

# Structured Expert Judgement

July 2020

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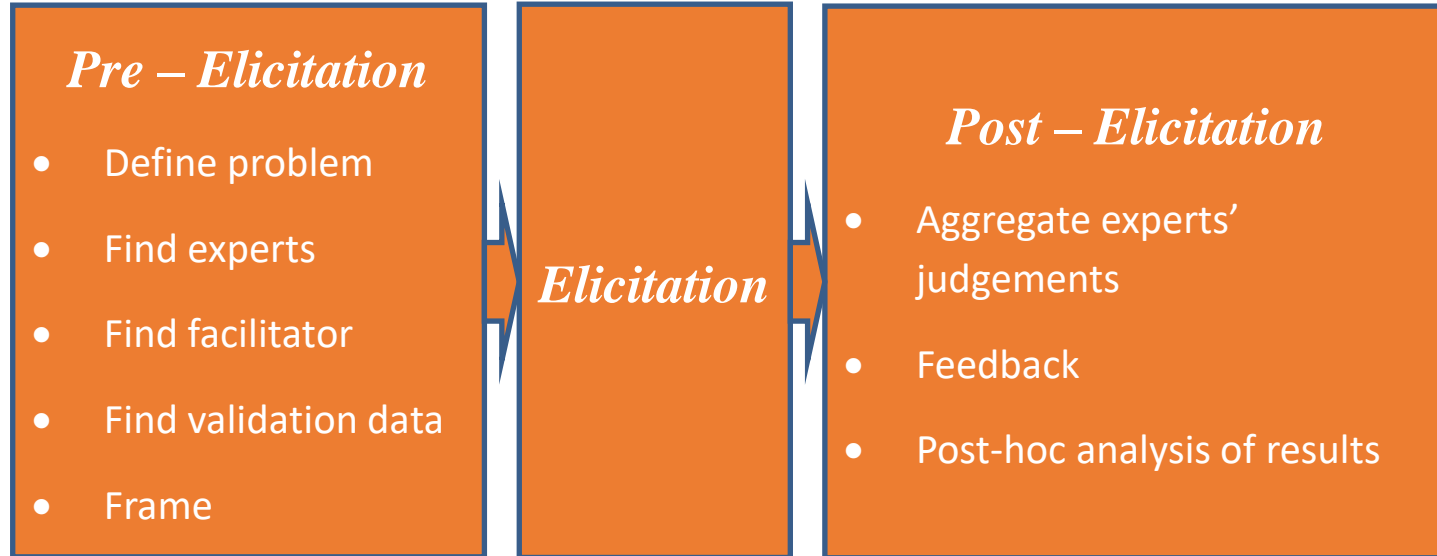
With thanks to Dr Anca Hanea

# EXPERTS ARE OFTEN CONSULTATION FOR:

- Framing and structuring of a problem
- Identifying variables and relationships
- Sources of data / Data
- Quantifying uncertainty
  - Uncertain parameters (uncertain quantities, probabilities)



## Structured expert judgement



# WHAT IS THE BEST WAY TO DO IT?

- Nobody knows!
- ...but we know more experts are necessary
- ...and we agree that the following are important:
  - Preparation and planning
  - The selection, phrasing and sequence of questions
  - The aggregation of multiple judgements
  - Documentation of the process

# CONDITIONS THAT CHARACTERISE 'WISE CROWDS':

- diversity of opinion
- independence
- decentralisation (individuals draw on their own local knowledge)
- aggregation (having a suitable means to generate a group judgement from multiple individual estimates).



# PHRASING & SEQUENCE OF QUESTIONS

- *What* questions we ask the experts, and *how* we ask them, influence their answers
- Psychologists have studied the process of making judgements in uncertainty
- Heuristics and cognitive biases

# AGGREGATION

- The process of deriving a single probability (distribution) or a single estimate to represent the knowledge of a group of experts
  - Divergent opinions on how best to do this
  - Mathematical versus behavioural



# STRUCTURED EXPERT JUDGEMENT

An elicitation protocol that:

- asks questions with clear operational meanings
- follows transparent methodological rules
- mitigates psychological and motivational biases
- includes the possibility of identifying the experts
- allows empirical control
- is thoroughly documented





## Questions

*What % of a watermelon is water?*

5%

95%

50%

Lower plausible bound

Upper plausible bound

Best estimate

## Weighting schemes



# VALIDATION DATA FOR EMPIRICAL CONTROL

- Calibration / performance / seed variables needed
- Scores for good performance
  - Calibration / Statistical accuracy
  - Informativeness
- Use scores as weights



# COOKE'S PROTOCOL

- Requires that experts assess uncertainty for variables for which we (will) know the true values:

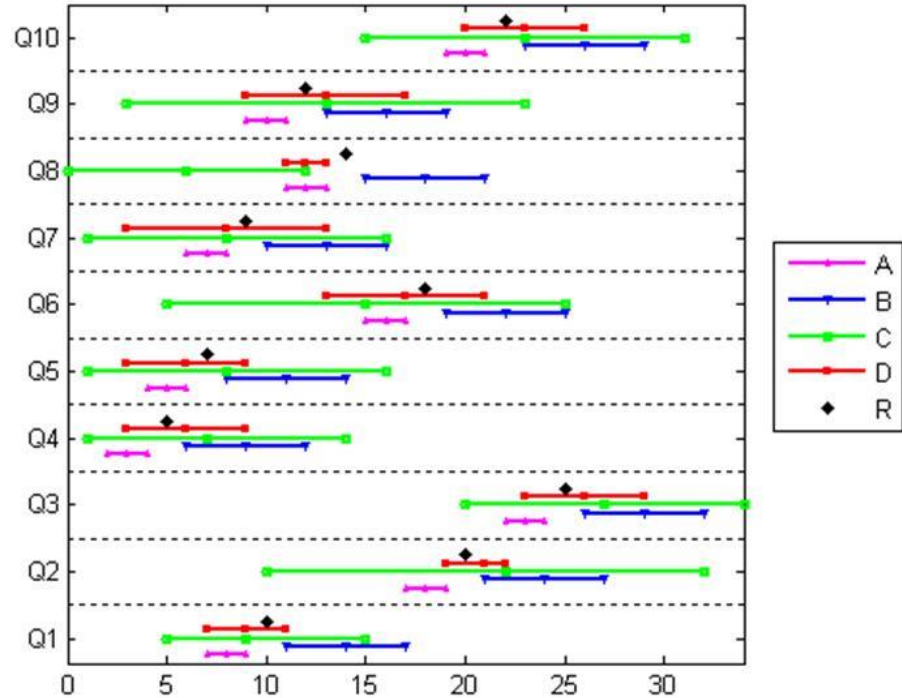
*Calibration / performance / seed variables*

- *Assumption* – the *future* performance of the experts on the variables of interest can be judged on the basis of their *past* performance on the seed variables

# RANGE GRAPHS

## calibration questions example

4 experts, 10 calibration questions, correct answer marked.



# IDEA (INVESTIGATE, DISCUSS, ESTIMATE, AGGREGATE)

## *Pre – Elicitation*

- Define problem
- Find experts
- Find validation data
- Frame
- Train

## *Elicitation*

- Individual Investigation & 1<sup>st</sup> set of individual estimates
- Feedback and facilitated Discussion
- 2<sup>nd</sup> set of individual Estimates

## *Post – Elicitation*

- Aggregate experts' judgements
- Feedback
- Post-hoc analysis of results

# IDEA MINIMISES COGNITIVE BIASES

- The 1<sup>st</sup> individual assessment avoids **anchoring** on other people estimates
- The discussion between rounds reduces the effect of the **availability** bias
- The 2<sup>nd</sup> individual anonymous assessment reduces **dominating effects and group think**
- The way we ask the questions reduces the **anchoring & overconfidence**



# IDEA PROTOCOL : WHAT WE'VE LEARNED

- Feedback and facilitated interaction are crucial
- Discussion induces very weak dependence and helps improve experts' performance
- aligns expert opinions in the direction of the truth
- Mathematical aggregation is essential
- Equal weighting may be outperformed by unequal weighting
- Performance measures should determine the weights (when unequal)





# IDEA :

## USE IN DIAGRAM

- Involved archivists from a range of archives to be as general as possible
- Used performance weighted aggregation
- Facilitated discussion between archivists
- Provided data where there was none
- Quantified uncertainty
- Enabled the model to be completed

