In preparation for writing your RP- Malcomb et al (2014) discussion… Consider a framework of vulnerability modeling and uncertainty (Tate 2013)

Modelling Phase	Common Decisions	Malcomb et al (2014)
Model Structure	*Deductive* (based on theory) *Hierarchical* (deductive, organized by sub-themes) *Inductive* (based on data)	
Indicator Set (Hinkel 2011)	Choosing variables… *Deductive* (theory-based) *Normative* (value judgements) *Inductive / statistical* (based on data characteristics *vis a vis* outcomes) *Non-substantial* (based on data characteristics alone with no outcome) *Practical* (availability and cost)	
Analysis Scale	County Polygons Census Tract Polygons	
Measurement Error	Census Undercounts American Community Survey 90% Confidence Interval Margin of Error	
Transformation (often called normalization in cartography)	Raw Counts Density Percentage Rates	

Normalization	Inversion
	`1 / x` or `max - x`
	min-max scaling
	`(x – min) / (max – min)`
	Z-score standardization
	`(x – mean ) / stddev`	

Weighting	Normative Deductive Equal Weights (the normative decision not to decide) Inductive / Statistical	
Aggregation	Additive (compensable/substitutable) Multiplicative / Geometric (interactive) Pareto ranking	
Uncertainty analysis Sensitivity analysis Validation (Rufat et al 2019)	Monte Carlo simulation Expert opinion Statistical test *vis a vis* outcomes	

Recalling our model for thinking about error, uncertainty, and ethics in spatial research…

1) Real World (Referent) 2) Problem Conceptualization & Problem Framing a) Are you asking the right questions? Framing them the right way? b) Are the concepts & theories even appropriate? 3) Construct Validity a) Referent – Symbol – Concept b) Applies to data representations and analytical models 4) Error (Measurement / Representation) a) Accuracy vs Precision b) Location vs Attribute 5) Error in Motion (Analysis) a) Propagation b) Uncertainty c) Sensitivity 6) Ethics a) Should we be doing this research? How should we represent results? b) Participants, Audience, Responsibility	Real World *--- filter ---* Conception *--- filter ---* Measurement & Representation *--- filter ---* Analysis *--- filter ---* Interpretation, validation

Can conducting **reproductions** (using the same data and techniques to attempt to produce the same outputs) help with vulnerability model uncertainty? How?

Can conducting **replications** (using new data & study contexts to test generalizability of the original study findings) help with vulnerability model uncertainty? How?

References

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