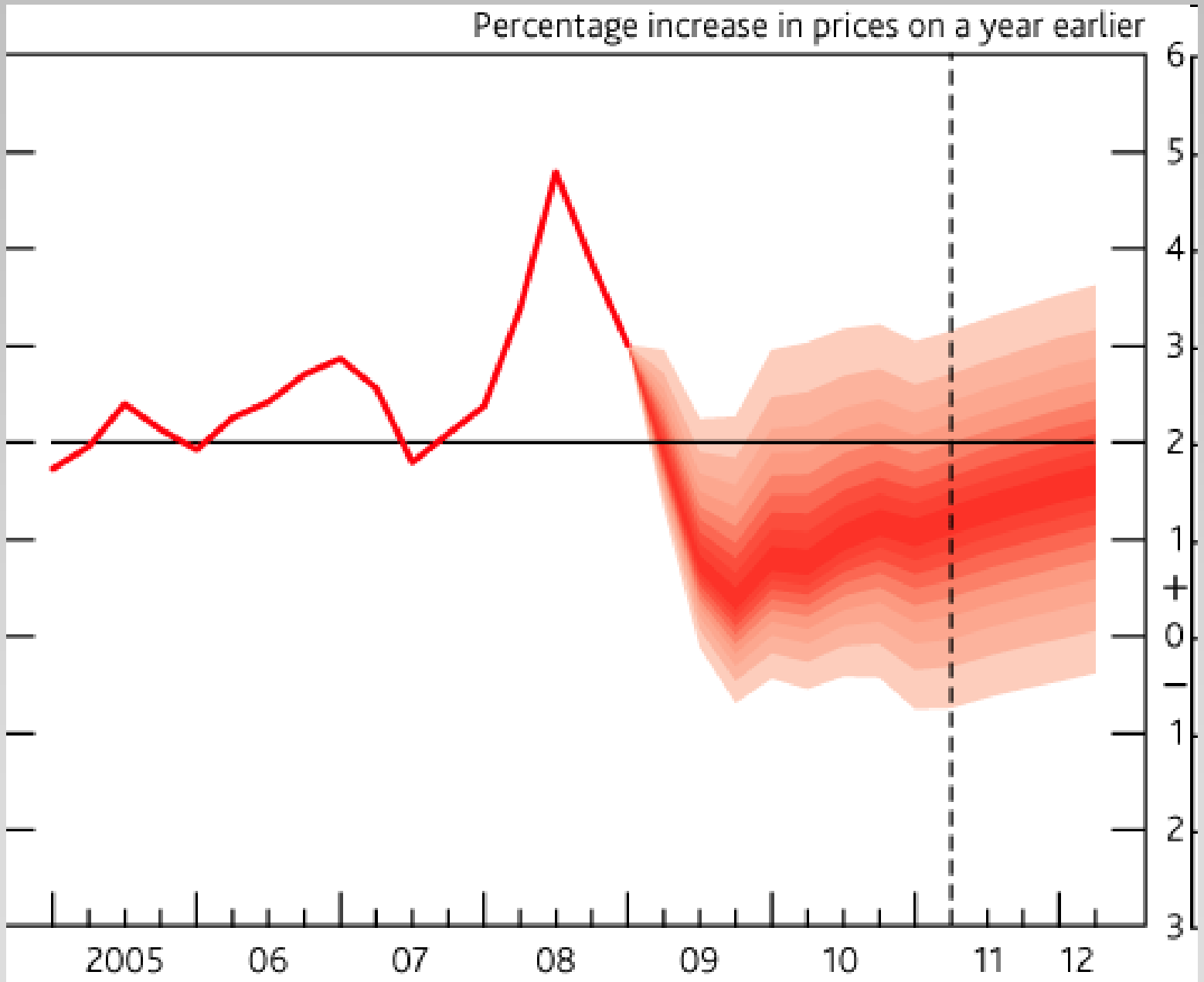
Spinning-the-risk: www.understandinguncertainty.org/node/233

Express as a probability distribution, such as Bank of England fan charts for GDP



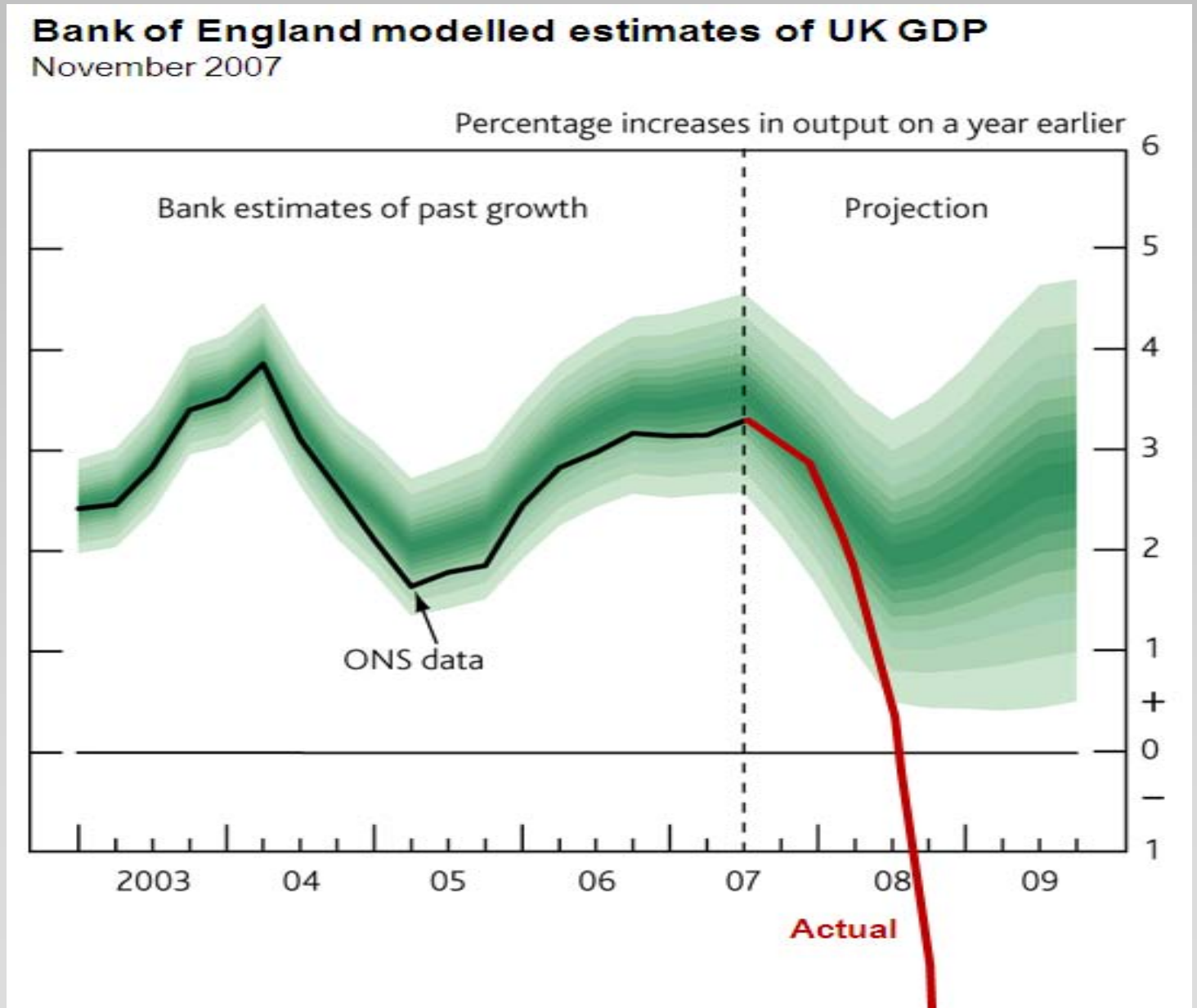
May 09

Bank of England ‘fan charts’



May 09

Can compare with what happened



Do these provide reasonable betting odds?

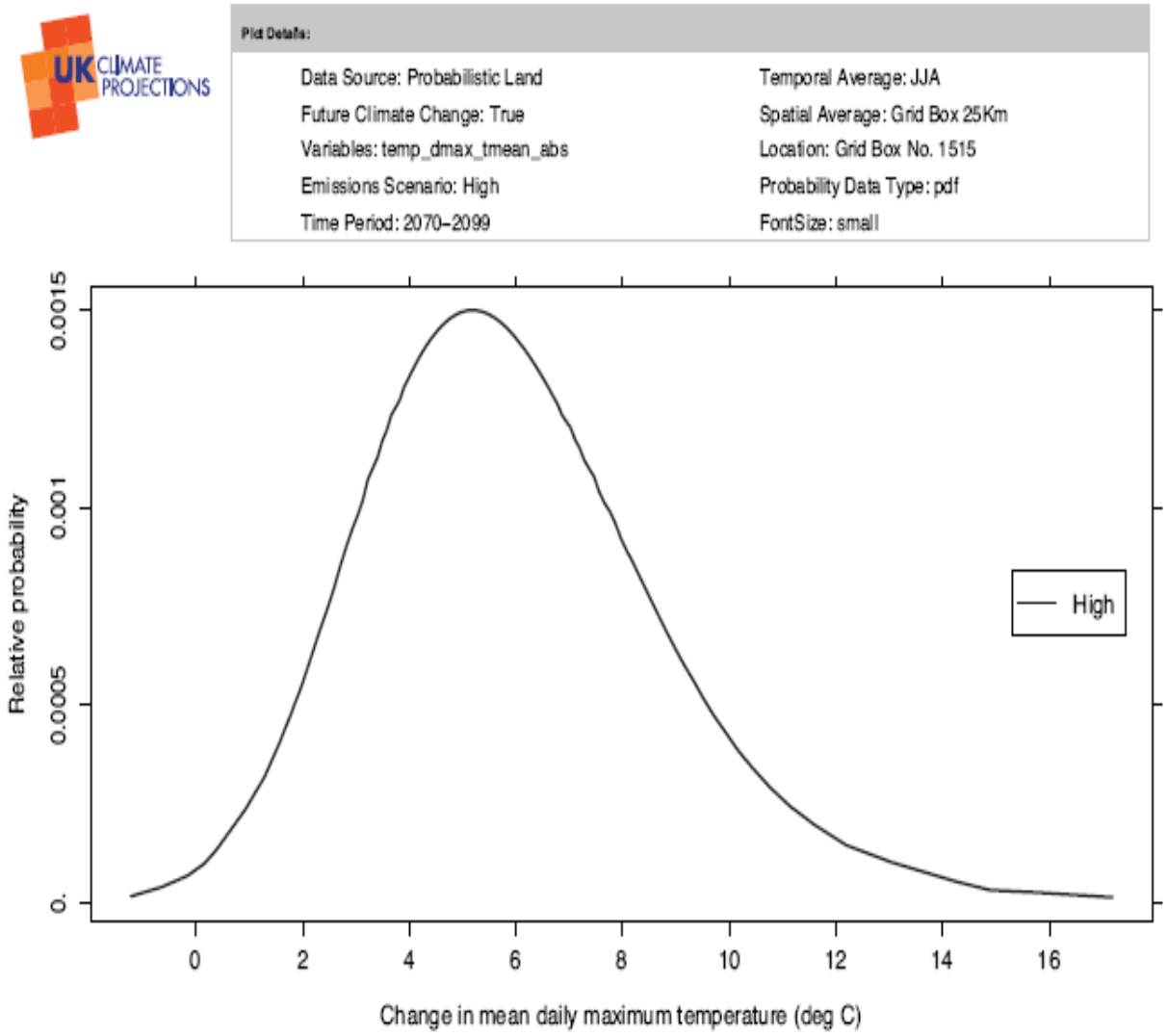


Figure 4.26: A PDF of the change in summer-mean daily maximum temperature, for a 25 km square in the East of England, by the 2080s under the High emissions scenario.

Flipping coins

Two types of uncertainty

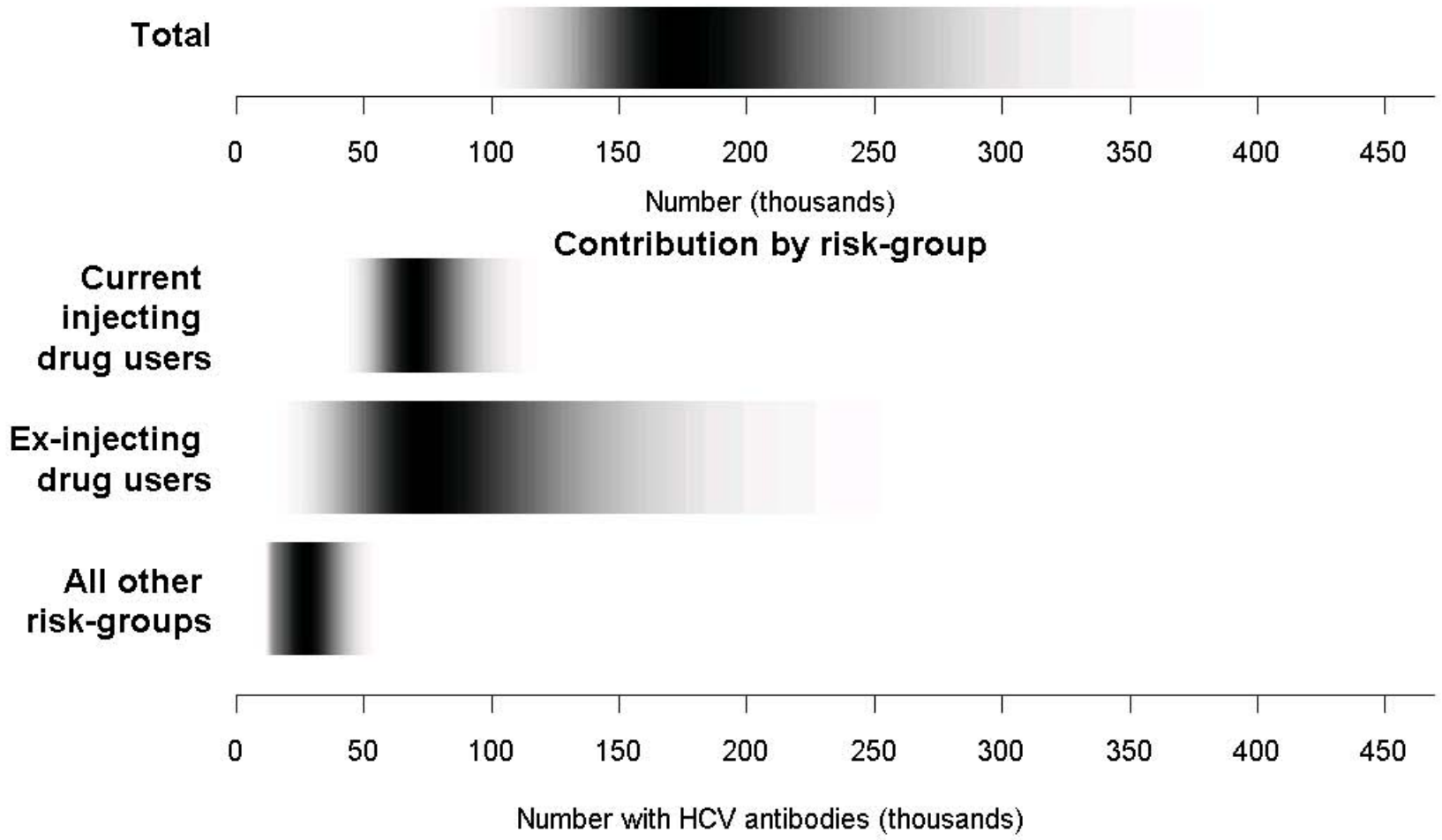
Aleatory

– chance, unpredictable

Epistemic

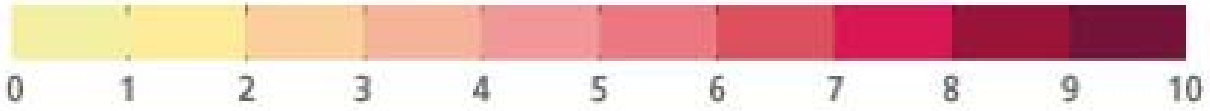
– lack of knowledge, ignorance

Hepatitis C prevalence in UK



Problems with confidence limits

- Suggestion that all points in interval are equally likely
- Media can report “up to X people might have Hepatitis C”



Change in winter mean temperature (°C) Medium emissions

2020s
90% probability level:
very unlikely to be greater than

Link to customisable version

2050s
90% probability level:
very unlikely to be greater than

Link to customisable version

2080s
90% probability level:
very unlikely to be greater than

Link to customisable version

Stuff with bags

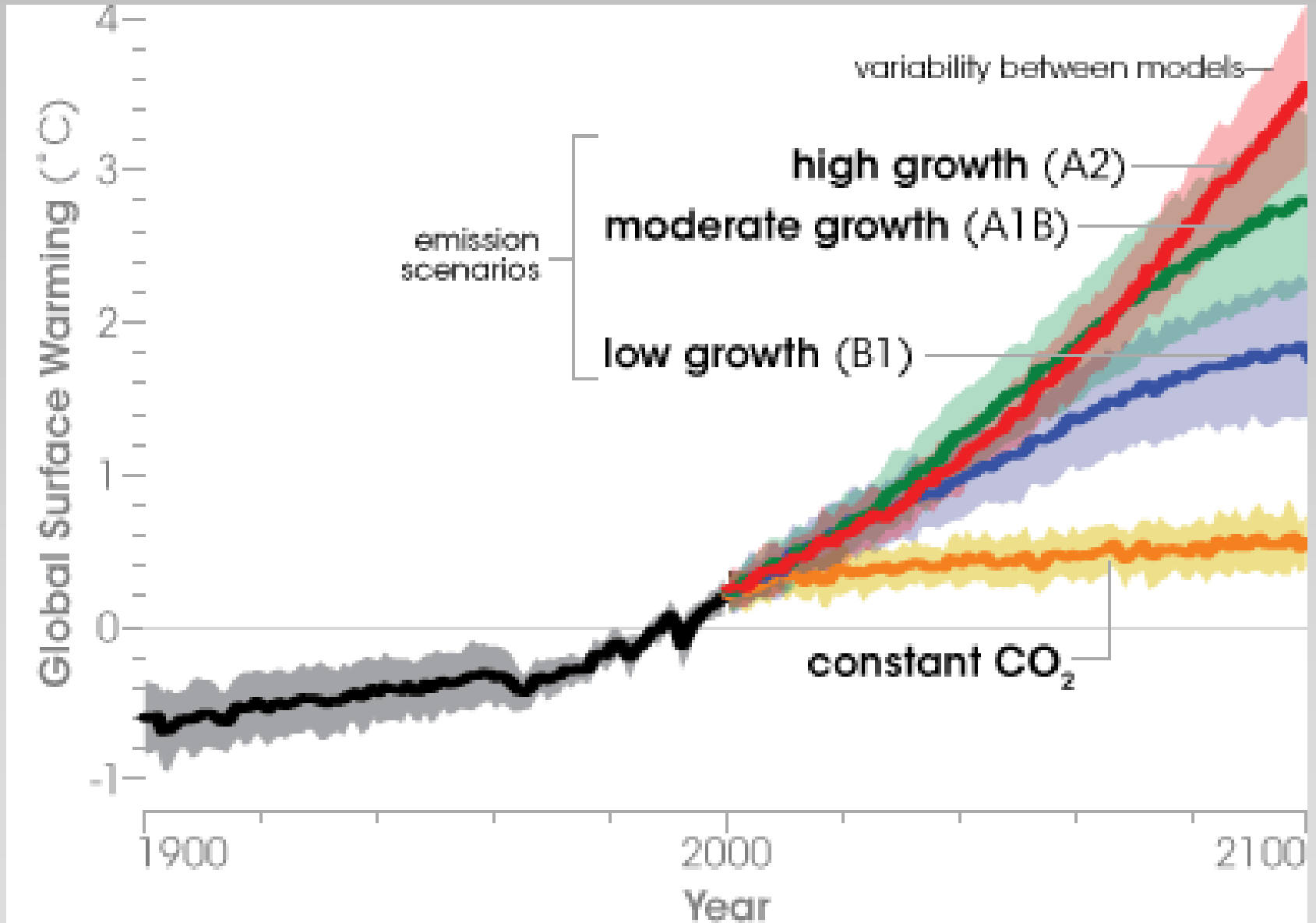
When building risk models, we can acknowledge uncertainty at different levels:

1. Specific future events
2. Quantities/parameters in a model
3. Assumptions underlying the ‘best’ model (both internal and external)
4. Inadequacies of our ‘best’ model

But what about unacknowledged uncertainties?

		Object of	**uncertainty**	
Specification	Events	Parameters	Models	Discrepancy
Denial	We are certain what will happen		‘we know how the world works’	
Probability distribution		Epistemic distribution		
List (quantified outcomes)			List of scenarios	
Informal acknowledge-ment				We know our models are inadequate
No discussion				

IPCC projections



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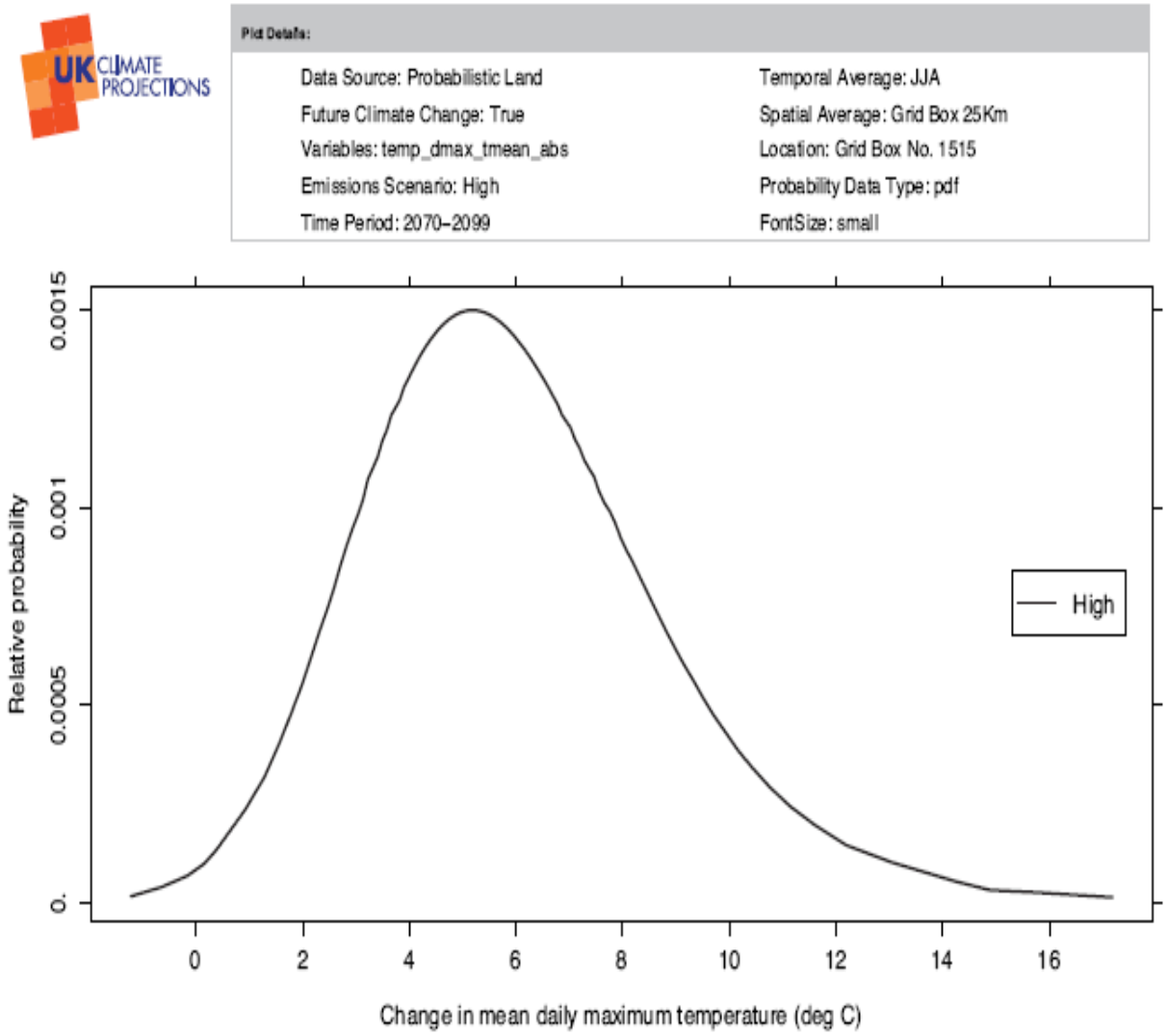

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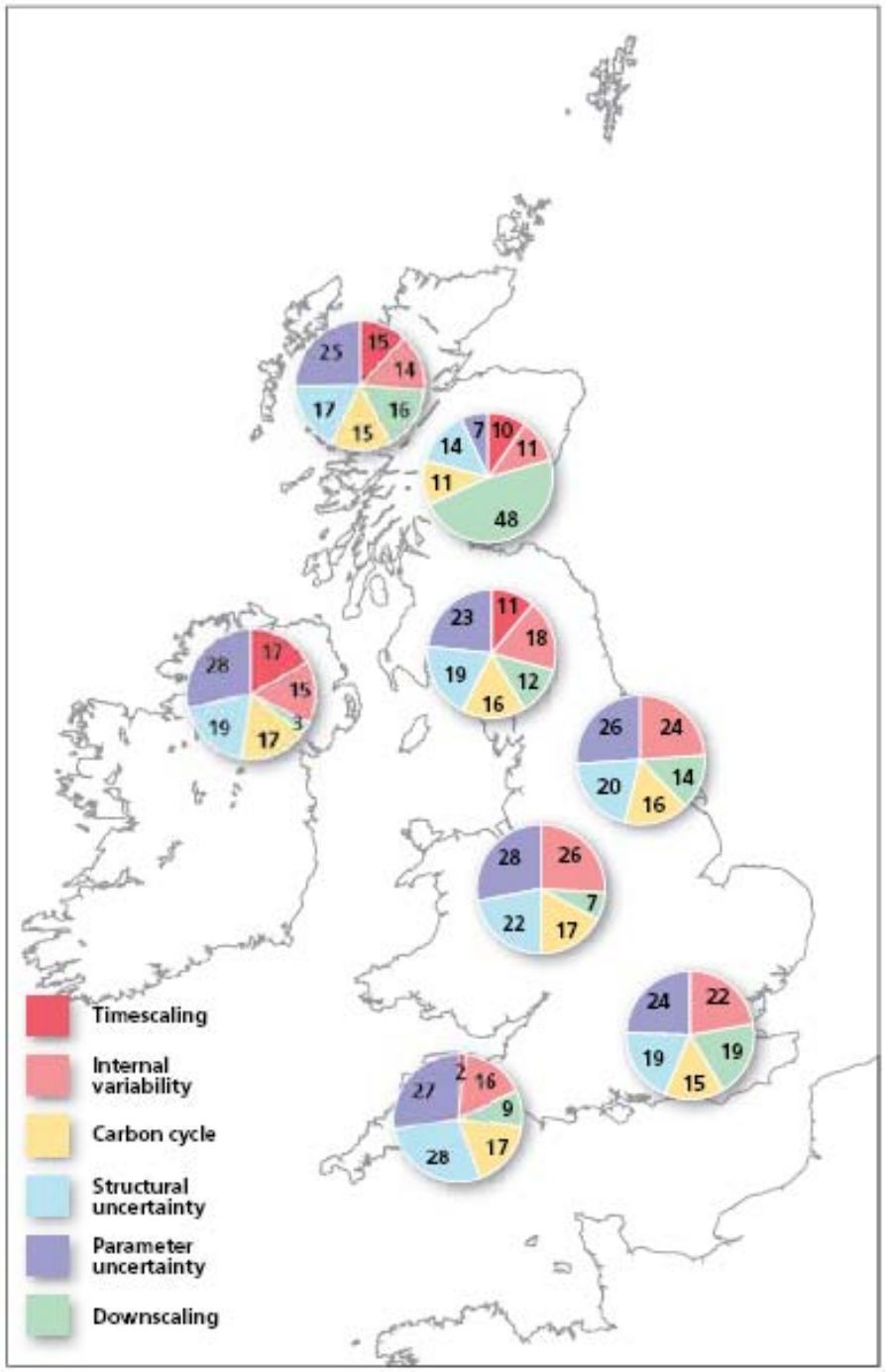


Figure A2.7: Contributions to the uncertainty in winter precipitation changes for 2070–2099 relative to 1961–1990, at selected 25 km grid squares. Contributions are calculated as in Figures A2.5 and A2.6, and also include that due to downscaling from global climate model grid squares to regional climate model grid squares (see text for details).

Structural uncertainty + discrepancy only assessed by comparing with other models

‘extra-model’ uncertainties

- So far examined 4 levels of (potentially) quantifiable ‘intra-model’ uncertainties
- What about ‘unquantifiable’ extra-model sources?
  - ‘unknown unknowns’: possibilities that have not been thought of
  - unrecognised major scientific error
  - unacknowledged cultural assumptions
  - ambiguities in meaning
  - unrecognised implicit value judgements as to what is ‘important’
  - ‘indeterminacy’ – human element beyond modelling (Wynne)
- Not a clear division with acknowledged inadequacies
- Is this the responsibility of the modeller or risk manager?

Studying ignorance

Nescience (1615)

- lack of knowledge; ignorance.
- agnosticism.

Agnotology (modern)

Cultural production of ignorance

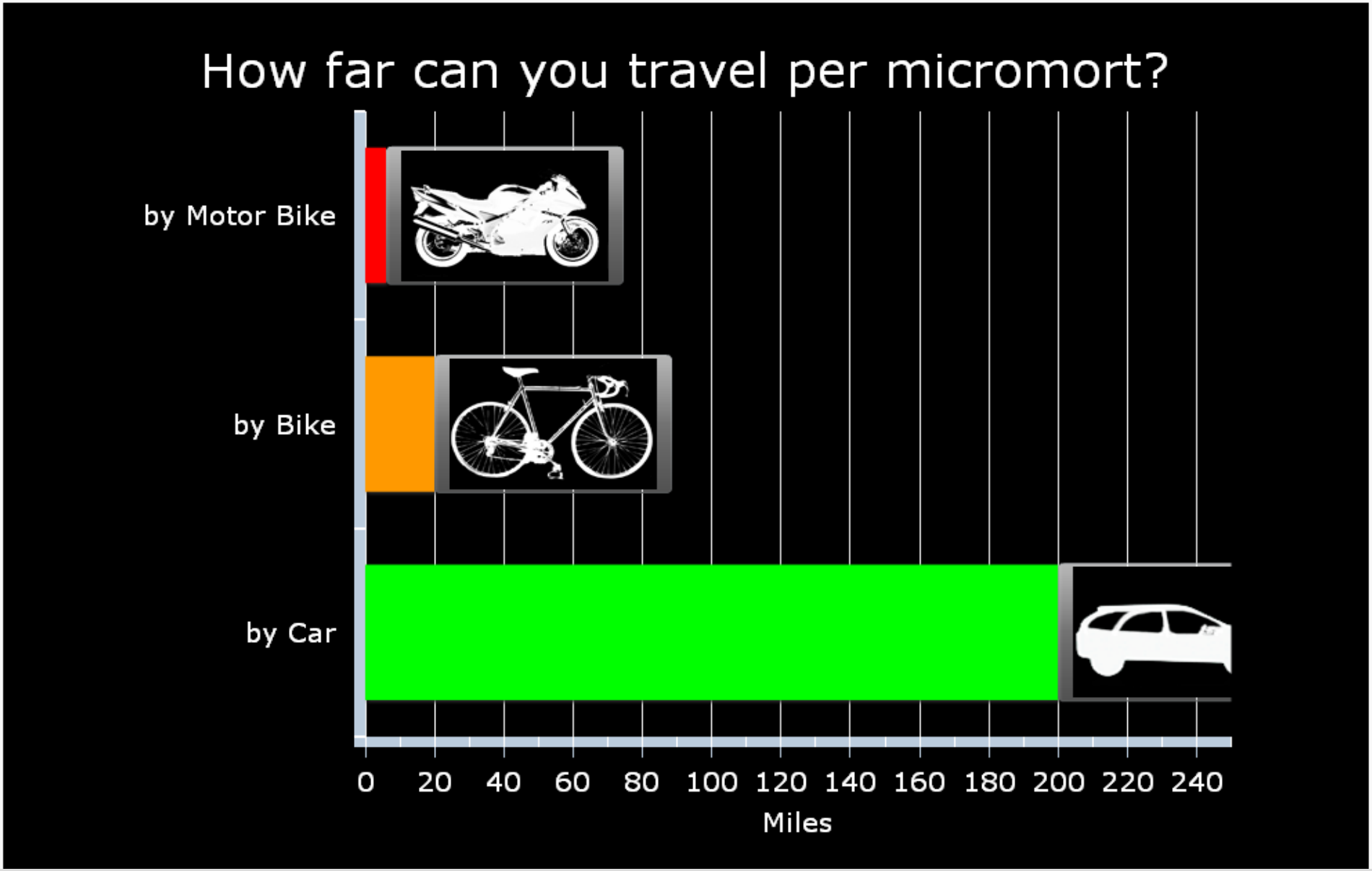
Memorable quote #325

“But there are also unknown unknowns. There are things we do not know we don’t know”

		Object of	**uncertainty**	
Specification	Events	Parameters	Models	Discrepancy
Denial				
Probability distribution	Inherent variability	Parameters, random effects	Structural component	
List (quantified outcomes)			List of emision scenarios	
Informal acknowledge-ment				No account of solar radiation, volcanoes etc
No discussion				

“*What are the risks?*”

- Need a friendly unit of deadly risk
- A ***Micromort*** is a 1-in-a-million chance of dying
- Each day 50 people die of *non-natural* causes in England and Wales (about 50 million)
- So we (on average, in good health) experience a micromort every day



Micromort animation:

Ways of spending a micromort

- Hang-gliding?
  ~ 8 each trip
- Scuba?
  ~ 5 each dive
- Horse-riding?
  ~ 0.5 each ride
- Taking ecstasy?
  ~ 1 each tablet
- Being admitted into hospital?
  ~ ??? ?

‘Conclusions’

- Statisticians/modellerS tend to have (or at least are taught) a rather narrow view of uncertainty
- Different communities approach the hierarchy of uncertainty from opposite ends
- Impact of different sources of uncertainty needs to be clearly communicated
- Robust use of quantitative methods, *with due humility*, is of huge value
- Users need to *use due caution*