

*Uncertainty and Expert Opinion  
Asian Carp and the Great Lakes*

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**Consideration of BMP Performance Uncertainty in Chesapeake Bay Program  
Implementation, Fairfax, VA**

**November 14, 2017**




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# Great Lakes Mississippi River Interbasin Study

This green dot is Bandon Road Lock and Dam.



A 3D rendered white figure is kneeling on a light blue surface, leaning forward to touch a large white sphere that is partially buried in a hole dug into the ground. The hole is filled with brown soil. To the left of the hole, a shovel with a silver head and a wooden handle stands upright, its blade resting on a pile of soil. A large, blue, oval-shaped speech bubble is positioned above the figure, containing white text. The background is a solid light blue color.

We're not asking you to fill the hole.  
We are asking you to help describe  
the hole.

Expert elicitation cannot create knowledge. At its best, it characterizes uncertainty. Consequently, preserving that uncertainty is essential.

# Experts	One	More
Elicitation	Individually	Group
Aggregation	Mathematical	Behavioral
Instrument	Interview	Questionnaire



# Preparing For Elicitation

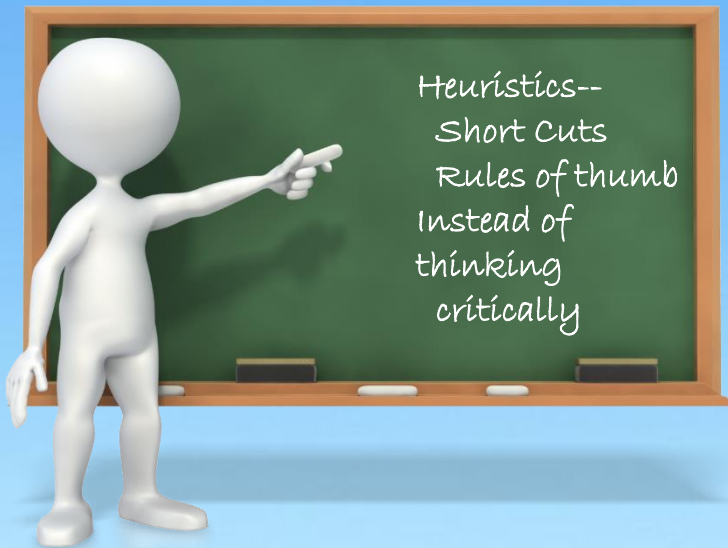
- Identify experts
- Read ahead-common body of materials
- Meeting
  - Presentation
  - Clarification
  - Assumptions
  - Discussion
  - Calibration/Heuristics
- Elicitation

We need you all to debate and discuss the things you think are important. We need to identify uncertainty.



# Heuristics

- Calibration
- Confidence
- Motivation
- Availability
- Representativeness
- Anchoring
- Framing
- Confirmation
- Status Quo
- Sunk Cost







# Motivational Bias

Maybe I meant to do that maybe I didn't.



# Availability Bias

I'm telling you smoking does not cause cancer. My grandfather smoked three packs of cigarettes a day and he lived to be 100.



# Representativeness Bias



Which 10 coin toss result is most likely to occur in a single toss of 10 coins?



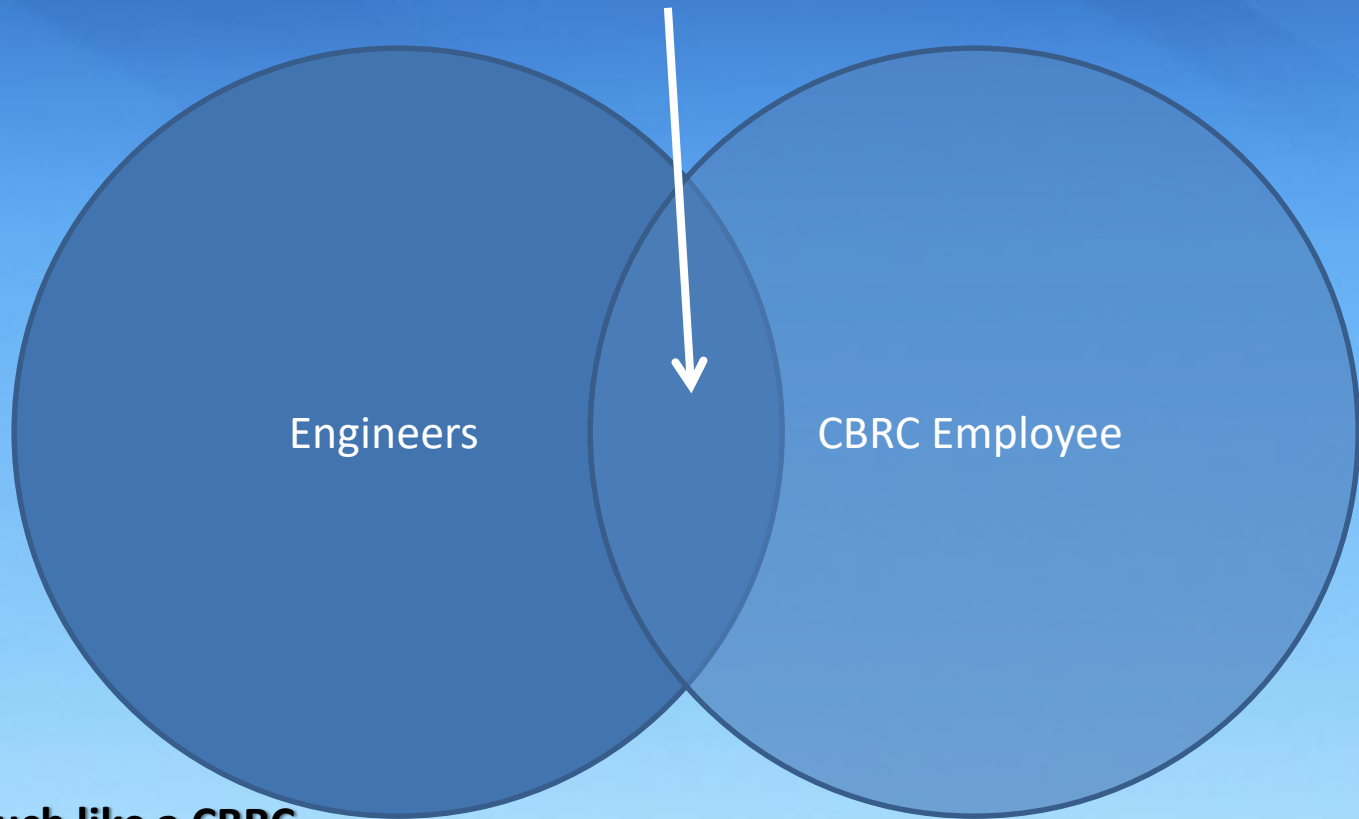
Linda is 31 years old, single, outspoken, and very bright. She majored in civil engineering. As a student, she was deeply interested in Chesapeake Bay, pollution, and cleaning up the Bay. As a student she did an internship with the Chesapeake Bay Research Consortium and loved it. She got glowing reviews from CBRC. Which of the following is the most likely alternative.

**Linda is an engineer**

**Linda is an engineer and a CBRC employee**



Probability Linda is an engineer  
and a CBRC employee



**She sounds so much like a CBRC employee that we overestimate the probability of that event by ignoring the much greater probability of the base rate condition.**



**Suppose**  
**US population ~ 300,000,000**  
**Terrorists in US ~ 3,000**  
**New technology monitors all**  
**communications and within 3**  
**words can detect a terrorist with**  
**99% accuracy**  
**T+ = 99%**  
**F+ = 1%**  
**FBI is automatically contacted**  
**when terrorist is suspected.**

When the FBI gets a report from this system, what is the probability it has a real terrorist? Is it closer to 99% or 1%?



# Representativeness Bias


**$99\% \times 3,000 = 2,970$  correctly identified terrorists (T+)**

**$1\% \times 299,997,000 = 2,999,970$  incorrectly identified nonterrorists (F+)**

$$2,970 / (2,970 + 2,999,970) = 0.1\%$$


That high detection rate of terrorists fools us. If we ignore the base rates we get bad estimates of probabilities.





The answer is 1,122 miles, according to Google Maps.

**If the anchor is poorly chosen the interval constructed around it will, likewise, be poorly constructed**



**Most people, including experts, fail to make big enough adjustments to the anchor to capture the target value**



# Framing Bias

People tend to like this option better.

Plan A saves one species and 2000 habitat units

Plan B loses two species and 3000 habitat units

**Three species and 5000 habitat units will be lost if you do nothing**



# Confirmation Bias

There is too much information to pay attention to all of it, so we must choose what to pay attention to and list the strong evidence according to what we believe and like to believe.

I like to listen to all the facts before deciding.

Liar, liar, pants on fire

Liar, liar, pants on fire



# *P(Establishment)*

$$P(\text{Establishment}) = P(\text{Pathway}) \times P(\text{Arrives}) \times P(\text{Passage}) \times P(\text{Colonization}) \times P(\text{Spread})$$



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# Capture Individual Expert's Uncertainty

**Without Condition**

**Arrival**

Population Probabilities

	2021	2031	2071
0 Negligible	0	0	0
1 Small	25	0	0
2 Medium	50	50	50
3 Large	25	50	50
Sum	100	100	100

**Passage**

	Small	Medium	Large
Minimum	0	20	100
0.33 33rd	5	30	120
0.67 67th	10	50	120
Maximum	100	100	150

**Colonization**

Colonization Threshold

	2021	2031	2071
Minimum	1000	1000	1000
0.33 33rd	3000	5000	5000
0.67 67th	4000	6000	6000
Maximum	5000	7500	7500

**Spread**

Minimum	0.25
0.33 33rd	0.5
0.67 67th	0.75
Maximum	1

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**Nonstructural Plan**

**Arrival**

Population Probabilities

	2021	2031	2071
0 Negligible	0	0	0
1 Small	25	50	60
2 Medium	50	30	30
3 Large	25	20	10
Sum	100	100	100

**Passage**

	Small	Medium	Large
Minimum	0	20	100
0.33 33rd	5	30	120
0.67 67th	10	50	120
Maximum	100	100	150

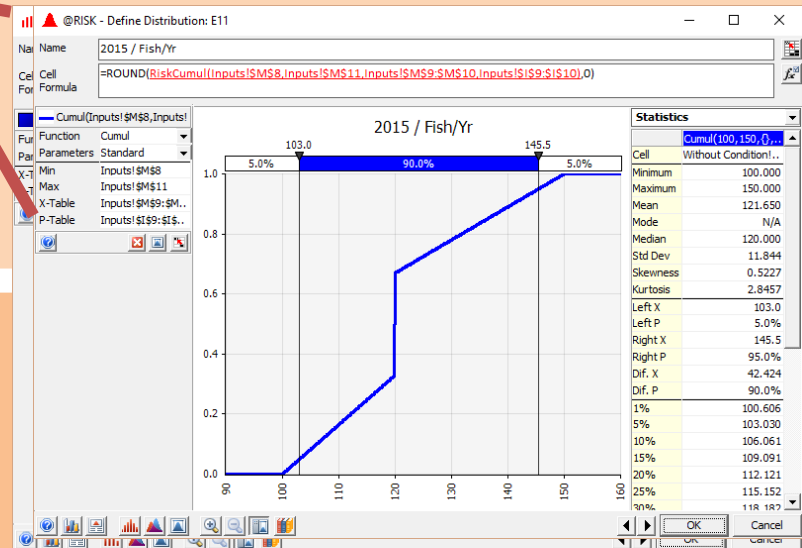
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**Technology Alternative-Electric Barrier**

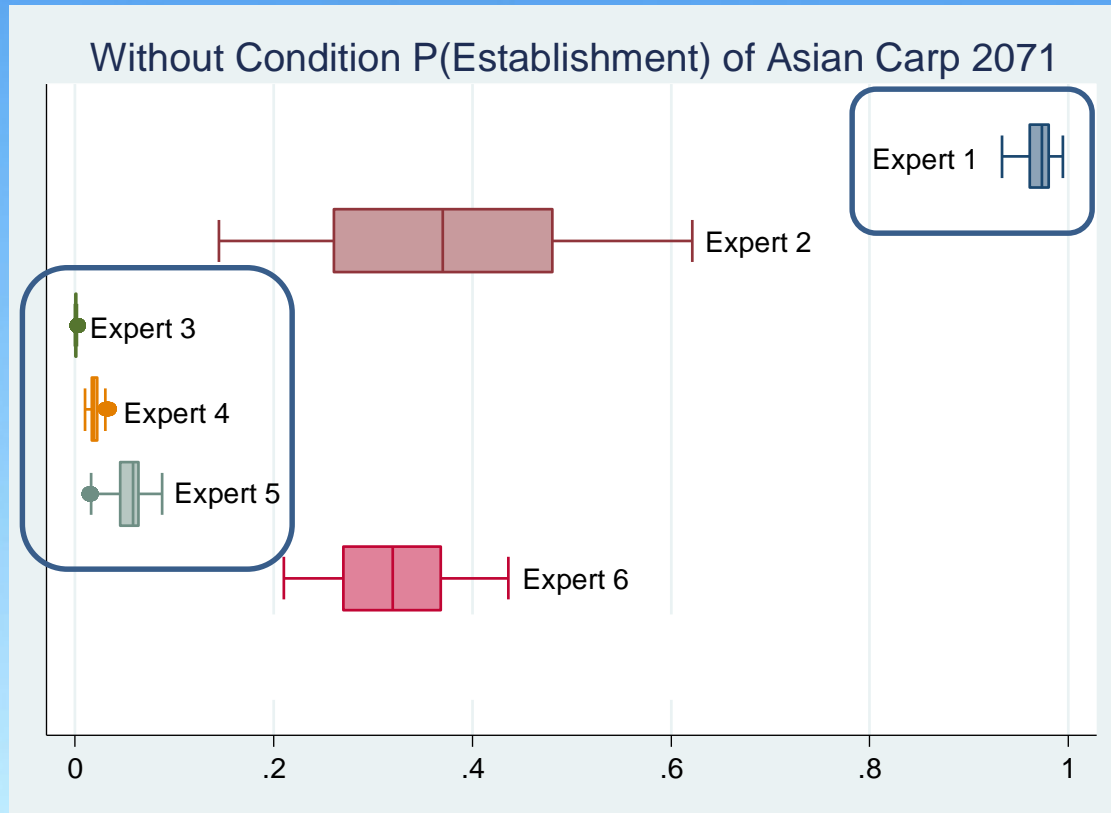
**Passage**

EB

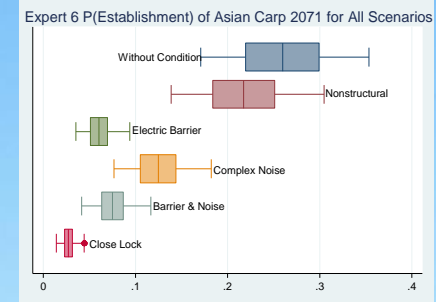
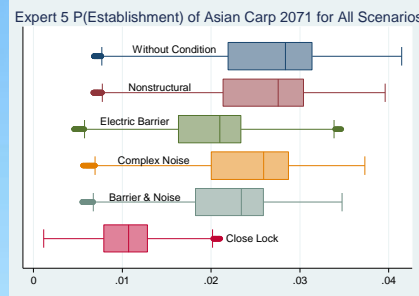
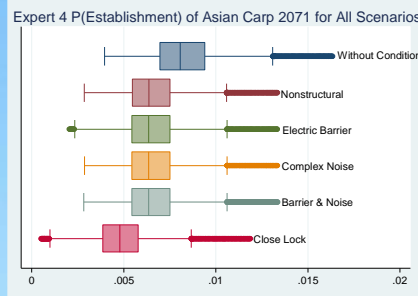
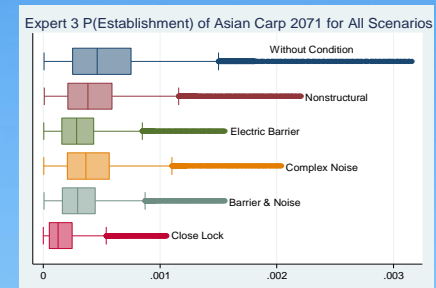
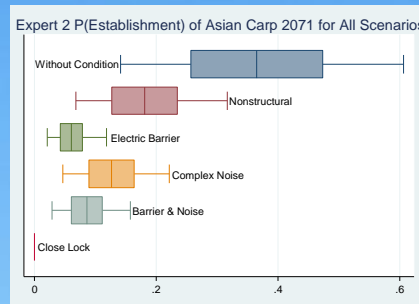
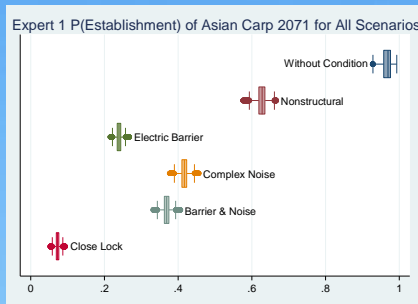
	Small	Medium	Large
Minimum	0	0	10
0.33 33rd	5	10	20
0.67 67th	10	30	60
Maximum	50	50	100



# Experts are uncertain



# There is disagreement among experts



FWOP > NS > CN > B&N > EB > CL



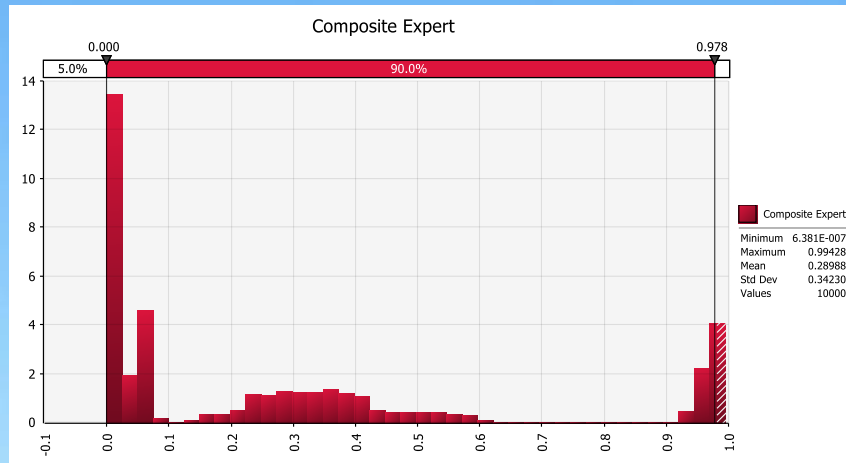
# *Behavioral Aggregation*

We will arrive at a common answer.

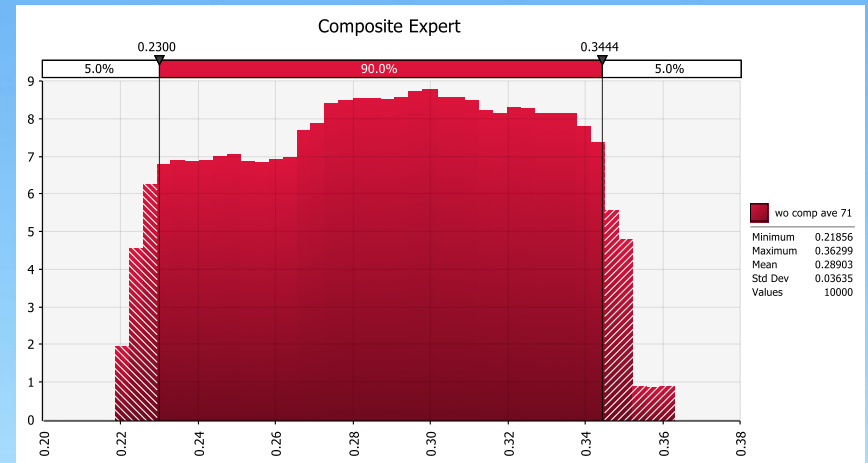


# Preserving and Summarizing Uncertainty-Mathematical Aggregation

Preserves Uncertainty

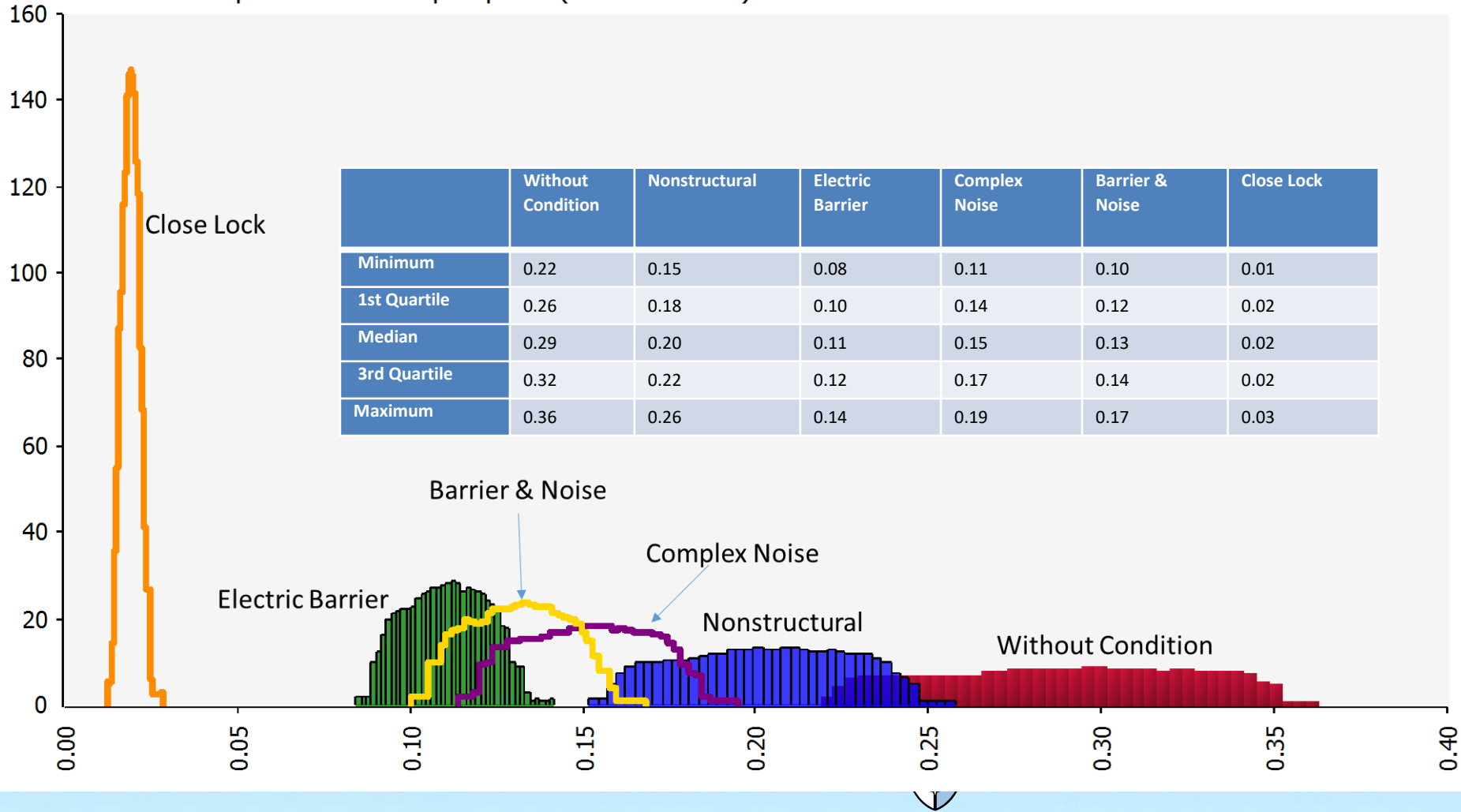


Narrows Uncertainty to  
Expected Value



# There is no such thing as “the number”

Composite Asian Carp Expert P(Establishment) Distributions for Without Condition and 5 Plans



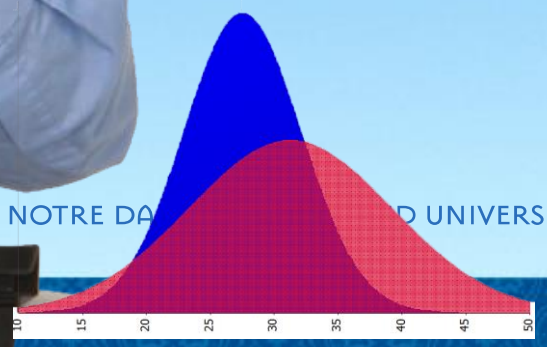
# Decision Making With Uncertainty

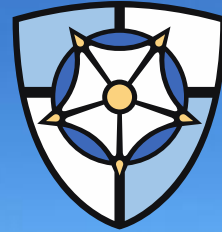


Can't you just give me the damn number!



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Thank you!

Questions?



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