

Representing Uncertainty: A Case Study in Categorizing Uncertainty in Support of Decision Making



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one: an introduction to uncertainty
and the domain of floodplain mapping

two: research questions and focus group design

three: findings (organized by research question)

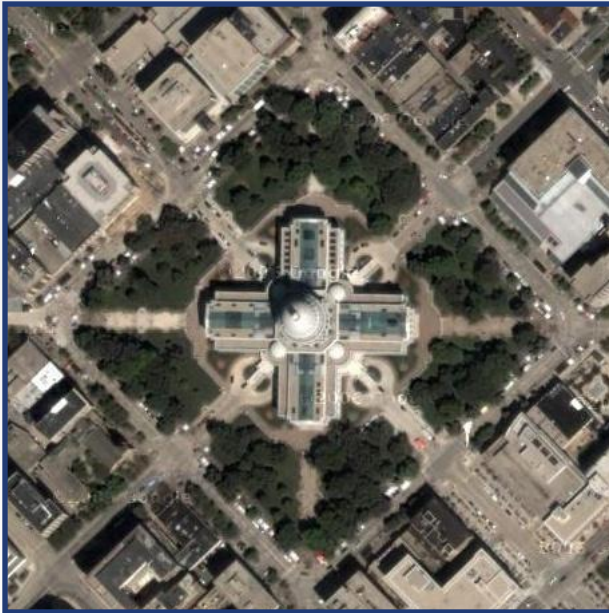
conclusions: towards a fully informed view of geographic
information in support of decision making



uncertainty



power (useful and usable)



abstraction



certainty





uncertainty take home point #1

“uncertainty is an intrinsic property of knowledge and not just a flaw that needs to be excised”

Helen Couclelis (2003, 166)

“The certainty of uncertainty: GIS and the limits of geographical knowledge”



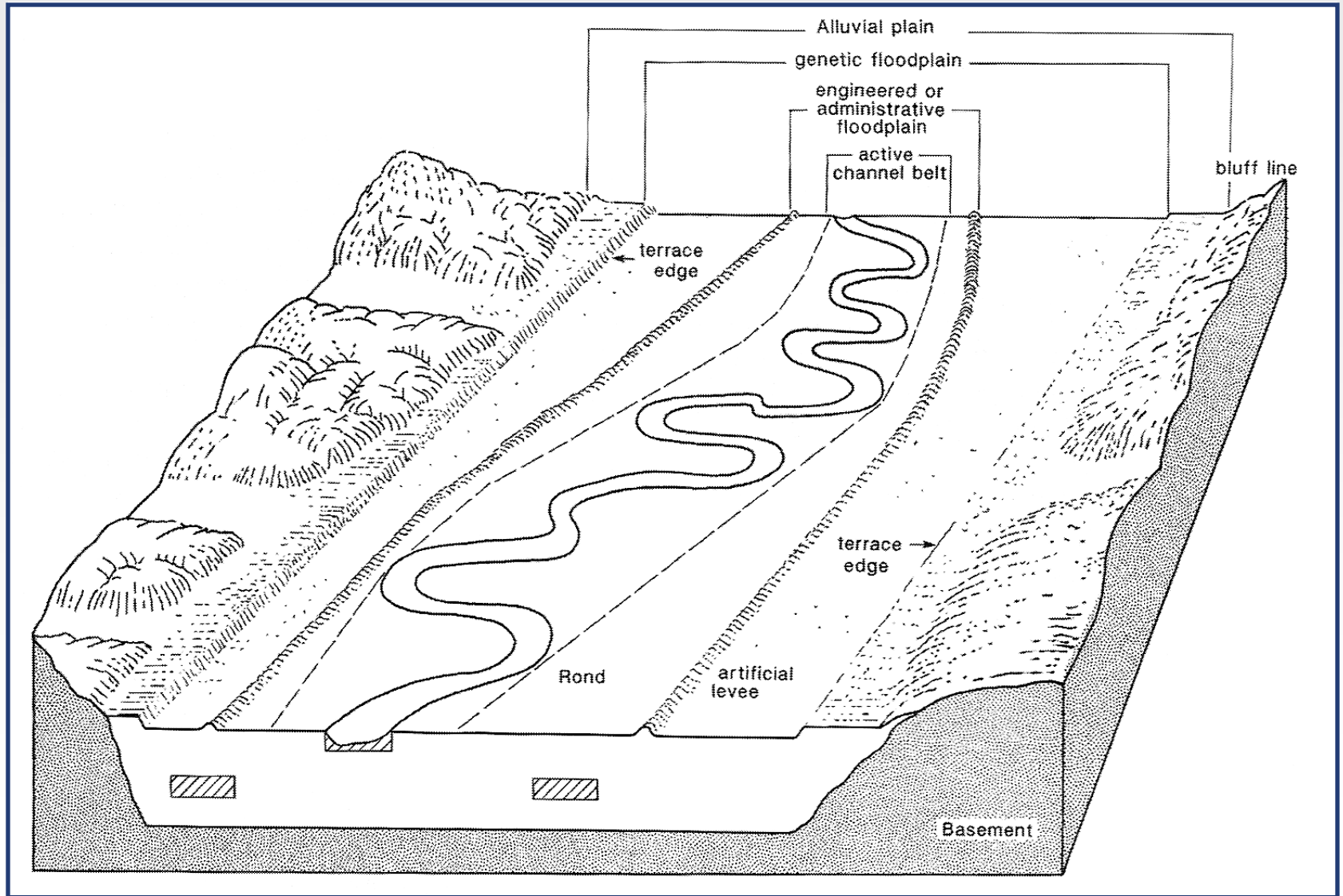
uncertainty take home point #2

uncertainty categorization: the designation, articulation, and analysis of the unique subcomponents which together constitute the multifaceted concept of uncertainty.

Category	Definition
Accuracy/error	difference between observation and reality
Precision	exactness of measurement
Completeness	extent to which info is comprehensive
Consistency	extent to which info components agree
Lineage	conduit through which info passed
Currency/timing	temporal gaps between occurrence, info collection & use
Credibility	reliability of info source
Subjectivity	amount of interpretation or judgment included
Interrelatedness	source independence from other information

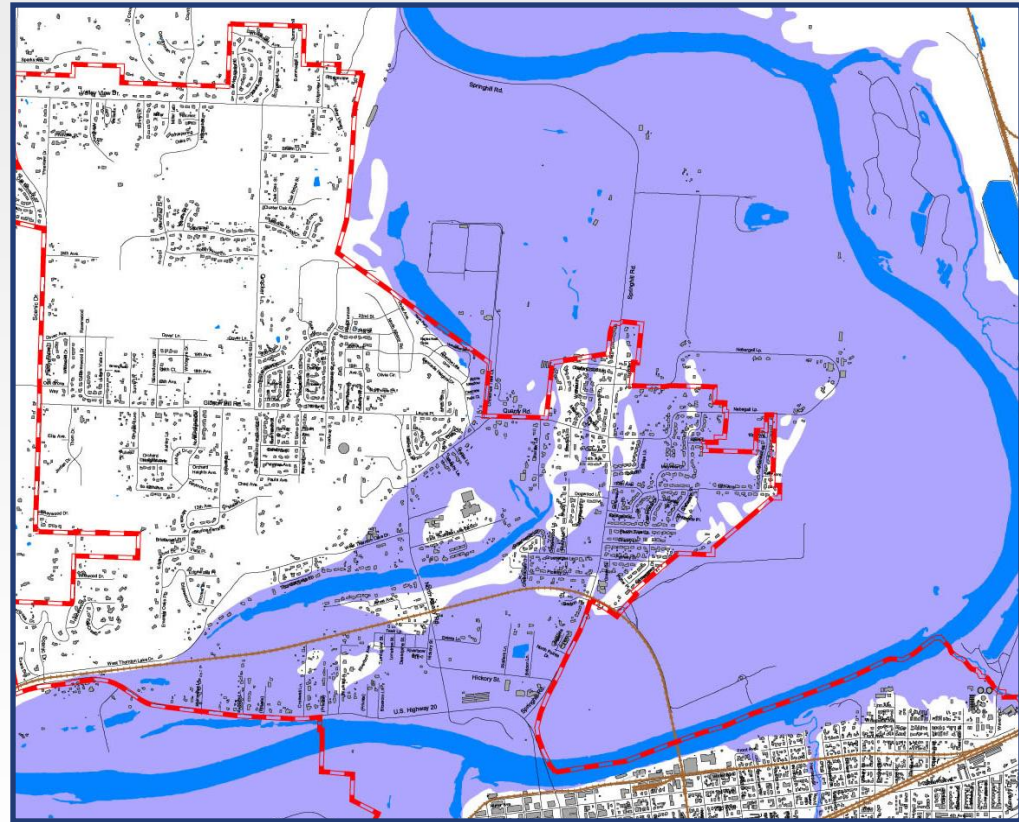
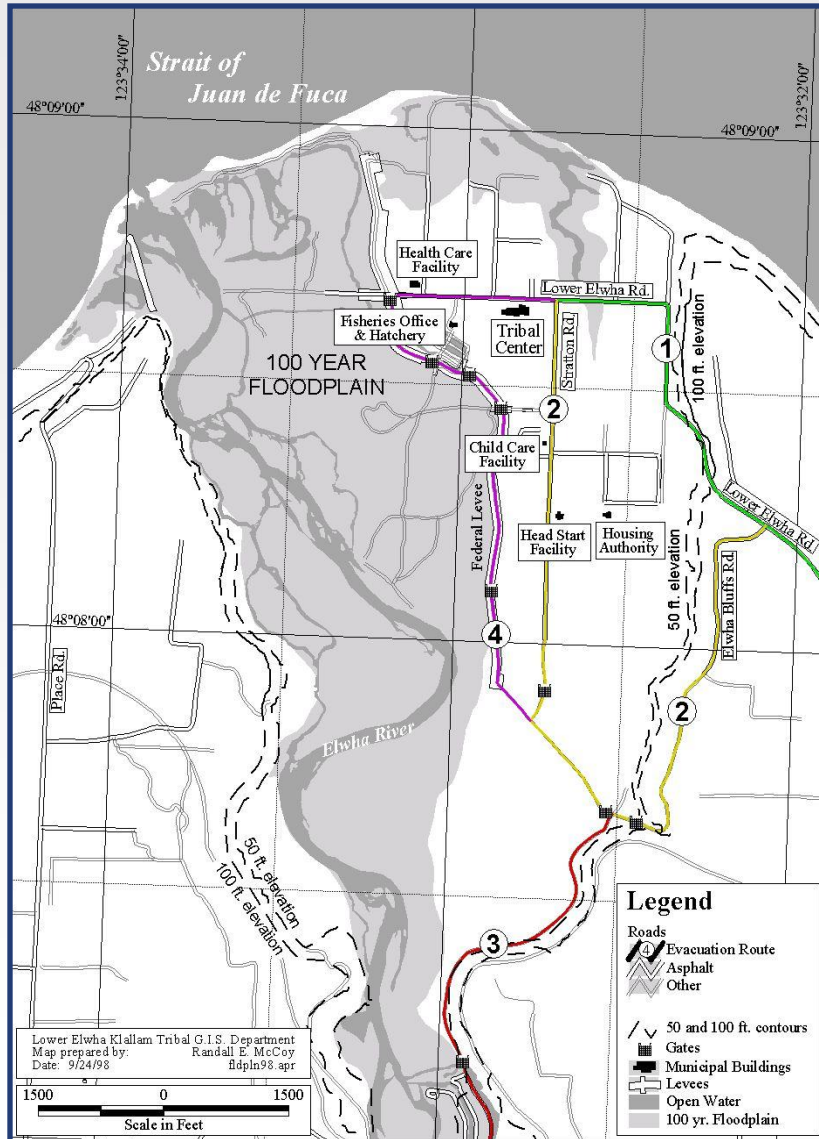


case study domain





case study domain





problem statement

Floodplain maps are a formalized cartographic tool for the evaluation of flood liabilities. Decisions based upon floodplain representations hold real world significance, with millions of dollars and lives hanging in the balance. However, it appears as though current floodplain maps ignore the *intrinsic* and *multifaceted* uncertainty necessary for providing a fully informed view of the representation.

What categories of uncertainty information do we then need to incorporate into the floodplain map in order to present a fully informed view of the geographic information?



research questions

- (1) How is uncertainty **involved** in the creation, representation, and use of geospatial data in the domain of floodplain mapping? How can this practice be improved?
- (2) Is the MacEachren et al. (2005) typology a **valid** categorization of uncertainty when applied to the domain of floodplain mapping? Are there categories that must be added, removed, or revised?
- (3) Which categories of uncertainty are considered to be most **influential** on the decision making process in the domain of floodplain mapping?



focus group design quick hits

- *sampled to include **only experts** with experience/expertise in both the creation of geospatial floodplain data and the use of this data to make decisions
- *proctored at the 2007 Wisconsin Land Information Association annual meeting
- * two one-hour focus group sessions of three experts each using the same protocol ($k=2, n=6$)
- *self-moderated but transcribed and coded by a third party
- *coding unit of one sentence and synoptic style of reporting



Q1: involvement in creation

“[the digitized line is only] an approximation”

“We created a line [by digitizing a firm’s maps] and of course it didn’t always fit right”

“Looking at the products that we have from FEMA right now, you're always uncertain”

“[there are] places [in the FEMA floodplain data] where they don’t even overlay a stream.”



Q1: involvement in representation

“You just have to assume that the line you draw [on the map] is a hard and fast line ...you got to put a line somewhere.”

“If you put [uncertainty] on the map it would probably draw undo attention.”

“ [representing uncertainty] would bring to the forefront the questionability of the map, the data...that's always an issue anyways, but now you're putting a logo on it and saying ‘Don't forget to ask me about this.’”



Q1: involvement in use

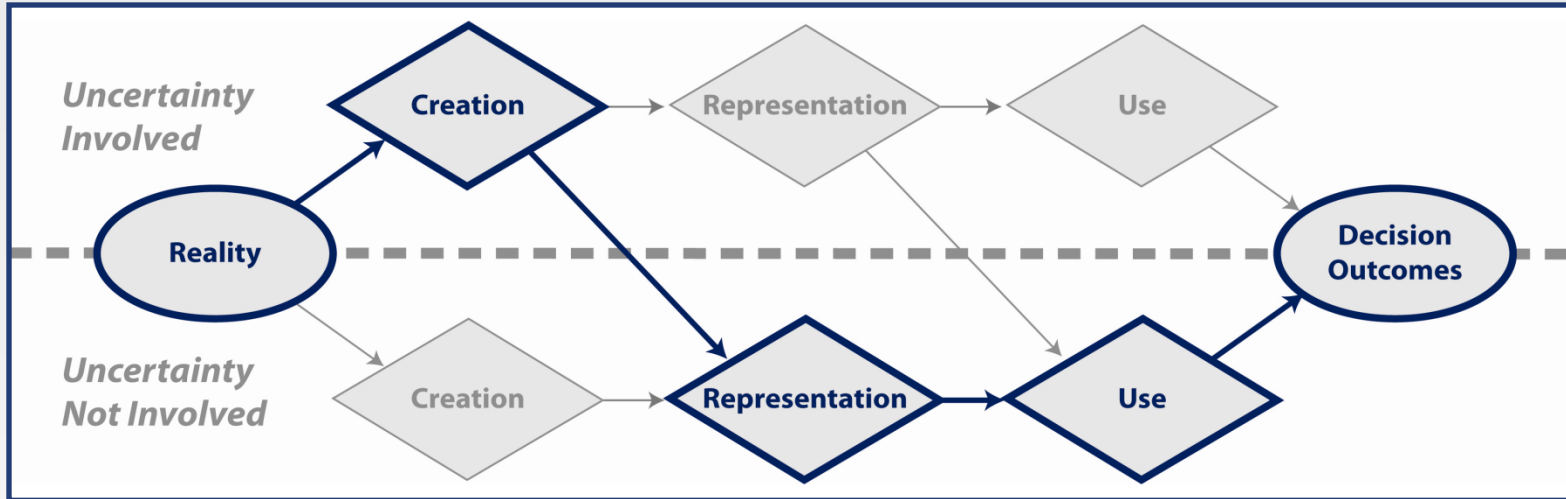
“You paid enough for it to be right...Of course it’s right.”

“maybe sometimes we don’t want to know that information.”

“if your decision has to be an absolute yes/no, putting the uncertainty on the map puts you in the position [where] you're the one that has to make the call...it has added problems to your life.”

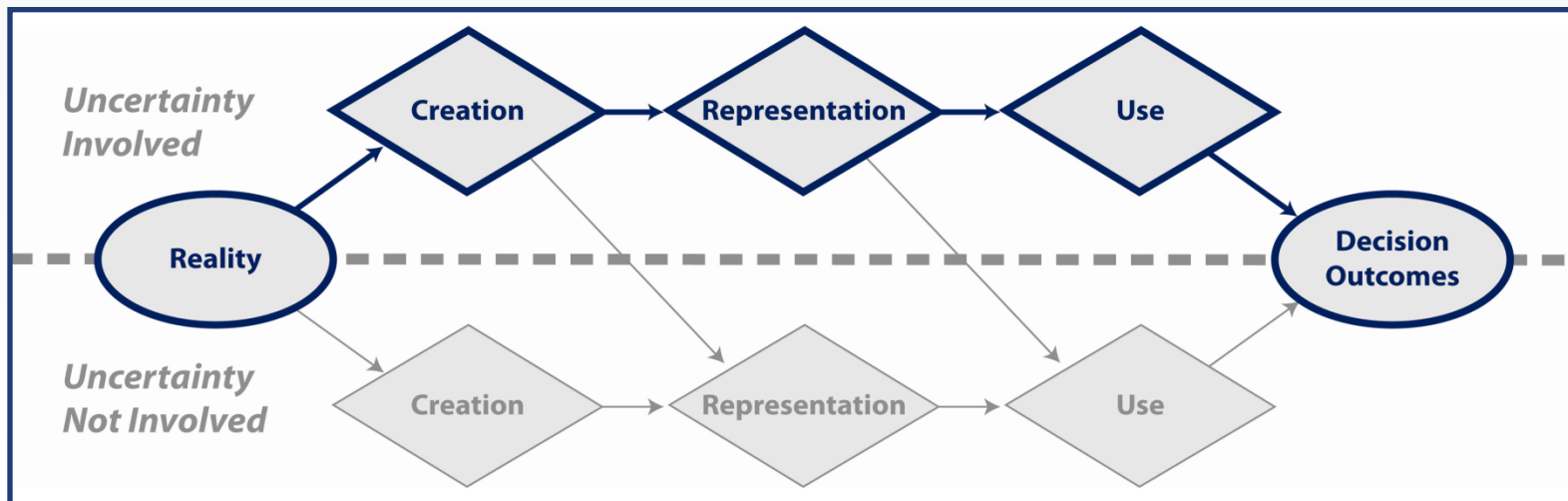


Q1: involvement



from this...

...to that





Q2: validity of MacEachren et al. typology

frequency: the number of times an individual code is present

extensiveness: the number of participants that mention an individual code

Category	Frequency			Extensiveness		
	Unprompted	Prompted	Total	Unprompted	Prompted	Total
Accuracy/Error	21	68	89	5	6	6
Precision	0	32	32	0	6	6
Completeness	0	15	15	0	5	5
Consistency	0	21	21	0	5	5
Lineage	2	16	18	2	5	5
Currency	8	40	48	4	6	6
Credibility	2	26	28	2	5	5
Subjectivity	7	32	39	3	6	6
Interrelateness	1	13	14	1	5	5



Q2: validity of MacEachren et al. typology

“well I think they all play a role to some degree.”

“I'm sure at the time that ours was compiled all nine of these were taken into consideration...and it probably wasn't approved either until all nine of these were taken into consideration, both at the FEMA, state, and local level.”

“I think that it's such an important thing to get right that if you don't have the time to take all nine of these things into consideration, then you just have to ask to have the deadline extended to get it right.”



Q3: type influence

influence: as the degree to which participants in the focus groups reported the importance of recording and disclosing a particular category of uncertainty for making fully informed decisions



Q3: influence of accuracy/error

“The number one thing that people are bringing up...is the accuracy issue, and, hands down, that is the number one issue.”

“accuracy is the one thing that [decision makers] always come for.”



Q3: influence of precision

“accuracy, I would also put precision under the same which is second here, are both cases that, those are the things that the engineers and the people are really looking under the hood for.”

“Accuracy and precision is in the specs that you did... So you're absolutely right, that's what they go after in any mapping, floodplain or anything else.”



Q3: influence of currency

“I think you start with currency.”

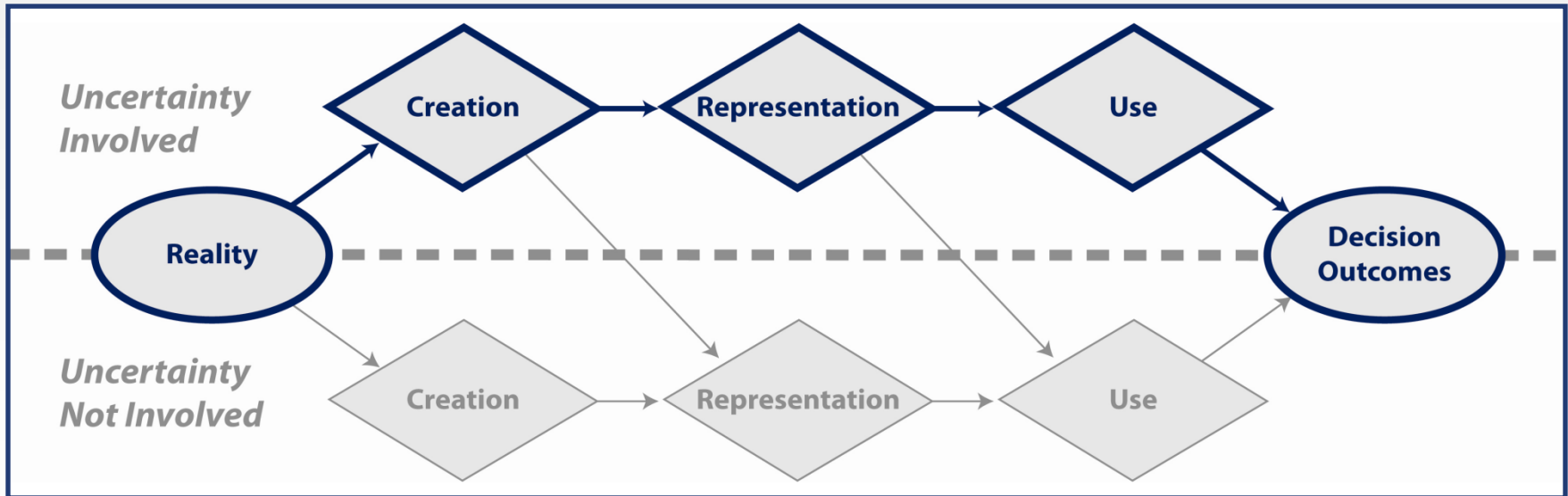
“accuracy is one thing, but currency, and that is obviously on your list [of categories], is a big deal.”

“So my take on that is that accuracy is number one but certainly currency would be two.”



conclusion: bringing it all together

towards a **fully informed view** of geographic information in support of decision making



...thanks for listening!

~Rob