Multiverses and miscellanea

SIADS 542: Presenting uncertainty – Week 4, Lecture 2

Matthew Kay
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School of Information
University of Michigan

Today

We’re mostly going to talk about an important topic in large world uncertainty: **multiverse analysis**

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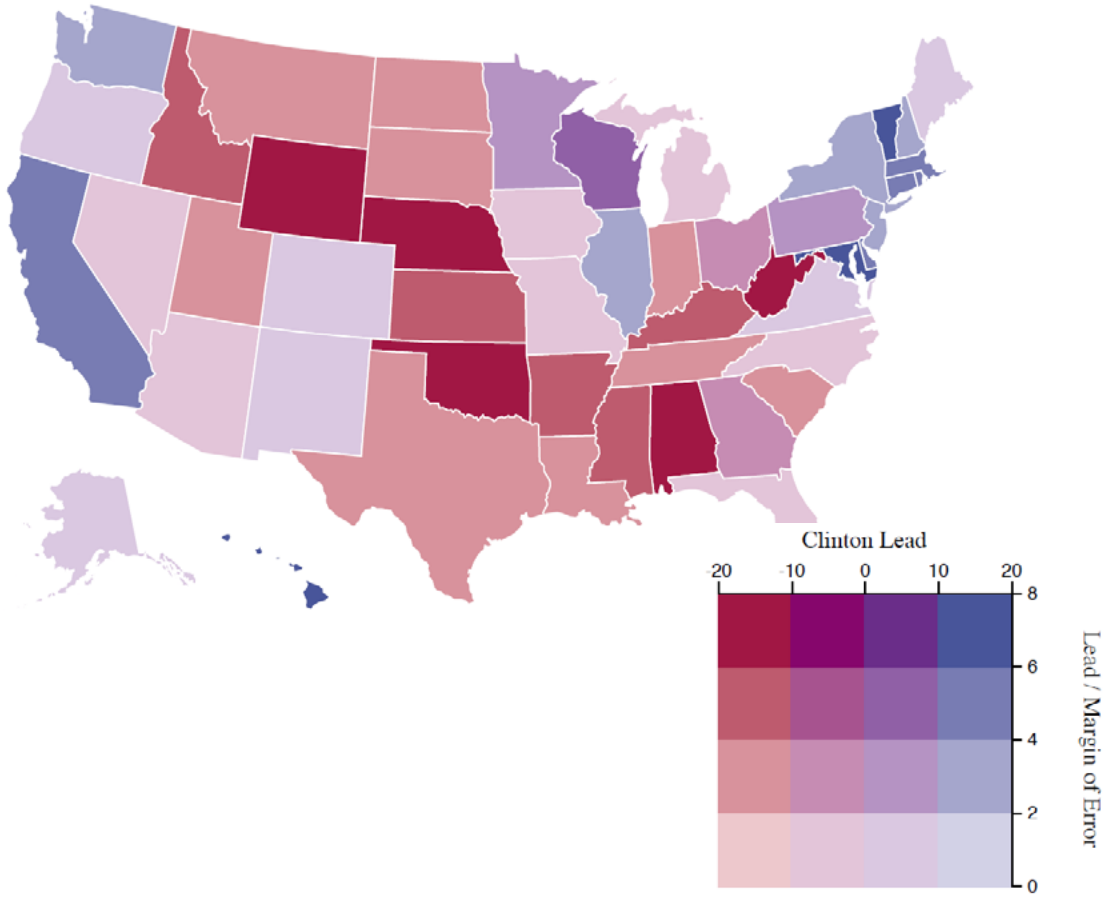
We'll also touch on a few miscellaneous topics, like probability perception

Addressing bias in perception of probability...

Value-suppressing uncertainty palettes

[Correll, Moritz, Heer. Value-Suppressing Uncertainty Palettes. CHI 2018]



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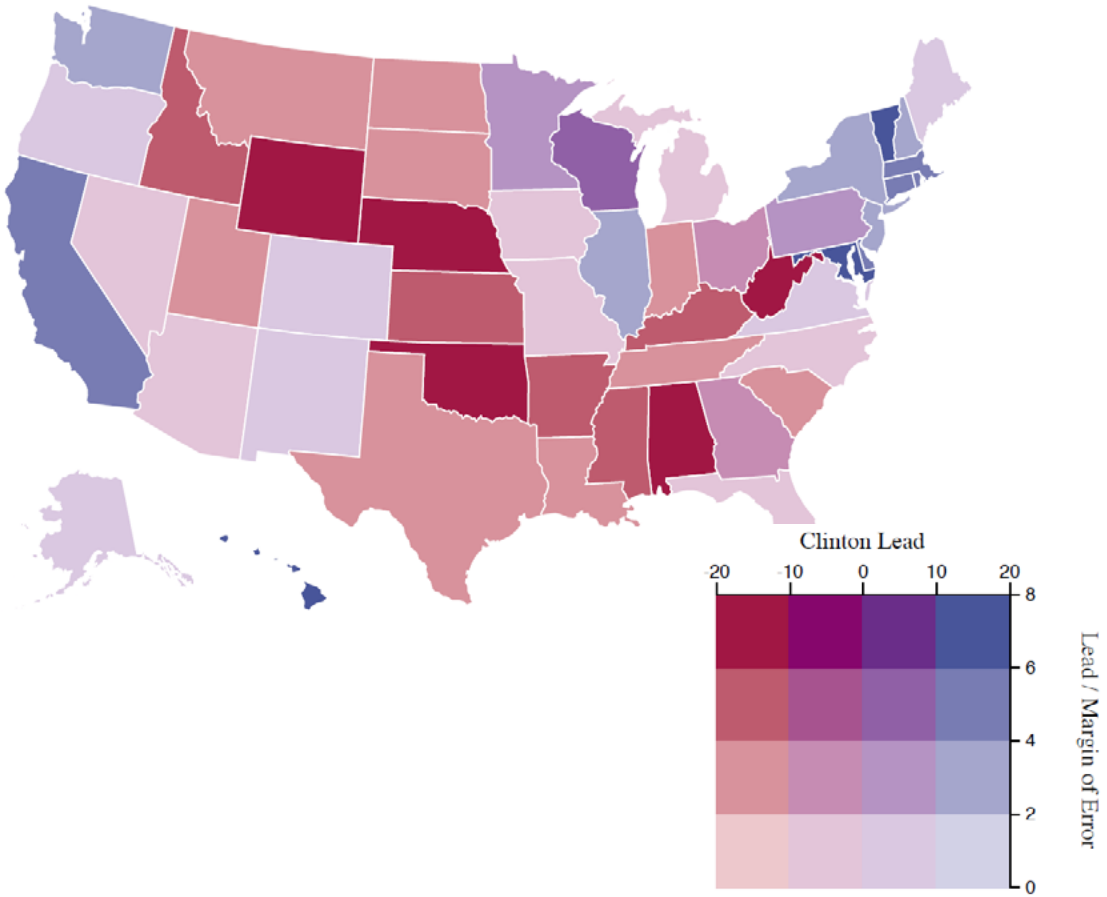
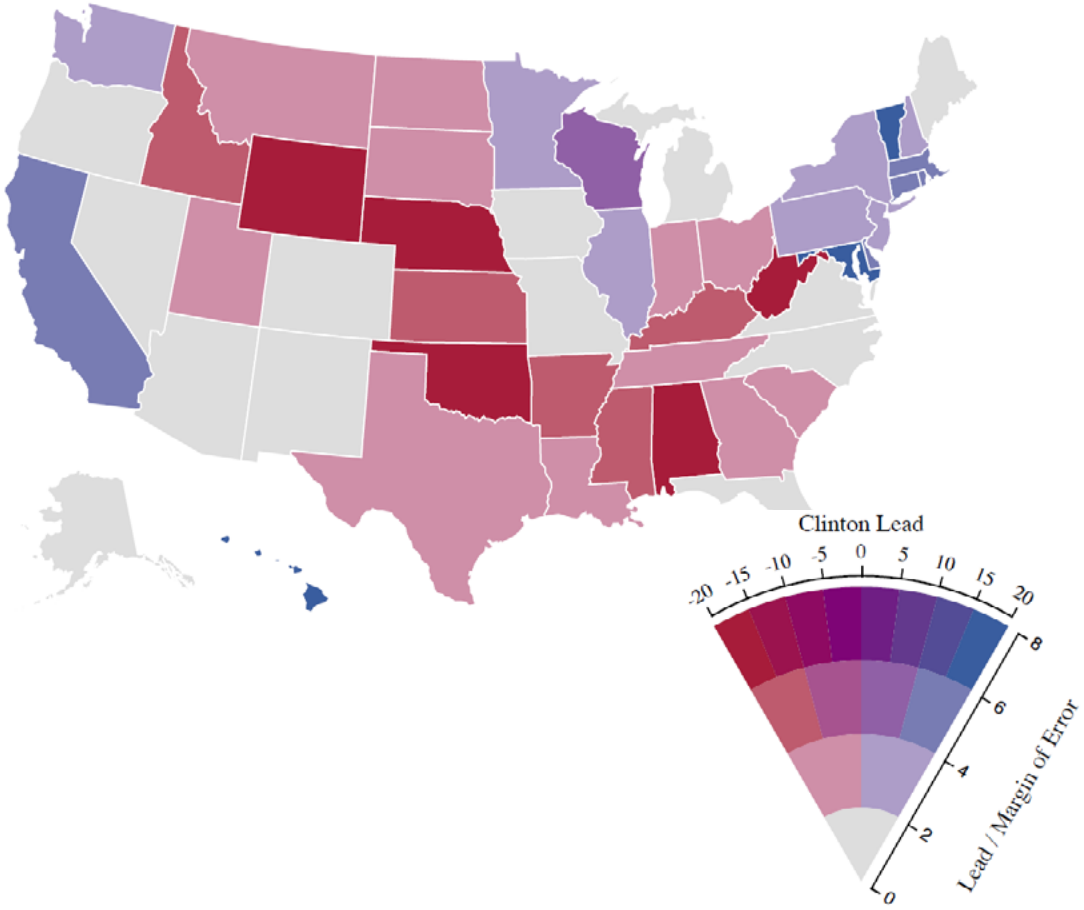
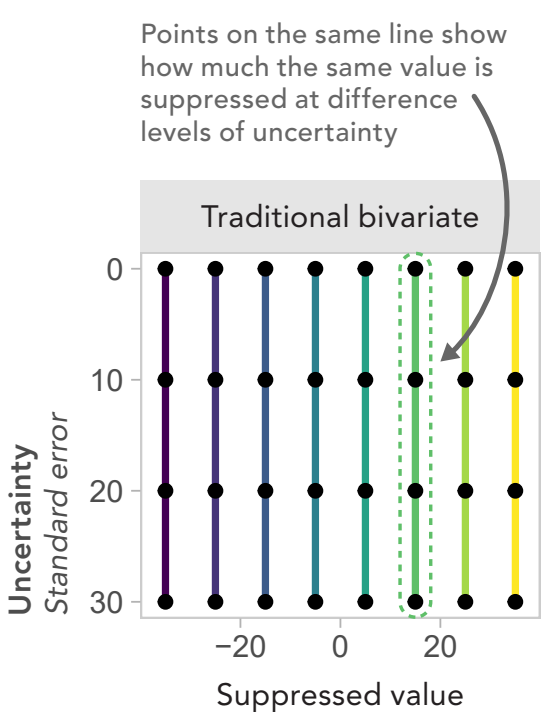
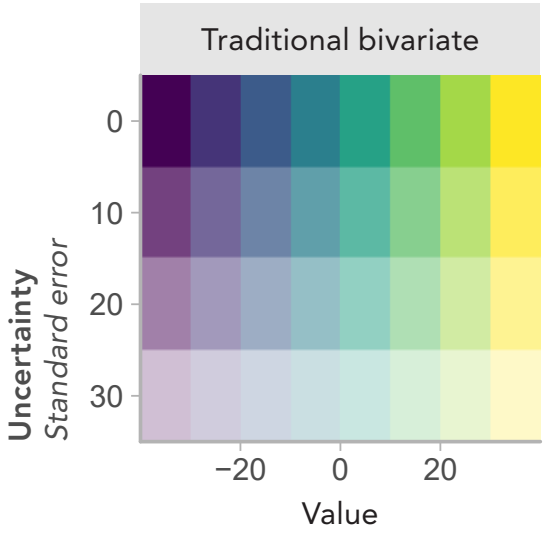


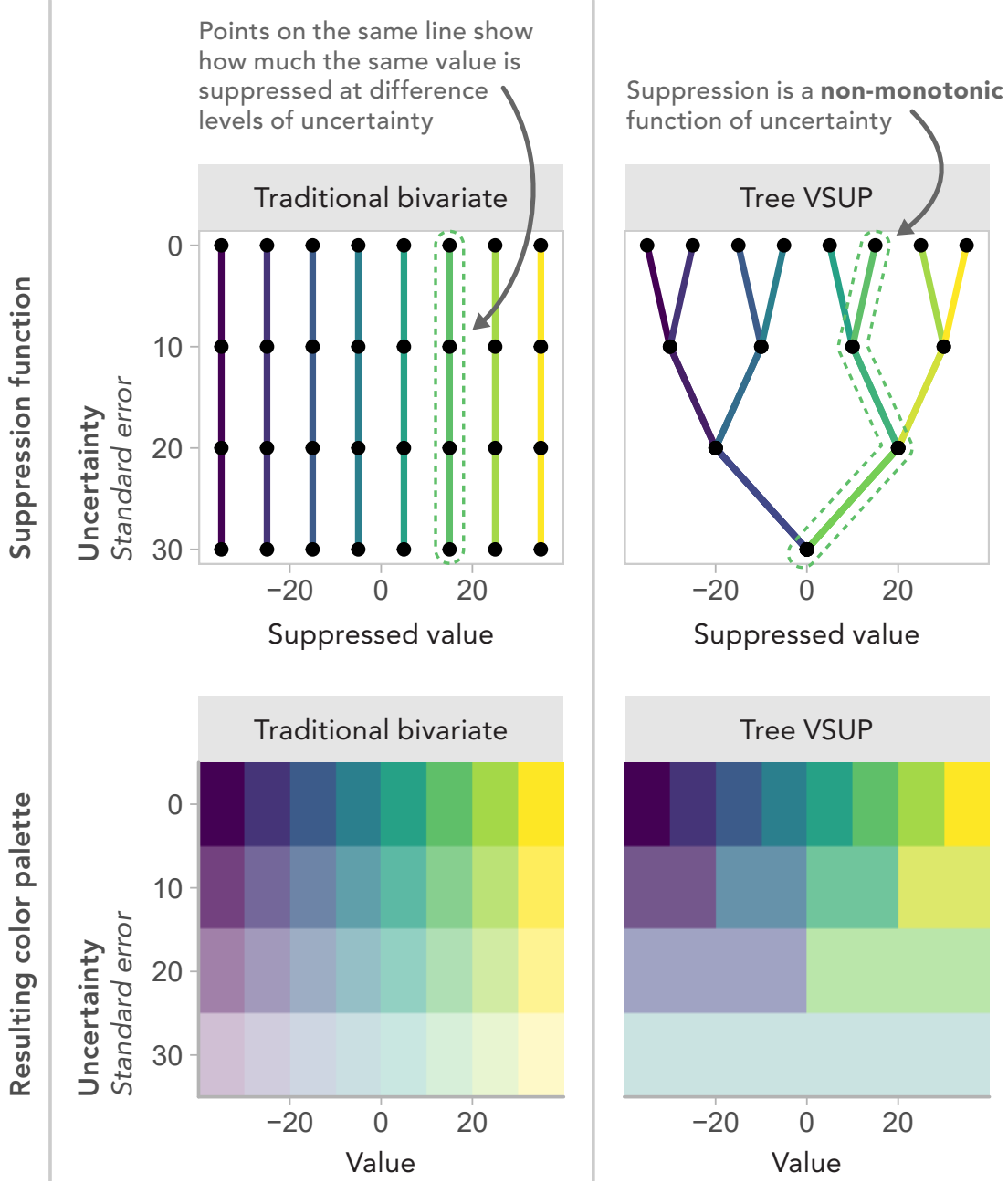


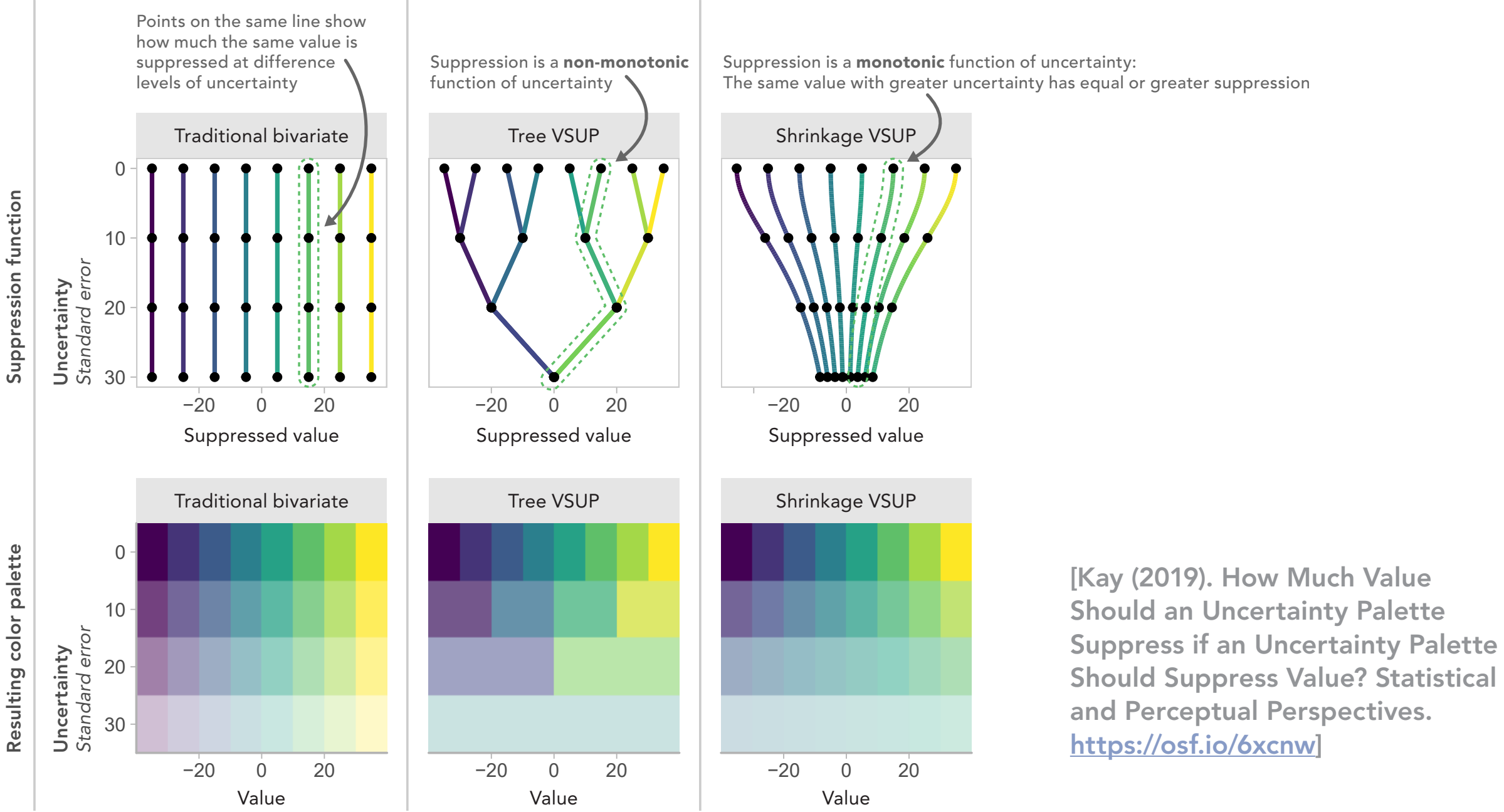
Suppression function



Resulting color palette



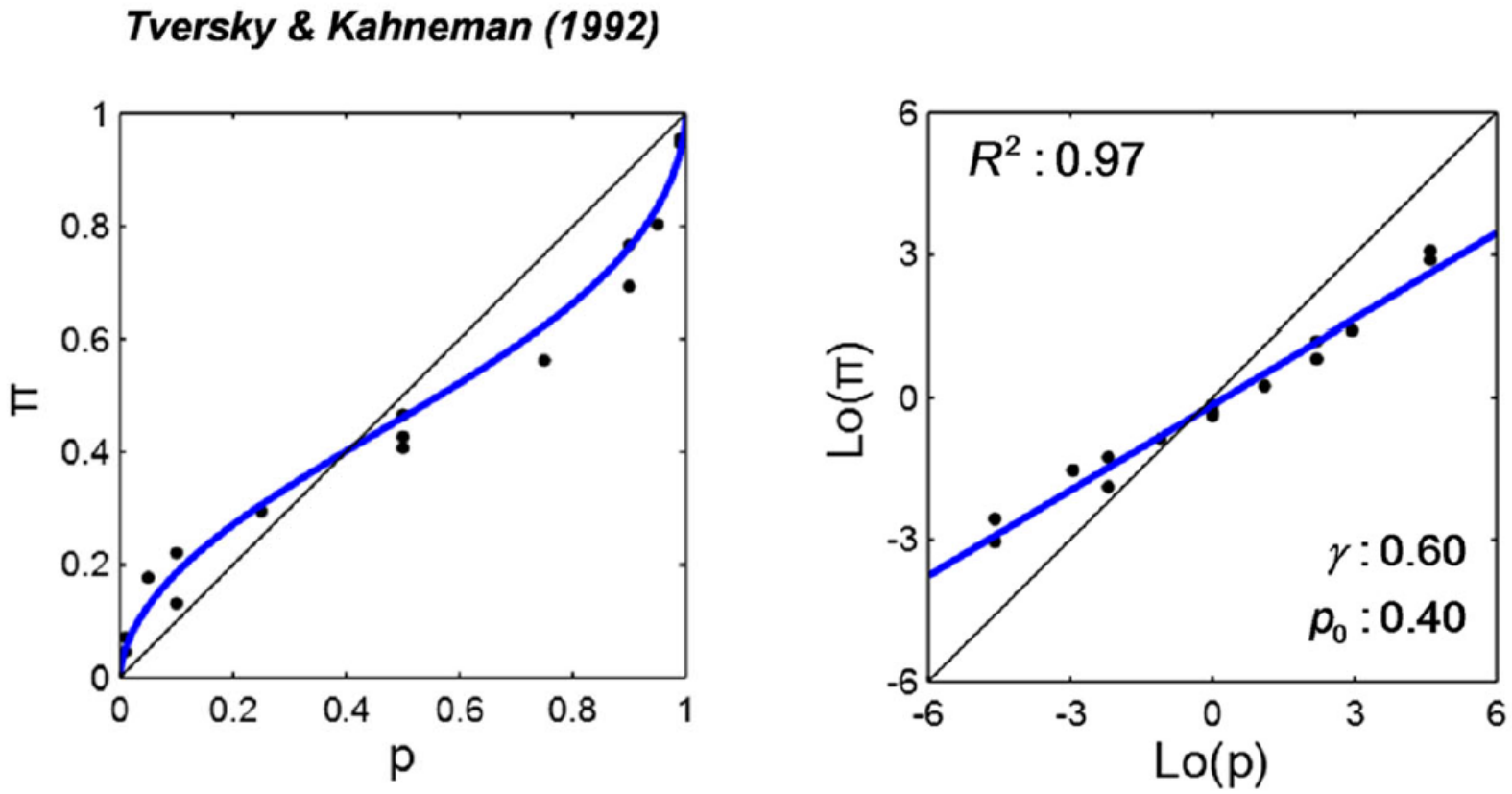

Suppression function
Resulting color palette
Points on the same line show how much the same value is suppressed at difference levels of uncertainty
Suppression is a non-monotonic function of uncertainty
Traditional bivariate
Tree VSUP
Uncertainty
Standard error
0
10
20
30
−20
0
20
Suppressed value
Value



[Kay (2019). How Much Value Should an Uncertainty Palette Suppress if an Uncertainty Palette Should Suppress Value? Statistical and Perceptual Perspectives. https://osf.io/6xcnw]

Linear-in-log-odds perception of proportions

[Zhang & Maloney. Ubiquitous log odds: A common representation of probability and frequency distortion in perception, action, and cognition. Frontiers in Neuroscience, 6(JAN), 1–14, 2012]



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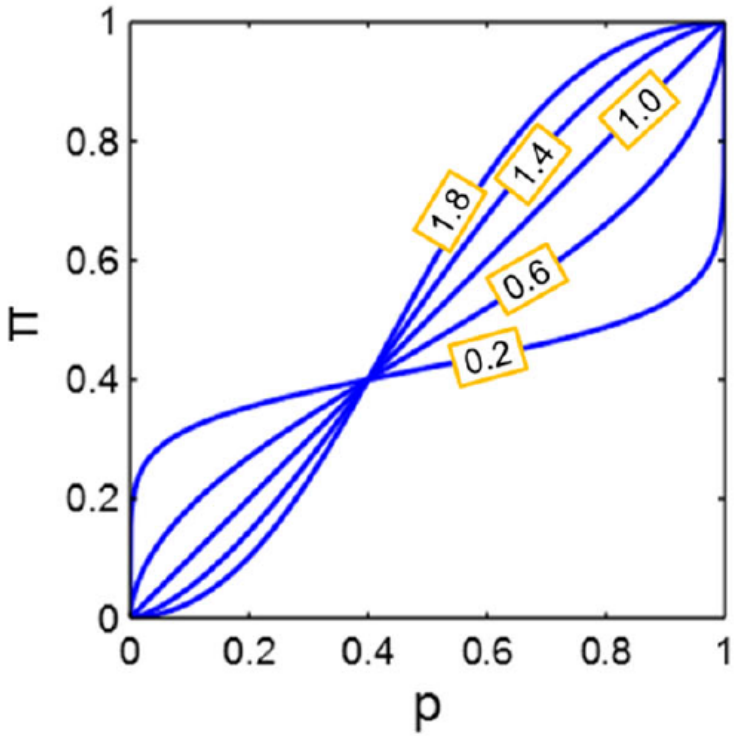
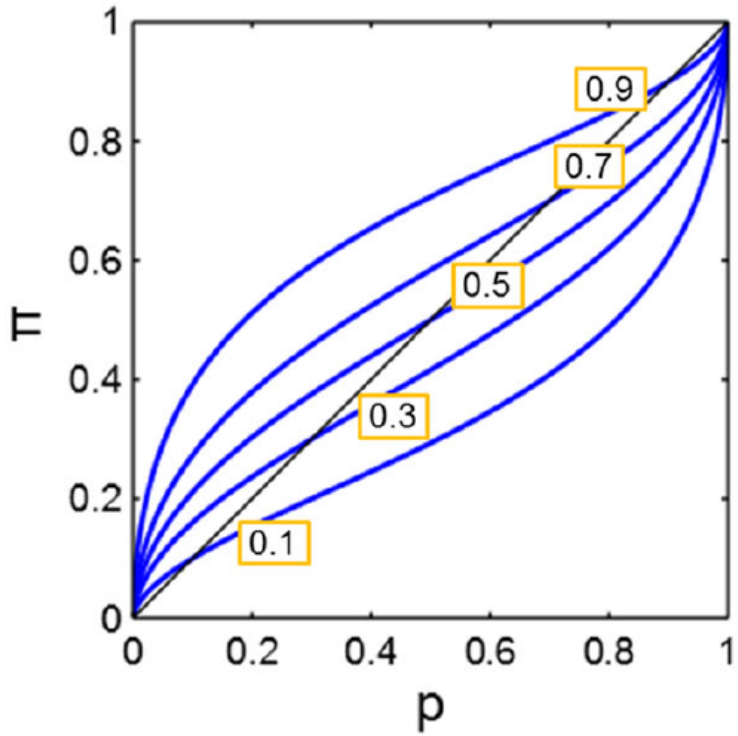
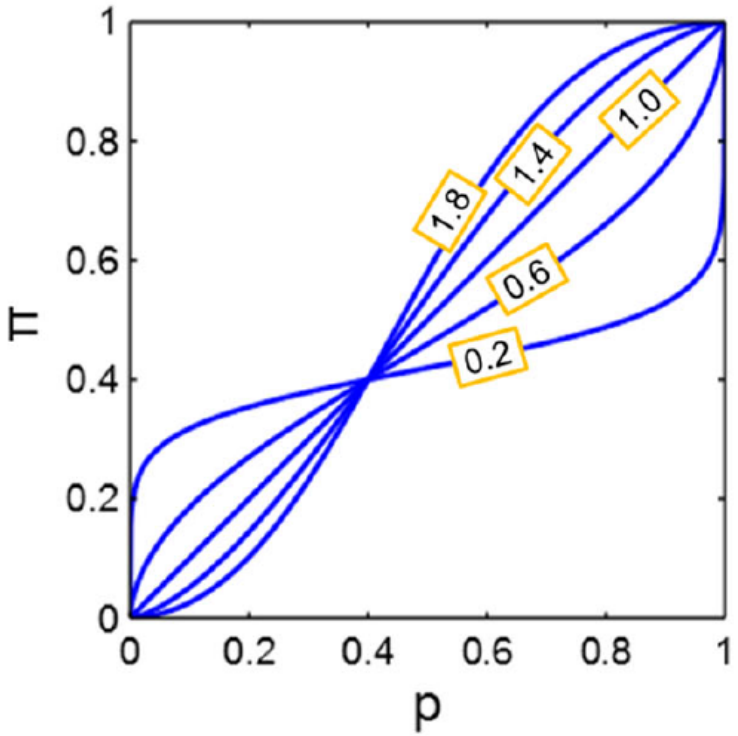
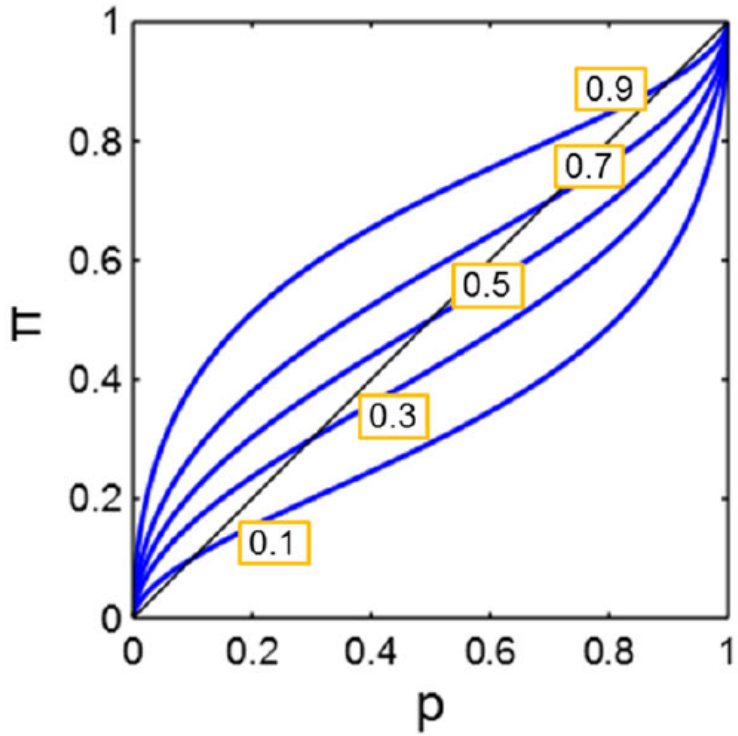


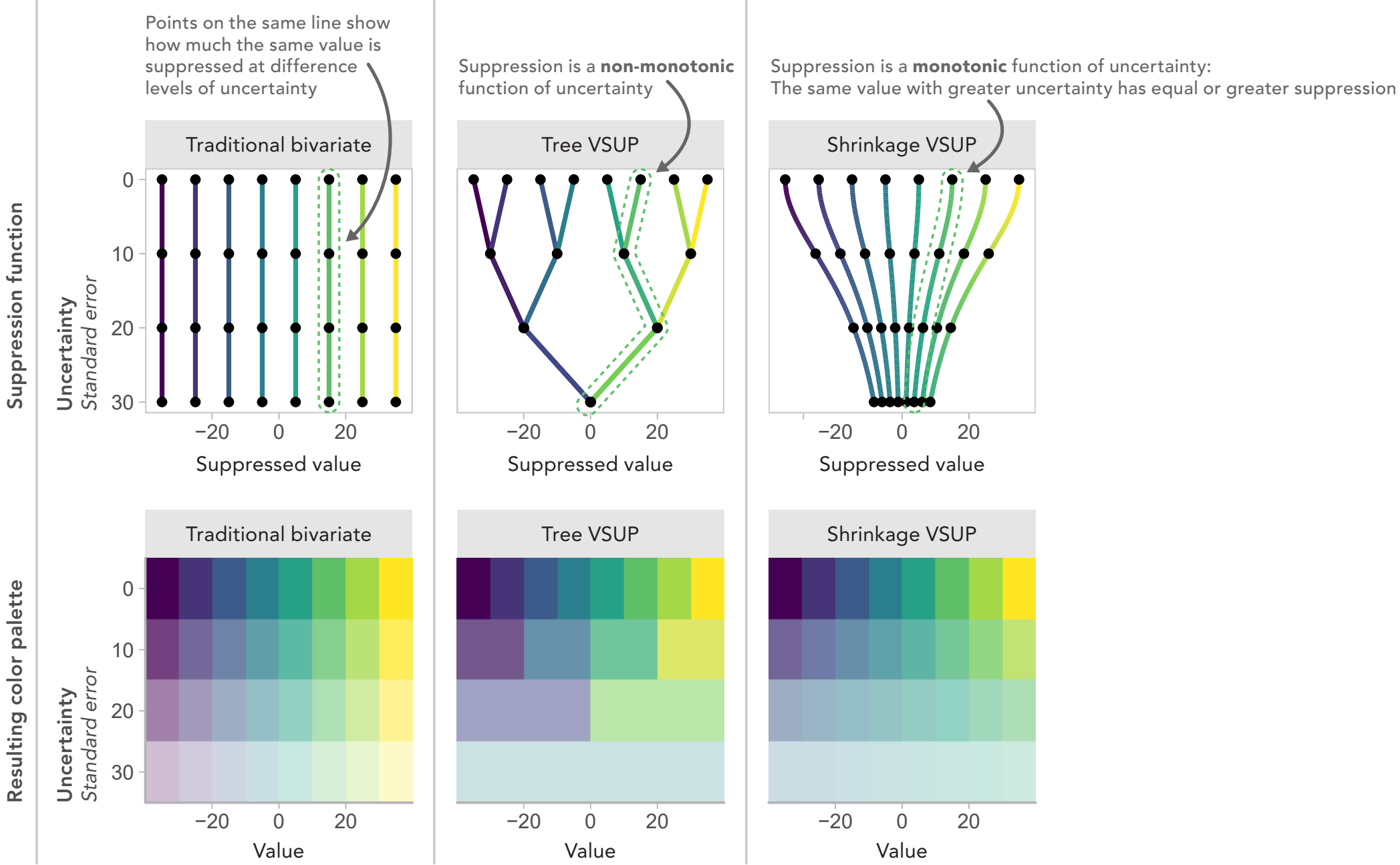


Linear-in-probit perception of proportions

[Zhang & Maloney. Ubiquitous log odds: A common representation of probability and frequency distortion in perception, action, and cognition. Frontiers in Neuroscience, 6(JAN), 1–14, 2012]



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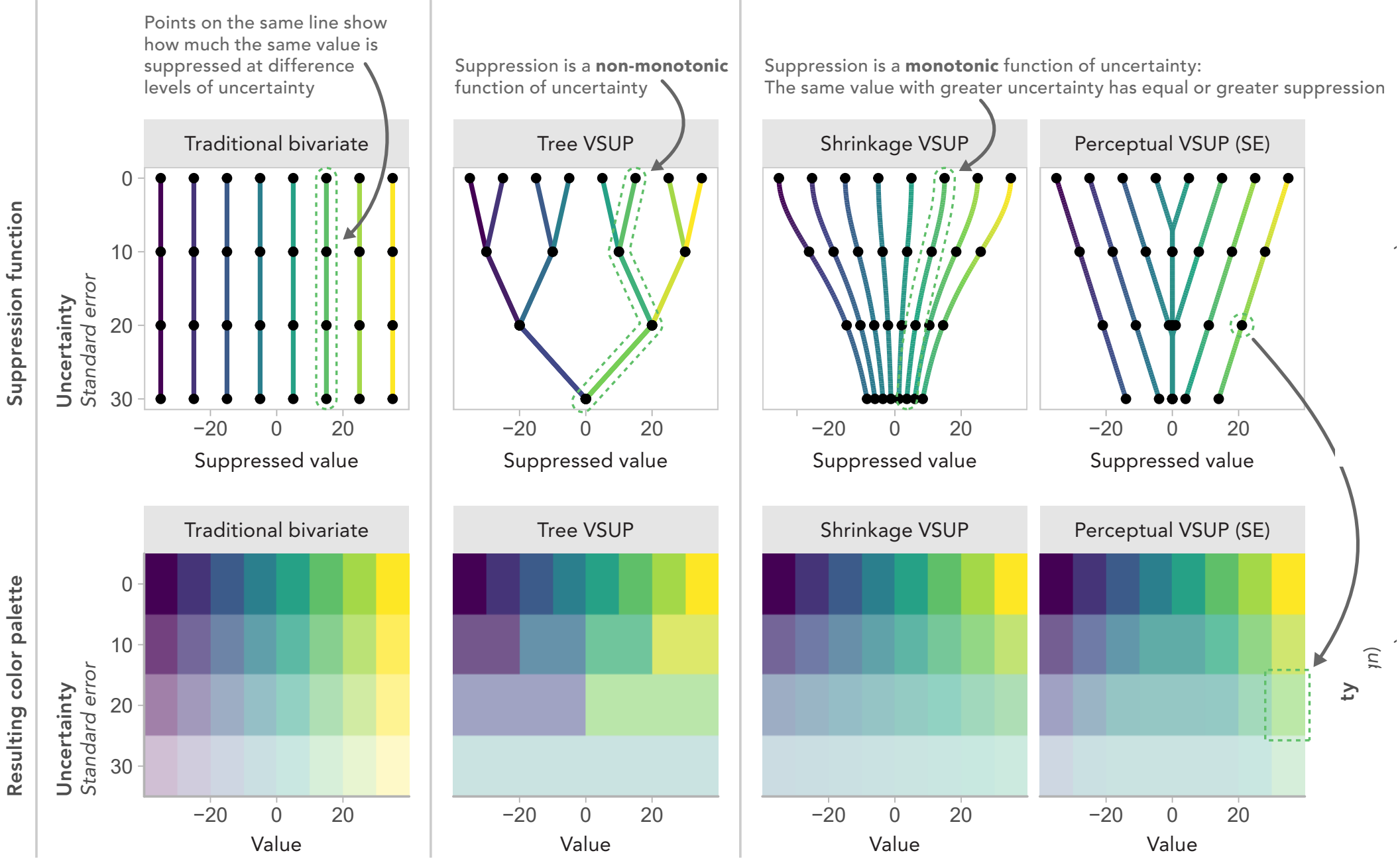
Suppression is a monotonic function of uncertainty:
The same value with greater uncertainty has equal or greater suppression
Traditional bivariate
Tree VSUP
Shrinkage VSUP
Uncertainty
Standard error
0
10
20
30
−20
0
20
Suppressed value
Value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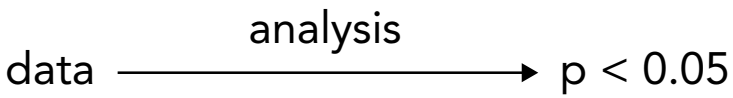
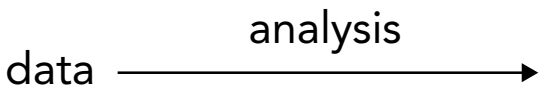
The same value with greater uncertainty has equal or greater suppression
Suppression function
Resulting color palette
Traditional bivariate
Tree VSUP
Shrinkage VSUP
Perceptual VSUP (SE)
Uncertainty
Standard error
0
10
20
30
−20
0
20
Suppressed value
Value

“de-biasing” is hard

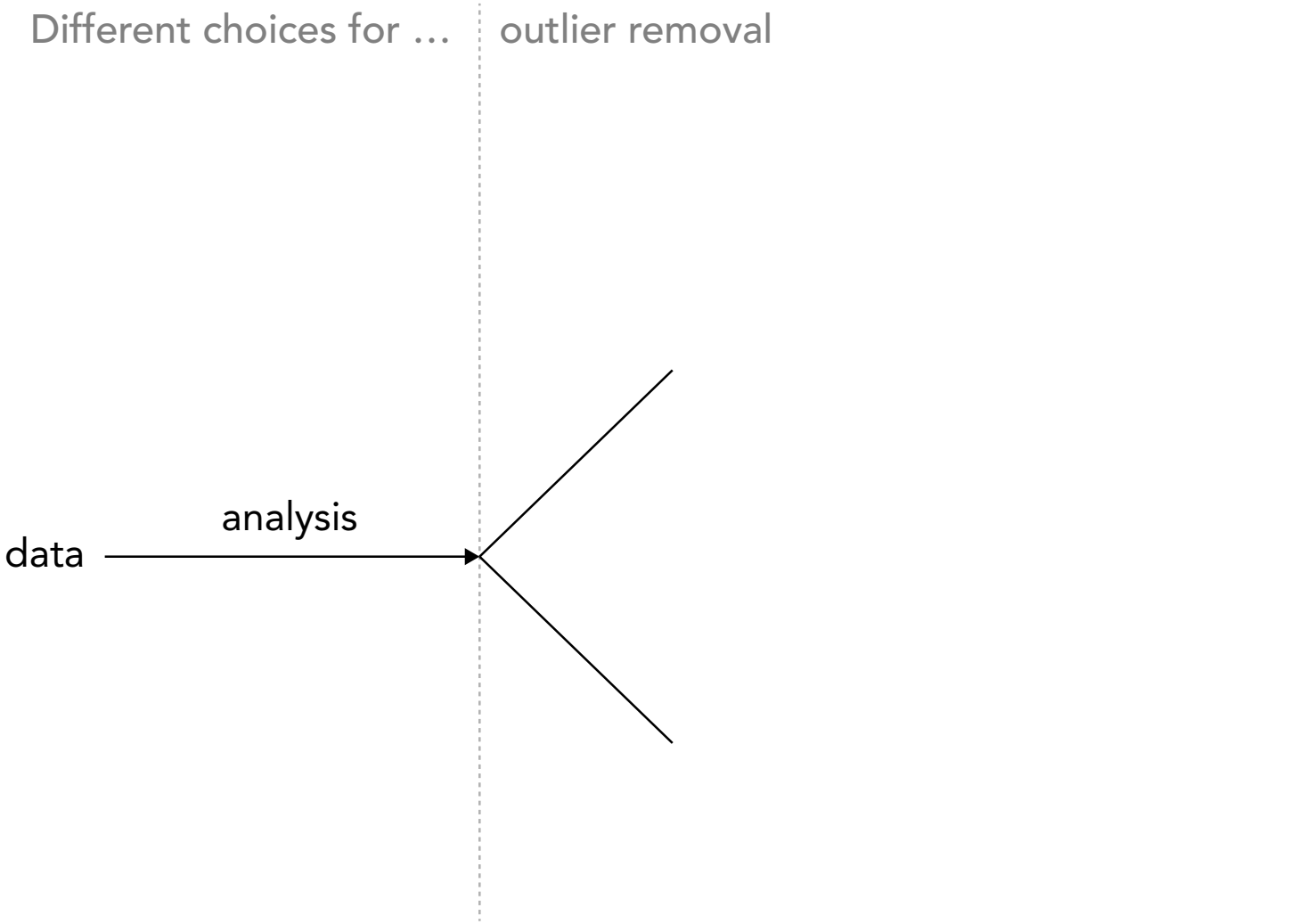
With care and domain knowledge, it **may** be possible to improve decision-making under uncertainty by suppressing value under high uncertainty

Let's step back from
strictly probabilistic uncertainty


analysis
data
p < 0.05


analysis
data

Garden of forking paths [Gelman and Loken 2014]



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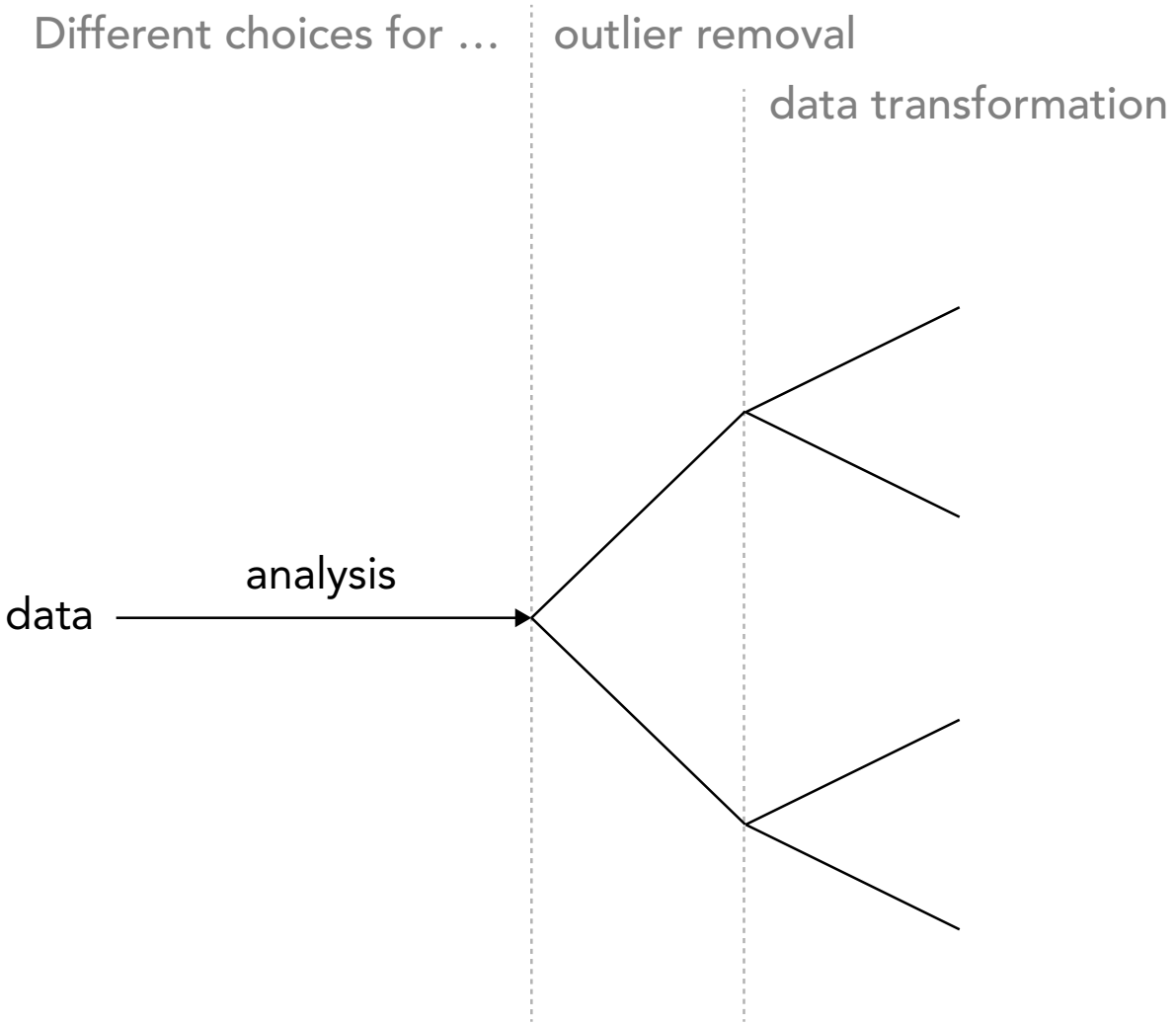

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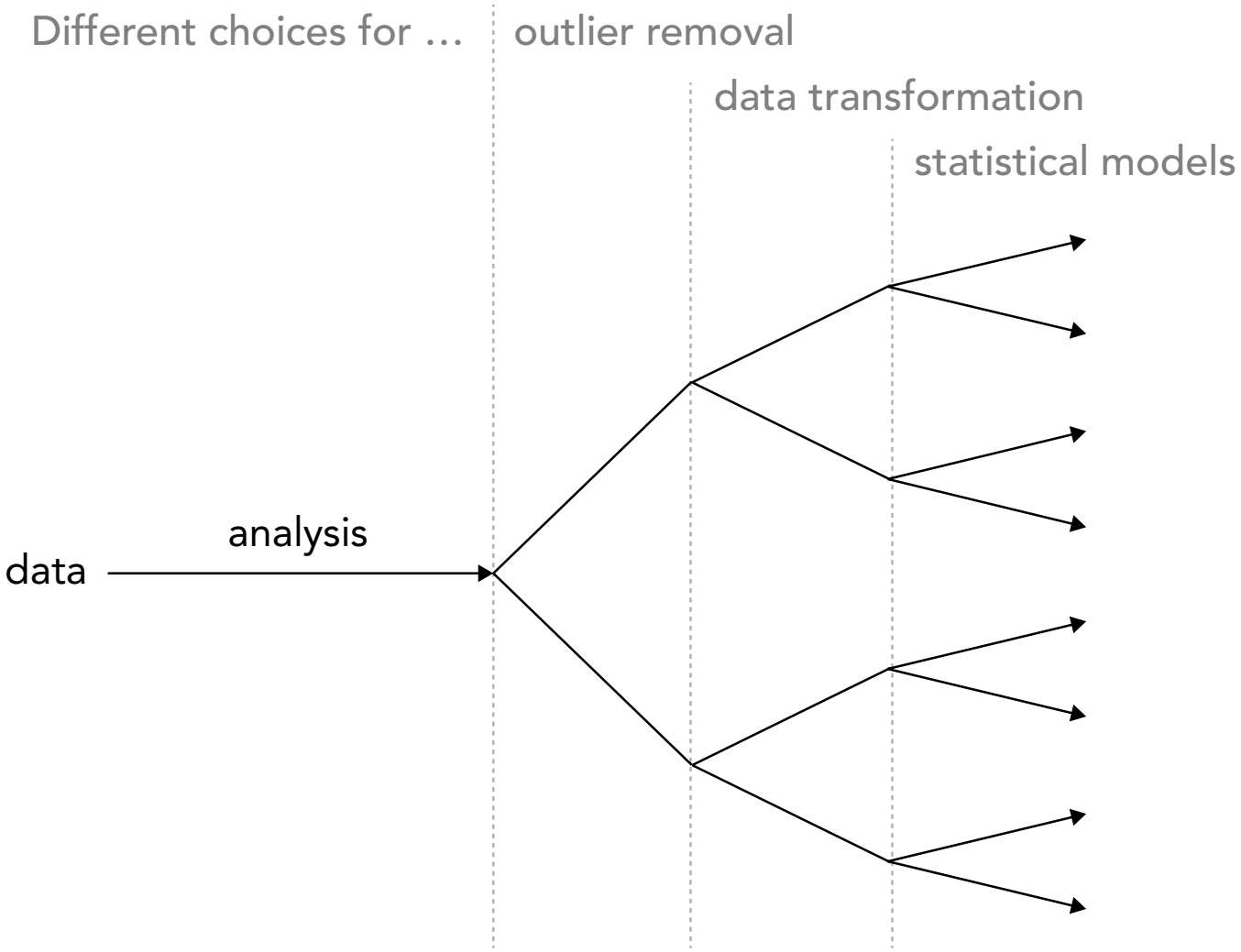

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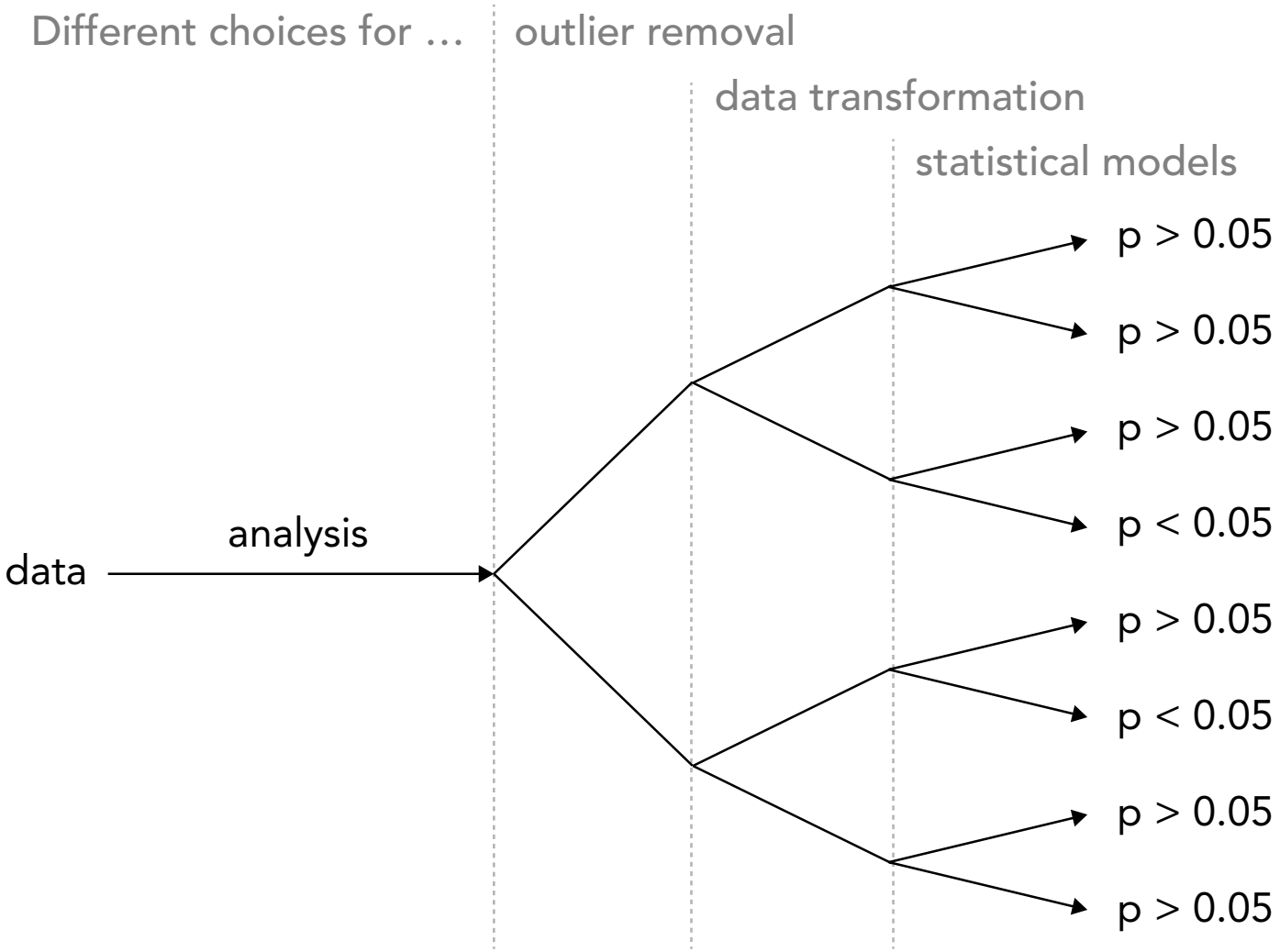

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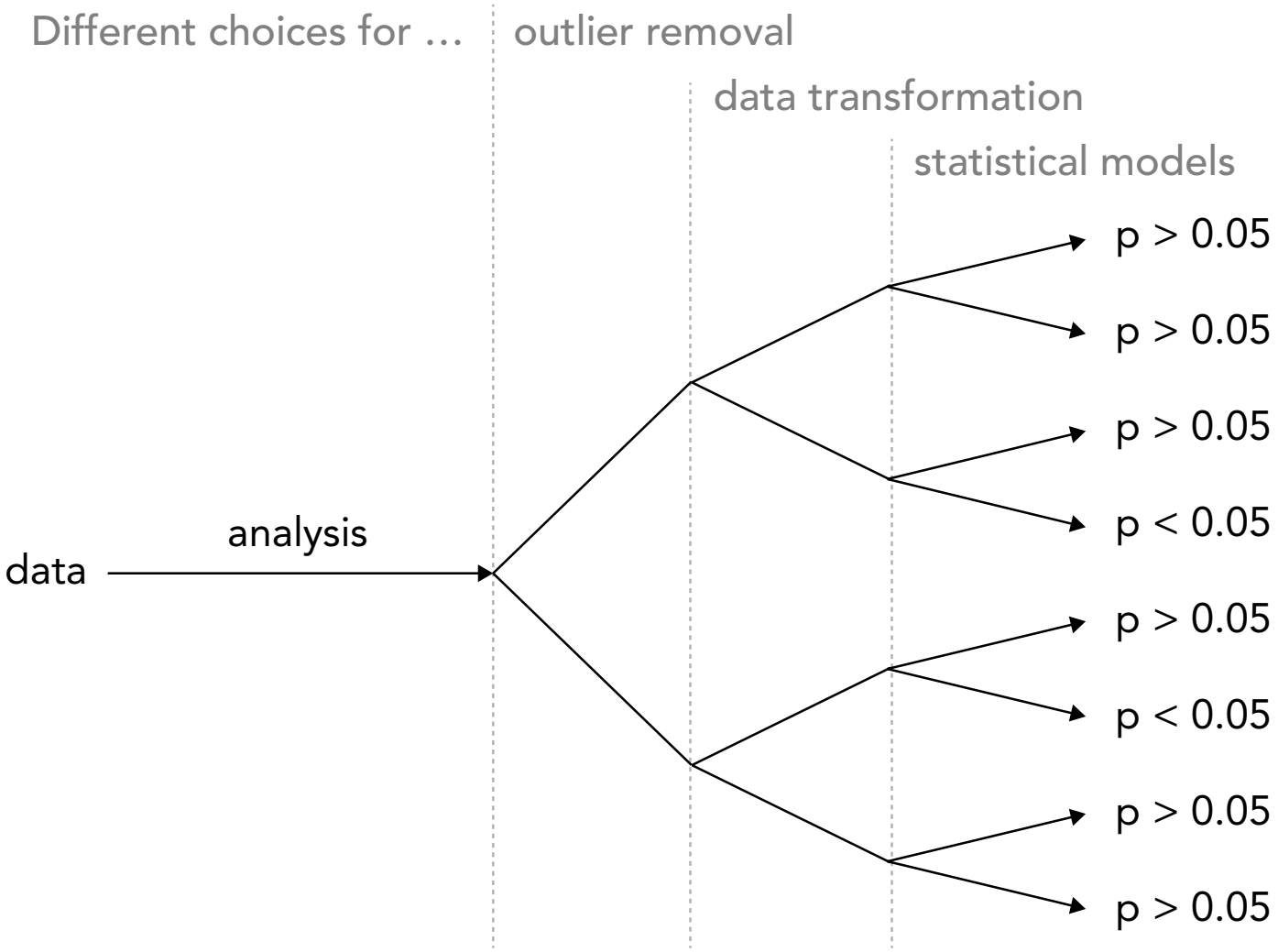
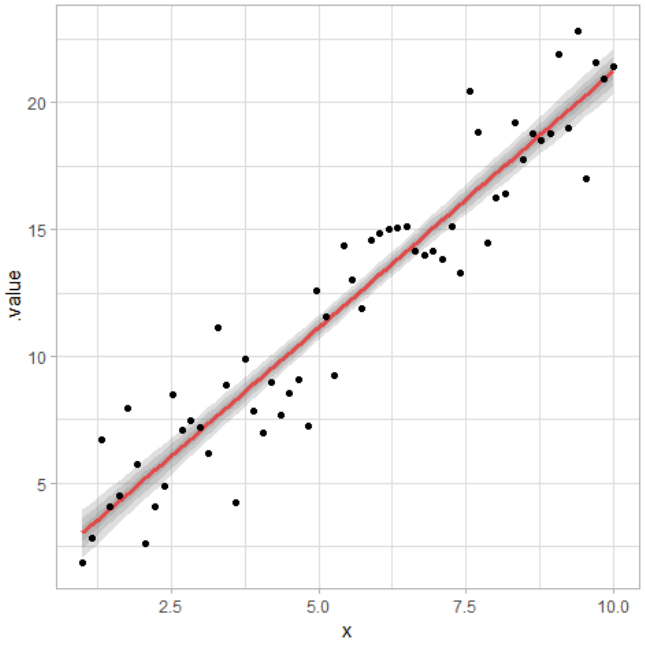


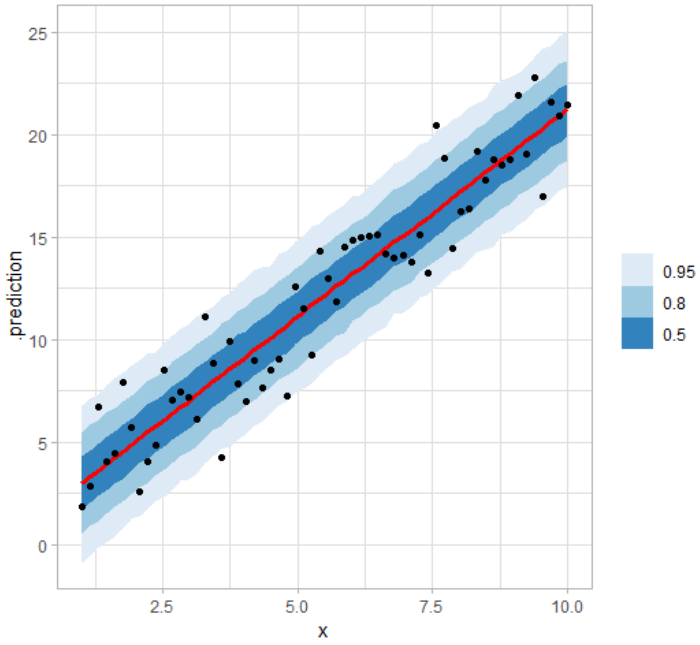
This is model/ specification uncertainty

Small world uncertainty

Parameter uncertainty

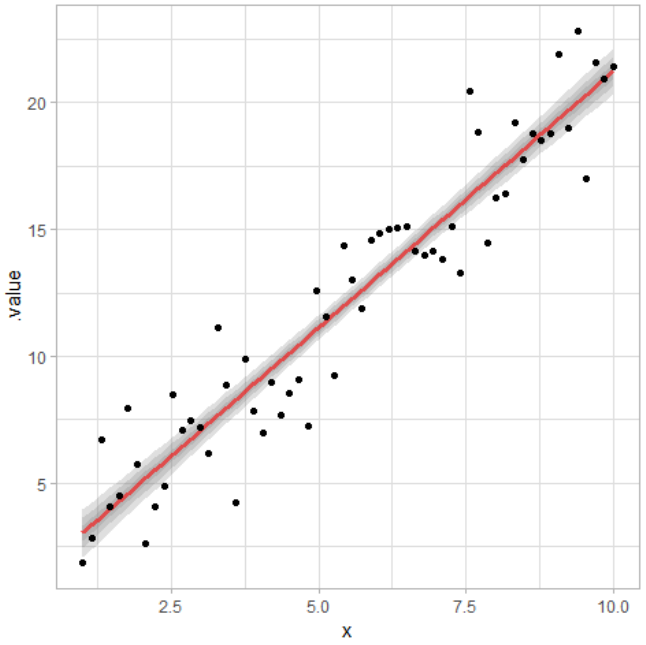


Predictive uncertainty



Small world uncertainty

Parameter uncertainty



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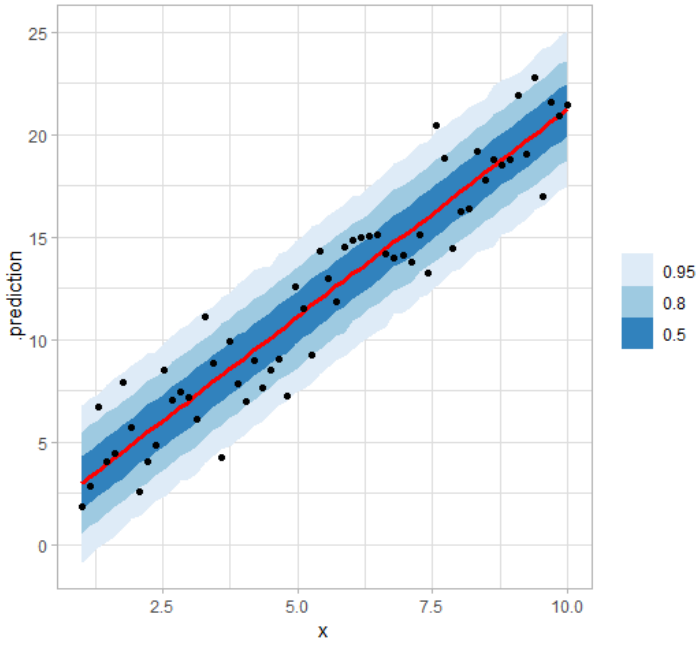
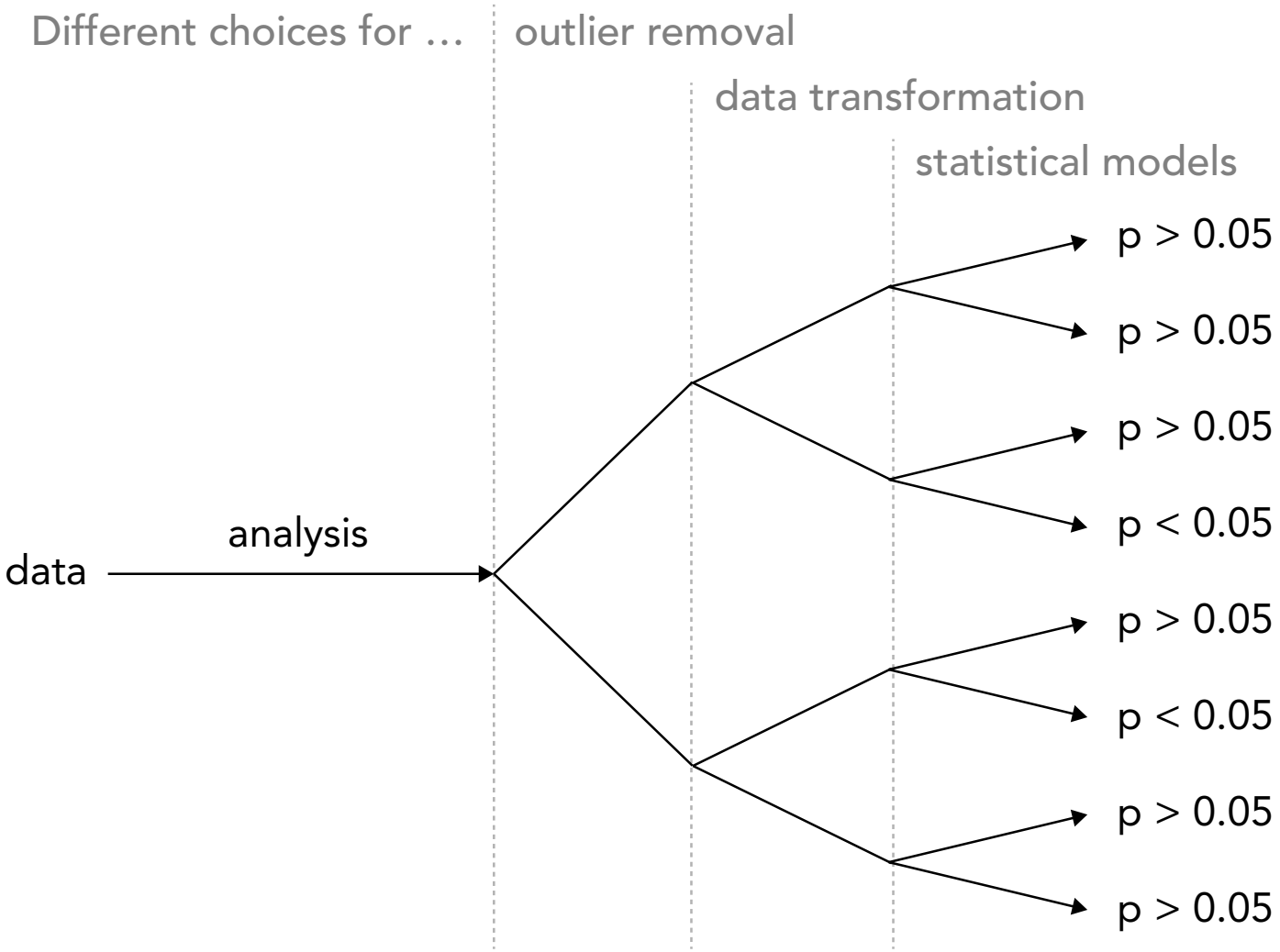


Large world uncertainty

How well does this describe reality?

Garden of forking paths [Gelman and Loken 2014]



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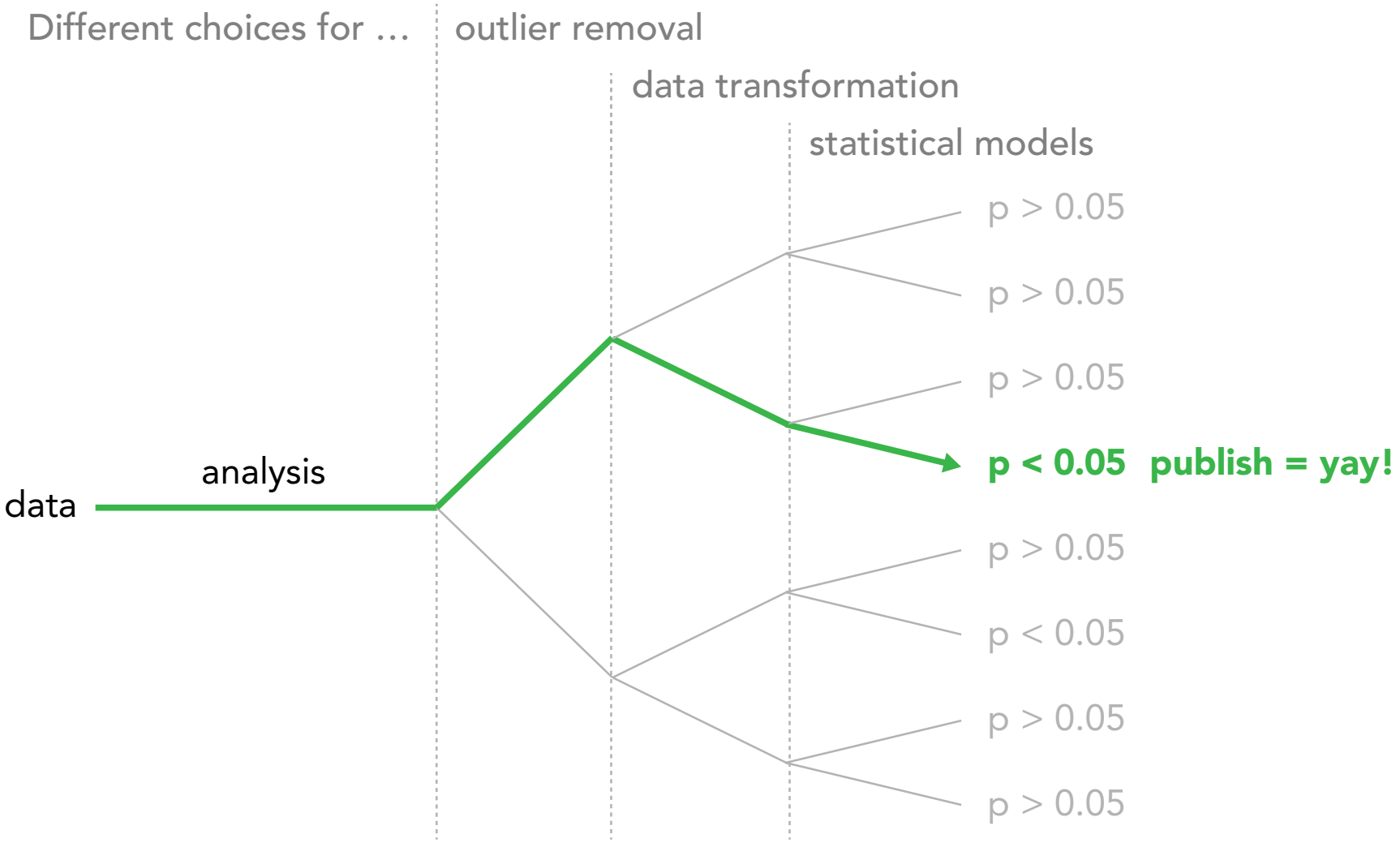
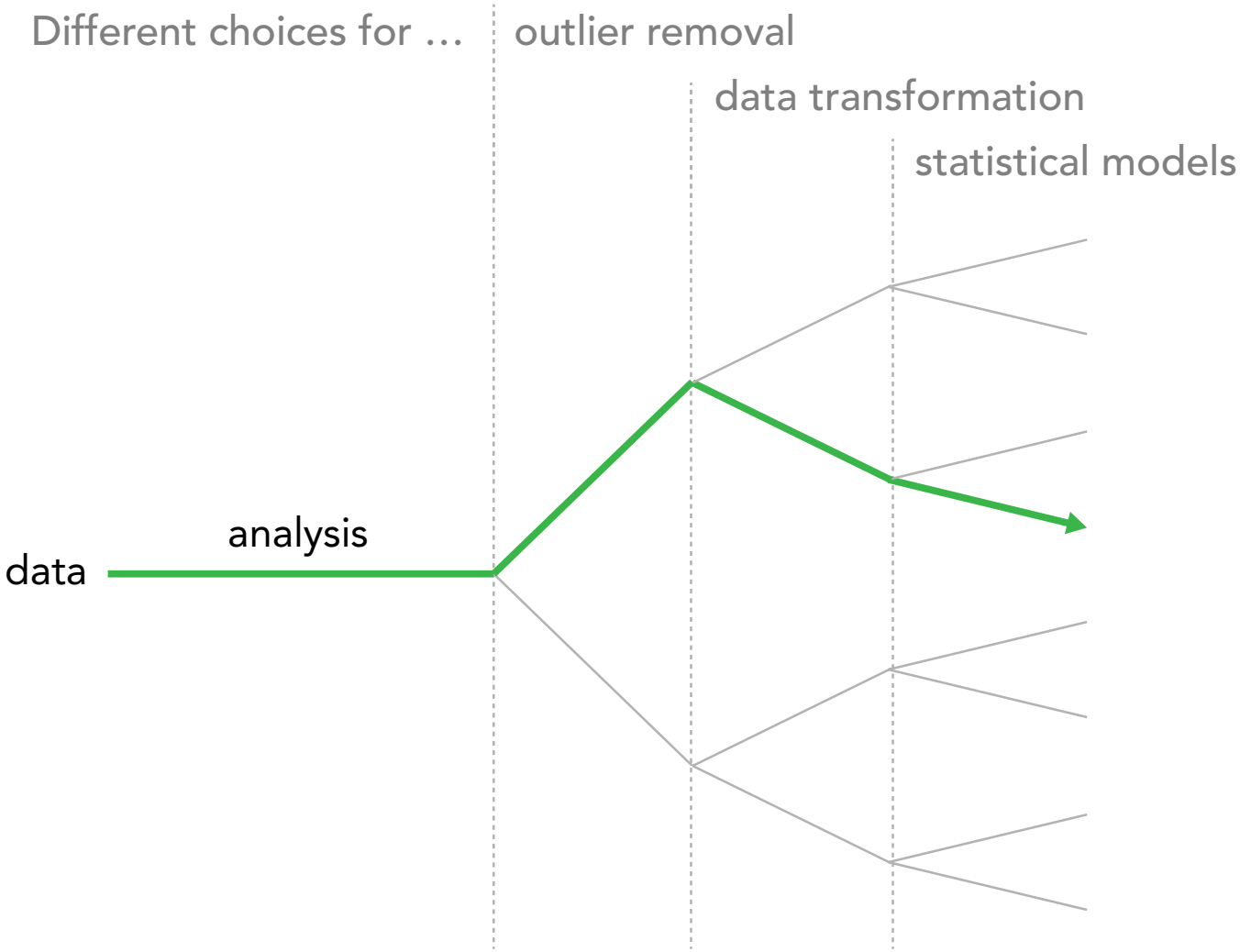


(pre-registration / hold-out)



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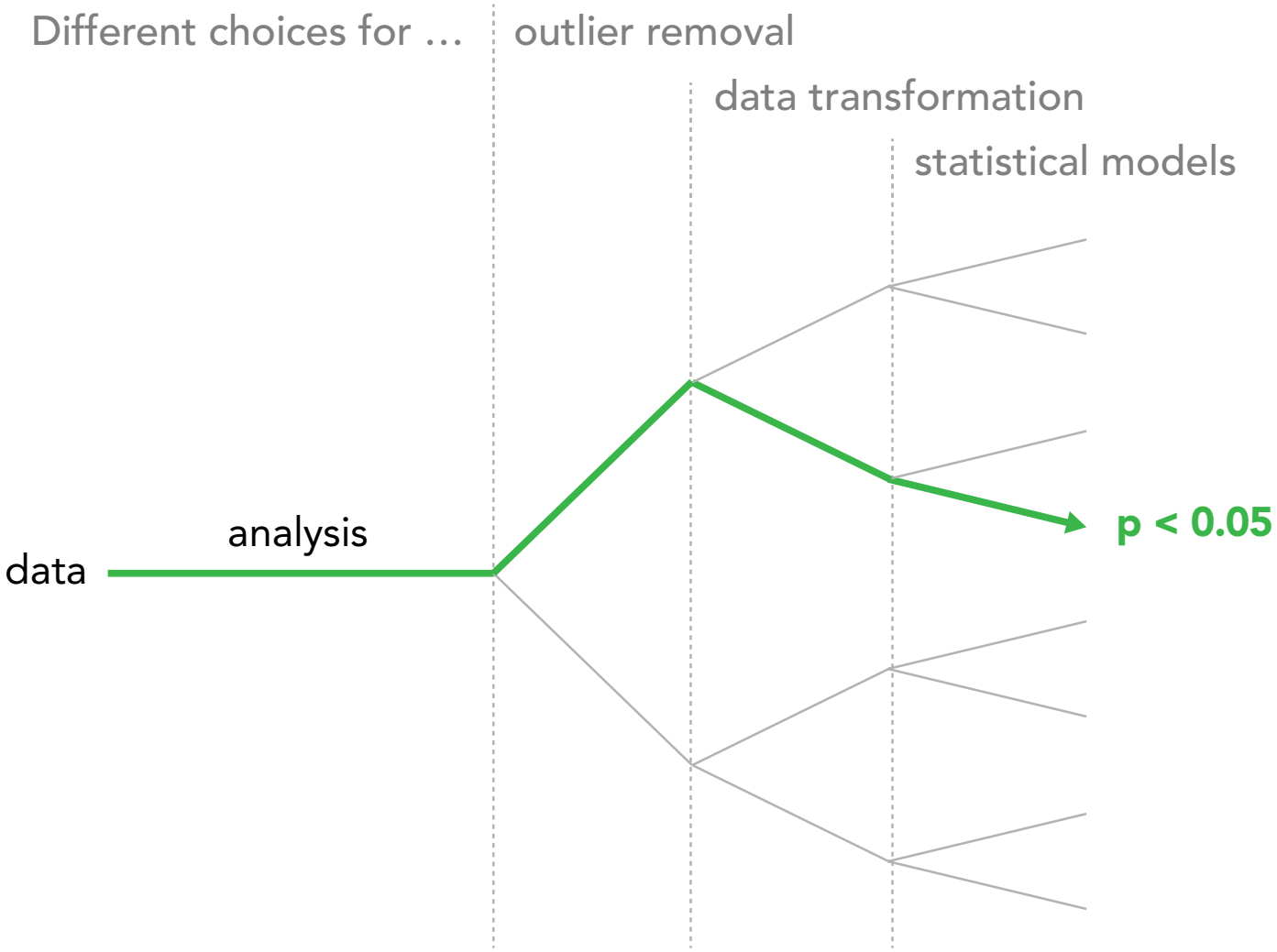
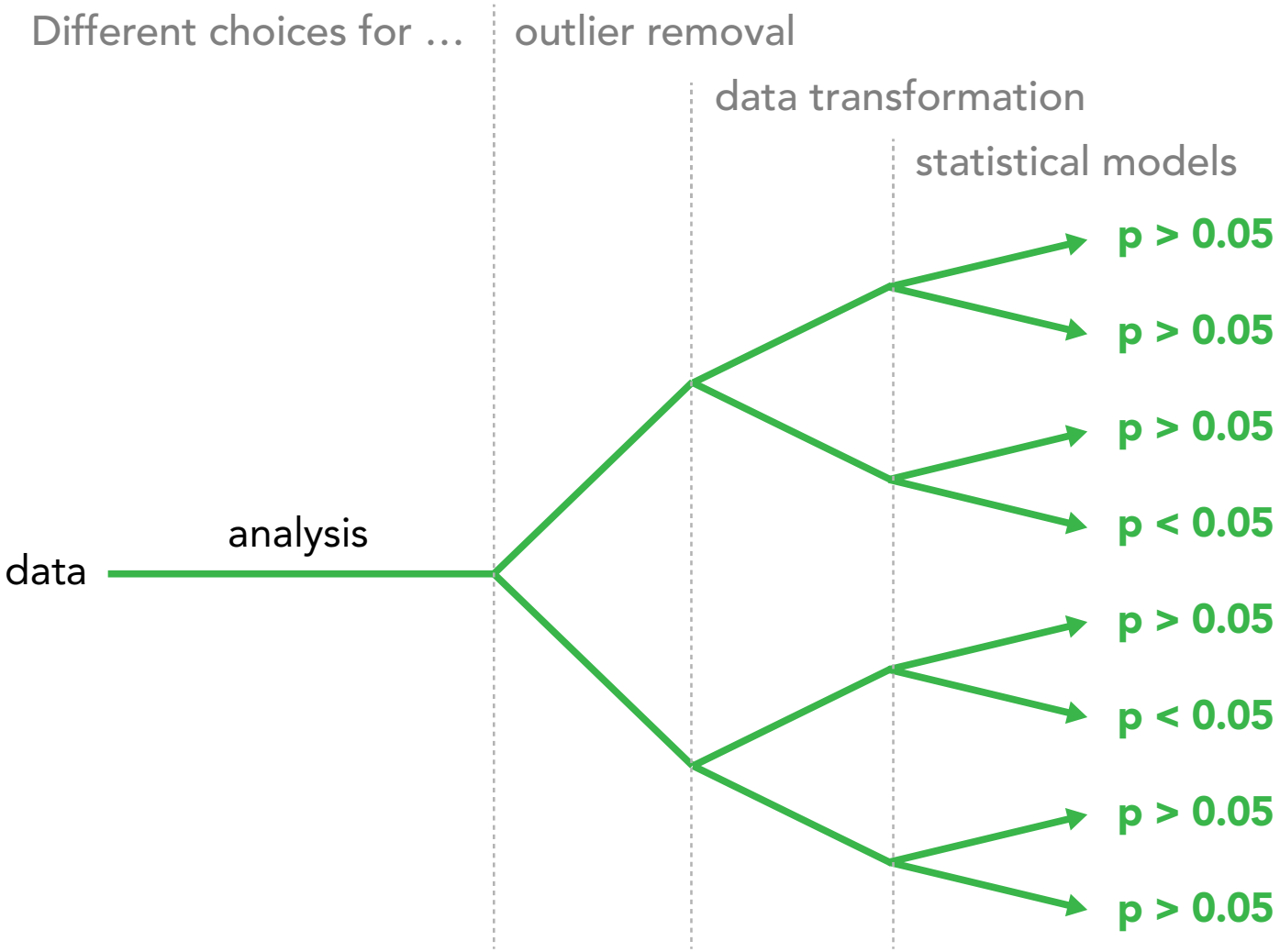
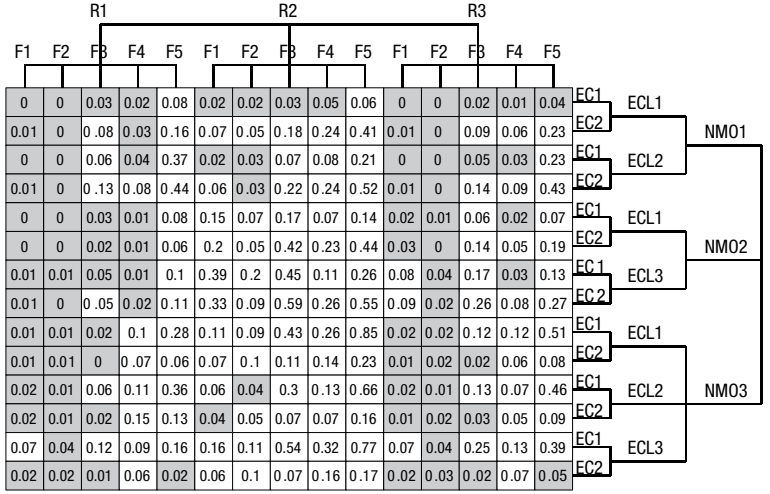


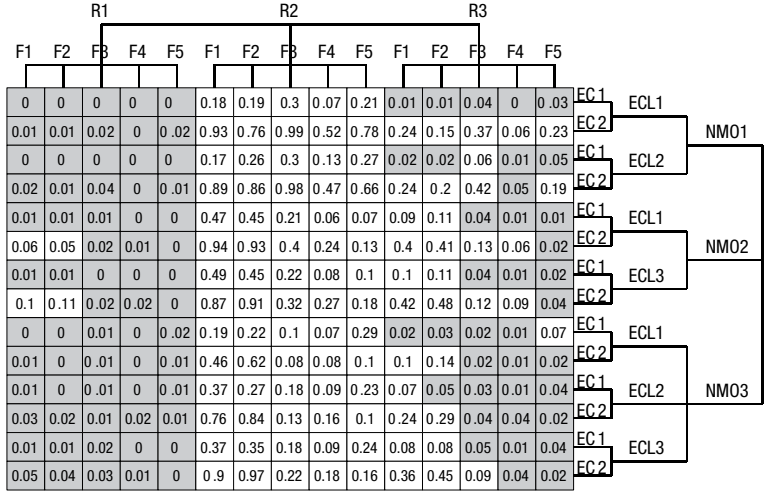
(multiverse analysis) [Steegen, Tuerlinckz, Gelman, Vanpaemel 2014]



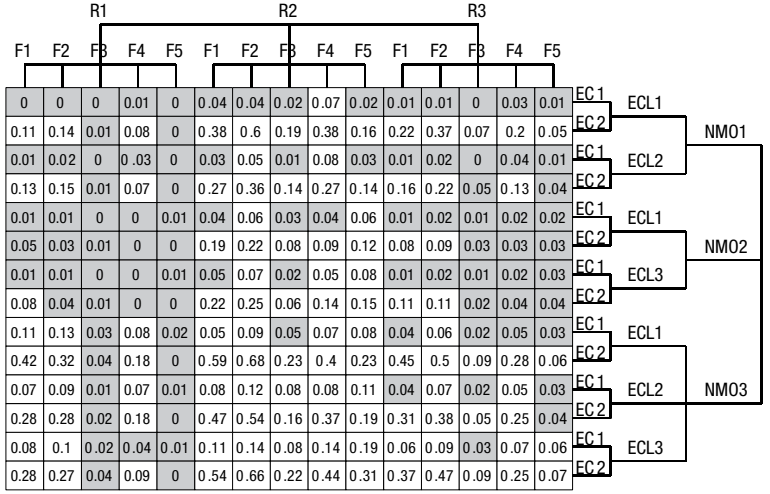
Religiosity (Study 2)



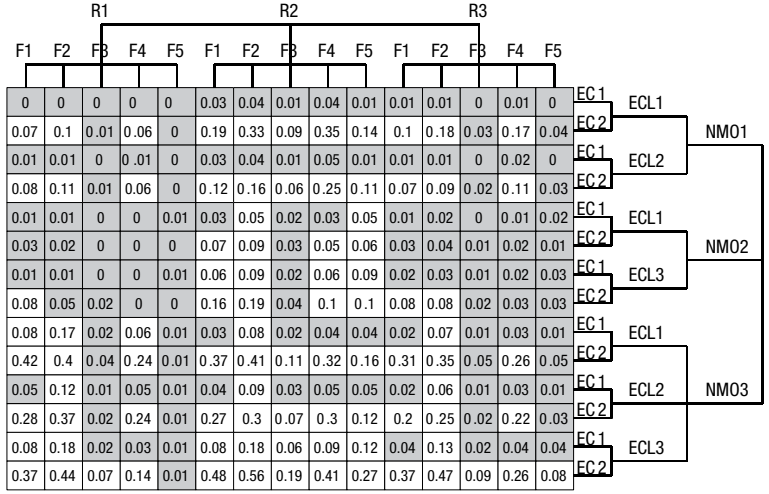
Social political attitudes



Voting preferences



Donation preferences



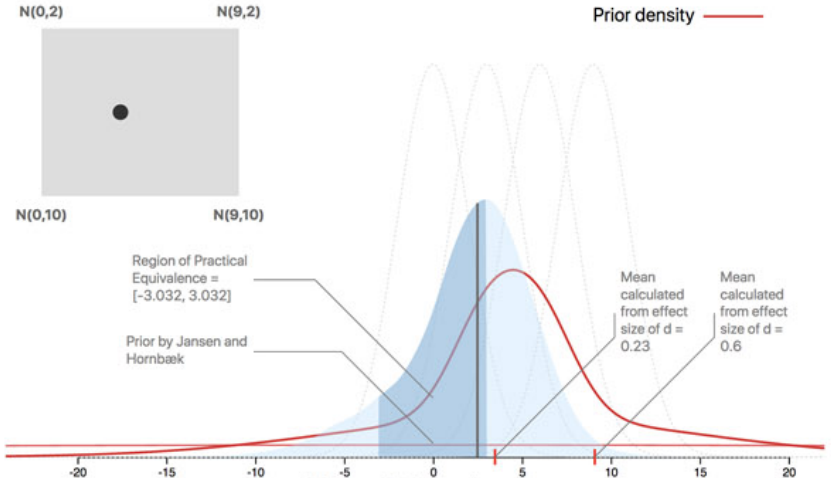
[Steegen, Tuerlinckz, Gelman, Vanpaemel. Increasing Transparency Through a Multiverse Analysis. Perspectives on Psychological Science, 2016]

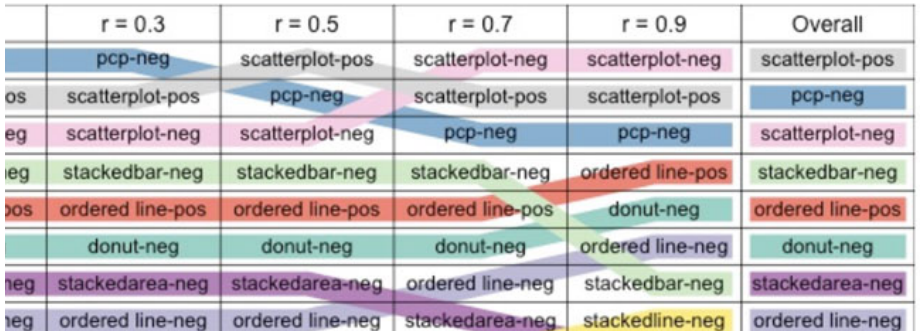
Explorable Multiverse Analysis Reports

[Dragicevic, Jansen, Sarma, Kay, and Chevalier. Increasing the Transparency of Research Papers with Explorable Multiverse Analyses. CHI 2019: https://explorablemultiverse.github.io/]

Figure 3. Average task completion time (geometric mean) for each condition. Error bars are 95% t-based CIs.

We focus our analysis on task completion times, reported in Figures 3 and 4. Dots indicate sample means, while error bars are 95% confidence intervals computed on log-transformed data [6] using the t-distribution method. Strictly speaking, all we can assert about each interval is





Explorable Multiverse Analysis Reports

[Dragicevic, Jansen, Sarma, Kay, and Chevalier. Increasing the Transparency of Research Papers with Explorable Multiverse Analyses. CHI 2019: https://explorablemultiverse.github.io/]

We need better ways to acknowledge large world uncertainty and have a conversation about it through the literature

Let's revisit election data...

New York Times Election Needle

[https://www.nytimes.com/interactive/2016/11/08/us/elections/trump-clinton-election-night-live.html]

The Fake Twitchy Hell Dials of the New York *Times*' Forecast Only Made Last Night Worse

By **Jake Swearingen**

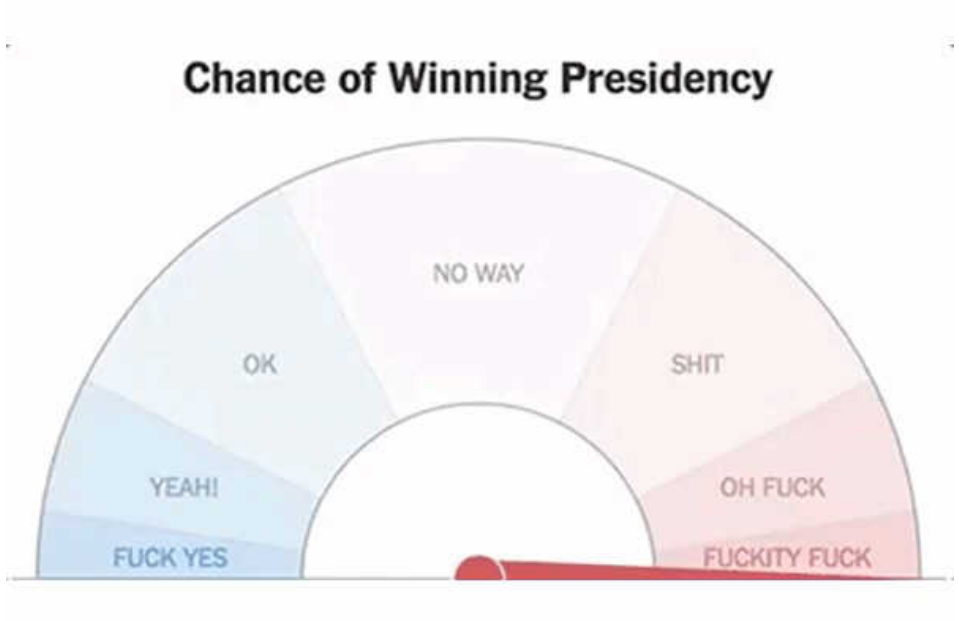


Photo: rhyselsmore/Twitter

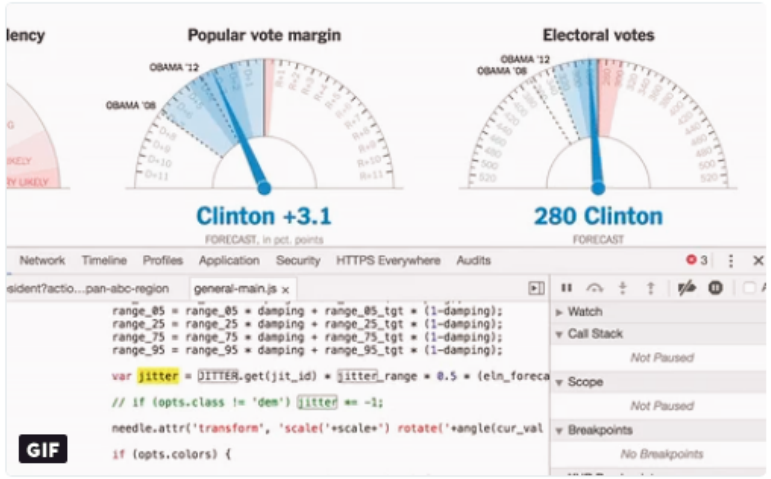
Around 9:30 last night, this tweet popped up on my timeline:

> stop tweeting the fucking hell dial
>
> — **erictoral vote (@ericlimer)** November 9, 2016

Alp Toker ✓
@atoker

Follow

Looking for trends in @nytimes's presidential forecast needle? Don't look too hard - the bounce is random jitter from your PC, not live data



Richard Porczak
@tsiro

Follow

straight up: the NYT needle jitter is irresponsible design at best and unethical design at worst and you should stop looking at it

9:58 PM - 8 Nov 2016

509 Retweets **882** Likes

17 509 882

But shouldn't anxiety be proportional to uncertainty?

Uncertainty visualization as a moral imperative

We should…

present well-calibrated uncertainty
that cannot be ignored
in ways people can actually understand

Multiverses and miscellanea

SIADS 542: Presenting uncertainty – Week 4, Lecture 2

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