Information Visualization

Uncertainty Visualization

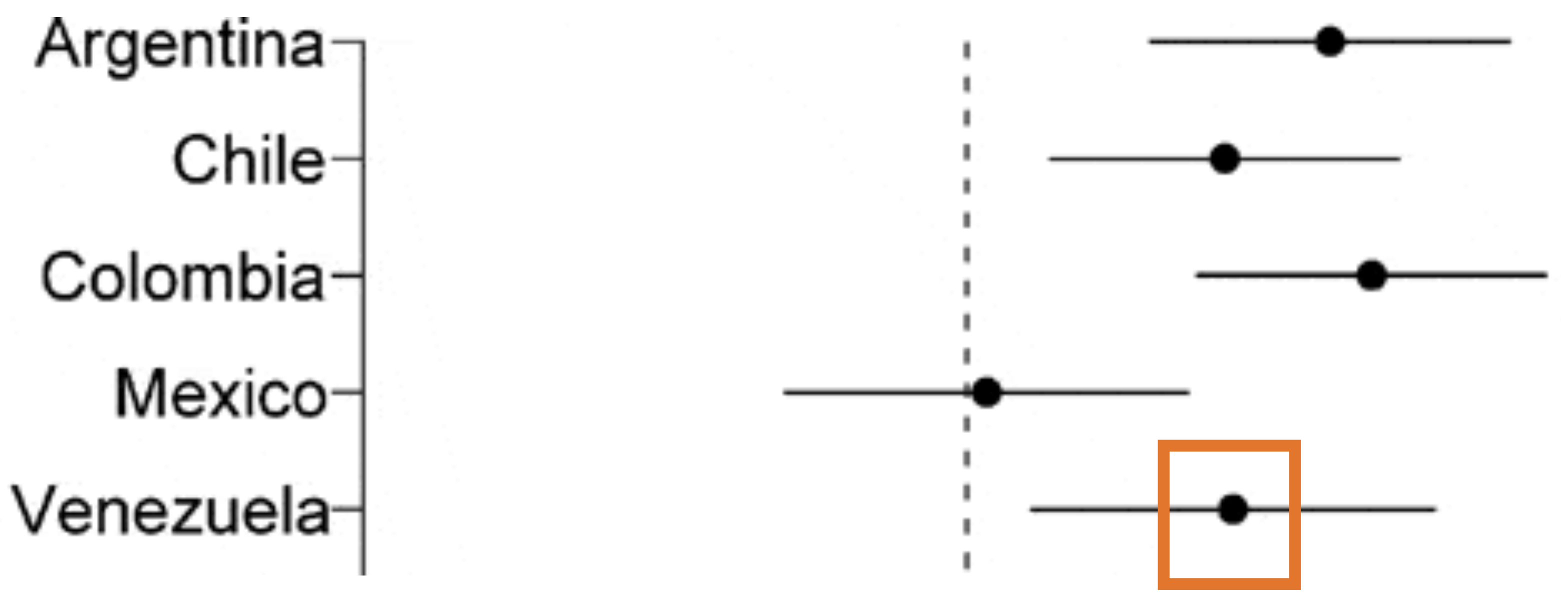
Dr. David Koop

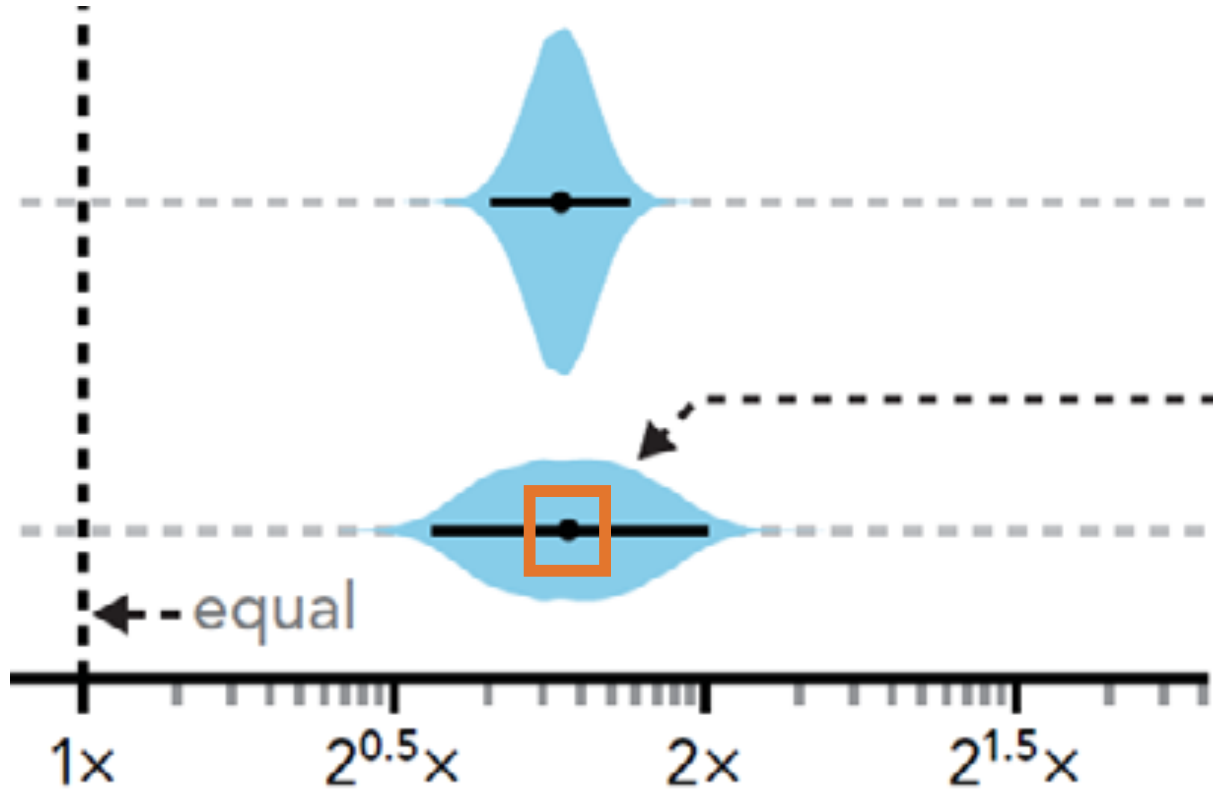
Uncertainty

- Uncertainty shows up in science all the time
  - Measuring
  - Modeling
  - Forecasting
- People know there is uncertainty in data analysis, but don't actually understand most ways of communicating the amount of uncertainty

People Ignore Uncertainty

Variable	Coefficient (Standard Error)
Constant	.41 (.93)
Countries	
Argentina	1.31 (.33)**B,M
Chile	.93 (.32)**B,M
Colombia	1.46 (.32)**B,M
Mexico	.07 (.32)A,CH,CO,V
Venezuela	.96 (.37)**B,M





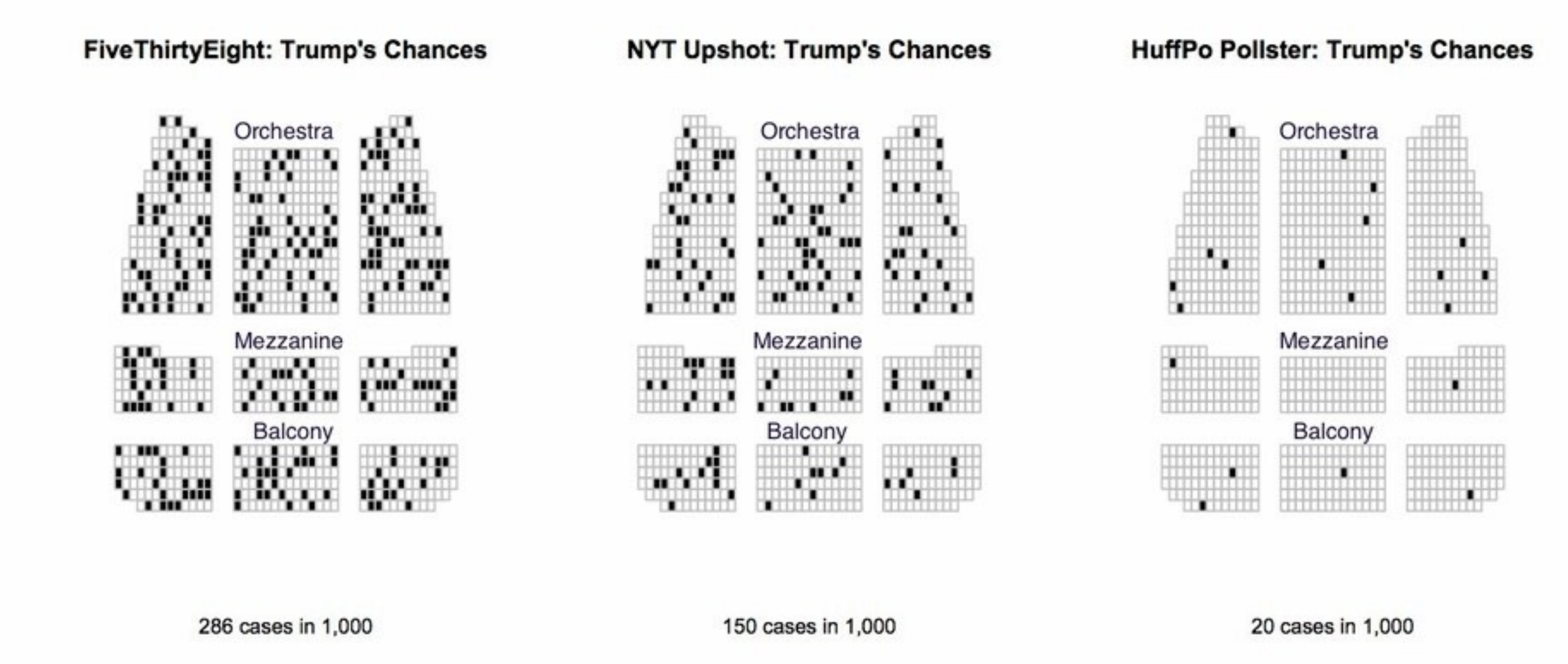
[M. Kay]

People Ignore Uncertainty

FiveThirtyEight: Trump's Chances	NYT Upshot: Trump's Chances	HuffPo Pollster: Trump's Chances
28.6%	15.0%	2.0%

[M. Kay]

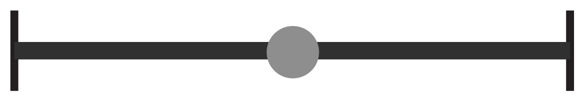
Better Ways to Present Uncertainty

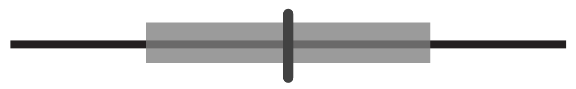


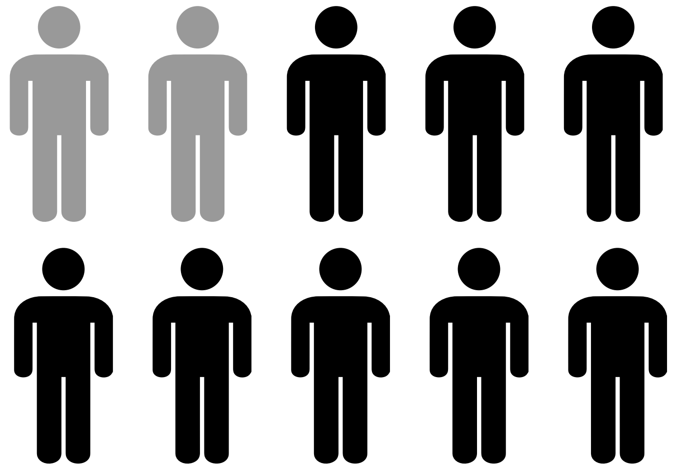
[J. H. Gross, Washington Post, 2016]

Graphical Annotations of Distributional Properties

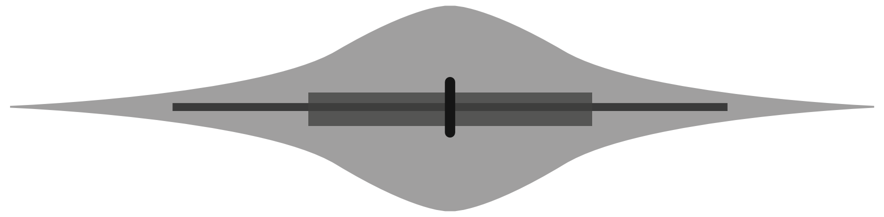
Intervals and Ratios

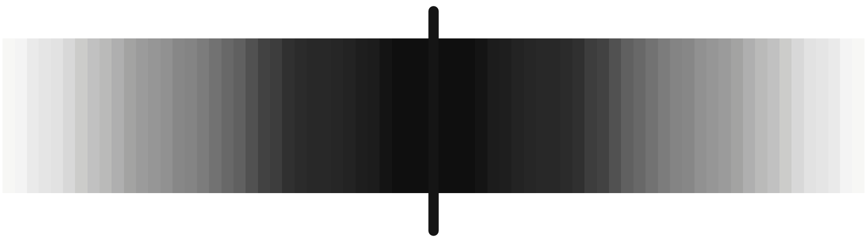

error bars

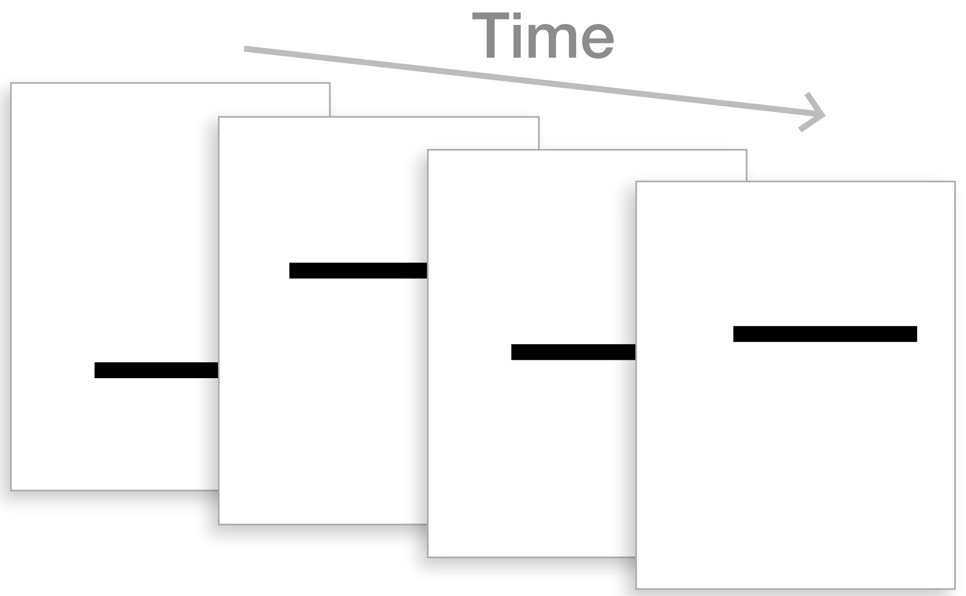

box plot


icon array

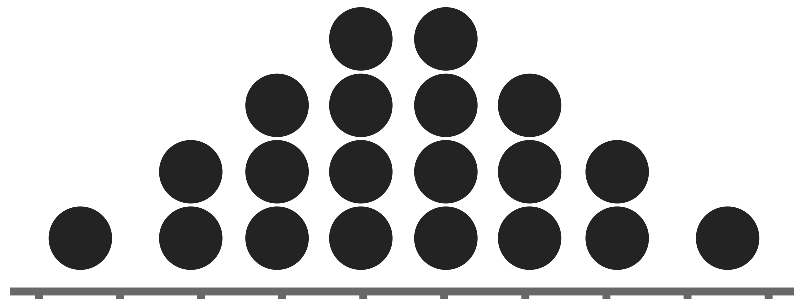
Distributions

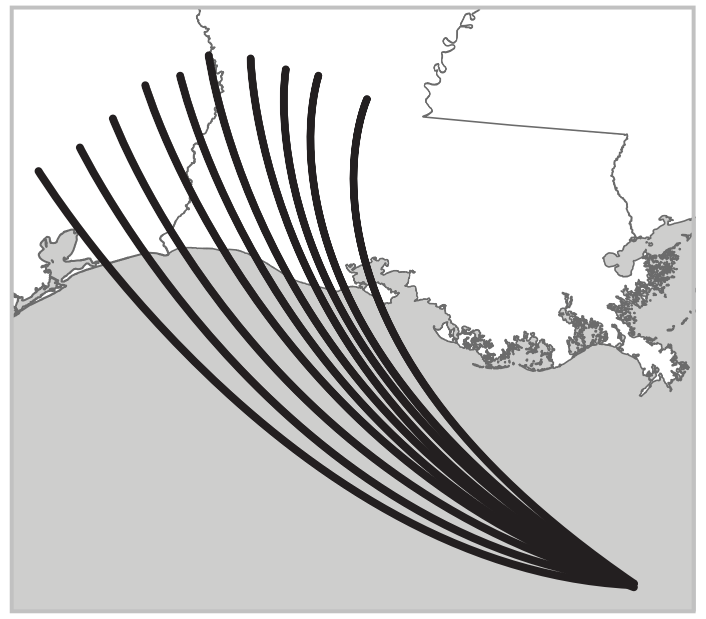

violin plot


gradient plot



hypothetical outcome plot


quantile dot plot


ensemble plot

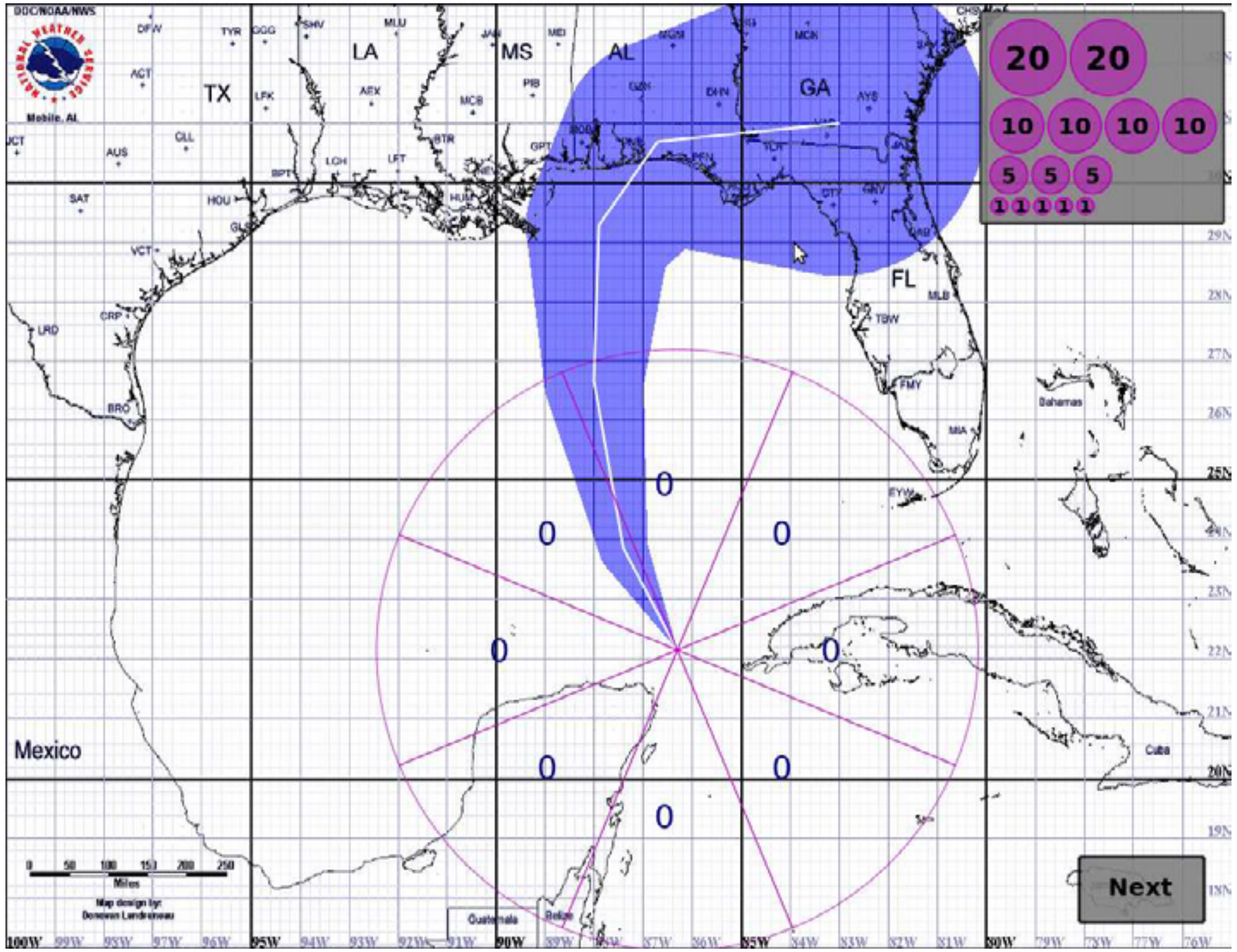
[L. Padilla et al.]

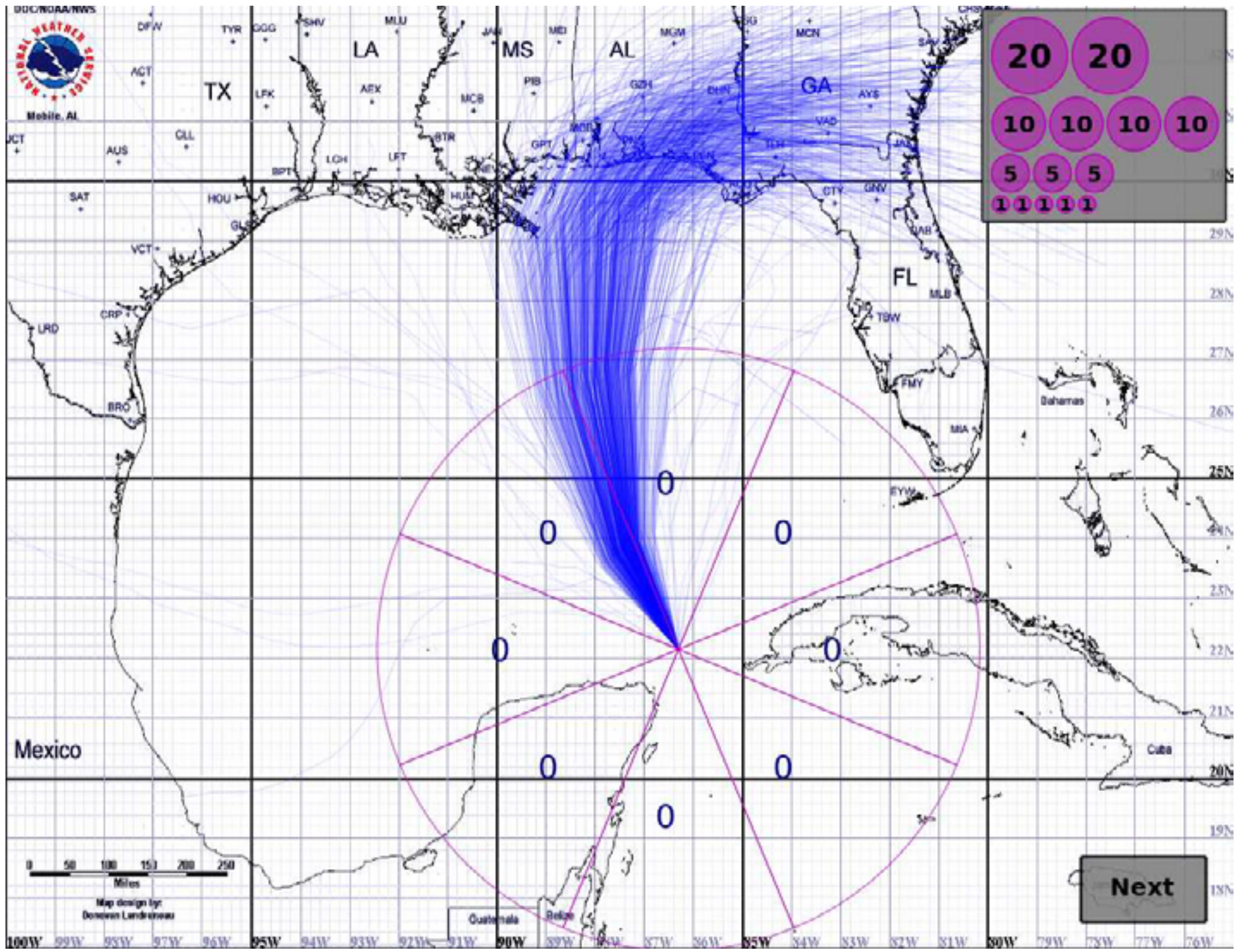
Uncertainty Visualization Theories

Theory	Summary	Visualization Techniques
Frequency Framing [30] (Section 1.2)	Uncertainty is more intuitively understood in a frequency framing (1 out of 10) than in a probabilistic framing (10%)	icon array [13], quantile dotplot [11], hypothetical outcome plots [10]
Attribute Substitution [31] - Deterministic Construal Error [32] (Section 1.2)	If given the opportunity, viewers will mentally substitute uncertainty information for data that are easier to understand	hypothetical outcome plots [10]
Visual Boundaries = Cognitive Categories [21] (Section 1.2)	Ranges that are represented by boundaries lead people to believe that data inside and outside the boundary are categorically different	ensemble display [12], error bar alternatives [7, 9]
Visual Semiotics [14] (Section 1.2)	Some encoding techniques naturally map onto uncertainty	fuzziness, transparency, location, etc. [14], value-suppressing color pallet [25]

[L. Padilla et al.]

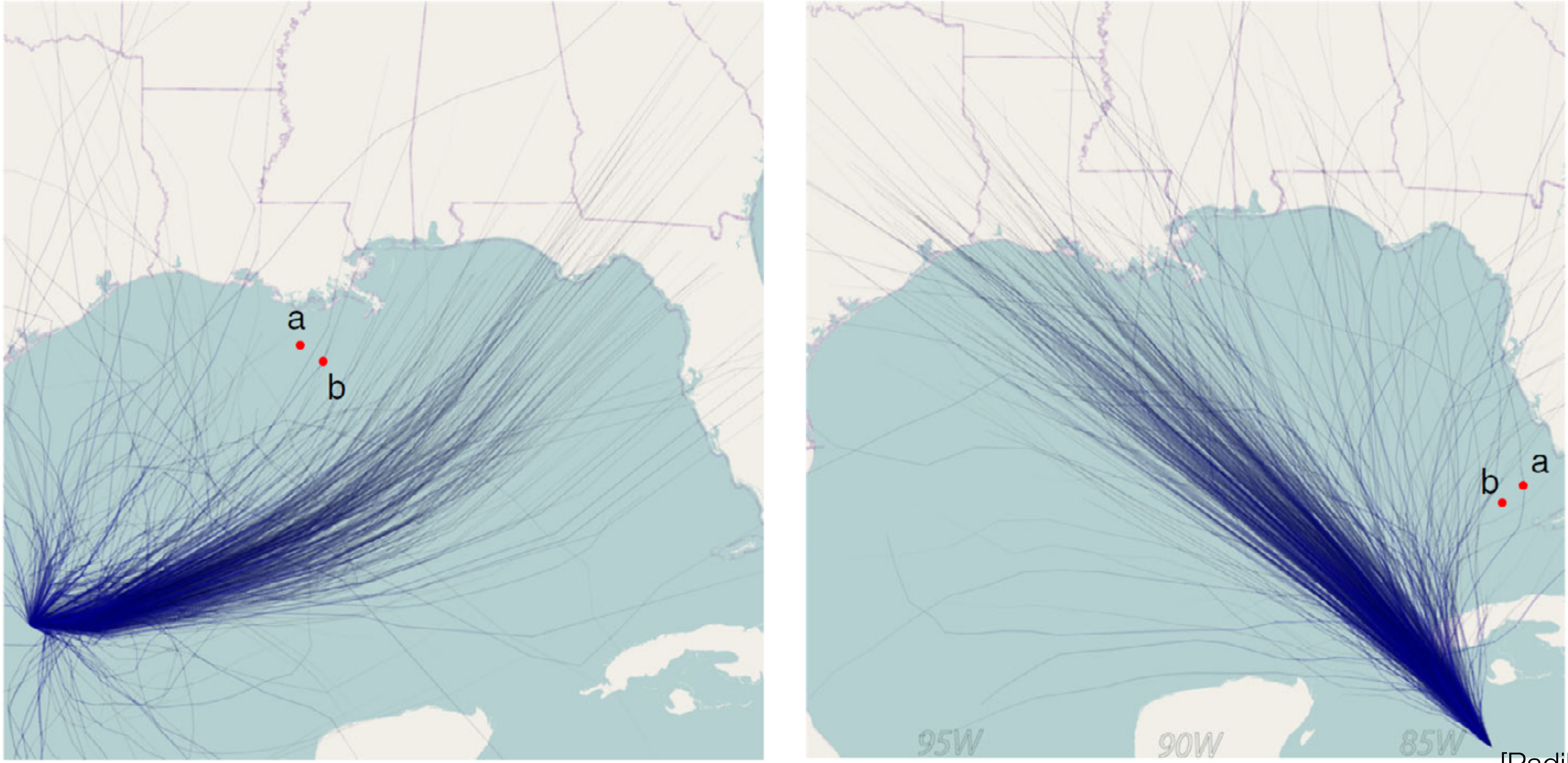
Hurricane Error Cones vs. Ensembles





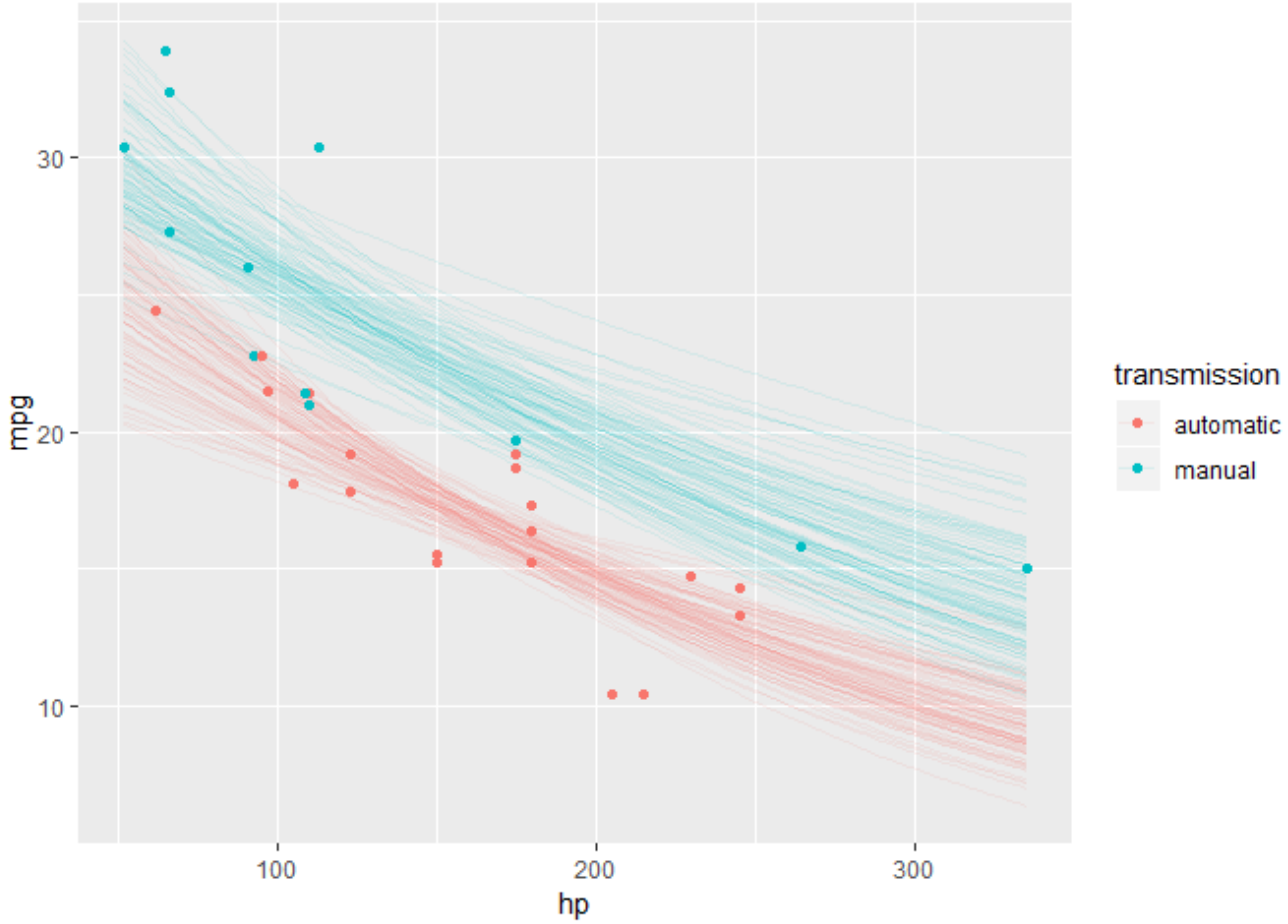
[Cox et al.]

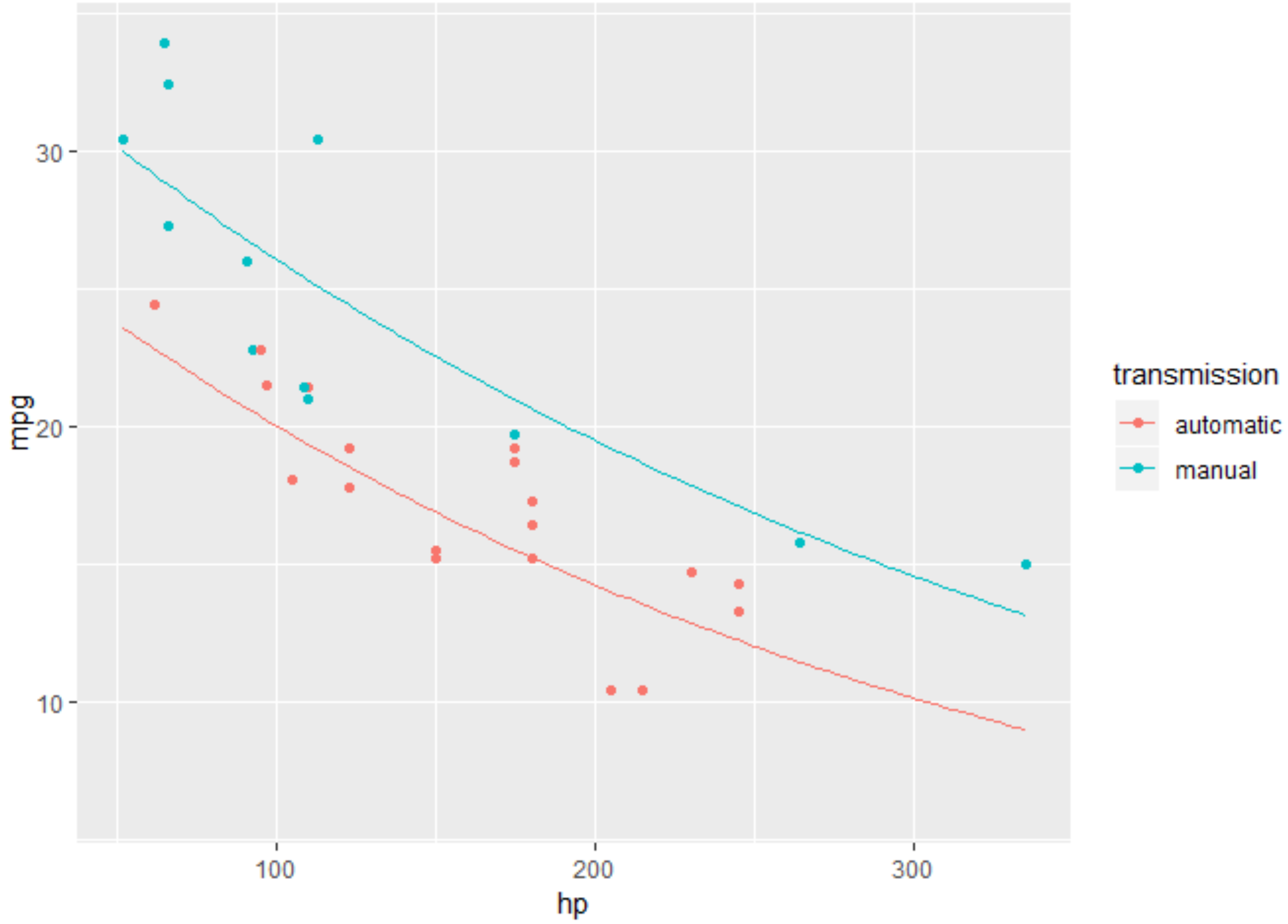
Ensembles not perfect either



[Padilla et al.]

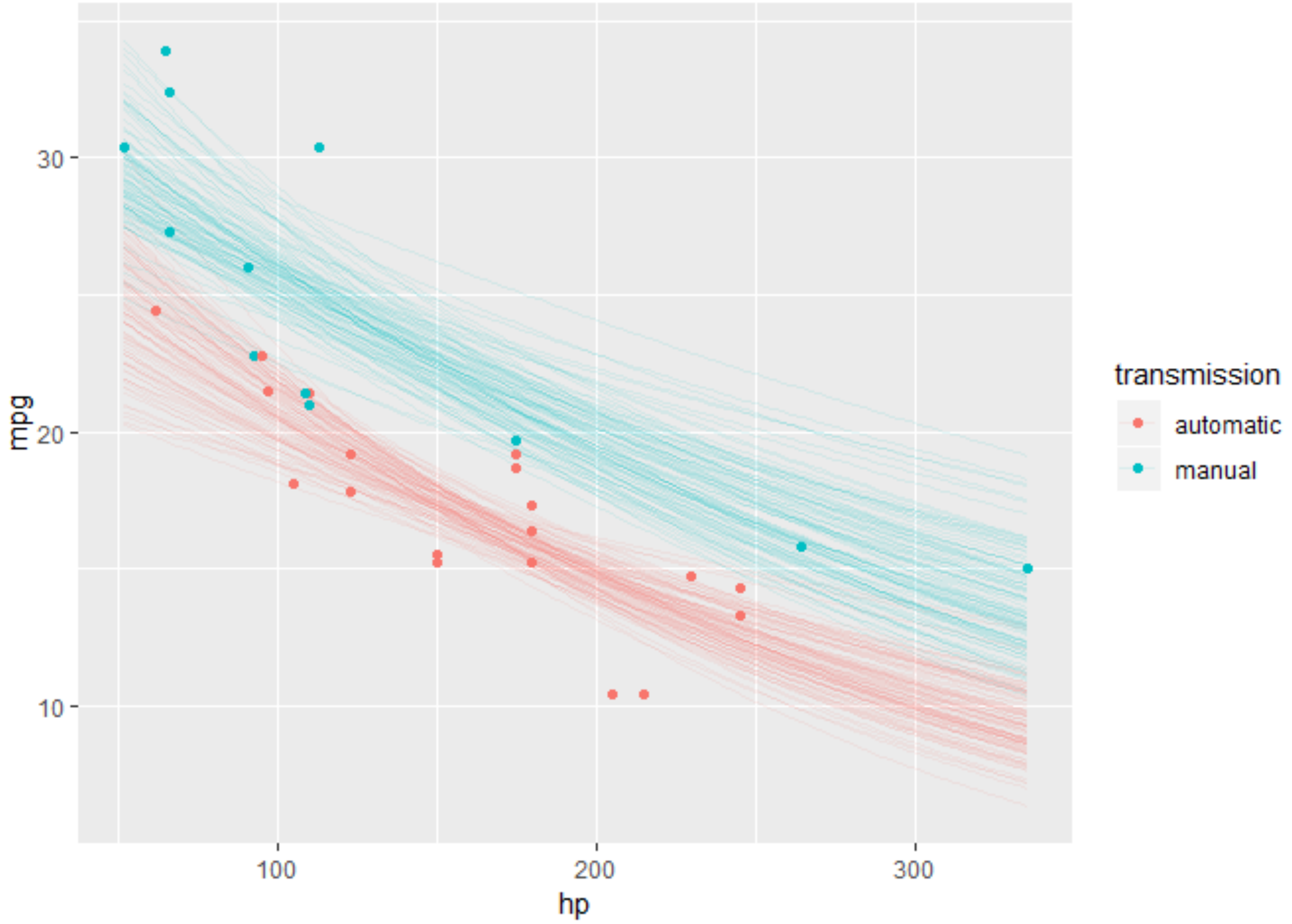
Spaghetti Plot vs. HOP

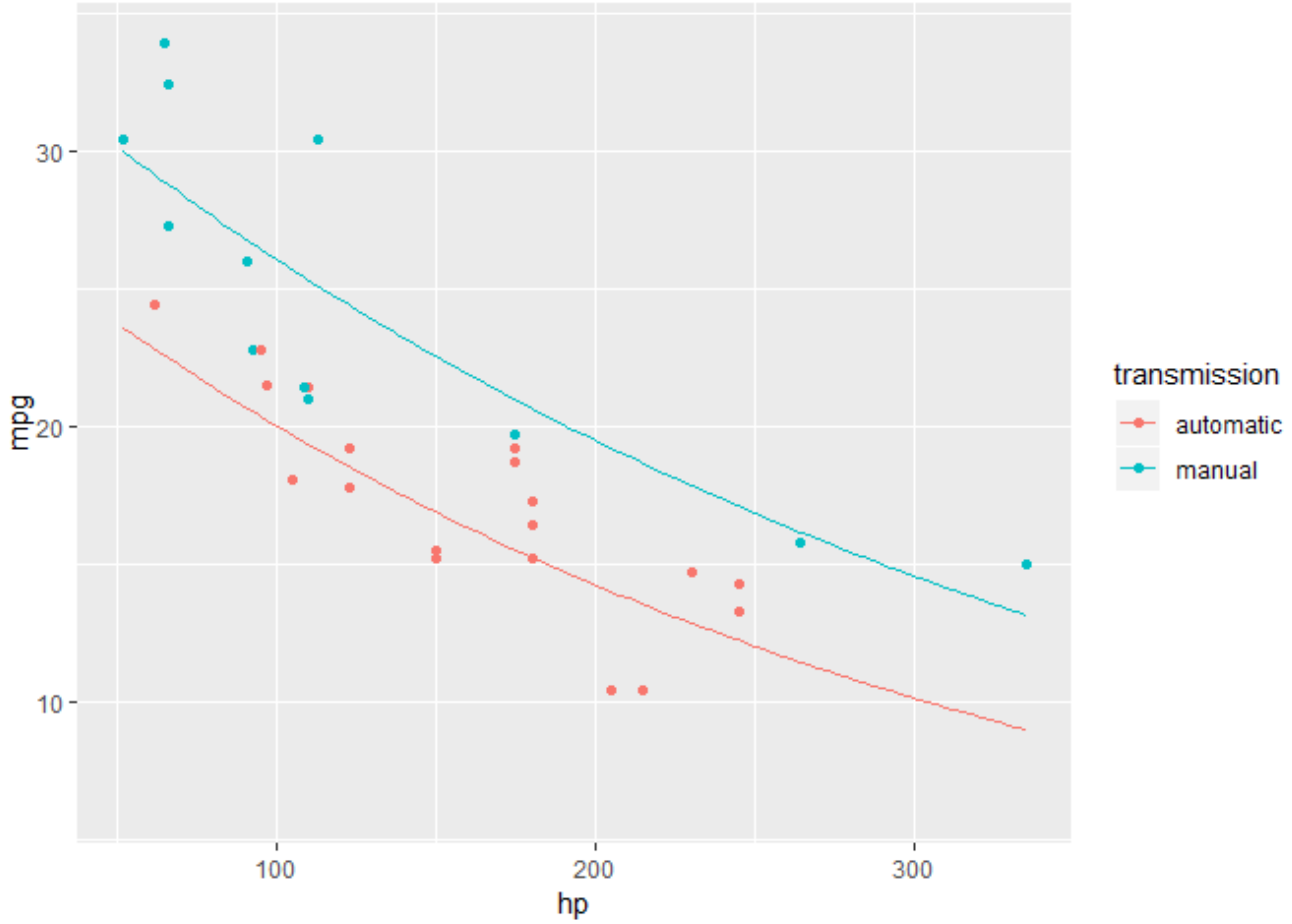




[M. Kay]

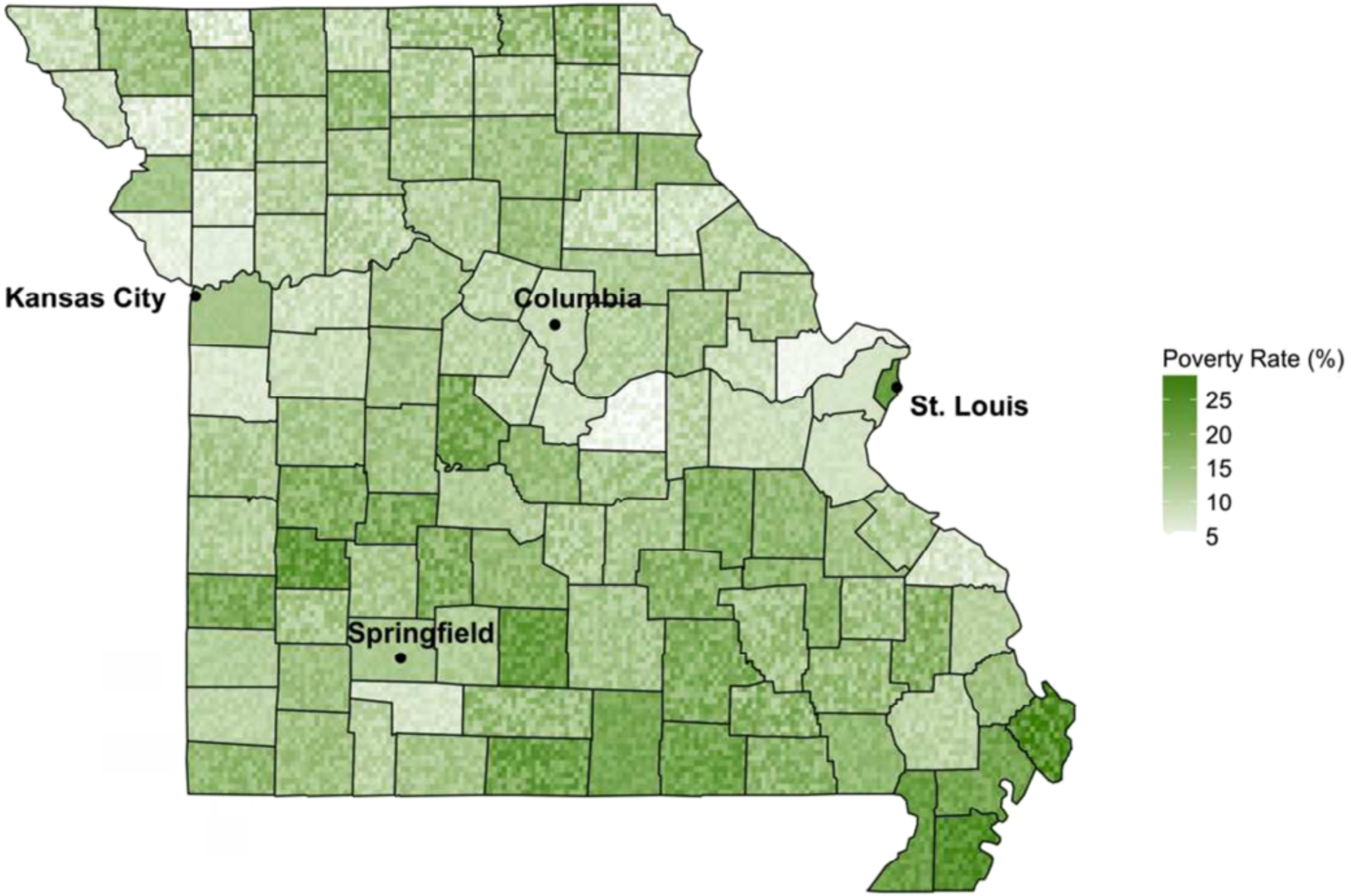
Spaghetti Plot vs. HOP





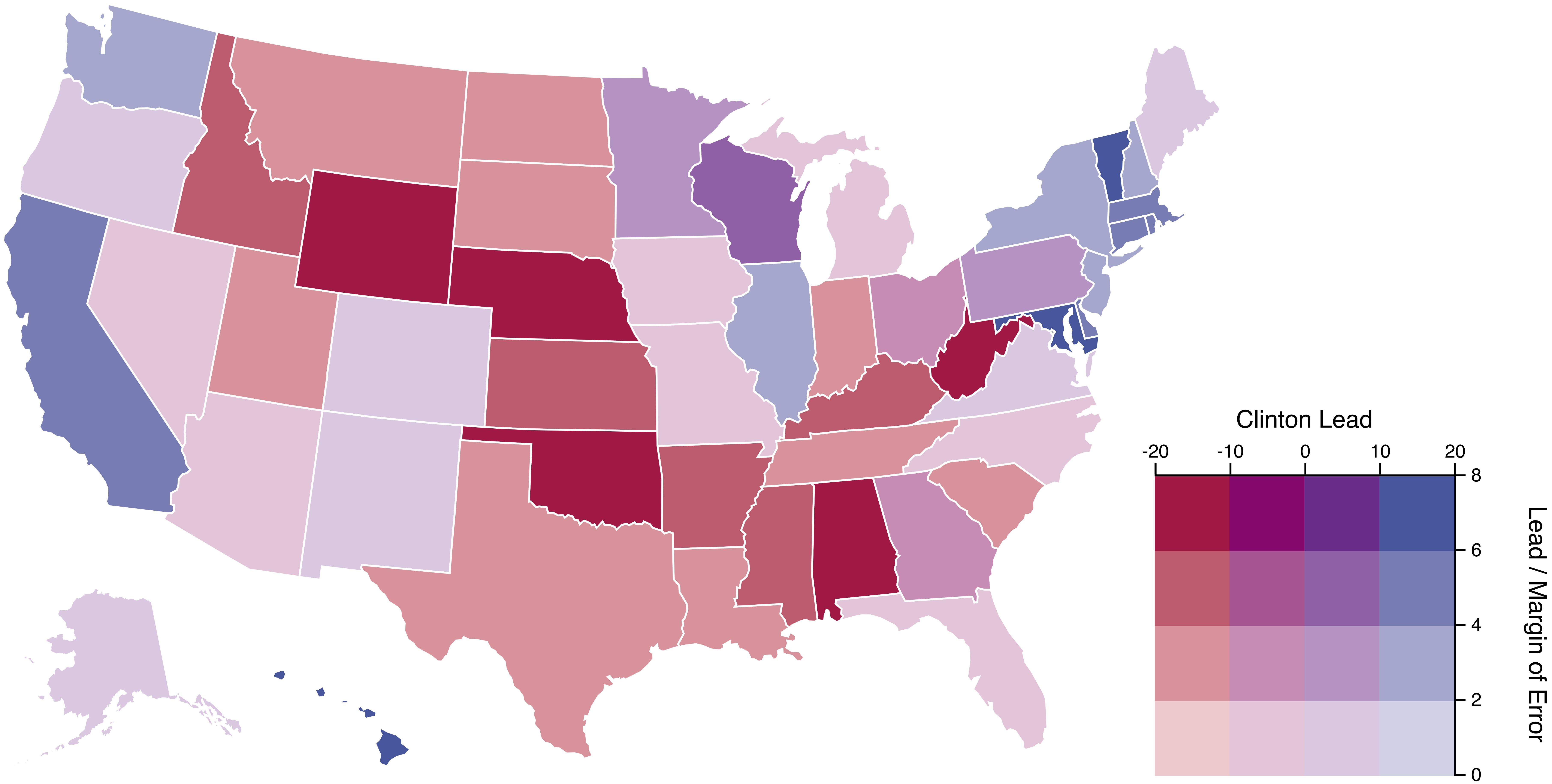
[M. Kay]

Dithering to show uncertainty



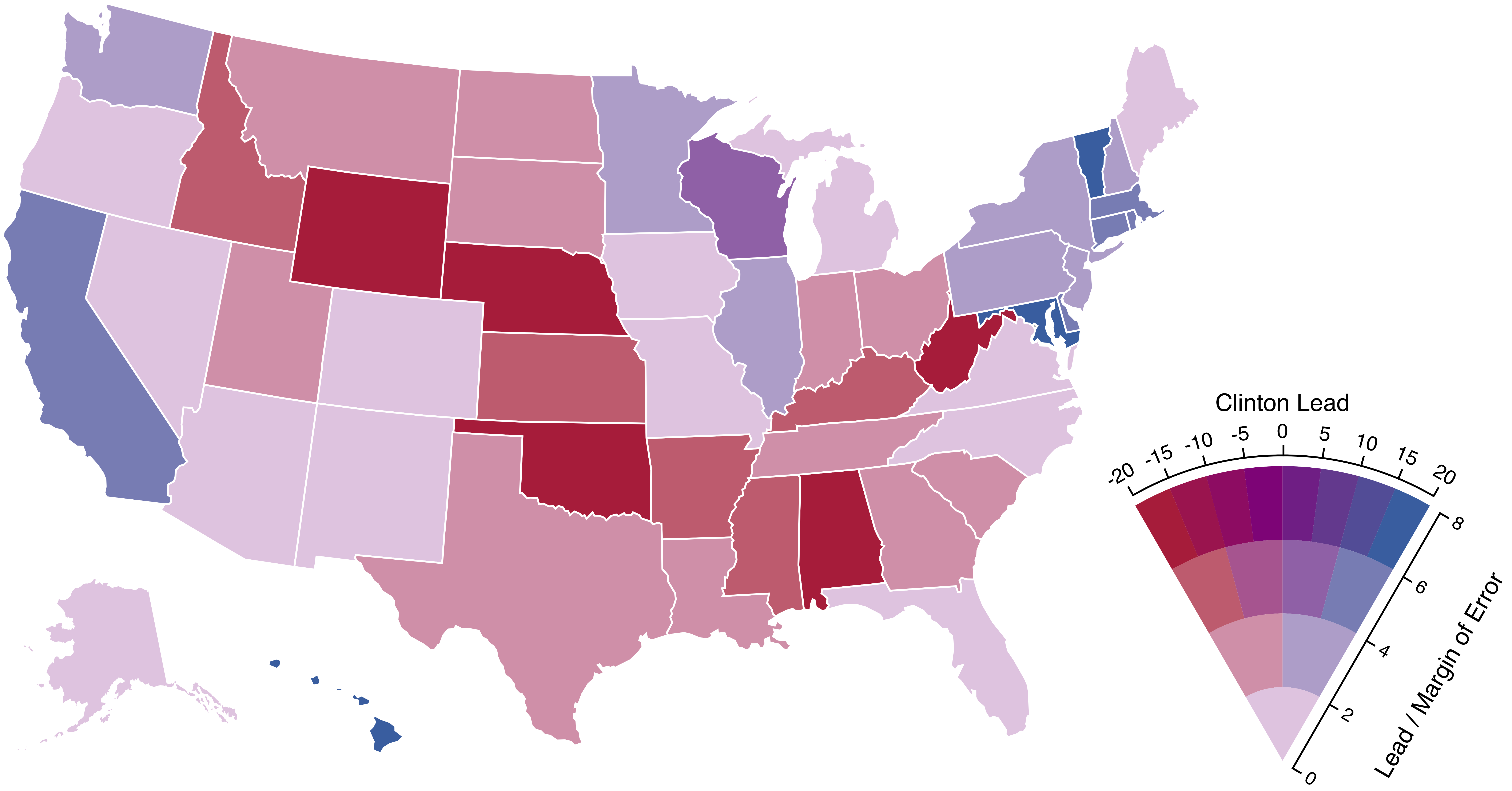
[Lucchesi and Wikle, 2017]

Bivariate Colormap (Uncertainty → Saturation)



[Correll et al., 2018]

Value-Suppressing Uncertainty Palette



[Correll et al., 2018]

Schedule

- Thursday: Progress Reports & Uncertainty
- Next Tuesday: Surveys Due & Presentations
- Tuesday, Oct. 26: No Class
- Thursday, Oct. 28: High-Dimensional Data Critique Due

Today's Paper: Critique Due

When (ish) is My Bus? User-centered Visualizations of Uncertainty in Everyday, Mobile Predictive Systems

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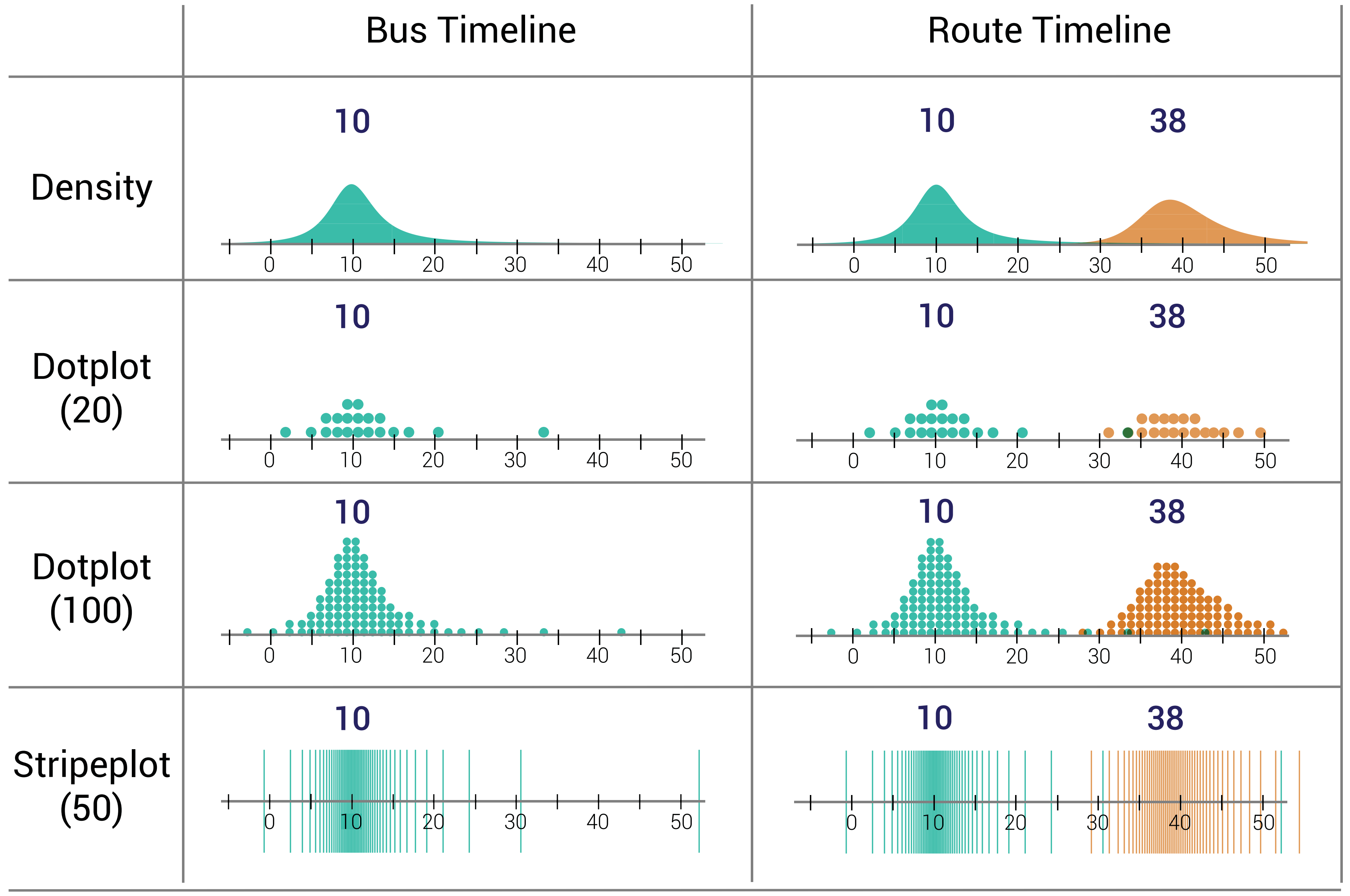

Paper Presentation

Critique

Questions & Discussion