The Influence of Uncertainty Visualization on Decision Making

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Introduction

- Geographic datasets, and social science datasets in general, are becoming more complex

- These complex datasets are often processed and presented for use in choosing between alternatives

Overview

Problem:

- Decision makers use uncertain information to make decisions – sometime this information is presented visually

Questions:

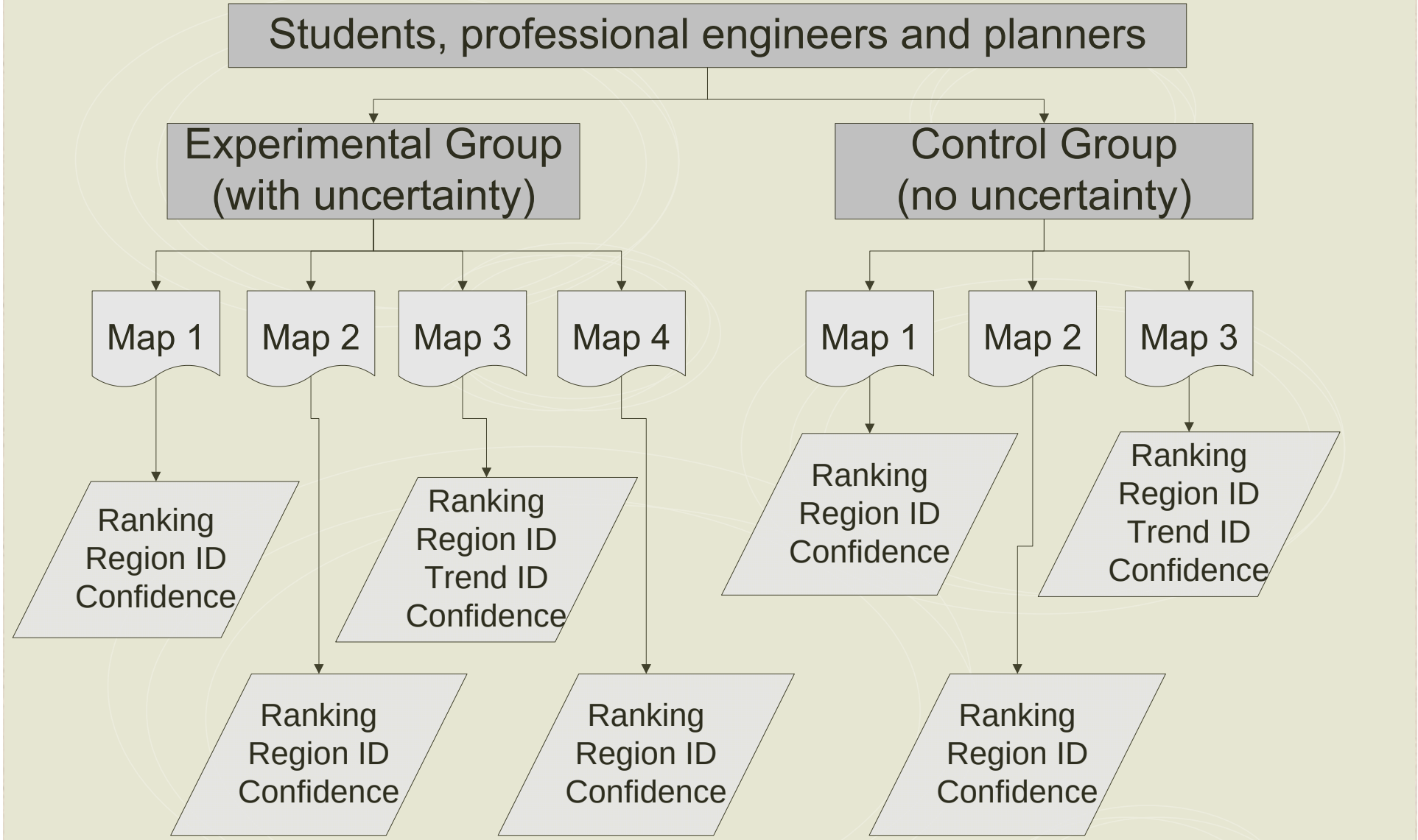
- Does displaying uncertainty information result in different decisions or conclusions?
- Does the inclusion of uncertainty result in a difference in confidence in decisions or conclusions?

Overview cont'd

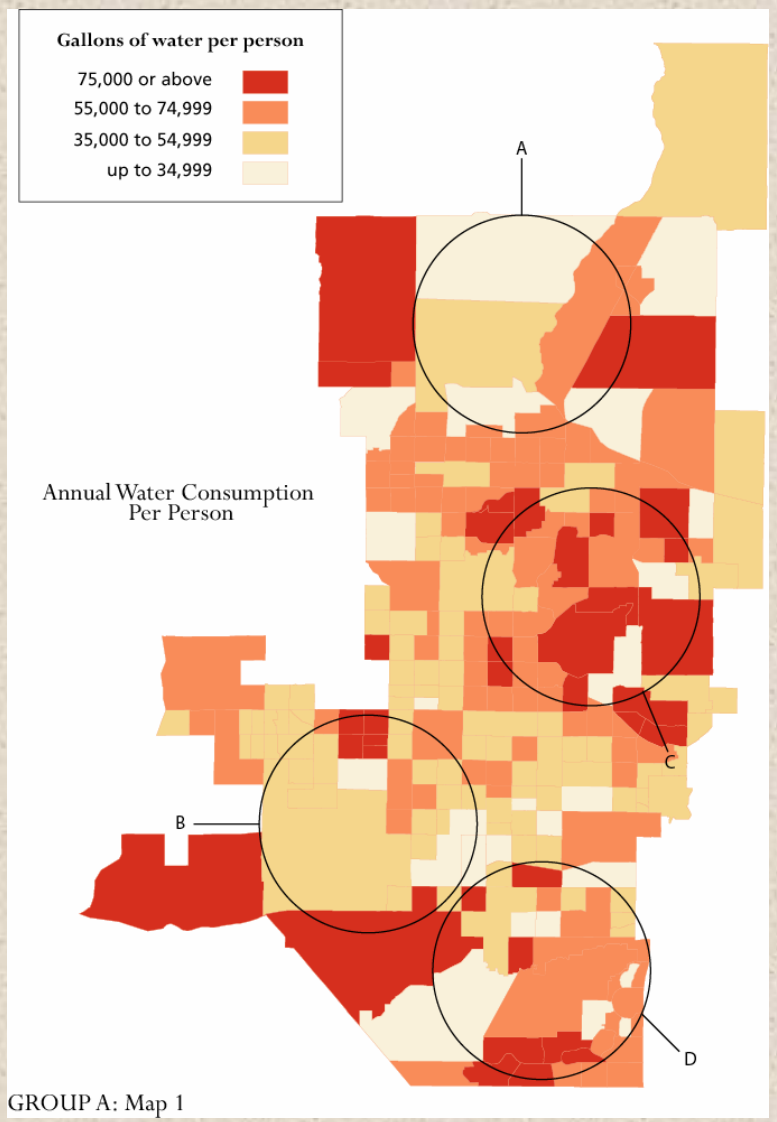
Methods:

- Human Subject Experiment:
  - Varied decision tasks
  - Measured confidence in decisions
  - Uncertain versus certain data

- Results:
  - The influence of uncertainty visualization depends on the type of decision task.

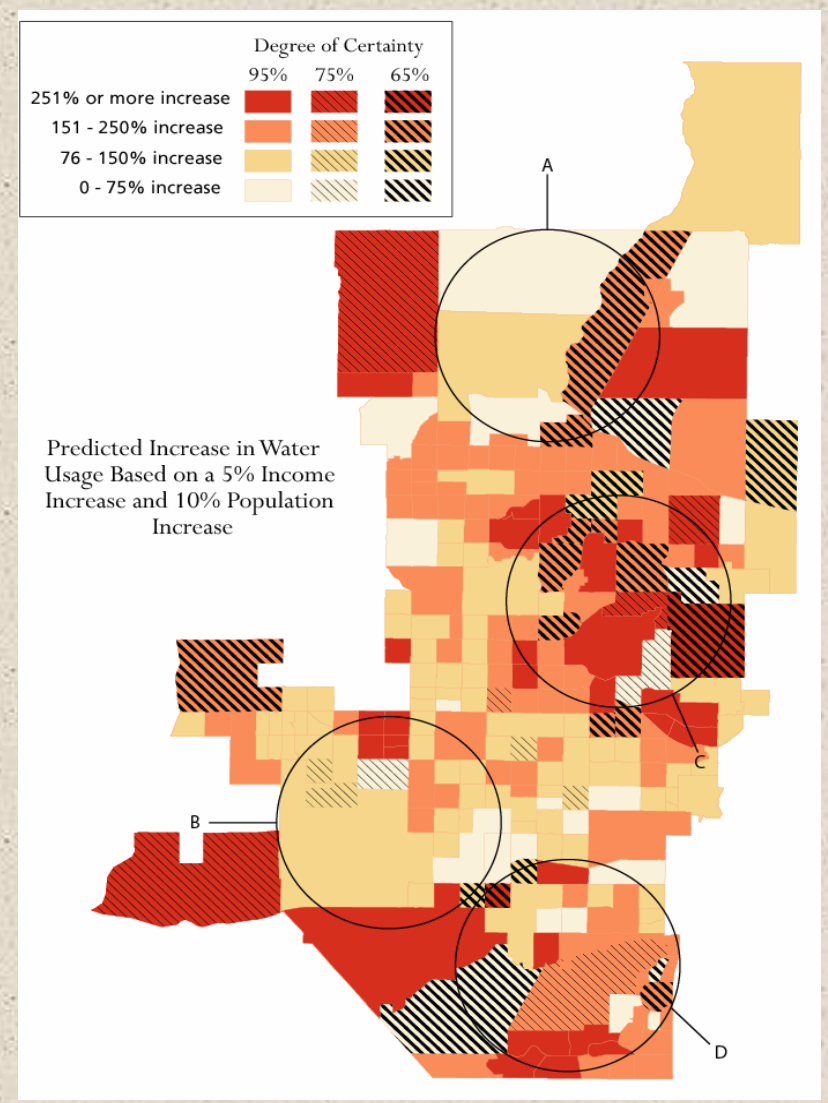


Study Design



Annual Water Consumption Per Person

GROUP A: Map 1

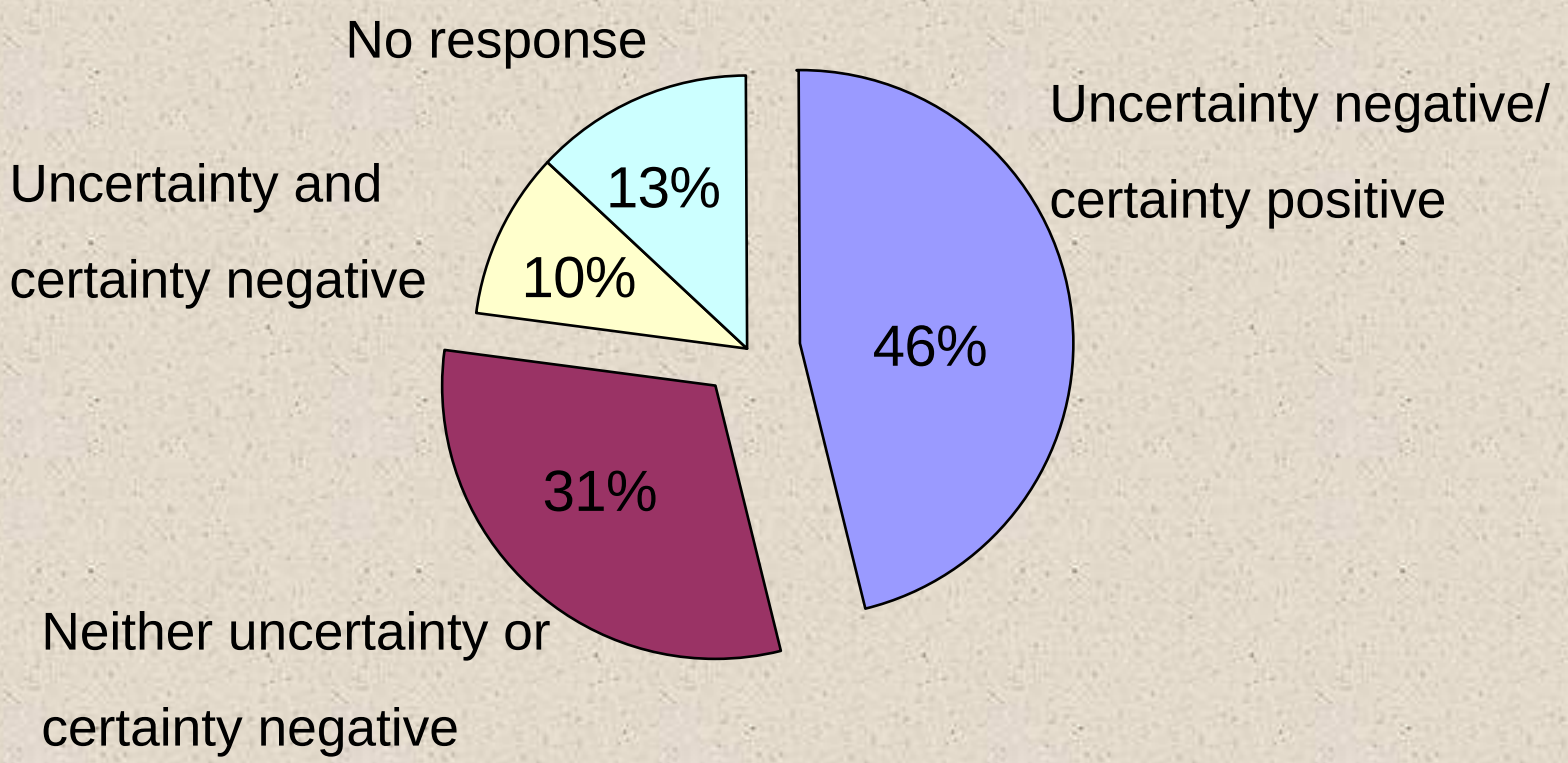


Predicted Increase in Water Usage Based on a 5% Income Increase and 10% Population Increase

Results

	Results: Statistically Signficant Difference?			
Map Number	Region ID	Trend ID	Ranking	Confidence
Map 1	no	no	yes	no
Map 2	no	no	yes	no
Map 3	no	no	yes	no
Map 4	no	no	yes	yes

Results


No response
13%
Uncertainty negative/
certainty positive
Uncertainty and
certainty negative
10%
46%
31%
Neither uncertainty or
certainty negative

Conclusions

- The influence of uncertainty visualization may be determined by the decision task and not the general effectiveness of the specific technique
  - Different decision tasks may have typology similar to discrete/continuous and nominal/ordinal/ratio distinctions

Future Research

- Develop uncertainty visualization typology based on types of decision tasks
- Evaluate whether the inclusion of uncertainty representations
  - change how a user evaluates the data and comes to a decision (process)
  - make users more cautious
  - cause user to obtain outside information to support their decisions
- Integrate uncertainty information in geospatial databases and GIS

Applications

- Visualizing and communicating the risk associated with various exit routes for emergency and evacuation

- Public policy applications
  - Water policy
  - Transportation engineering and design

Thank you

Questions?