Two Modes of Learning and the **Description-Experience Gap**

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Drosophila Melanogaster

Monetary gambles

„Would you rather have A or B?“

A	**B**
4€ with p=.8 otherwise 0	3€ with p=1

Allais Paradox (Allais, 1953)

Certainty effect (Kahneman & Tversky, 1979)

Reflection effect (Kahneman & Tversky, 1979)

Loss aversion (Kahneman & Tversky, 1979)

Framing effects (Kahneman & Tversky, 1984)

Risk aversion (Holt & Laury's, 2002)

(Ambiguity aversion) (Ellsberg, 1961)

Experience

Frank H. Knight
1885-1972

Statistical probabilities

'I know something land'

Uncertainty

'I know nothing land'

Risk

'I know probabilities land'

Certainty

'I know everything land'

Description-experience gap

and the weighting of small probability events

	A	**B**
	$3 for sure	$4 w/ p = .8 or **0 otherwise**
Description	**64%**	36%
Experience	12%	**88%**

Barron & Erev (2003); Hertwig et al. (2004); Weber et al. (2004); Hertwig & Erev (2009)

Agenda

Today Description-experience gap
1 **Interactive** Experience the gap
2 A meta analysis on the gap
3 Determinants of the gap
4 **Interactive** Reverse-engineering the gap
5 Conclusion

Tomorrow Modes of learning and risk communication
1 The merits of experience for risky communication
2 **Interactive** Experience Risk tool(s)
3 Modes of learning shape risk perception

Interactive element

Experience the gap

Task: Read and follow the instructions on the screen. Replay a couple of times.

dwulff.github.io/EADM_SS2018/

EADM summer school 2018

Dirk Wulff

Mouse-tracking

Get ready

Please download and install:

R
RStudio

Then run in RStudio's console window (run = copy & paste into the window and press ENTER):

```
install.packages('mousetrap')
```

If you encounter any problems please email me.

Get Mac OS (High Sierra) binary

Sessions

Intro to R

slides, Interactive

Trajectory types

slides, Interactive

Decisions from Experience

Sessions

Modes of learning and the description-experience gap

Slides: link
Interactive 1: link
Interactive 2: link, predictions

Modes of learning and risk perception

Slides: link
Interactive: link, data, results

Interactive element

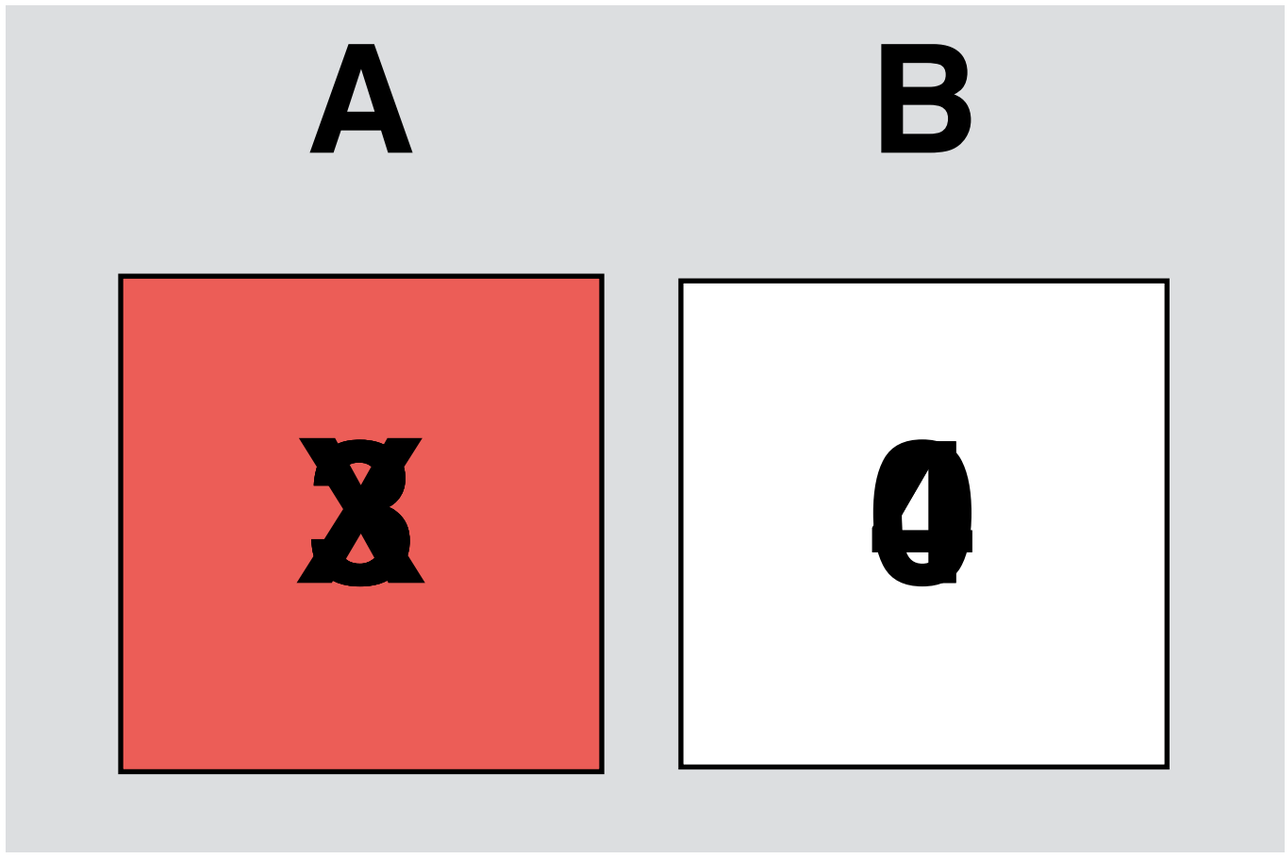
Experience the gap

Task: Read and follow the instructions on the screen. Replay a couple of times.

How robust is the gap and why does it occur?

Decisions from Experience

The sampling paradigm



(1) Choice between two Lotteries

(2) No prior information

(3) Search for as long as desired

(4) When ready, terminate search and make a choice.

Hertwig et al. (2004)

Data

Sampling paradigm

Experience

4,400 Ppt

45,240 Choices.

Description

2,208 Ppt

31,353 Choices

autonomous

28 papers

55 sets

2,643

45,240

matched

2

4

226

977

regulated

6

21

1,521

4,016

21 papers

46 sets

Wulff, Mergenthaler Canseco, & Hertwig (2018)

How to measure the gap?

Defintion 1

Discrete underweighting

In favor of the option with the rare event if it is desirable, and against the option with the rare event if it is undesirable. A rare event is the event with with the smallest probability between both options.

Defintion 2

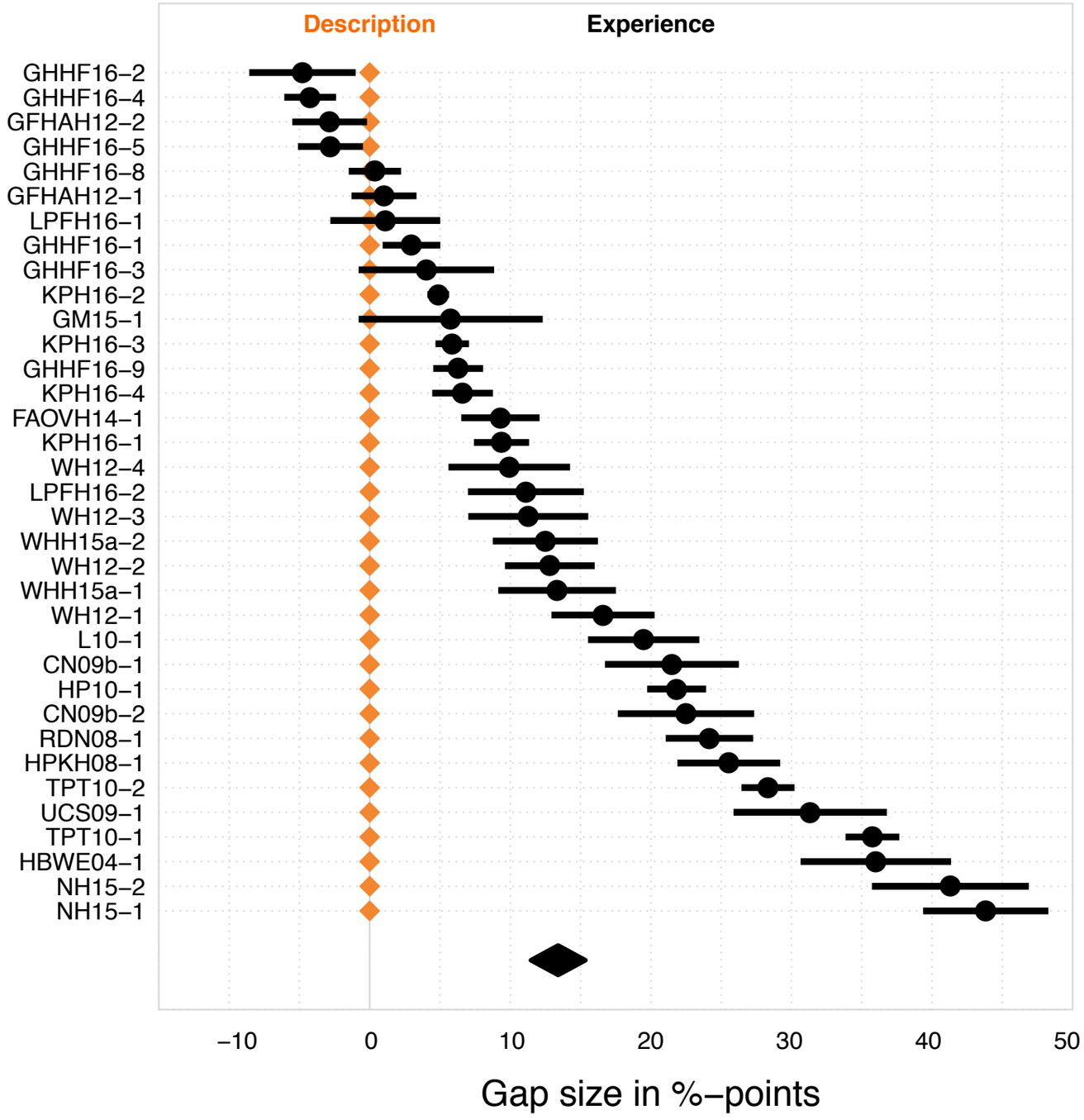
CPT-based

In favor of the option predicted by cumulative prospect theory (CPT) using the parameter values derived by Tversky and Kahneman (1992).

A	**B**
$3 for sure	$4, p = .8 or **0 otherwise**

Wulff, Mergenthaler Canseco, & Hertwig (2018)

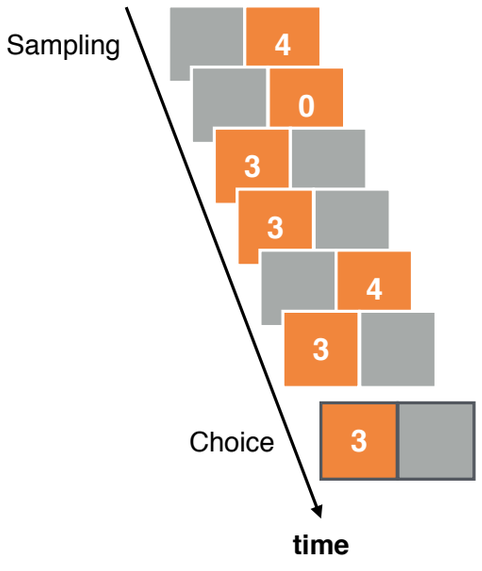
A robust Gap

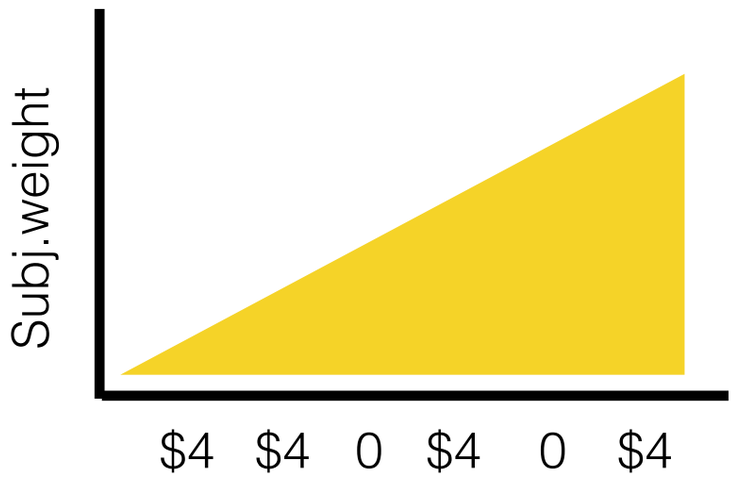


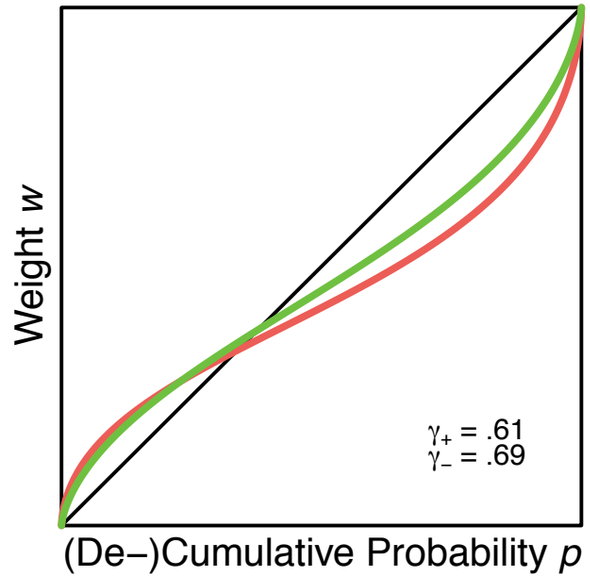
Wulff, Mergenthaler Canseco, & Hertwig (2018)

Determinants of the Gap

I: Small samples **II**: Order effects **III**: Prob. weighting

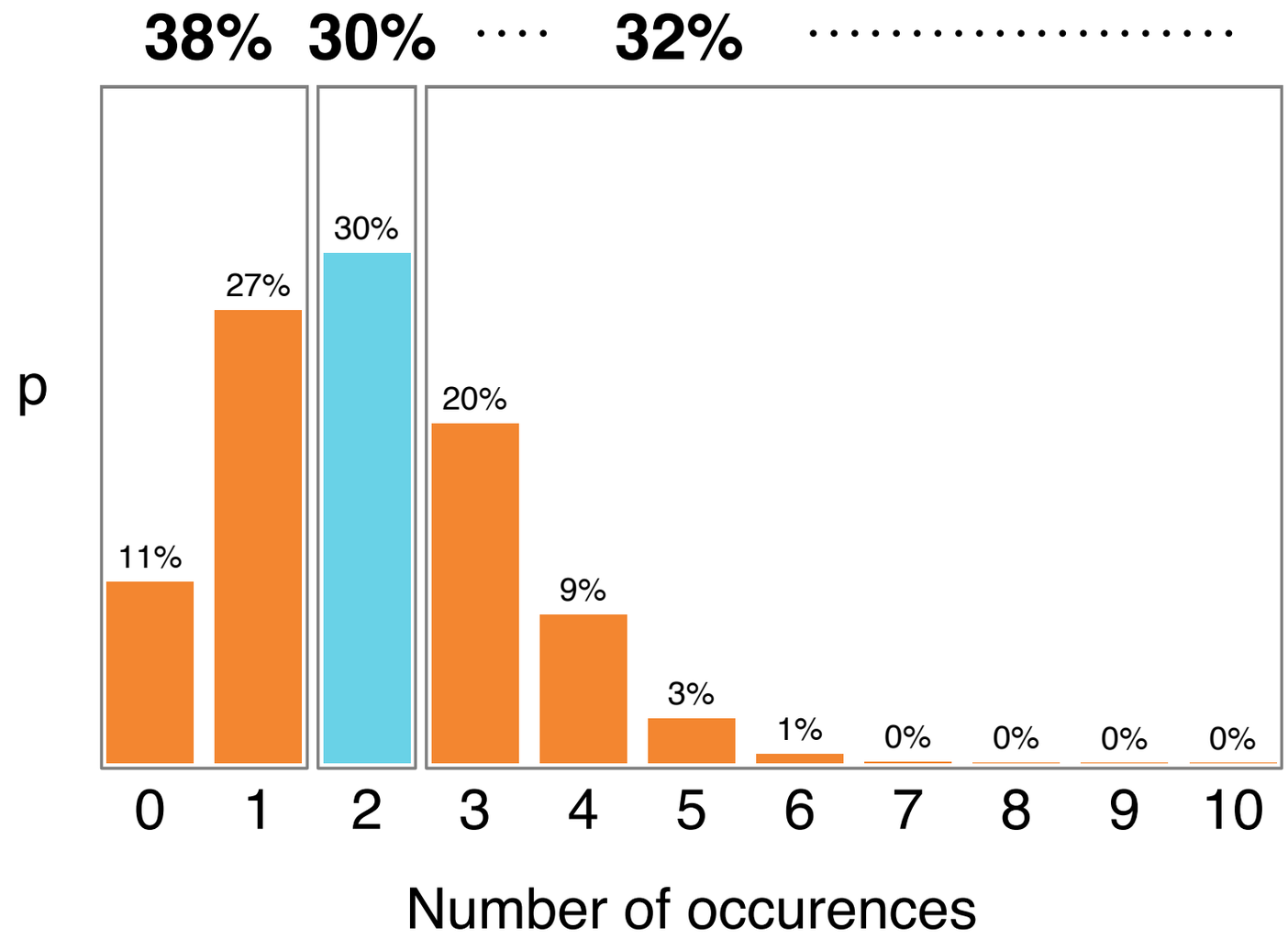






Wulff, Mergenthaler Canseco, & Hertwig (2018)

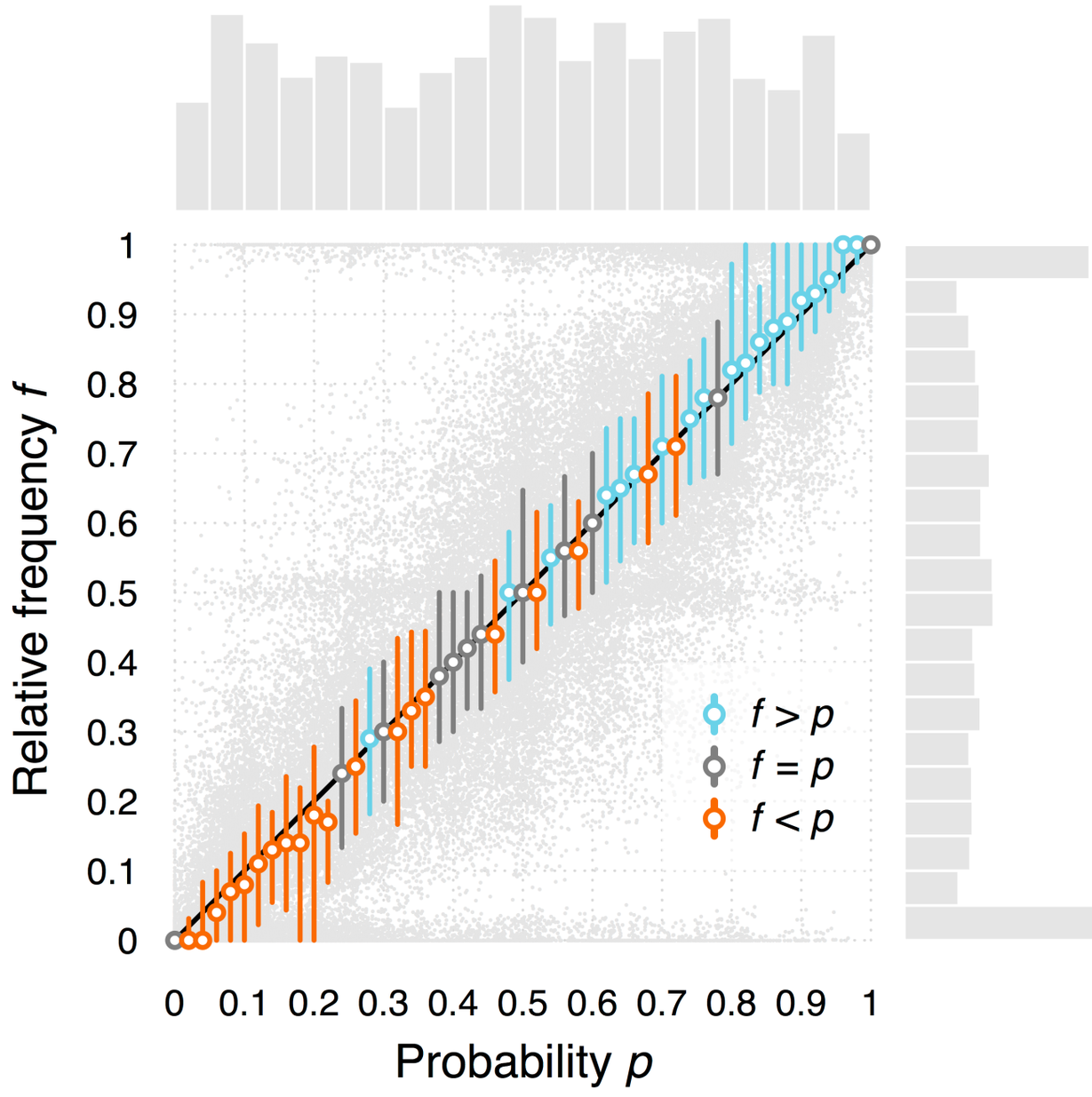
Small samples suppress rare events



Wulff, Mergenthaler Canseco, & Hertwig (2018)

Small samples polarise

experienced relative frequencies vs. probabilities



Wulff, Mergenthaler Canseco, & Hertwig (2018)

Small sample sizes

increase (as-if) underweighting

Small sample size

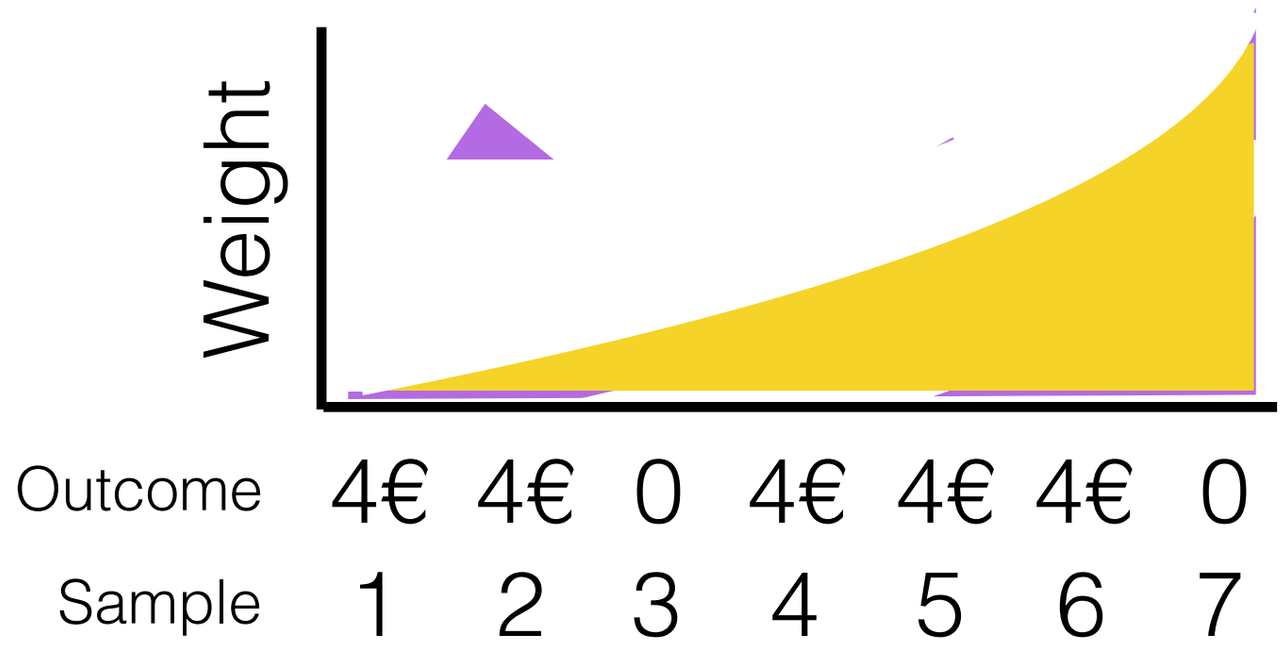
A	B
$3 for sure	$4, p = .8 **0 otherwise**

Large sample size

A	B
$3 for sure	$4, p = .8 **0 otherwise**

Order effects

Position-dependent weighting



Wulff, Mergenthaler Canseco, & Hertwig (2018)

Order effects

increase (as-if) underweighting

Recency/primacy/noise

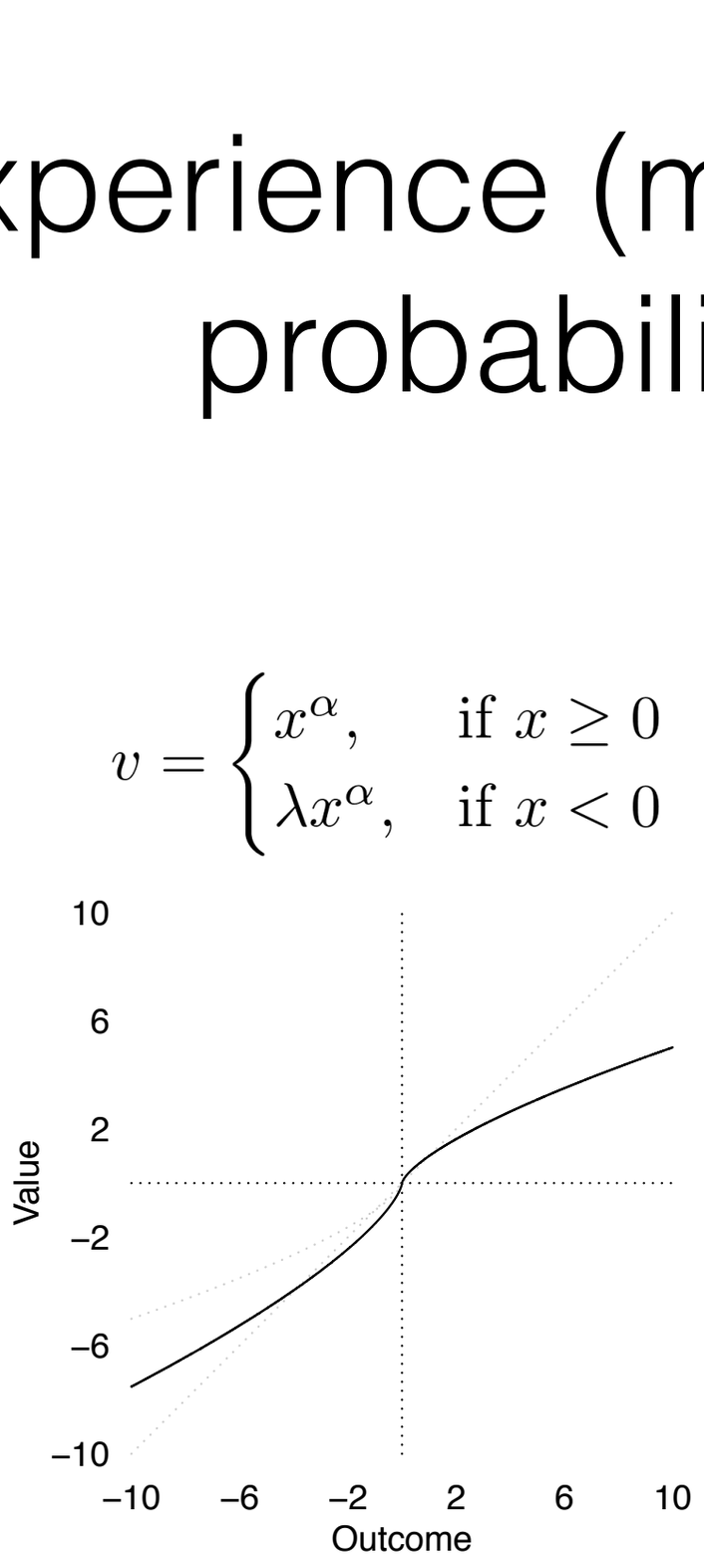
A	B
$3 for sure	$4, p = .8 **0 otherwise**

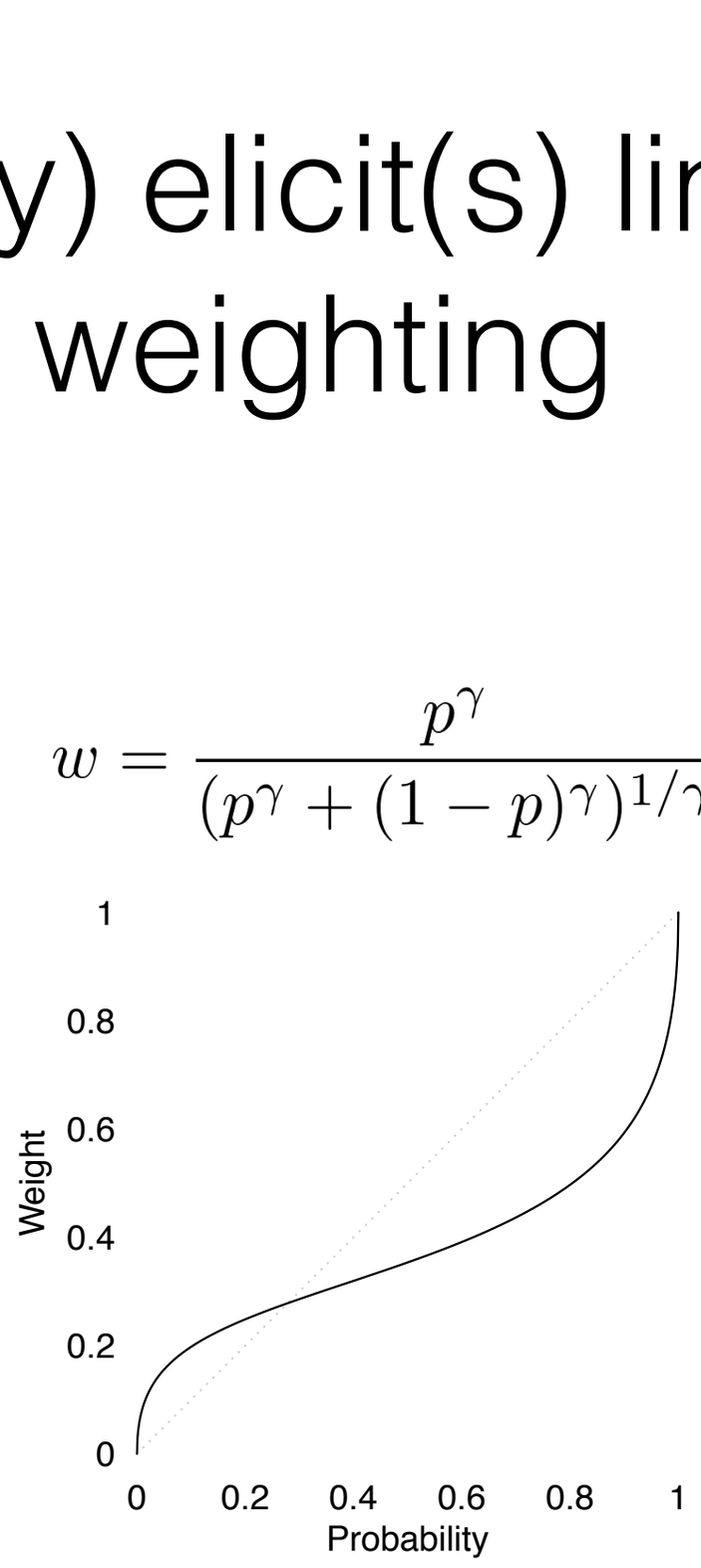
No order effects

A	B
$3 for sure	$4, p = .8 **0 otherwise**

Experience (may) elicit(s) linear probability weighting

$$v = \begin{cases} x^{\alpha}, & \text{if } x \geq 0 \\ \lambda x^{\alpha}, & \text{if } x < 0 \end{cases} \qquad w = \frac{p^{\gamma}}{(p^{\gamma} + (1-p)^{\gamma})^{1/\gamma}}$$





Tversky & Fox, 1995; Wulff, Mergenthaler Canseco, & Hertwig (2018)

High gamma (>1)

implies underweighting

gamma > 1

A	B
$3 for sure	$4, p = .8 **0 otherwise**

gamma = 1

A	B
$3 for sure	$4, p = .8 **0 otherwise**

Low gamma (<1)

implies overweighting

gamma < 1

A	B
$3 for sure	$4, p = .8 **0 otherwise**

gamma = 1

A	B
$3 for sure	$4, p = .8 **0 otherwise**

Interactive element

Reverse-engineering the Gap

Task: Change the slider settings to minimise the MSE value for experience. Provide your best estimate (for minimum MSE) via the form.

Exploring the Gap

Per-option sample size

1 — 10 — 40

1 5 9 13 33 37 40

Sample size distribution

CPT - alpha

0 — 0.7 — 2

0 0.2 0.4 0.6 0.8 1.6 1.8 2

Value Function

CPT - lambda

1 — 2.1 — 3

1 1.2 1.4 1.6 1.8 2 2.2 3

Value Function

CPT - gamma

0 — 1.75

0 0.2 0.4 1.2 1.4 1.6 1.8 2

Weighting Function

Recency

-1 — 0.6 — 1

-1 -0.8 -0.6 0.4 0.6 0.8 1

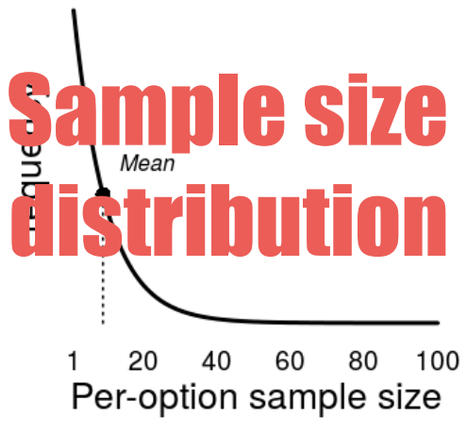
Position Weighting

Noise

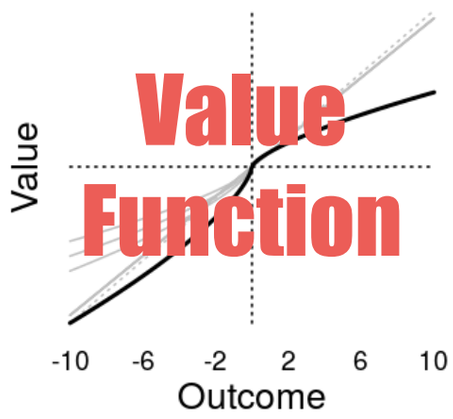
0 — 0.45 — 1

0 0.1 0.2 0.3 0.4 0.5 0.9 1

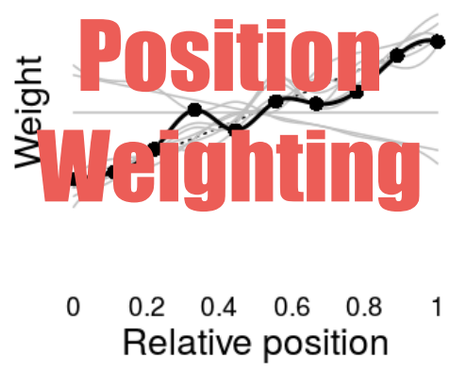
Position Weighting



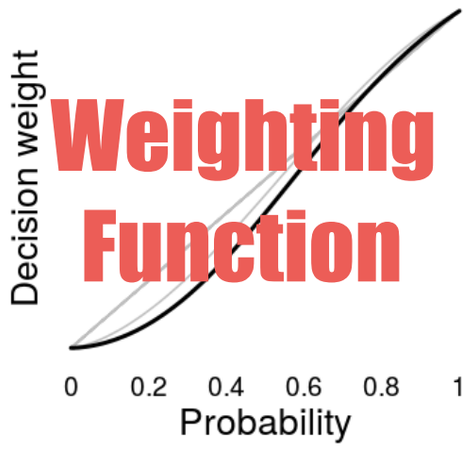
Sample size distribution



Value Function



Position Weighting



Weighting Function

Minimize

MSE

.034

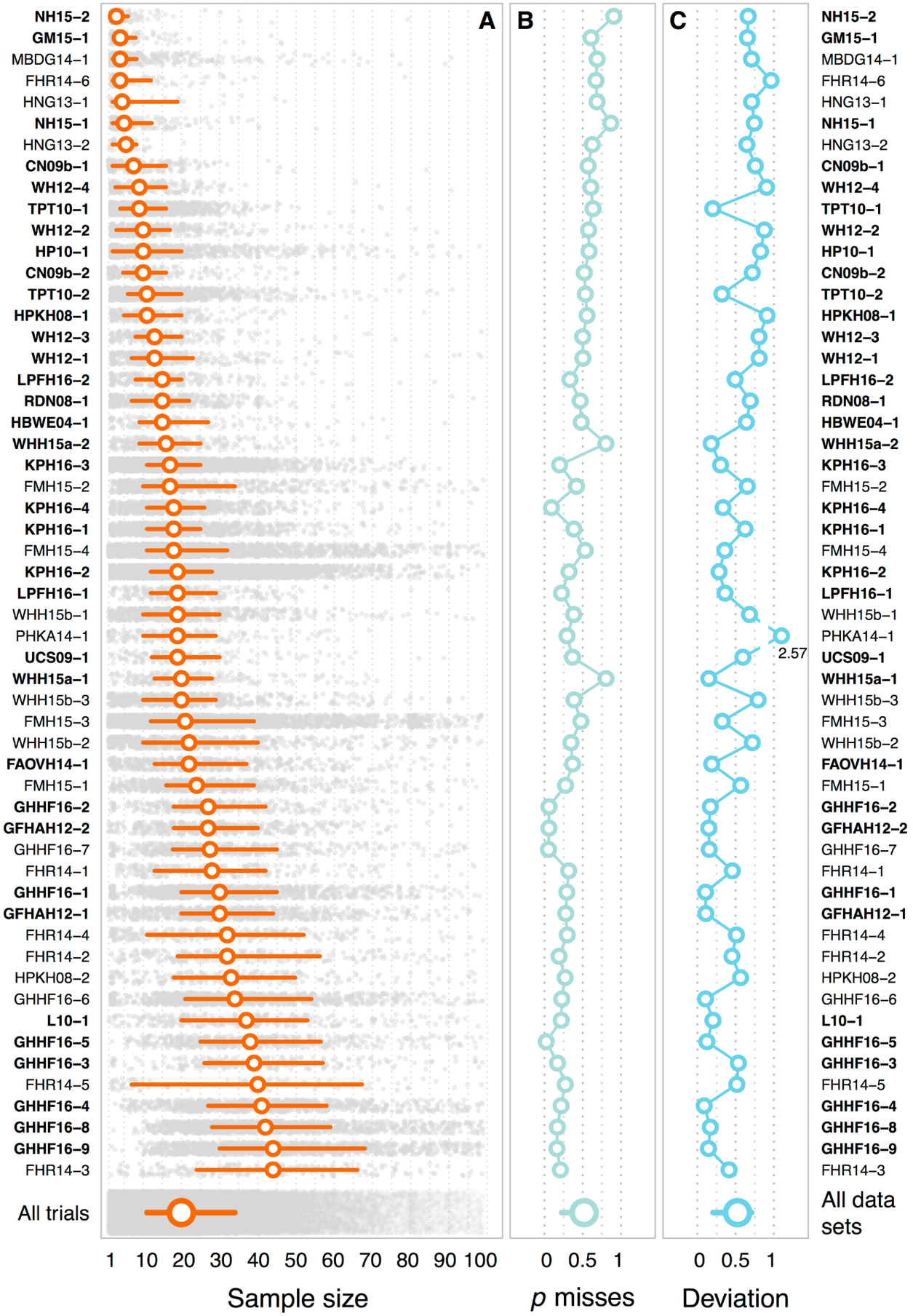
Irrelevant Information

Histogram DfE

Scatterplot DfE x DfE

What have we learned about the key drivers of the gap?

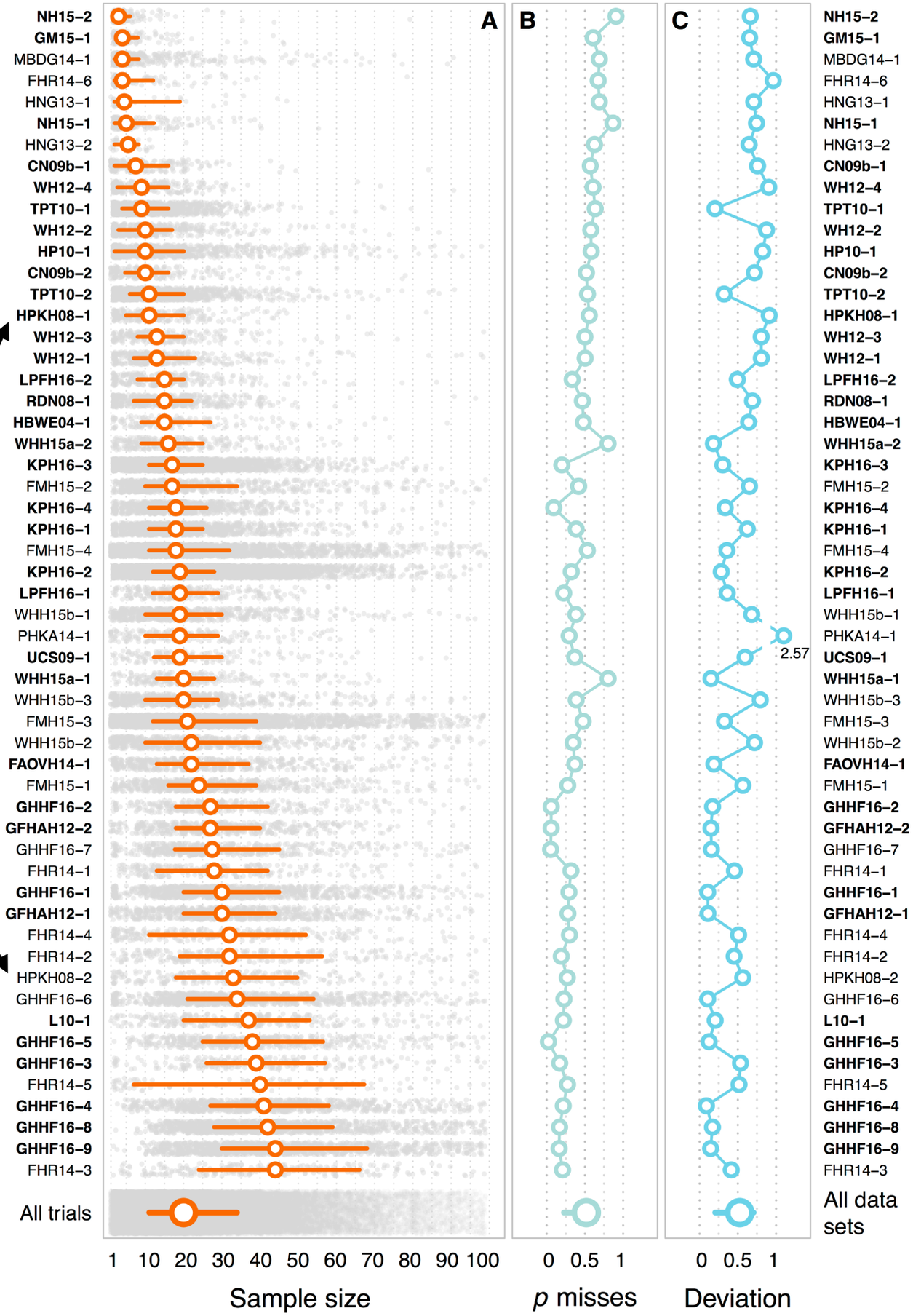
Sample size
outcome misses
& error



Wulff et al. (2018)

Sample size
outcome misses
& error

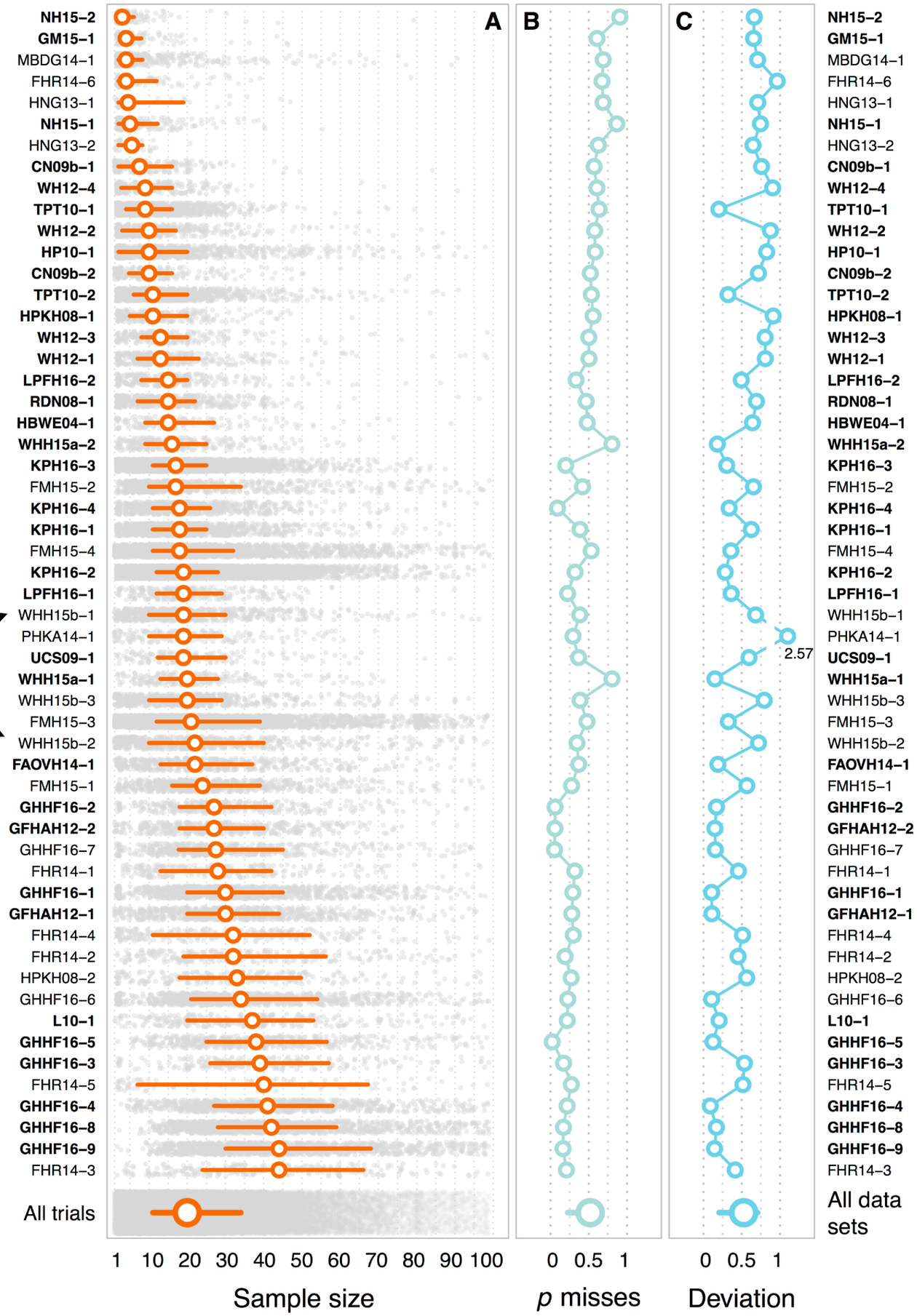
Hau et al. (2008)
High versus low
rewards



Wulff et al. (2018)

Sample size
outcome misses
& error

Wulff et al. (2015)
Long versus short
run



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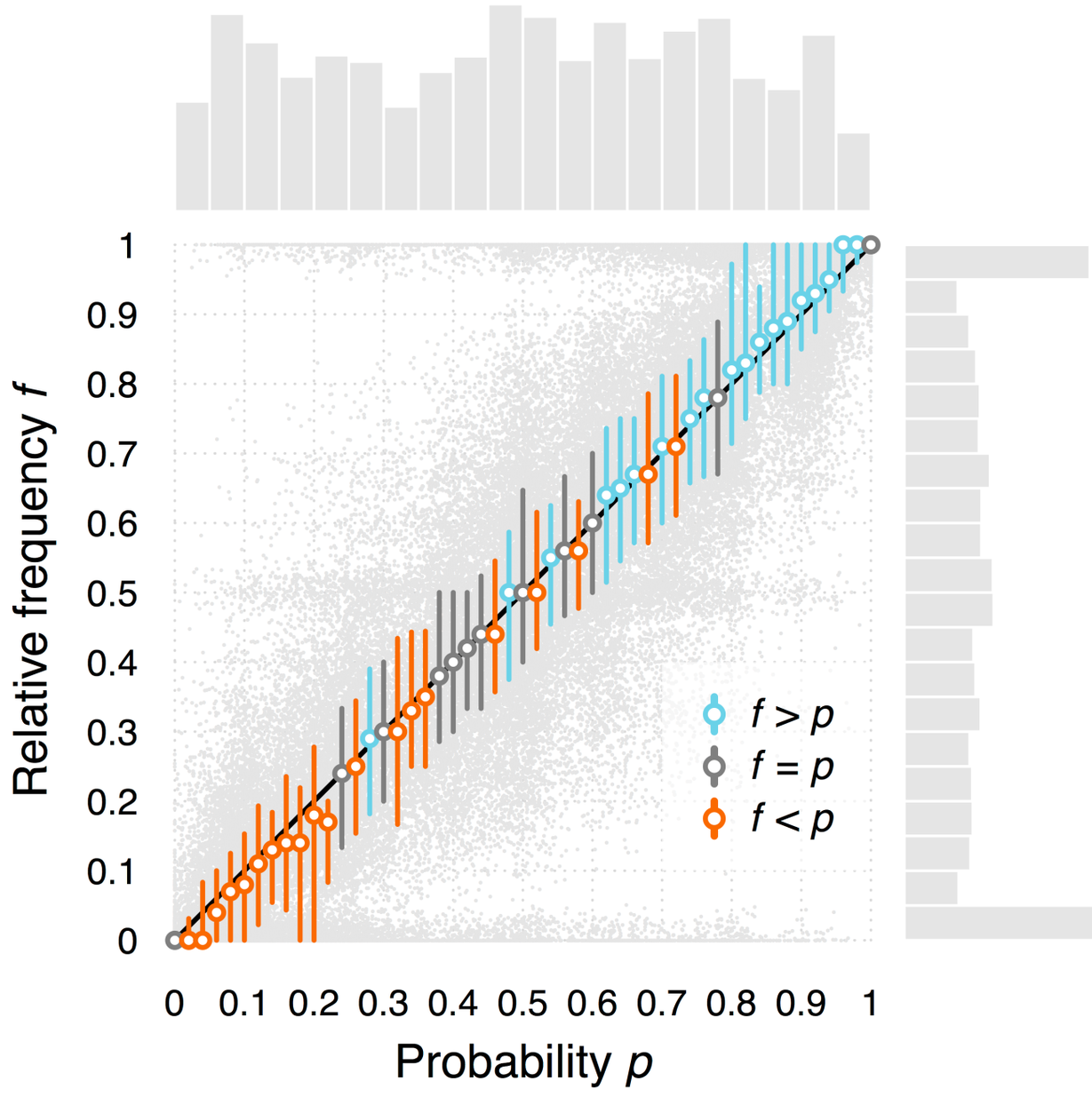
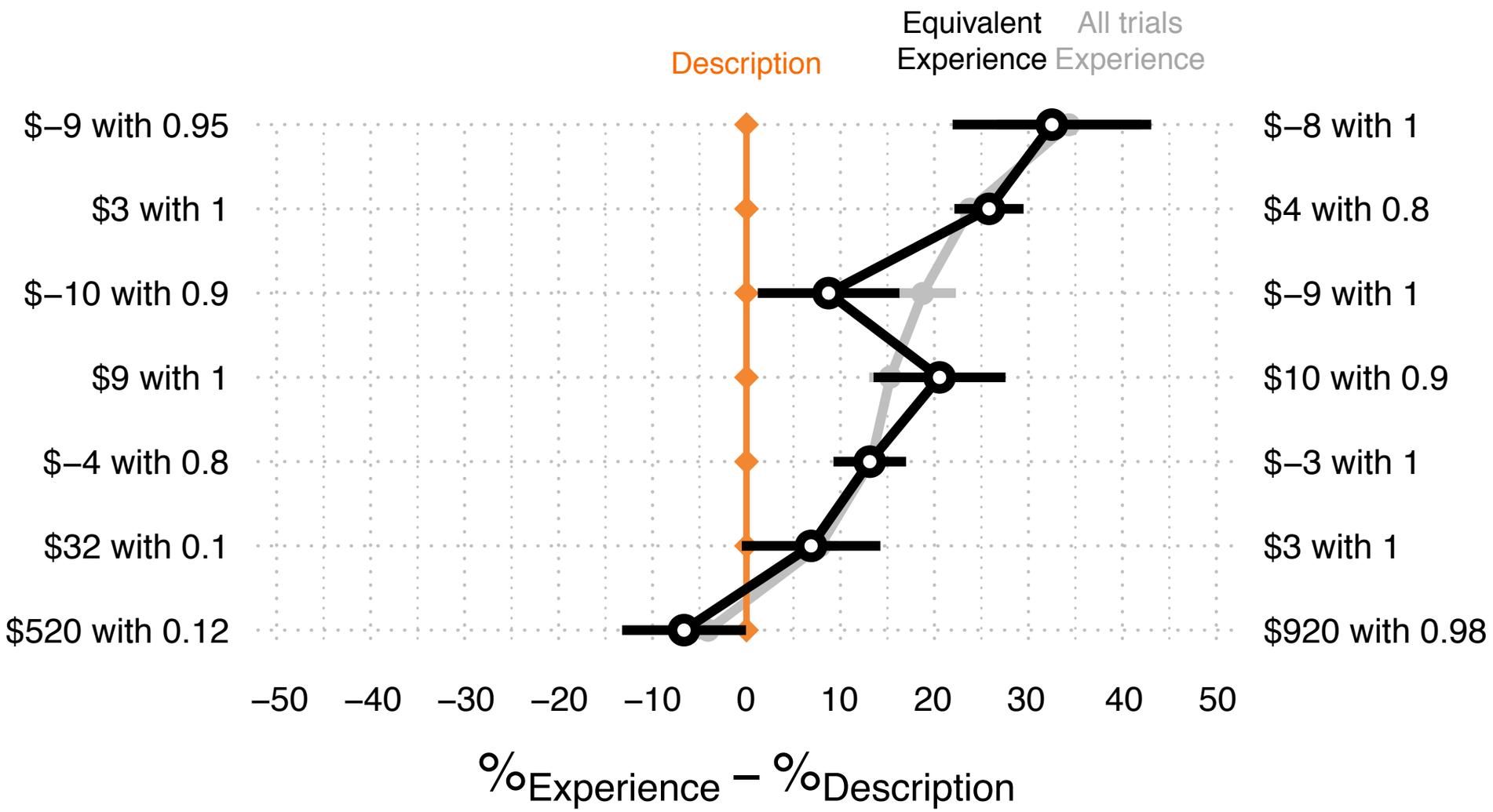
Small samples polarise

experienced relative frequencies vs. probabilities



Wulff, Mergenthaler Canseco, & Hertwig (2018)

Gap cannot be reduced to sampling error



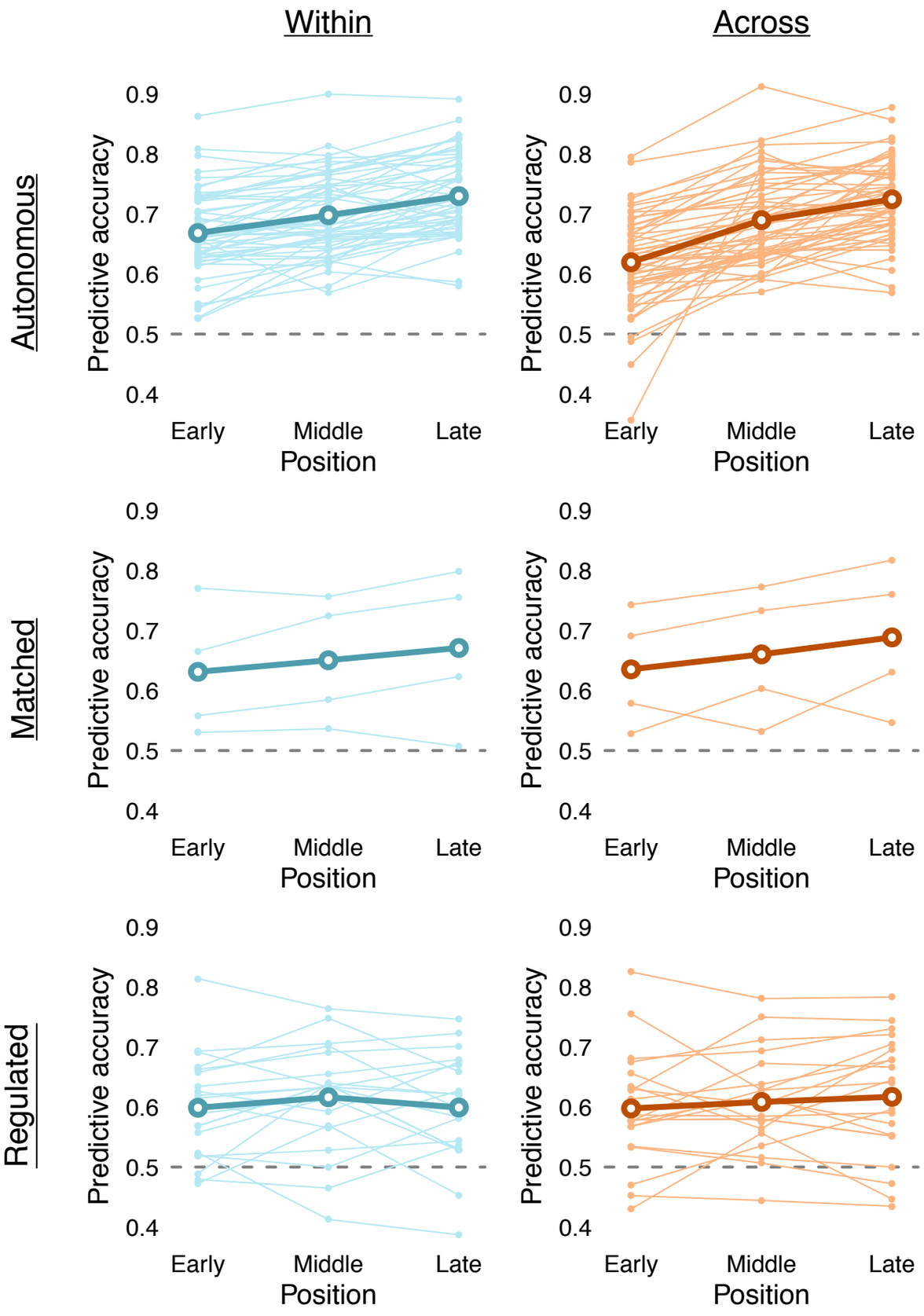
Wulff, Mergenthaler Canseco, & Hertwig (2018)

A robust recency effect in autonomous sampling

Wulff et al. (2018)

Linear position weighting

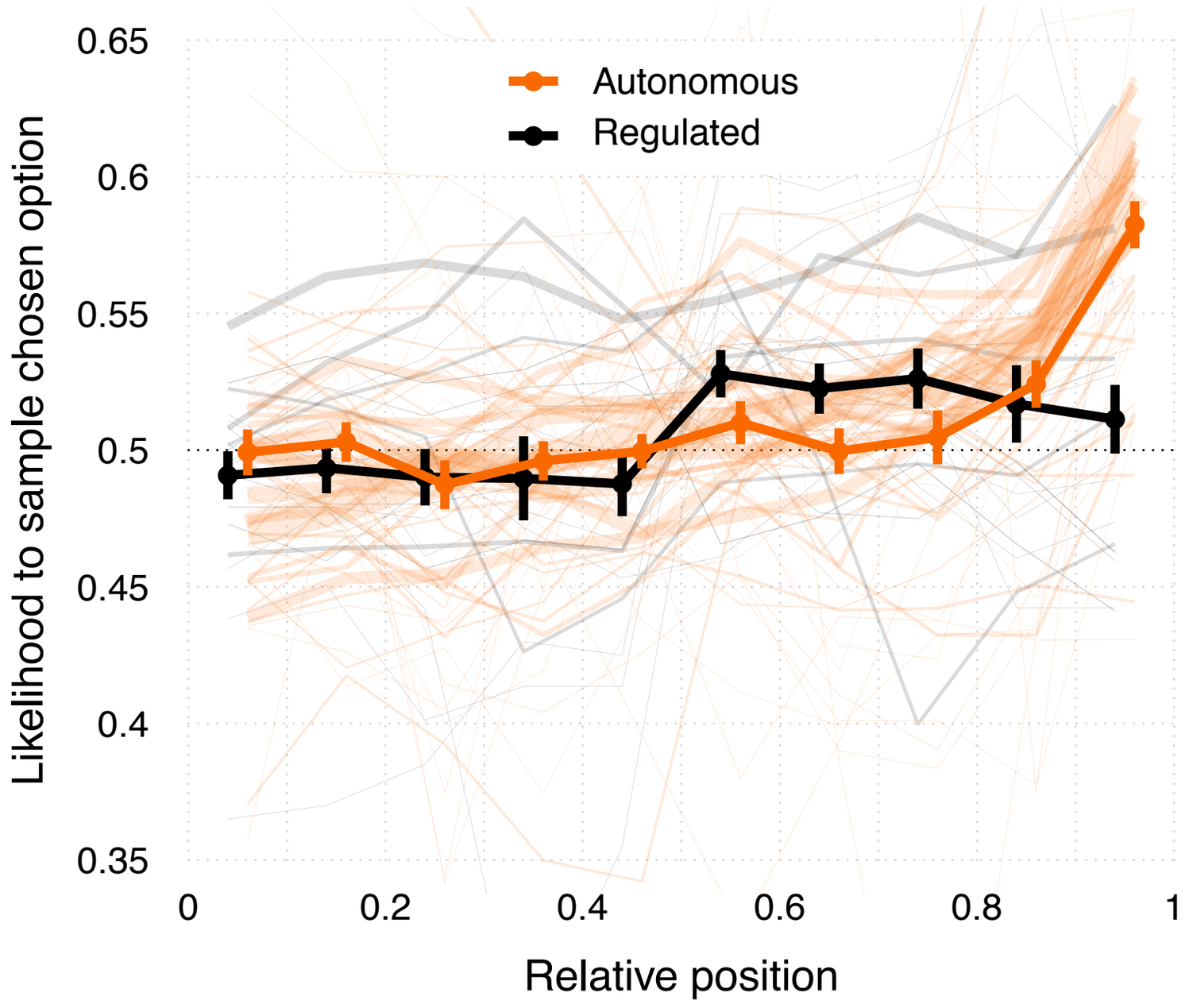
in autonomous sampling and flat in regulated sampling



Wulff et al. (2018)

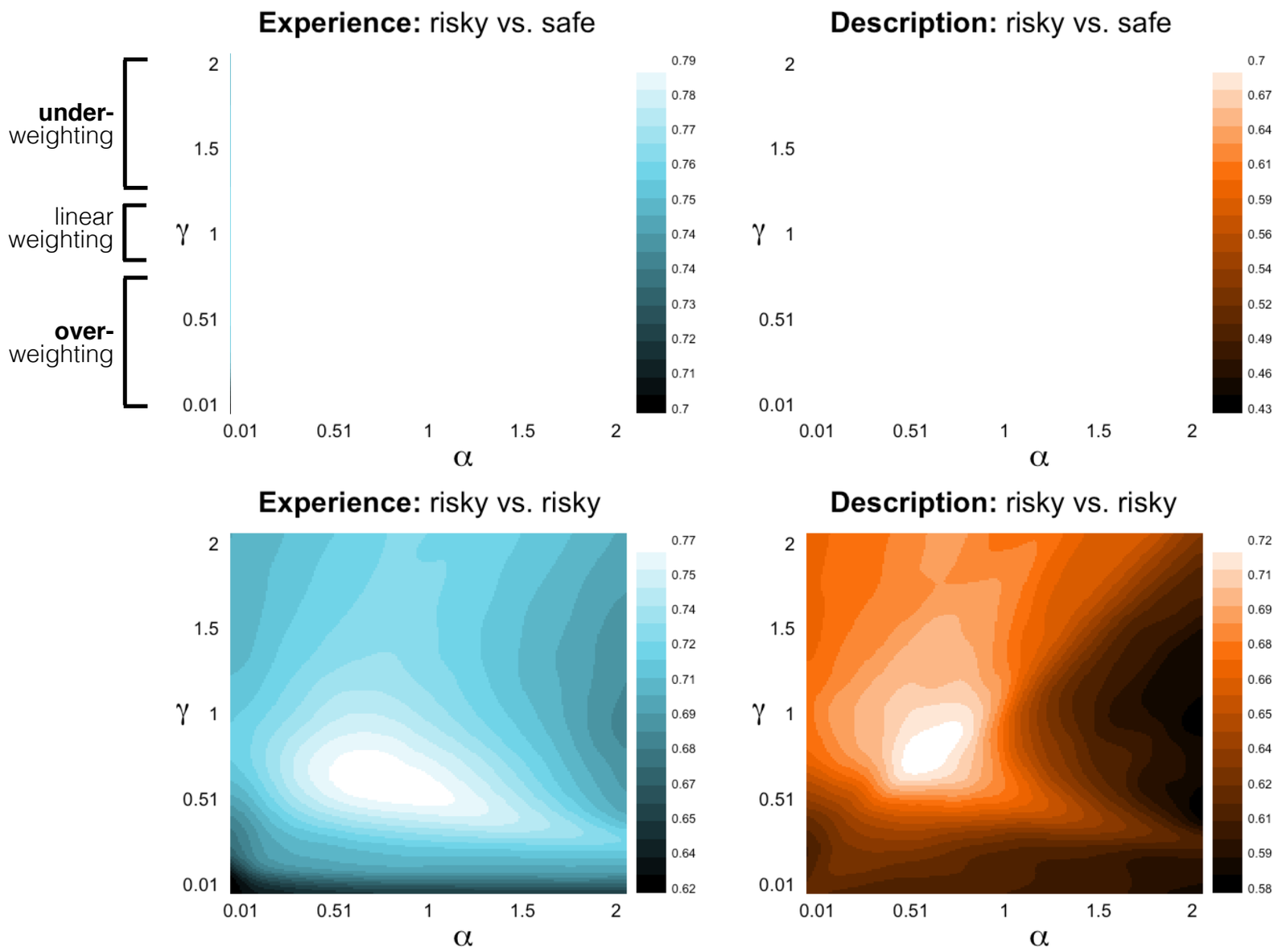
Optional stopping

A gaze-cascade-like effect



Wulff, Mergenthaler Canseco, & Hertwig (2018)

Experience (may) elicit(s) linear probability weighting

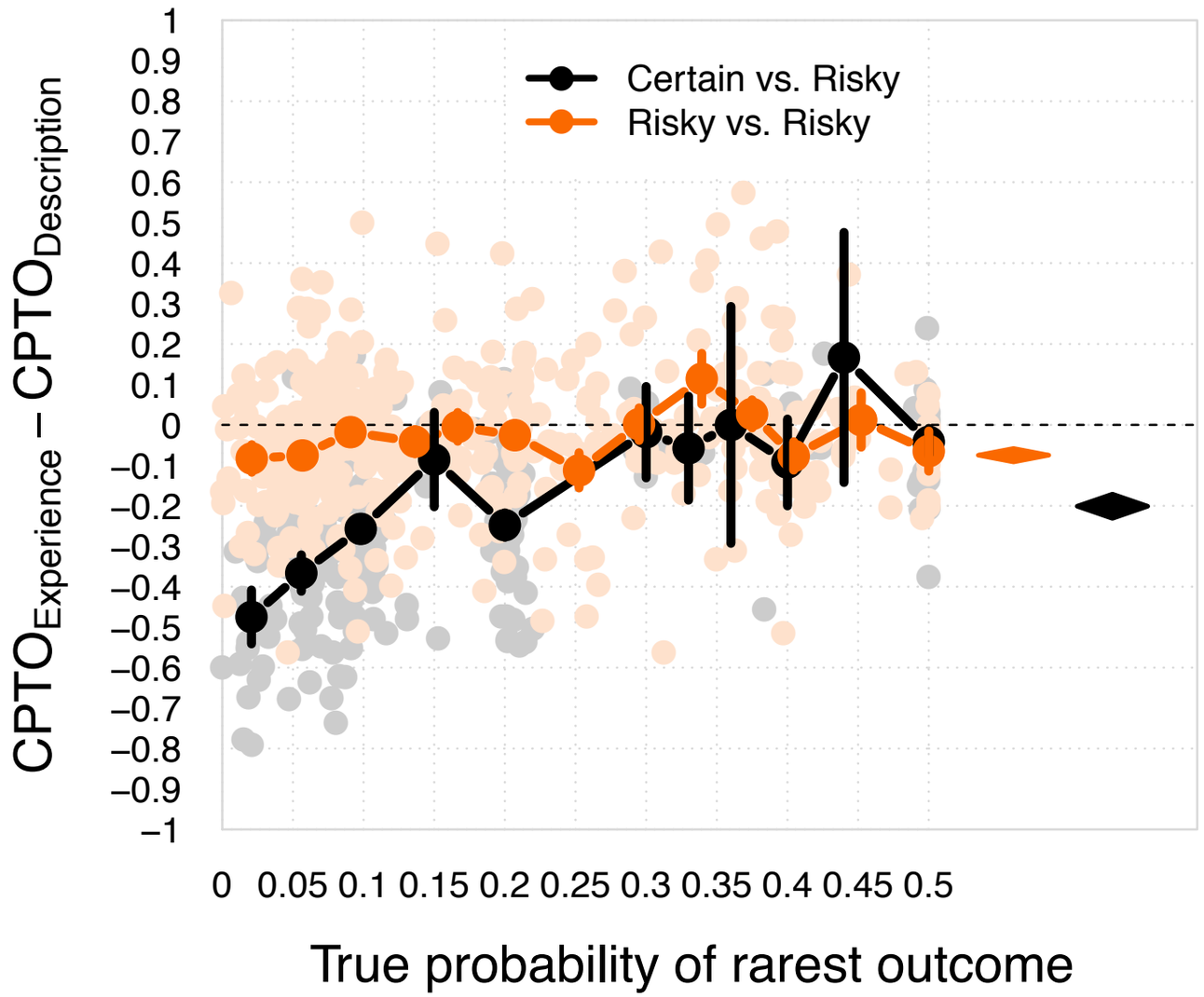


Wulff, Mergenthaler Canseco, & Hertwig (2018)

The gap is moderated by

(a) the problem structure (risky vs. risky or risky vs. safe)

(b) the probability of the rare event



Wulff, Mergenthaler Canseco, & Hertwig (2018)

Conclusions

I The gap is robust.

II The largest factor is sampling error.

III There is a gap beyond sampling error.

IV Recency is robust, but it may not contribute to the gap.

V Choices are consistent with different probability weighting across task and item formats, but mechanisms are unclear.

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Ralph Hertwig

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