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# Uncertainty

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# Outline

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- ◆ What is uncertainty
- ◆ Importance of quantifying uncertainty
- ◆ Methods for estimating uncertainty
- ◆ Challenges of these methods
- ◆ Decisions making

# Uncertainty

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*Life is full of uncertainties*

- a situation in which something is not known, or something that is not certain

# Probability

# Types of Uncertainty

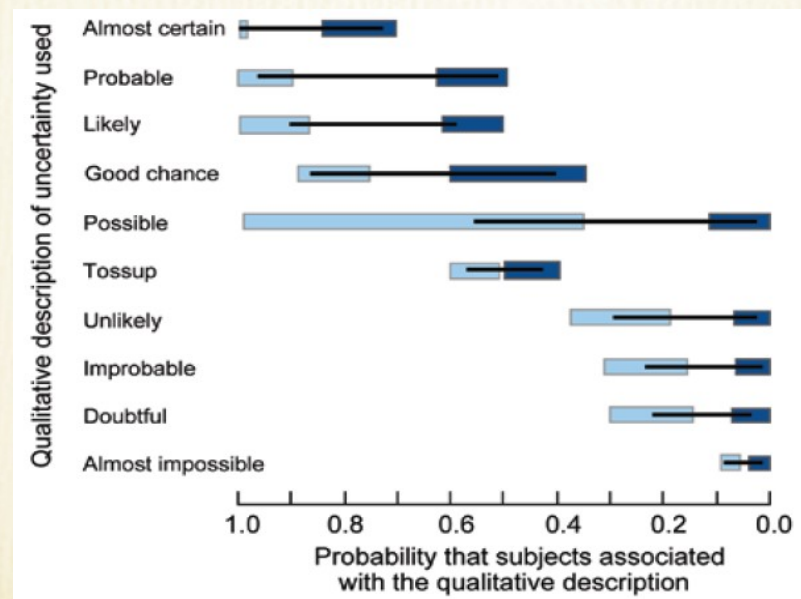
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1. Random errors in measurement
2. Systematic errors

# Quantifying Uncertainty

1. “I think its going to rain today”
2. “It is very unlikely nuclear war will occur”
3. “The doctor says that chemical X have is **unlikely** to cause cancer”

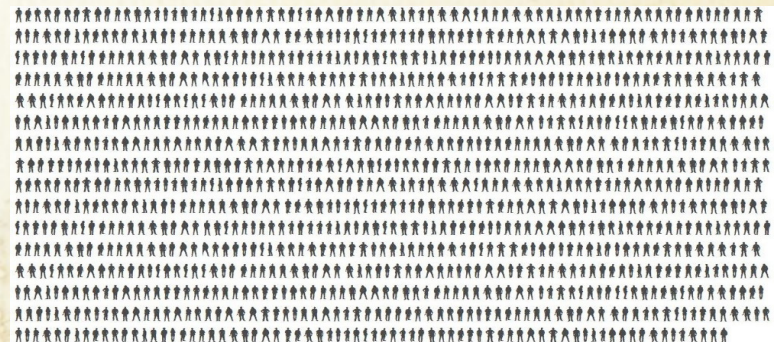
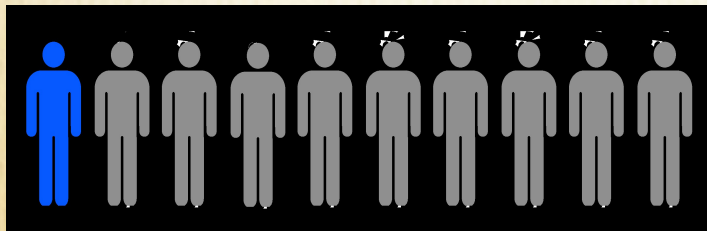


# Problems

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Such words have different meanings to different people in different situations

# Unlikely

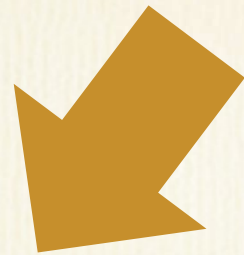


# Estimating Uncertainty

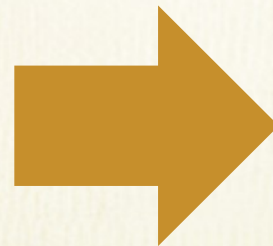
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How people estimate uncertainty?

**Odds of raining  
tomorrow**



Raining for 3 days  
straight



High chance of  
raining

# Availability Heuristics

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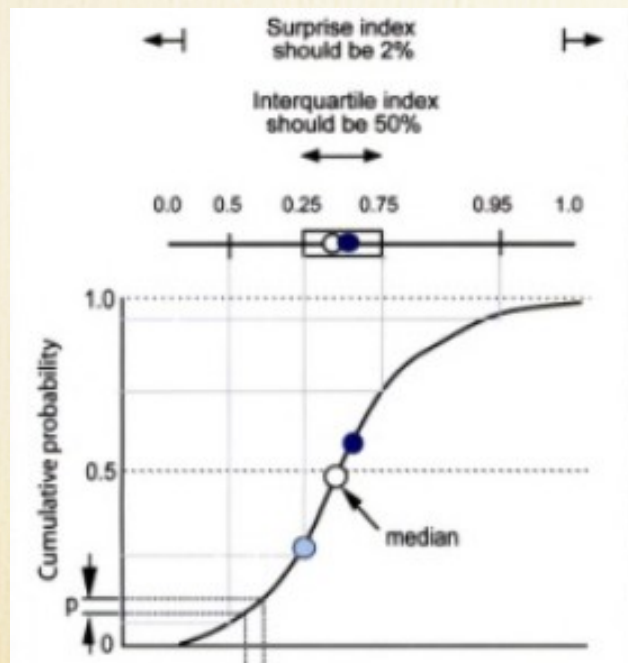
1. Past experience
2. Judgement
3. Ease with imagine such events occurring

**Odds of raining in New York  
Tomorrow**



# Challenges

## OVERCONFIDENCE



	Number of Assessments N	Interquartile index (Ideal 50%)	Surprise index (Ideal 2%)
<i>Alpert &amp; Raiffa (1969)</i>			
Group 1-A	880	33	46
Group 2 & 3	1,670	33	39
Group 4	600	36	21
<i>Hession &amp; McCarthy (1974)</i>			
Fractiles	2,035	25	47

# Methods

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Comparing Competing models

## Climate

Spacial and  
temporal  
variations

Rate of occurrence

M1

M2

# Likelihood Ratio (LR)

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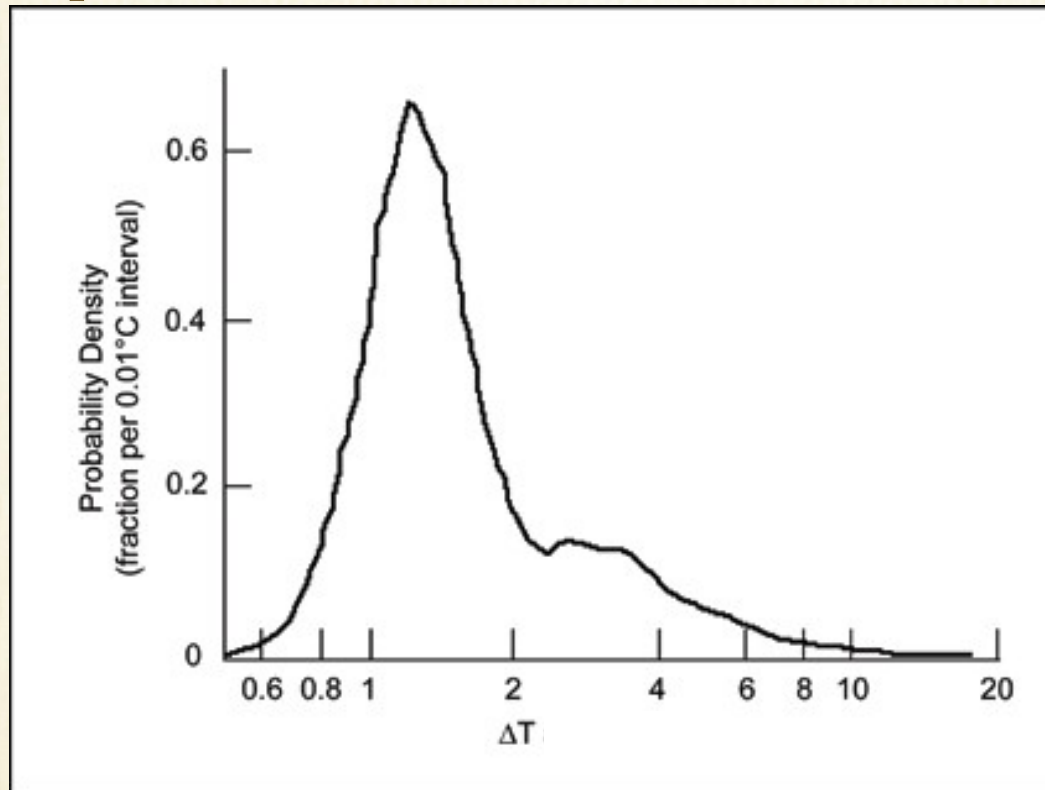
$$\frac{P(M1)}{P(M2)} = LR$$

***LR* > 1      *LR* < 1**

# Methods

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Can do a large number of runs on a single model or do runs on a large number of models made by experts.



# Decision Making

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Identify the  
problem



Research



Gain full  
understanding of  
relevant issues

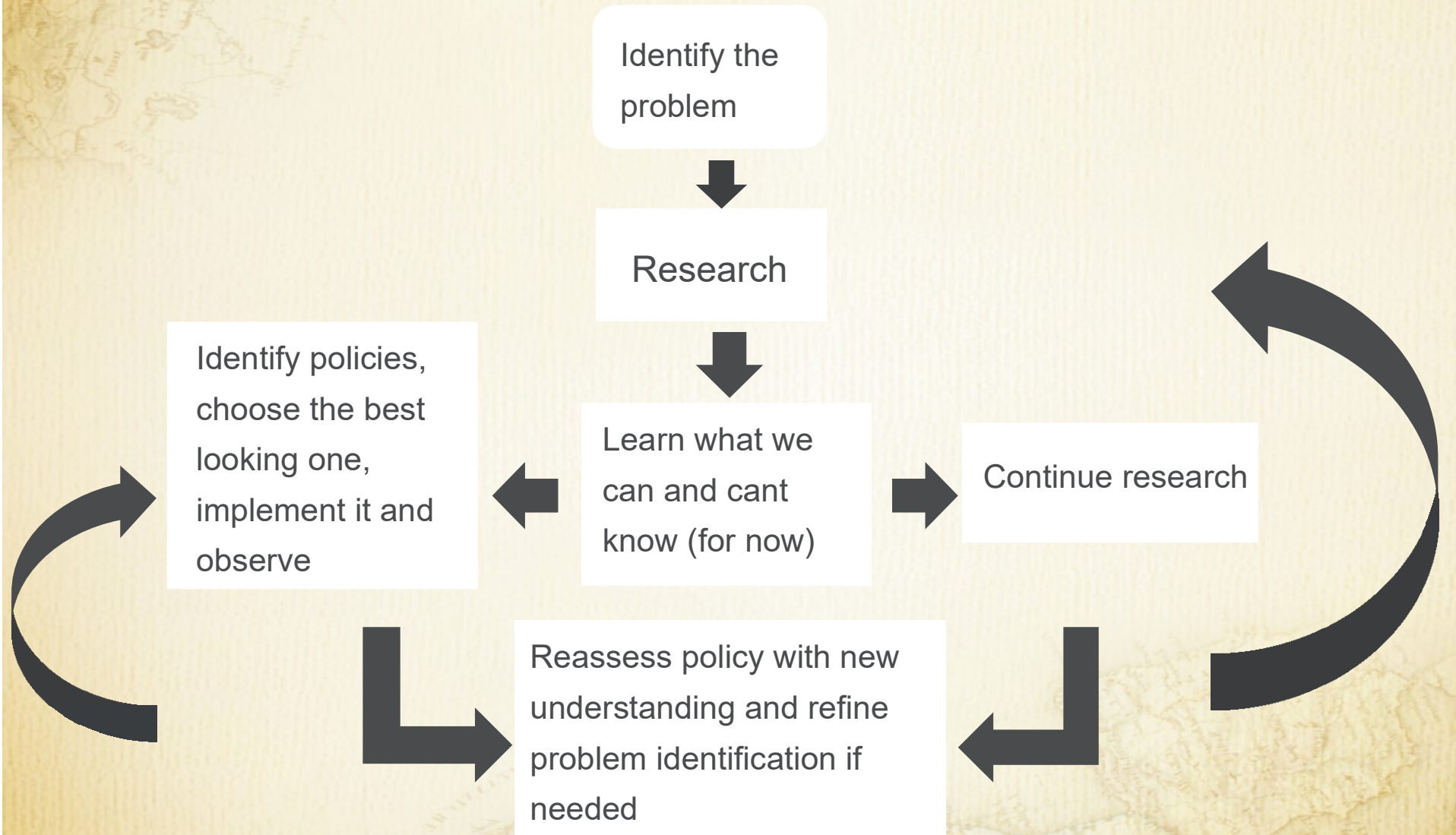


Identify policy  
options

**Solve the  
problem**



# High Uncertainty





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Thank you

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