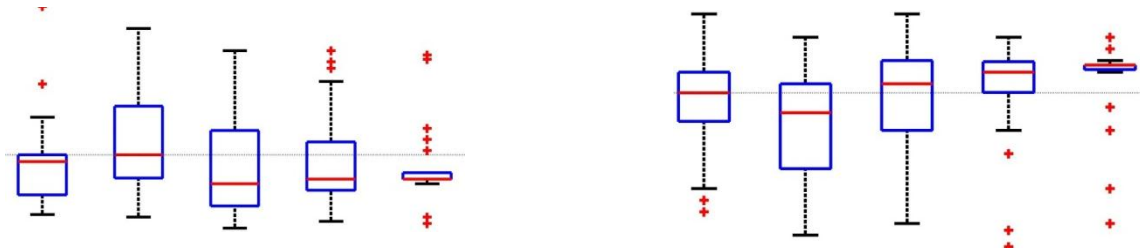




Methods for Communicating about Uncertainty: Levels of Confidence vs. Numerical Ranges



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Climate Science Communication

- An important issue facing climate scientists is how to communicate uncertainties (to the public).
- A variety of questions come up frequently in public & political debates
 - Some are related to the inherent uncertainties in climate science
 - Others reflect public's imperfect understanding of climate-related issues (Pew Center, 2009)
 - Others related to the uncertainties of the experienced outcome

Climate Science Communication

- Critics have used the inherent uncertainty as an excuse to dismiss findings altogether (e.g., Begley, 2007)
- Thus, it is critical to address the public's imperfect understanding of climate-related issues and misperceptions about the scientific consensus on the topic
 - By empirically testing the communications of climate-related findings and their underlying uncertainties

How can Communication be Evaluated?

- Communication is a two-way process
 - Develop and understanding of the science side
 - Develop an understanding of the stakeholder side
- Communications should target gaps between sides
 - Communications should then be tested for “success” at bridging gaps

Main Challenge

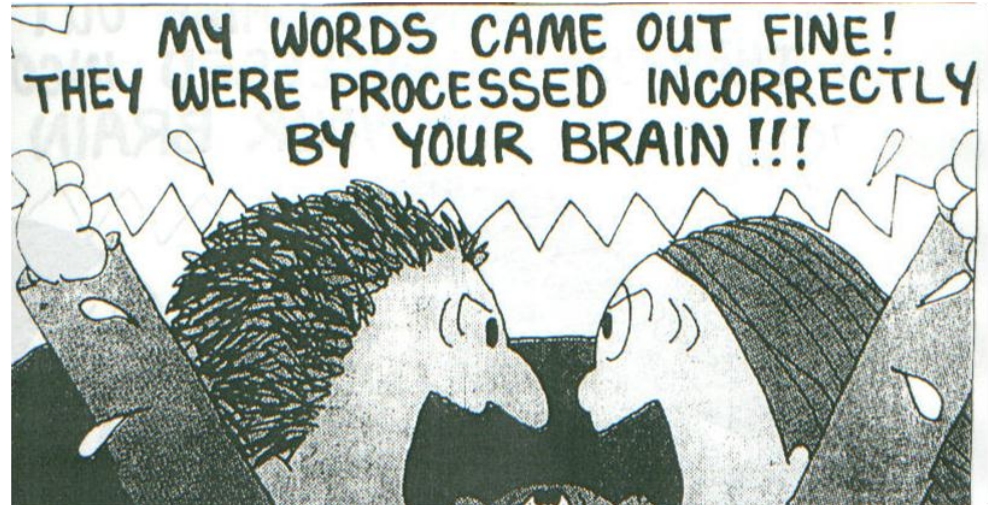
- The precision of the information conveyed to the public should match the precision of its source (Budescu & Wallsten, 1987; Wallsten & Budescu, 1994).
- Should not convey more precision than warranted by the evidence.
- Using precise probabilities in this case could be misleading.

Translation Table

IPCC Likelihood Scale	
Phrase	Likelihood of Occurrence
Virtually certain	> 99%
Very likely	> 90%
Likely	> 66%
More likely than not	> 50%
About as likely as not	33% to 66%
Unlikely	< 33%
Very unlikely	< 10%
Exceptionally Unlikely	< 1%

Addressing Precision

- Research has demonstrated that the use of verbal probability phrases generates more imprecision than intended by the IPCC.
 - Budescu, Broomell, and Por (2009)
 - Budescu, Por, and Broomell (2011)



Addressing Precision

- The amount of imprecision/uncertainty can be communicated using ratings of confidence.
 - Analytic Confidence has been defined to be based on:
 - Level/Quality of evidence used to produce the estimate
 - Level of agreement between experts in interpreting the evidence and producing the estimate
 - Analytic Confidence is intended to express various levels of uncertainty surrounding estimates.
 - Second Order Uncertainty

Confidence Definition:

Borrowed from National Intelligence Estimates

Confidence in Estimate	Description
High Confidence	Indicates that estimates are based on high-quality of evidence and there is high agreement among experts. High confidence estimates are not a certainty and may still carry a risk of being wrong.
Moderate Confidence	Indicates that estimates are based on either a moderate amount of evidence or there is a moderate amount of agreement among experts. Moderate confidence estimates carry a risk of being wrong.
Low Confidence	Indicates that estimates are based on questionable evidence and there is low agreement among experts. Low confidence estimates carry a high risk of being wrong.

Research Question

- Are consumers of risk communication appropriately sensitive to expressions of uncertainty based on:
 - confidence levels?
 - High, Moderate, Low
 - numerical ranges?

I THOUGHT I WAS
INTERESTED IN UNCERTAINTY
BUT NOW I'M NOT SO SURE



An Empirical Test of Communication Methods

- 155 volunteers were exposed to hypothetical risk communications, and paid \$5 for their time
 - (60% male; mean age 31)
- Subjects were randomly assigned to 3 conditions
 - Control
 - Verbal Confidence
 - Numerical Confidence
- The stimuli included:
 - Either phrases, *likely* and *unlikely*.
 - Either *high confidence* or *low confidence*
- Dependent measures included:
 - Best Estimate of Probability
 - Range of potential probability



Hypothesis

- Verbal Confidence Categories are psychologically incompatible with our definition of uncertainty, and will lead to error in interpretation.
 - Ranges will not be impacted
 - Best Estimates of likelihood will change with confidence
 - low confidence → probability phrase will be ignored
 - (estimates closer to 50%)
 - high confidence → probability phrase will be used
 - (estimates farther from 50%)

Verbal Confidence Condition

For example, if we use the word *likely* it is associated with the range (66% - 90%) from the table above:

A **high confidence** statement where chances could range from (76% - 80%) would be stated as follows:

An event is likely (with high confidence) to happen.

A **moderate confidence** statement where chances could range from (70% - 86%) would be stated as follows:

An event is likely (with moderate confidence) to happen.

A **low confidence** statement where chances could range from (66% - 90%) would be stated as follows:

An event is likely (with low confidence) to happen.

Begin Experiment

Example of Stimuli

Verbal Confidence

The Intergovernmental Panel on Climate Change (IPCC) has issued a warning that by 2015 it is **likely (with low confidence)** that global sea levels will have risen by 3 feet or more.

Based on the forecast of the IPCC, that it is **likely (with low confidence)** that global sea levels will rise by 3 feet or more by 2015, please provide a number between 0 (event is impossible) and 100 (event is certain to happen) that you think matches the chances of this event happening.

Numerical Confidence

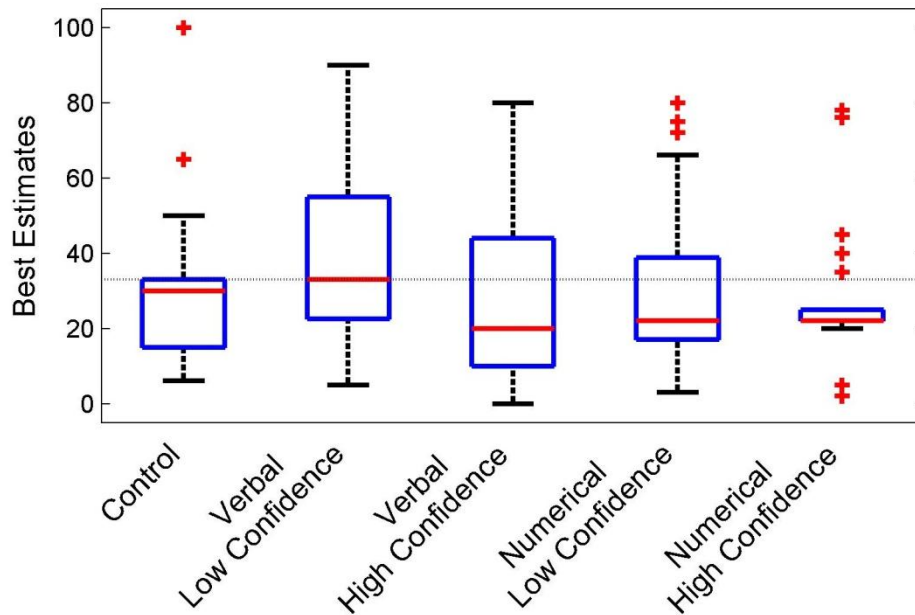
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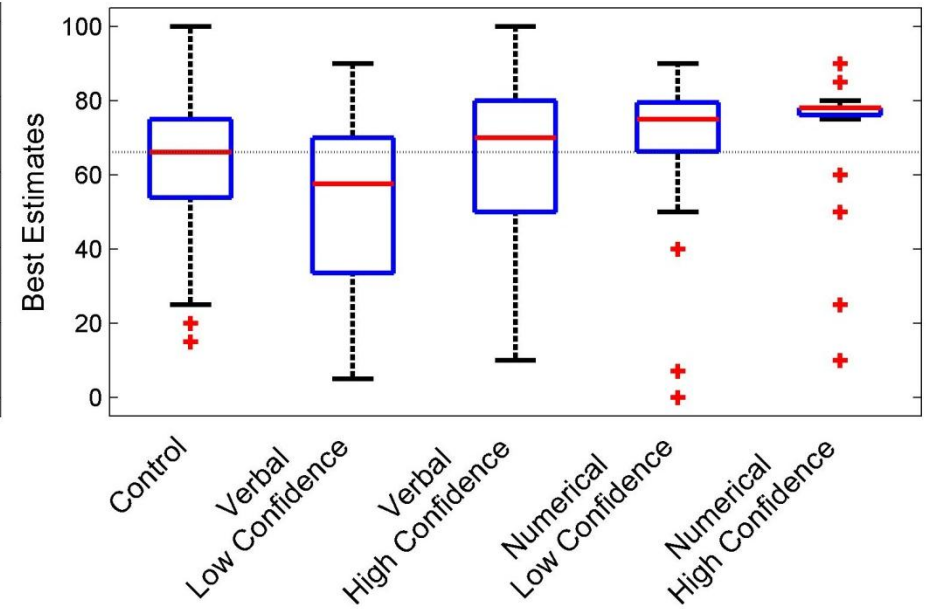
Graphical Results: Distributions

Best Estimates

Best Estimate of Unlikely

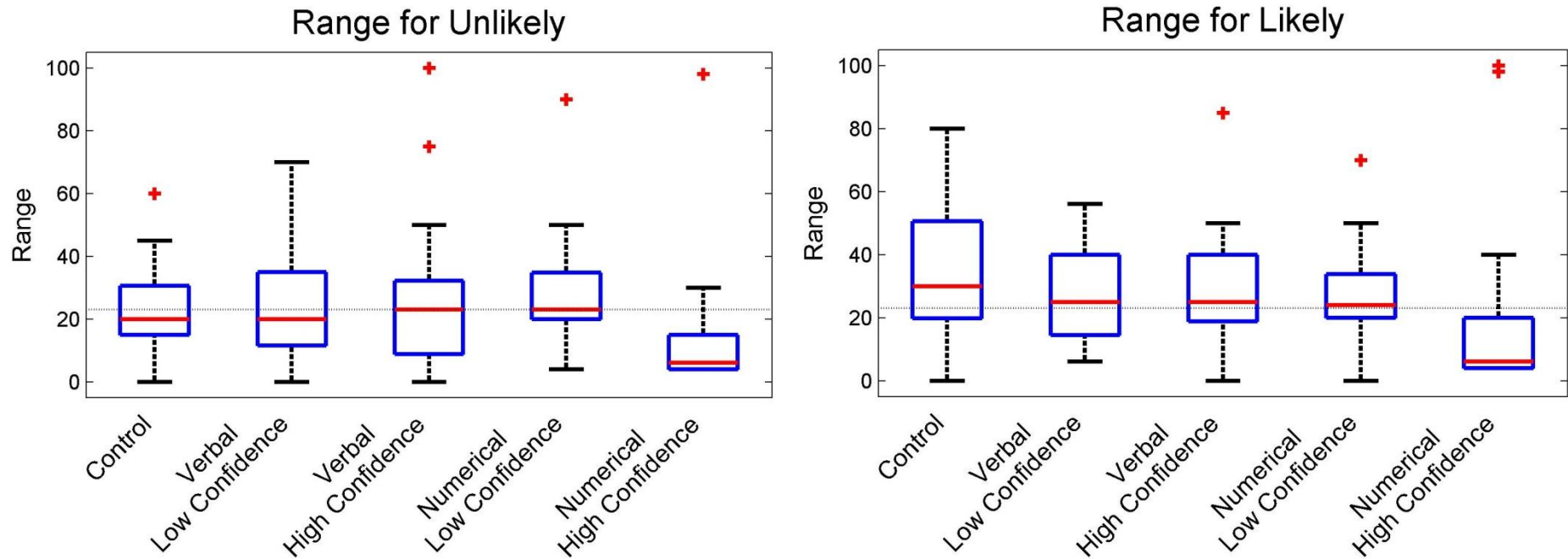


Best Estimate of Likely



Graphical Results: Distributions

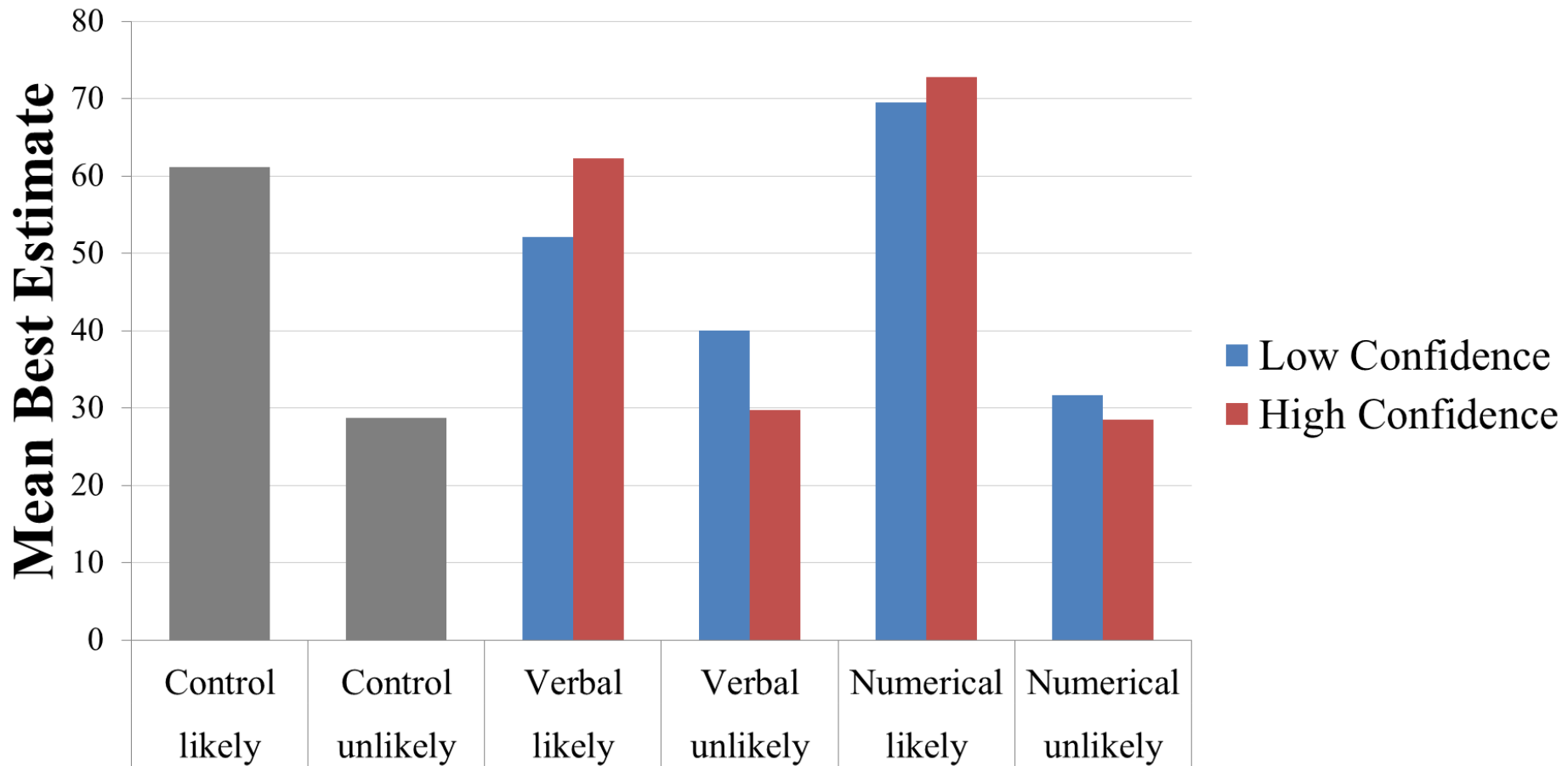
Range (Max - Min)



Thank You

Graphical Results: Means

Mean Best Estimate



Graphical Results: Means

Mean Log(Range)

