The European Association for Decision Making

Summer School 2018

Anton Kühberger
Michael Schulte-Mecklenbeck

What is eadm?

The European Association for Decision Making

The European Association for Decision Making (EADM) is an interdisciplinary organisation dedicated to the study of normative, descriptive, and prescriptive theories of decision making.

What is EADM?

organises SPUDM finances this summer school (and workshops)

Sign up!

Who are we?

Who are you?

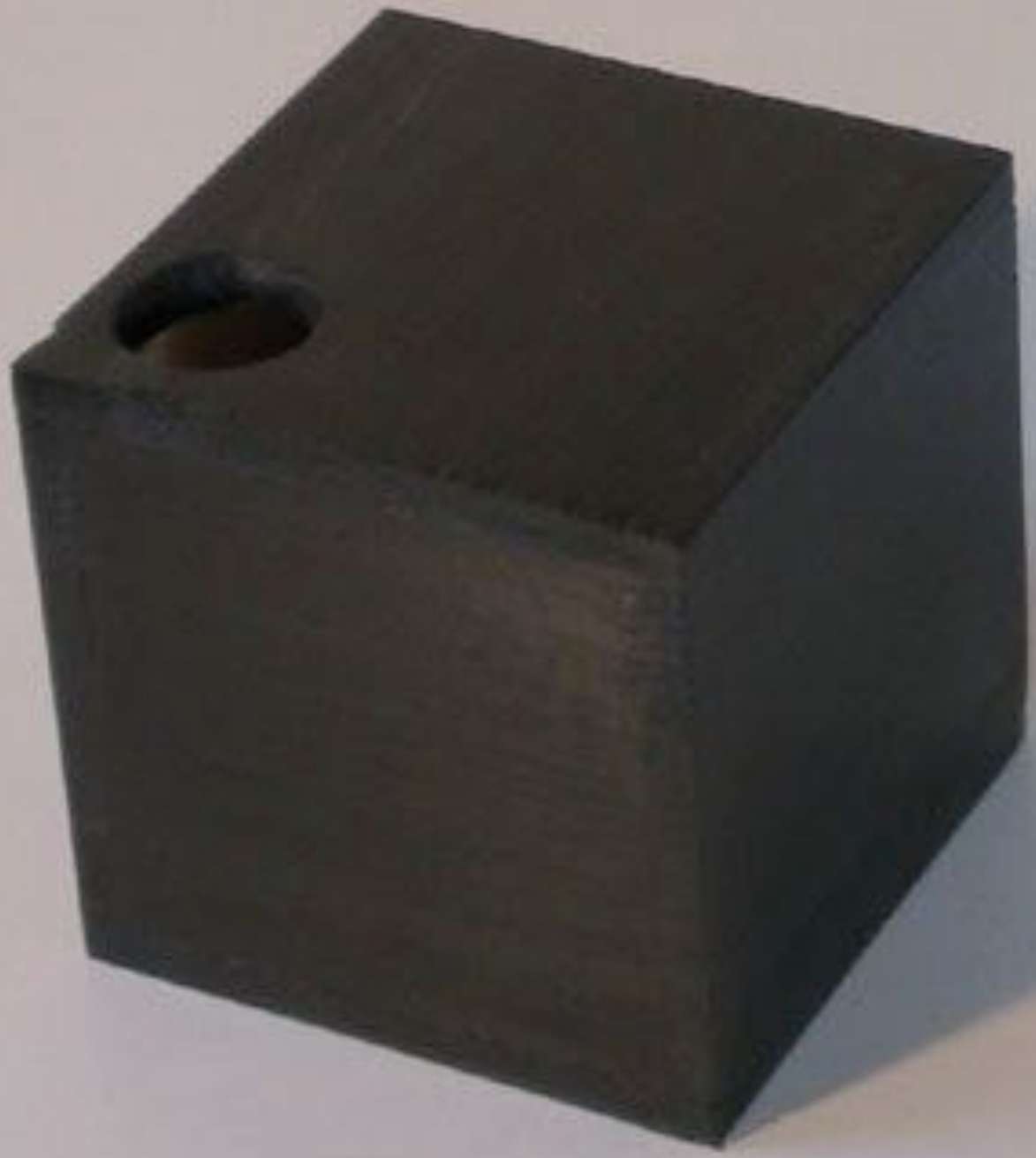
AIM 1:
Get to know (a bit of) process tracing

AIM 2:
Unfuck psychological science

AIM 1:
Get to know (a bit of) process tracing

I suppose it is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail.

Abraham H. Maslow, 1962



Published in: *Psychological Review, 98* (2), 1991, 254–267. www.apa.org/journals/rev/

From Tools to Theories: A Heuristic of Discovery in Cognitive Psychology[1]

Gerd Gigerenzer
Center for Advanced Study in the Behavioral Sciences
Stanford, California

This article deals with how scientists' tools shape theories of mind, in particular with how methods of statistical inference have turned into metaphors of mind.

Discovery

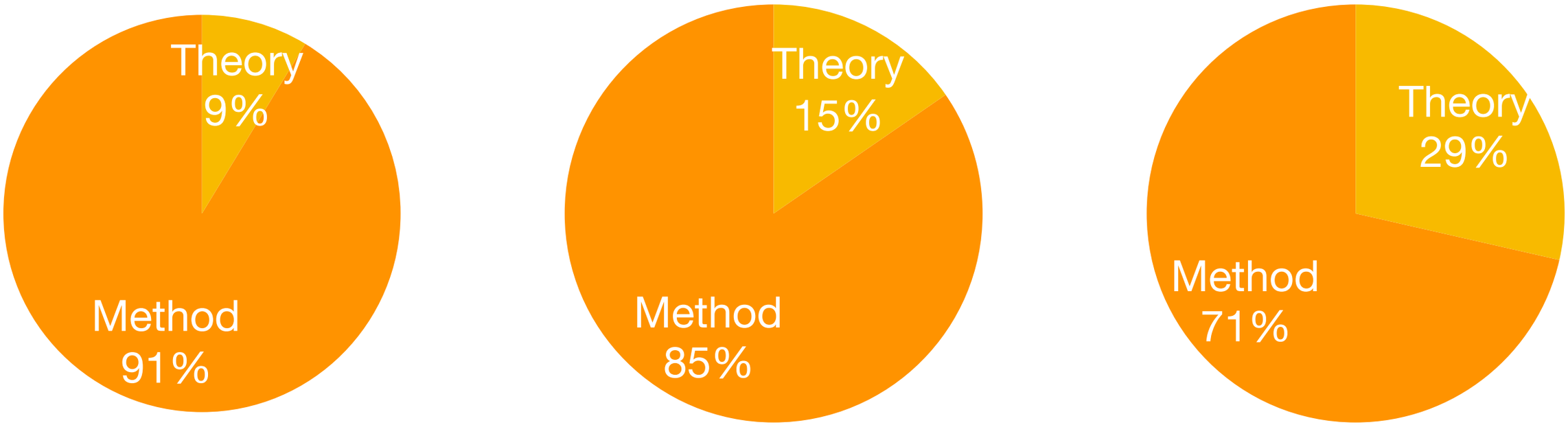
New scientific **tools**, once entrenched in a scientist's daily practice, **suggest** new ... **theoretical concepts**.

Acceptance

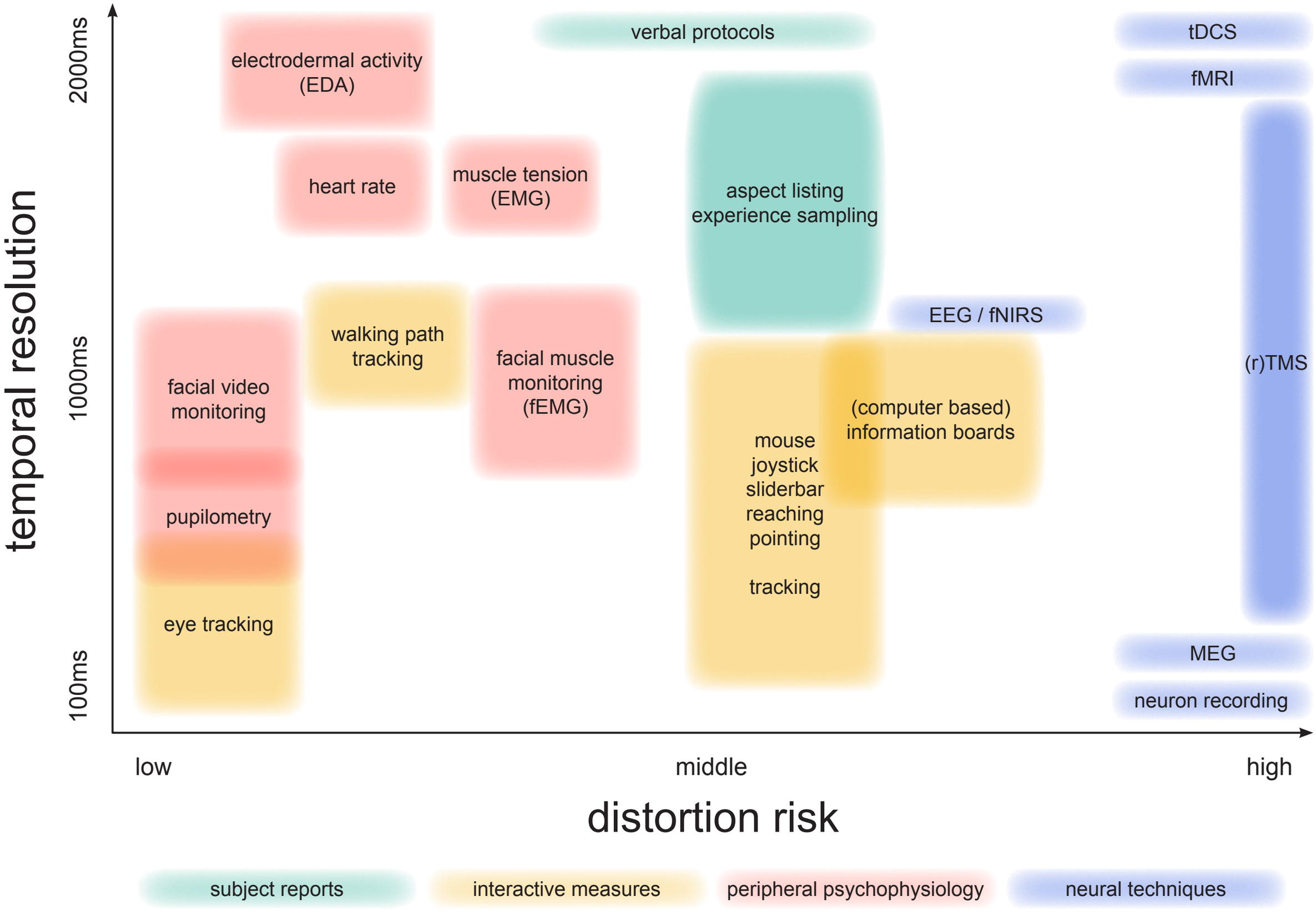
Familiarity with the tools within a scientific community also **lays the foundation** for the general **acceptance** of the theoretical concepts ... .

Gigerenzer, 1991

There Is Nothing So Theoretical as a Good Method



Greenwald, 2012



Schulte-Mecklenbeck, Johnson, Böckenholt, Goldstein, Russo, Sullivan & Willemsen (2017)

A short (selected) history of process tracing tools

Eye Tracking ~1970

Hunziker, 1970

Eye Tracking 2018

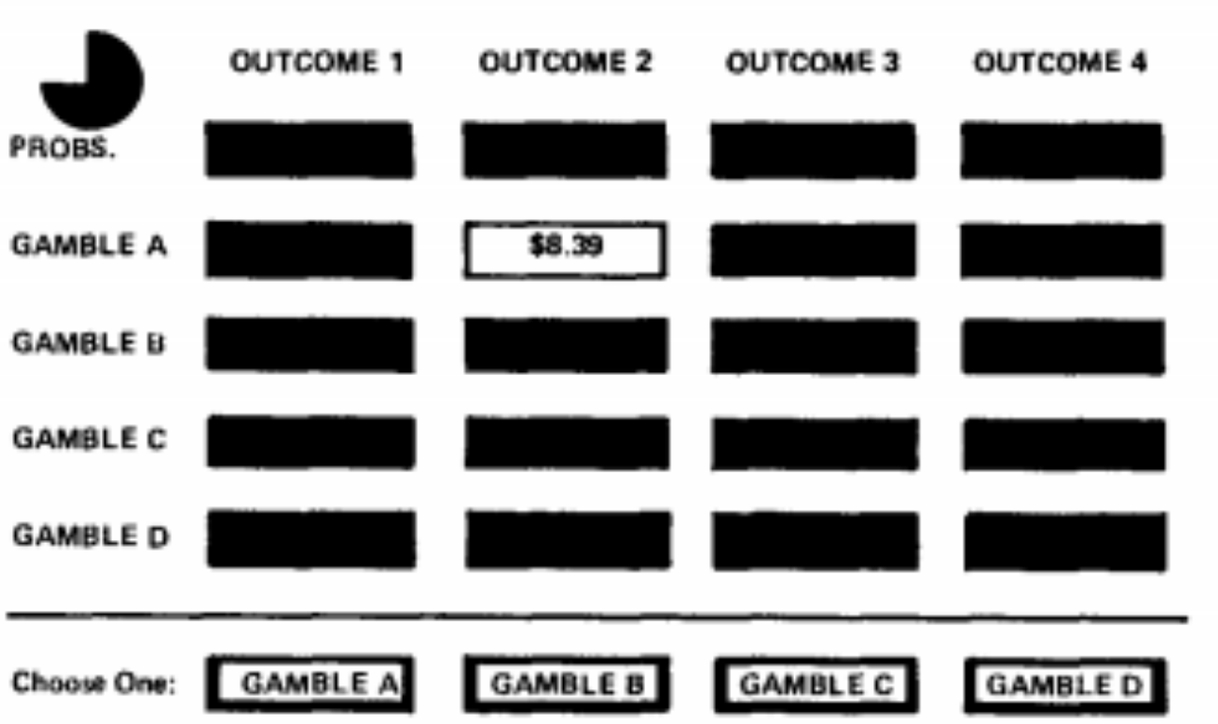
easy to setup

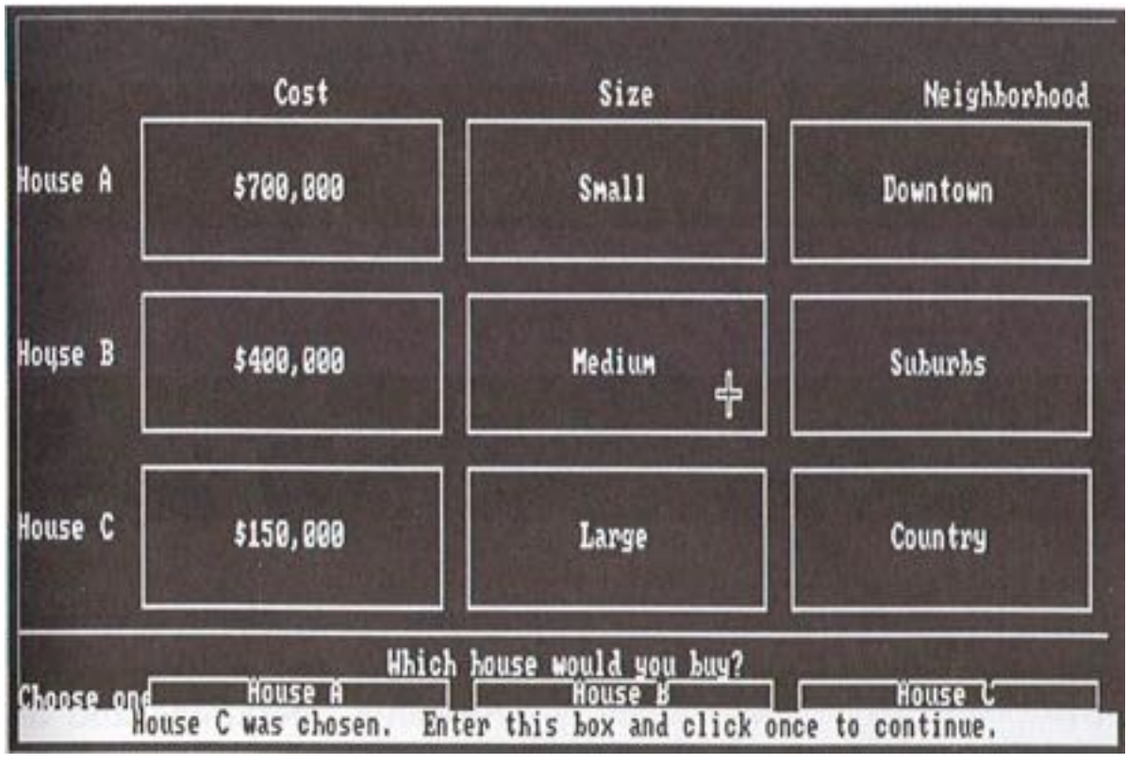
high resolution

(relatively) cheap

Tobii Systems, 2018

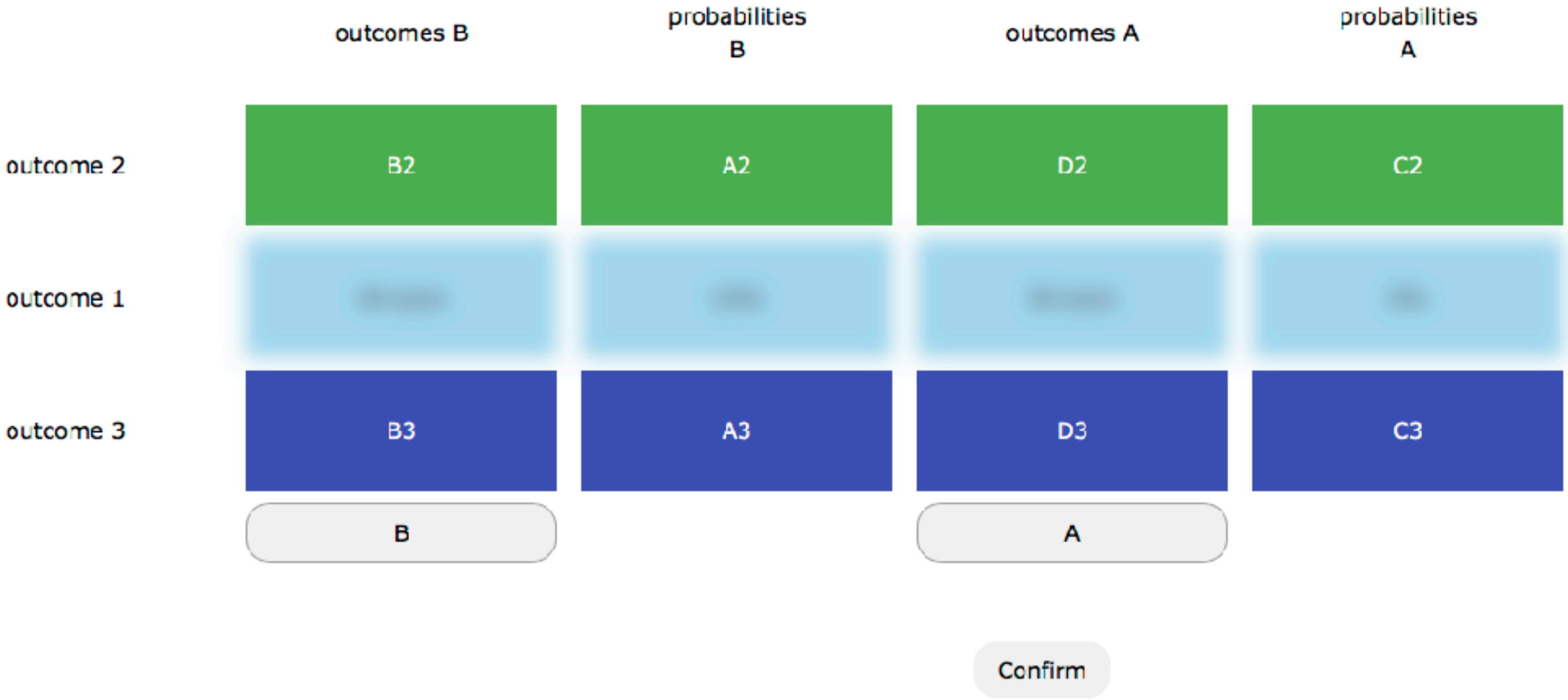
Information Boards ~1988





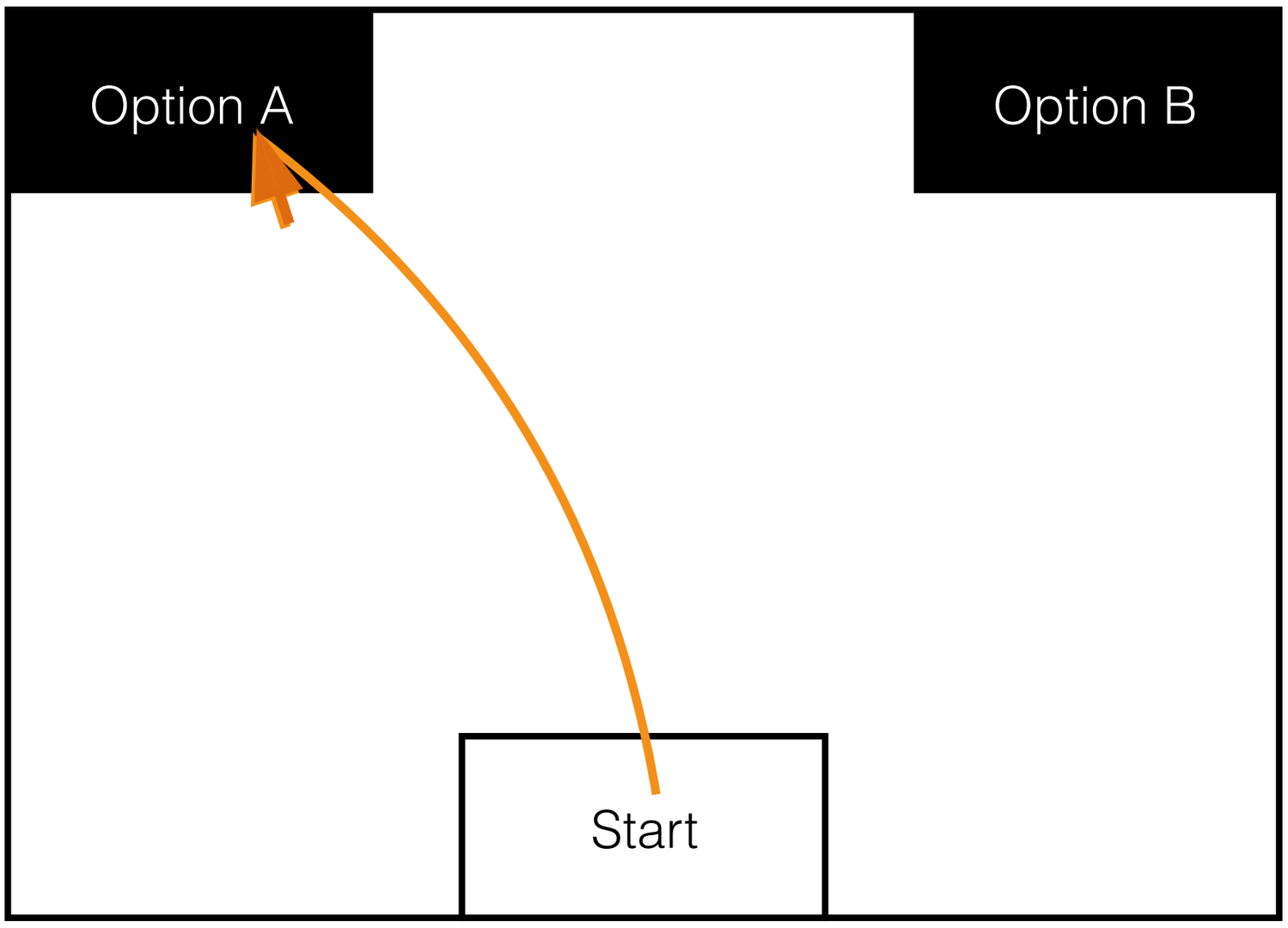
Payne, Bettman & Johnson, 1988, 1993

MouselabWeb
~2018



Willemsen & Johnson, 2018

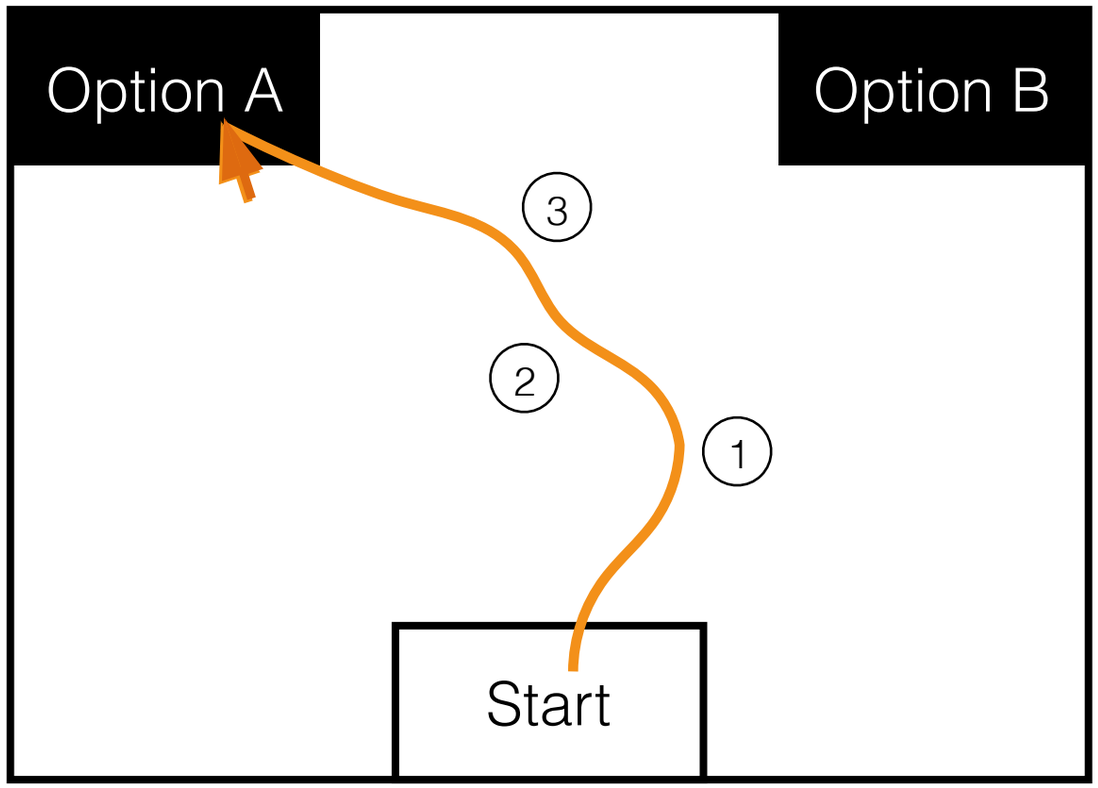
Mousetracking



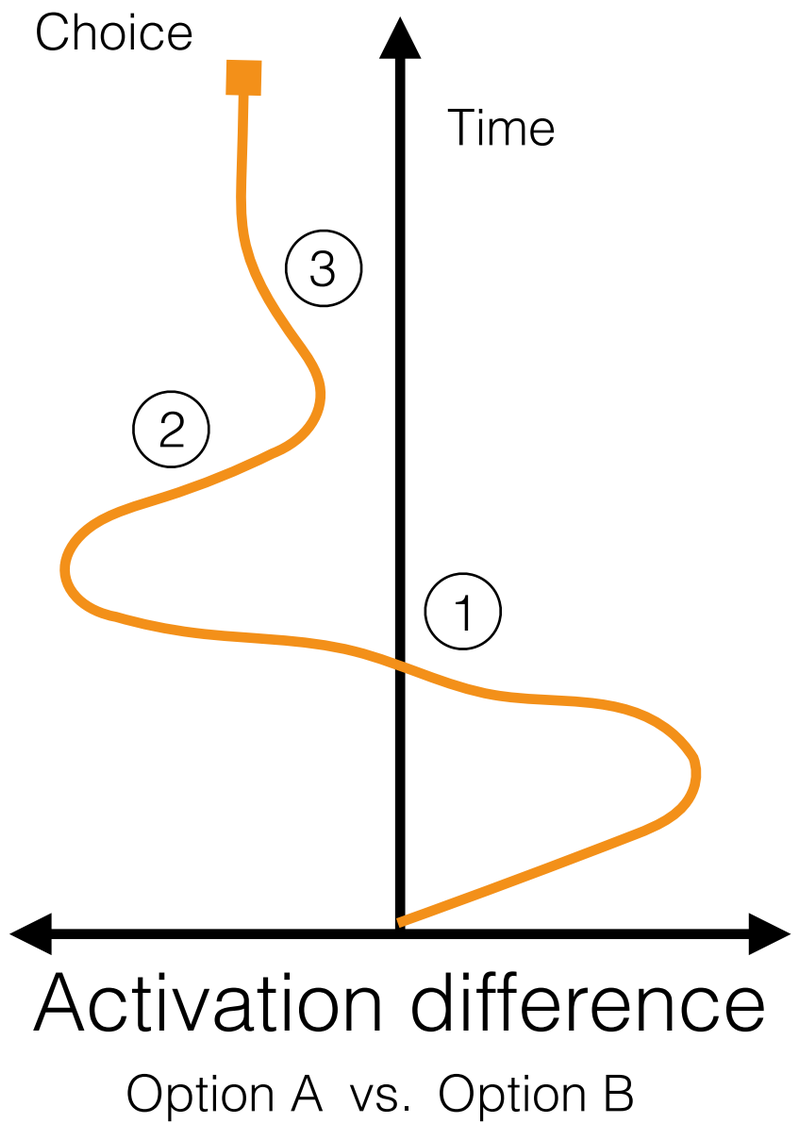
t	x	y
1	0	0
2	.014	.021
3	.039	.054
4	.071	.099
5	.119	.143
…	…	…
138	.873	1.34
139	.942	1.41
140	.981	1.45
141	1.00	1.50

Spivey et al., 2005; Spivey & Dale, 2006; Spivey, 2006; Song & Nakayama, 2009

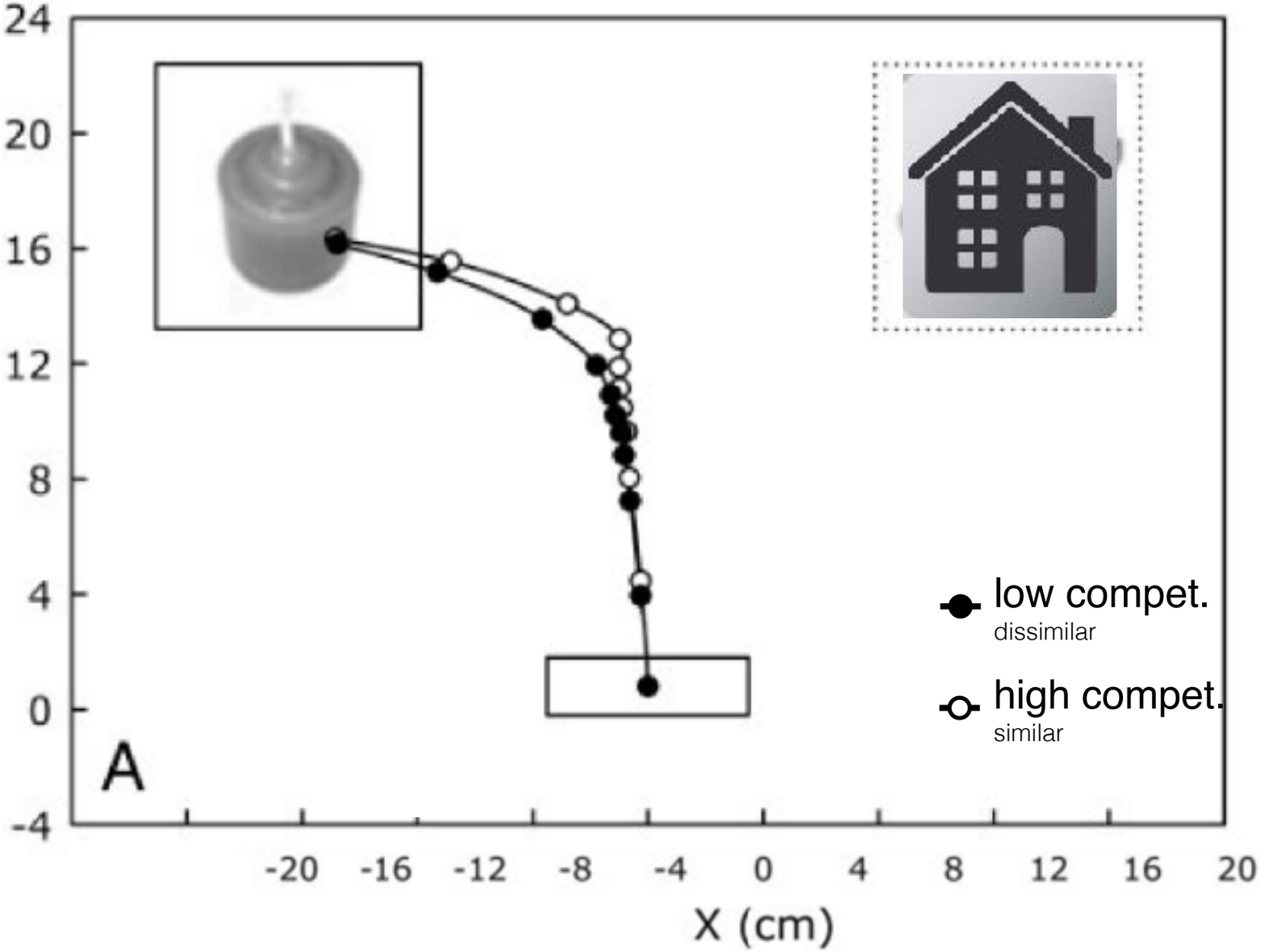
Measuring the continuous mind



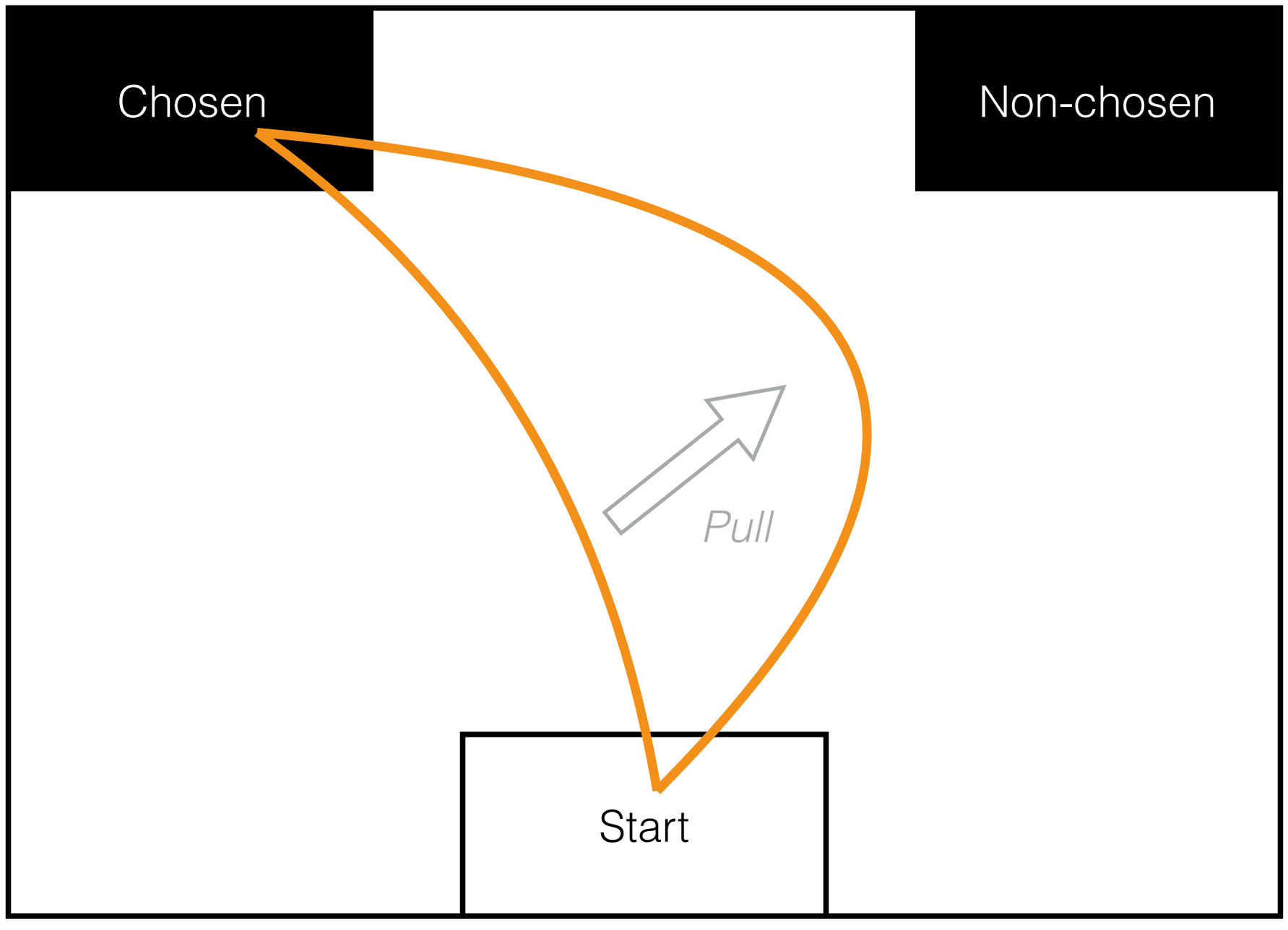
leads to

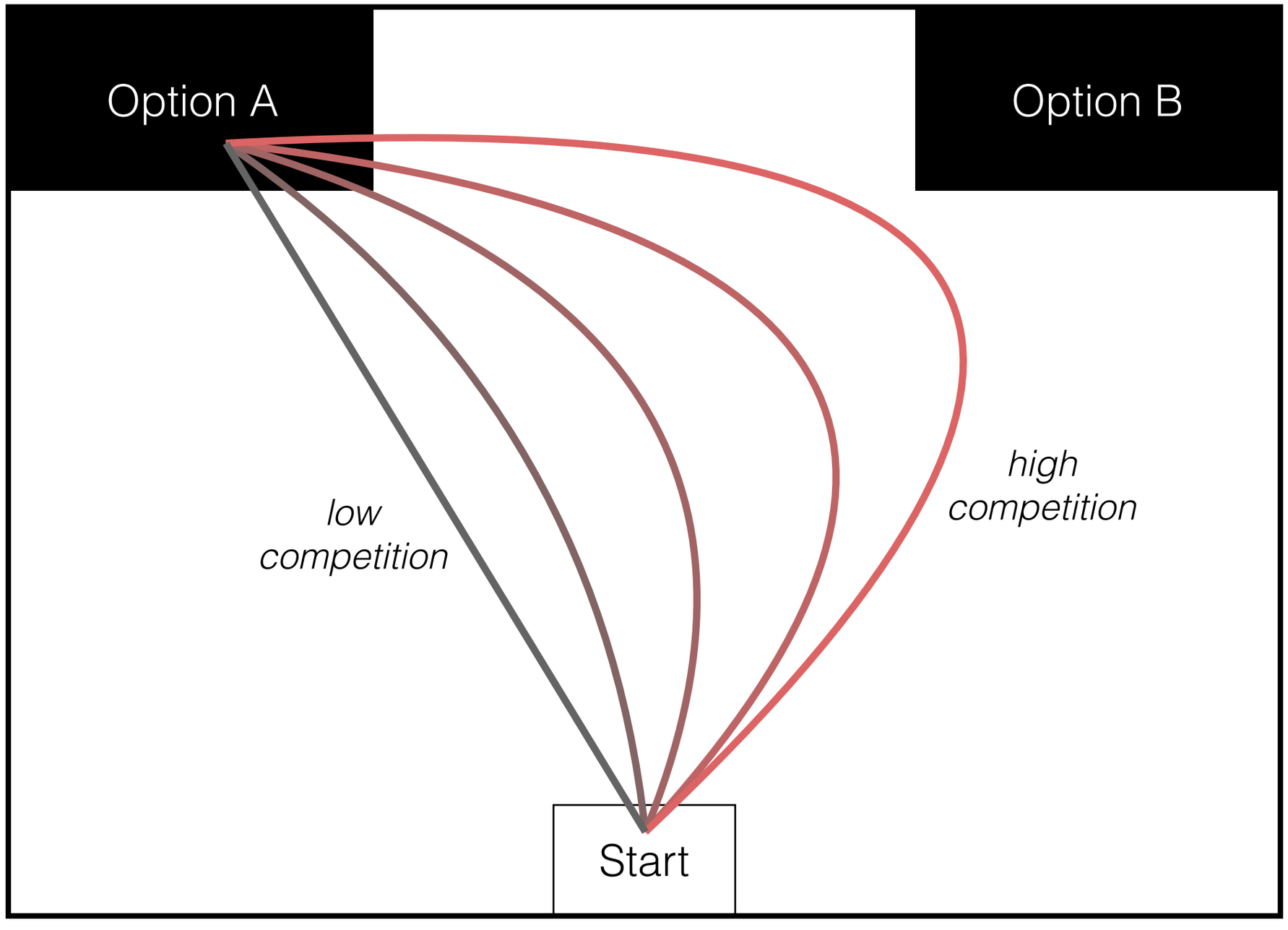


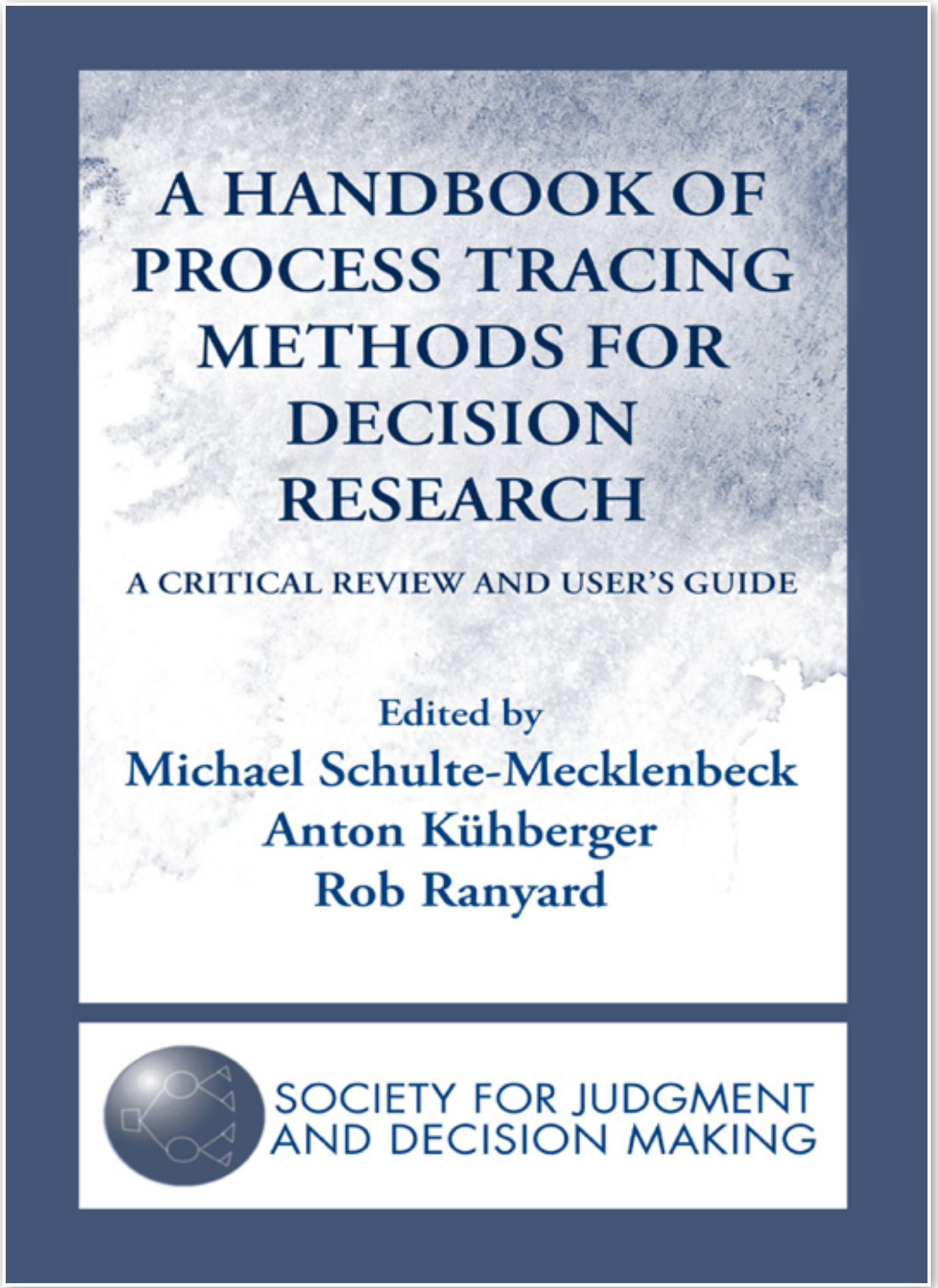
Spivey et al. 2005



Pull towards non-chosen option reveals competition




Option A
Option B
low
competition
high
competition
Start



Information acquisition

Information integration and evaluation

Physiological and neurological methods

Handbook of Process Tracing Methods (Schulte-Mecklenbeck, Kühberger, & Johnson, 2018)

1	Eye-tracking	Eye Fixations as a Process Trace	Jay Russo
2	Eye-tracking / mobile	Pervasive Eye Tracking for Real-World Consumer Behavior Analysis	Andreas Bulling, Michel Wedel
3	Eye-tracking	Investigating Pupil Dilation in Decision Research	Joseph Tao-yi Wang, Wei (James) Chen
4	Eye-tracking / Standards	A primer on eye tracking methodology for behavioral sciences	Jacob Orquin, Kenneth Holmqvist
5	Eye-tracking / mobile	Reporting standards in eye-tracking research	Susan Fiedler, Frank Renkewitz, Michael Schulte-Mecklenbeck, Jacob Orquin
6	Mouselab	(Re)Visiting the Decision Factory: Observing Cognition with MouselabWEB	Martijn Willemsen, Eric J. Johnson
7	Mouselab	Comparing Process Tracing Paradigms: Tracking Attention via Mouse and Eye Movements	Ana Franco-Watkins, Hayden Hickey, Joe Johnson
8	Mousetracking	Mouse-Tracking: A practical guide to implementation and analysis	Pascal Kieslich, Felix Henninger, Dirk Wulff, Jonas Haslbeck, Michael Schulte-Mecklenbeck
9	Mousetracking	Mouse-Tracking: Detecting Types in Movement Trajectories	Dirk Wulff, Jonas Haslbeck, Pascal Kieslich, Felix Henninger, Michael Schulte-Mecklenbeck
10	Mousetracking	Mouse-Tracking to Understand Real-Time Dynamics of Social Cognition	Ben Stillerman, Jon Freeman
11	Psychophys	Measuring electrodermal activity and its applications in judgment and decision making research	Bernd Figner, Ryan O. Murphy, Paul Siegel
12	Psychophys	Response times identification tools for cognitive processes as at the final decision stage	Mario Fific, Wolfgang Gaissmaier, Jörg Rieskamp, Joe Houpt
13	Psychophys	Automatic, video based emotion classification	Sabrina Stöckli, Michael Schulte-Mecklenbeck, Stefan Borer, Andrea Samson
14	Psychophys	EEG and ERPs as Neural Process Tracing Methodologies in Decision Making Research	Mary Frame
15	Psychophys	Decision Neuroscience: fMRI Insights into Choice Processes	Vinod Venkatraman, Crystal Reeck
16	Psychophys	Probing the Decisional Brain with noninvasive brain stimulation	Giorgio Coricelli, Elena Rusconi, Nadege Bault
17	Verbal data	Verbal Reports and Decision Process Analysis	Rob Ranyard, Ola Svenson
18	Verbal data	Thinking Aloud during Superior Performance on Tasks Involving Decision Making	Anders Ericsson, Jerad Moxley
19	Verbal data	Tracking Free Information Access: The Method of Active Information Search	Oswald Huber, Anton Kühberger, Michael Schulte-Mecklenbeck
20	Sampling	Uncovering the Anatomy of Search Without Technology	Dirk Wulff, Ralph Hertwig
21	Sampling	Process Tracing, Sampling, and Drift Rate Construction	Neil Stewart, Tim Mullet
22	Multi-method & Models	Using multiple methods to elicit choices and to identify strategies	Ulrich Hoffrage, Nils Reisen
23	Multi-method & Models	Testing cognitive models by a joint analysis of multiple dependent measures	Andreas Glöckner, Mark Jekel
24	Multi-method & Models	Building better process models	Joe Johnson, Mary Frame

AIM 1:
Get to know (a bit of) process tracing

How do we get there?

Time	Monday, 9.7.2018	Tuesday, 10.7.2018	Wednesday, 11.7.2018	Thursday, 12.7.2018	Friday, 13.7.2018	Saturday, 14.7.2018
09-10	Introduction	Kieslich	Kieslich + Wulff	Scheel	Hawelka	Wulff + Presentations
10-11	Schulte, Kühberger	*MT*	*MT*	*Repro*	*ET*	*DfE*
11-12						
12-13	Lunch	Lunch	Lunch	Lunch	Lunch	
13-14	Kieslich	Kieslich	Kieslich+Wulff	Scheel	Wulff	
14-15	*MT*	*MT*	*MT*	*Repro*	*DfE*	
15-16						
16-17		**Keynote: Stewart**	**Keynote: Fiedler**	**Keynote: Hertwig**	**Keynote: Jenny**	
17-18	**Drinks**	Meet the scientist	Meet the scientist	Meet the scientist	Meet the scientist	**Dinner**

https://github.com/michaelschulte/EADMSummerSchool

Smokers

§ 13 des Tabakgesetzes sieht ein generelles Rauchverbot in Räumen öffentlicher Orte vor. Ein öffentlicher Ort ist jeder Ort, der von einem nicht von vorneherein beschränkten Personenkreis ständig oder zu bestimmten Zeiten betreten werden kann. Unter die Bezeichnung „Raum“ fallen laut Gesundheitsministerium ortsfeste, geschlossene Baulichkeiten.

Swag


eadm
The European Association for Decision Making
SUMMER
SCHOOL
2018
RUS

Food

Menu 1

or

Menu 2

+ Salad

+ Water (glas at the entrance)

Vegetarian

Name tag!

Marshmallow Challenge

Build the Tallest Freestanding Structure

- Teams of Four People
- Eighteen Minutes
- Using the Following Ingredients

20 sticks of spaghetti +

one yard tape +

one yard string +

one marshmallow

Build the Tallest Freestanding Structure: The winning team is the one that has the tallest structure measured from the table top surface to the top of the marshmallow. That means the structure cannot be suspended from a higher structure.

The Entire Marshmallow must be on top: The entire marshmallow needs to be on the top of the structure. Cutting or eating part of the marshmallow disqualifies the team.

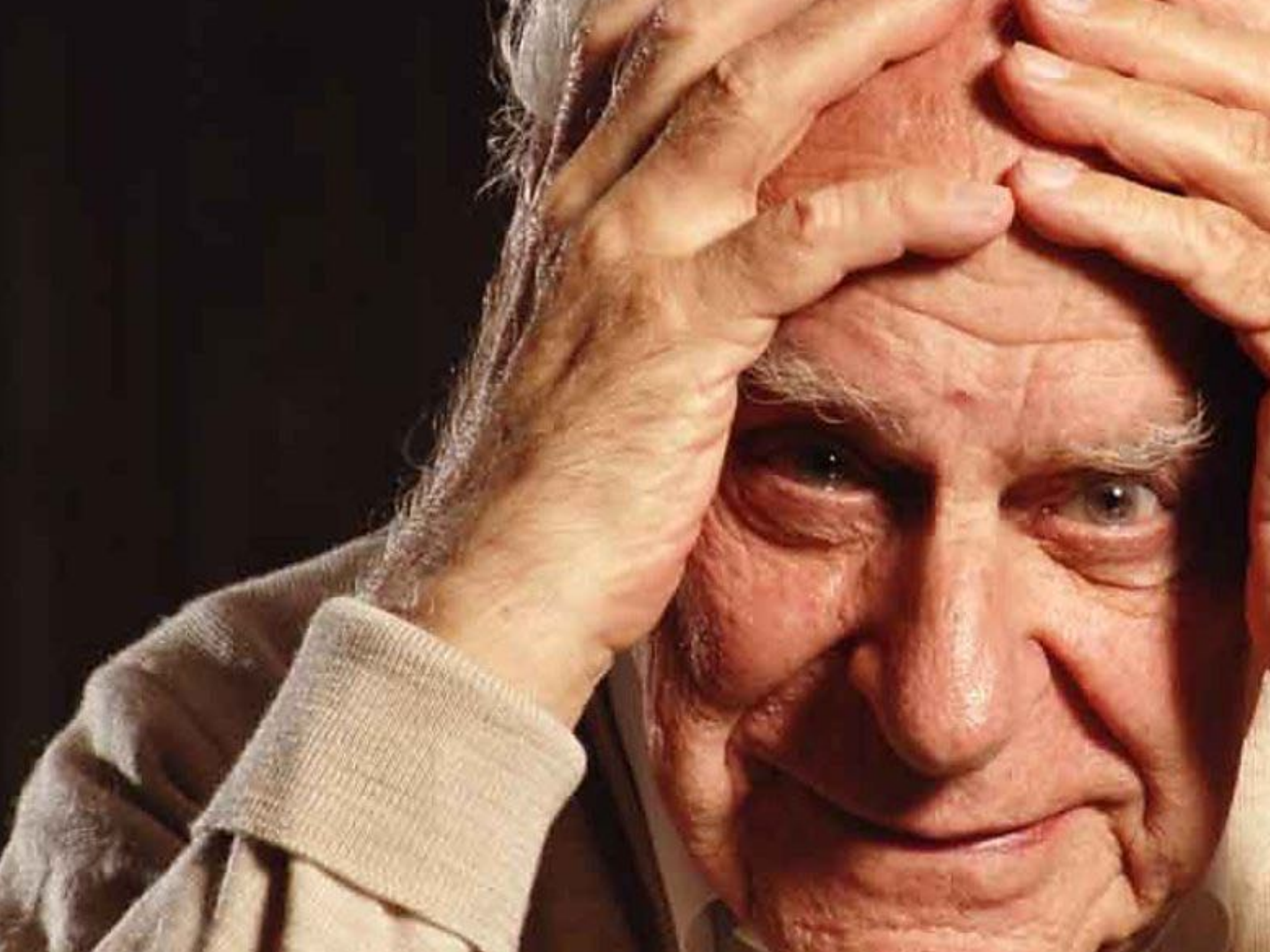
Use as Much or as Little of the Kit: The team can use as many or as few of the 20 spaghetti sticks, as much or as little of the string or tape.

Break up the Spaghetti, String or Tape: Teams are free to break the spaghetti, cut up the tape and string to create new structures.

The Challenge Lasts 18 minutes: Teams cannot hold on to the structure when the time runs out. Those touching or supporting the structure at the end of the exercise will be disqualified. The structure has to hold until all the measurements are finished.

AIM 2:
Unfuck
psychological science

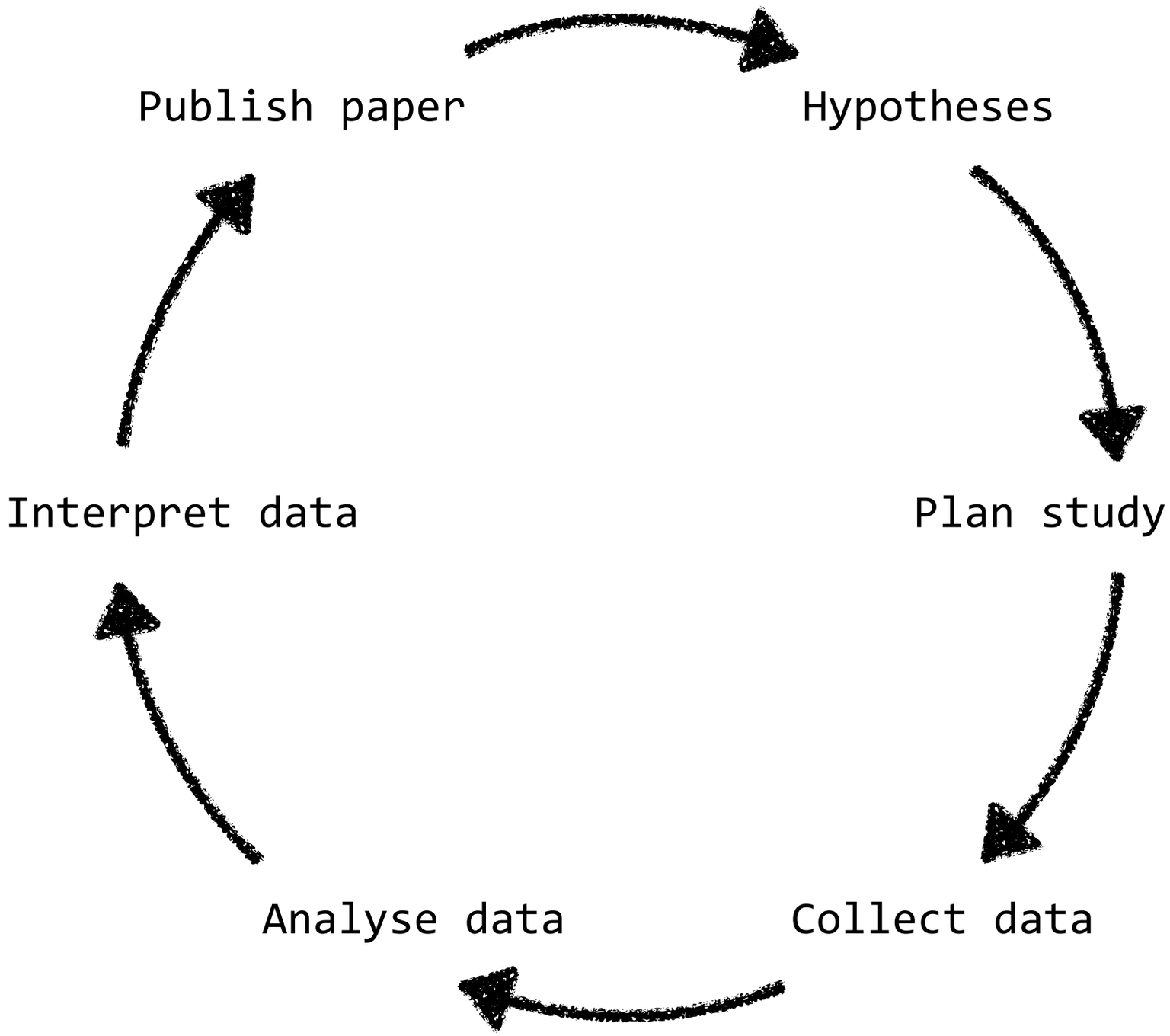
‘cause it is 2018



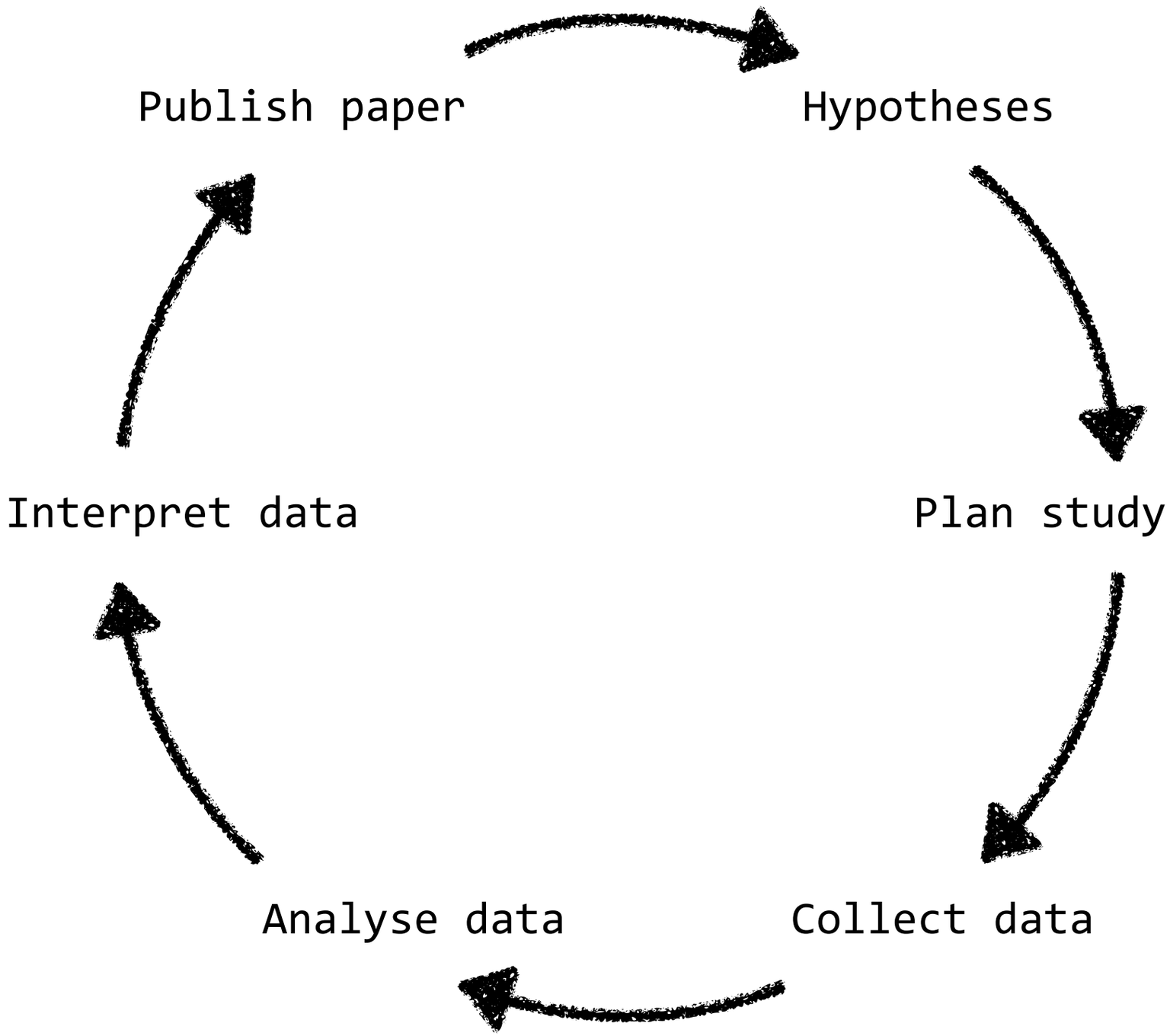
> Only when certain events recur in accordance with rules or regularities, as in the case of **repeatable experiments**, can our observation be tested — in principle — by anyone (…).
> Only by such **repetitions** can we convince ourselves that we are … dealing with … events that, because of their **regularity and reproducibility**, are in principle intersubjectively testable.

Popper, S. 23 (1959)

Scientific circle



Scientific circle



Replication

Hypotheses

Plan study

Collect data

Analyse data

Interpret data

Publish paper

Only by such **repetitions** can we convince ourselves that we are not dealing with a mere isolated ‘coincidence’.

Overview

The problem

Why most of published research findings are false.

The catalyst

Questionable Research Practices
Betrug

More bad news

Psychology

Solutions

Registered Replication Report
Pre-Registration
Standards
Open Science (osf.io)

Why most published research findings are false

Essay

Why Most Published Research Findings Are False

John P. A. Ioannidis

Summary

There is increasing concern that most current published research findings are false. The probability that a research claim is true may depend on study power and bias, the number of other studies on the same question, and, importantly, the ratio of true to no relationships among the relationships probed in each scientific field. In this framework, a research finding is less likely to be true when the studies conducted in a field are smaller; when effect sizes are smaller; when there is a greater number and lesser preselection of tested relationships; where there is greater flexibility in designs, definitions, outcomes, and analytical modes; when there is greater financial and other interest and prejudice; and when more teams are involved in a scientific field in chase of statistical significance. Simulations show that for most study designs and settings, it is more likely for a research claim to be false than true. Moreover, for many current scientific fields, claimed research findings may often be simply accurate measures of the prevailing bias. In this essay, I discuss the implications of these problems for the conduct and interpretation of research.

Published research findings are sometimes refuted by subsequent evidence, with ensuing confusion and disappointment. Refutation and controversy is seen across the range of research designs, from clinical trials and traditional epidemiological studies [1–3] to the most modern molecular research [4,5]. There is increasing concern that in modern research, false findings may be the majority or even the vast majority of published research claims [6–8]. However, this should not be surprising. It can be proven that most claimed research findings are false. Here I will examine the key factors that influence this problem and some corollaries thereof.

The Essay section contains opinion pieces on topics of broad interest to a general medical audience.

Modeling the Framework for False Positive Findings

Several methodologists have pointed out [9–11] that the high rate of nonreplication (lack of confirmation) of research discoveries is a consequence of the convenient, yet ill-founded strategy of claiming conclusive research findings solely on the basis of a single study assessed by formal statistical significance, typically for a *p*-value less than 0.05. Research is not most appropriately represented and summarized by *p*-values, but, unfortunately, there is a widespread notion that medical research articles

It can be proven that most claimed research findings are false.

should be interpreted based only on *p*-values. Research findings are defined here as any relationship reaching formal statistical significance, e.g., effective interventions, informative predictors, risk factors, or associations. "Negative" research is also very useful. "Negative" is actually a misnomer, and the misinterpretation is widespread. However, here we will target relationships that investigators claim exist, rather than null findings.

As has been shown previously, the probability that a research finding is indeed true depends on the prior probability of it being true (before doing the study), the statistical power of the study, and the level of statistical significance [10,11]. Consider a 2×2 table in which research findings are compared against the gold standard of true relationships in a scientific field. In a research field both true and false hypotheses can be made about the presence of relationships. Let R be the ratio of the number of "true relationships" to "no relationships" among those tested in the field. R is characteristic of the field and can vary a lot depending on whether the field targets highly likely relationships or searches for only one or a few true relationships among thousands and millions of hypotheses that may be postulated. Let us also consider, for computational simplicity, circumscribed fields where either there is only one true relationship (among many that can be hypothesized) or the power is similar to find any of the several existing true relationships. The pre-study probability of a relationship being true is $R/(R + 1)$. The probability of a study finding a true relationship reflects the power $1 - \beta$ (one minus the Type II error rate). The probability of claiming a relationship when none truly exists reflects the Type I error rate, α. Assuming that c relationships are being probed in the field, the expected values of the 2×2 table are given in Table 1. After a research finding has been claimed based on achieving formal statistical significance, the post-study probability that it is true is the positive predictive value, PPV. The PPV is also the complementary probability of what Wacholder et al. have called the false positive report probability [10]. According to the 2×2 table, one gets $\text{PPV} = (1 - \beta)R/(R - \beta R + \alpha)$. A research finding is thus

Citation: Ioannidis JPA (2005) Why most published research findings are false. PLoS Med 2(8): e124.

Abbreviation: PPV, positive predictive value

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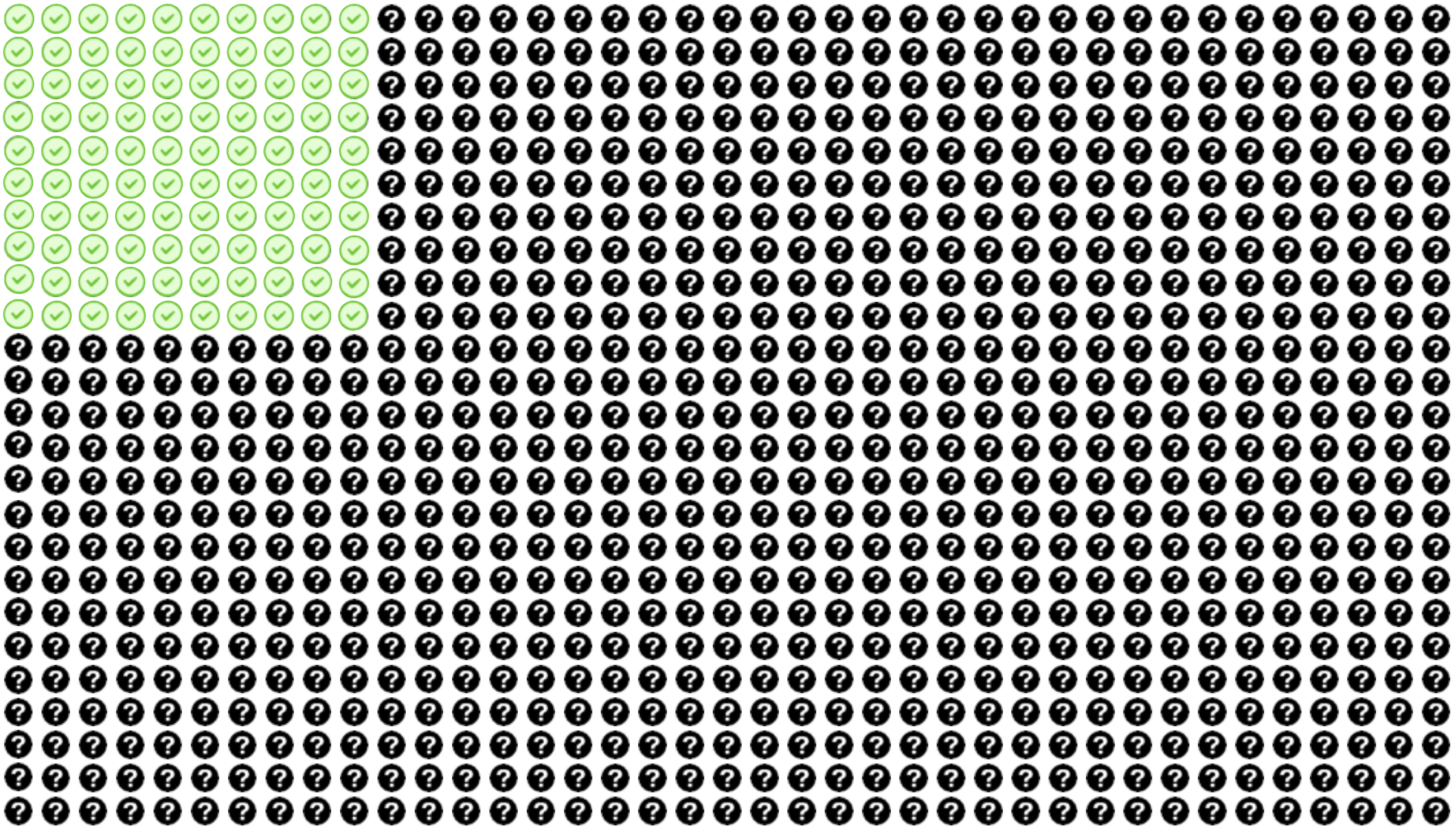
Competing Interests: The author has declared that no competing interests exist.

DOI: 10.1371/journal.pmed.0020124

Ioannidis (2005)

100

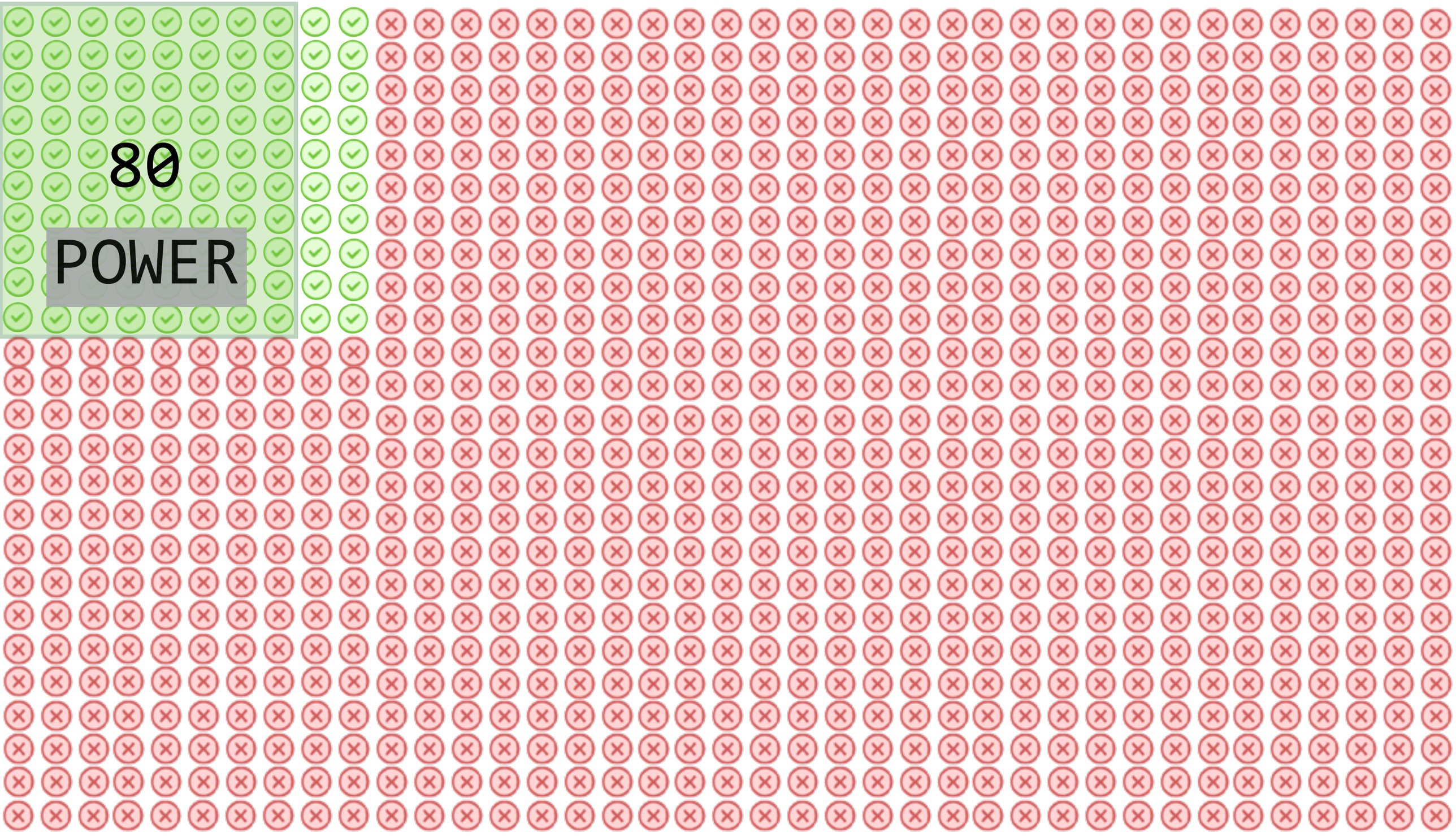


100

900

80

POWER



State of the world

100

900

80

20

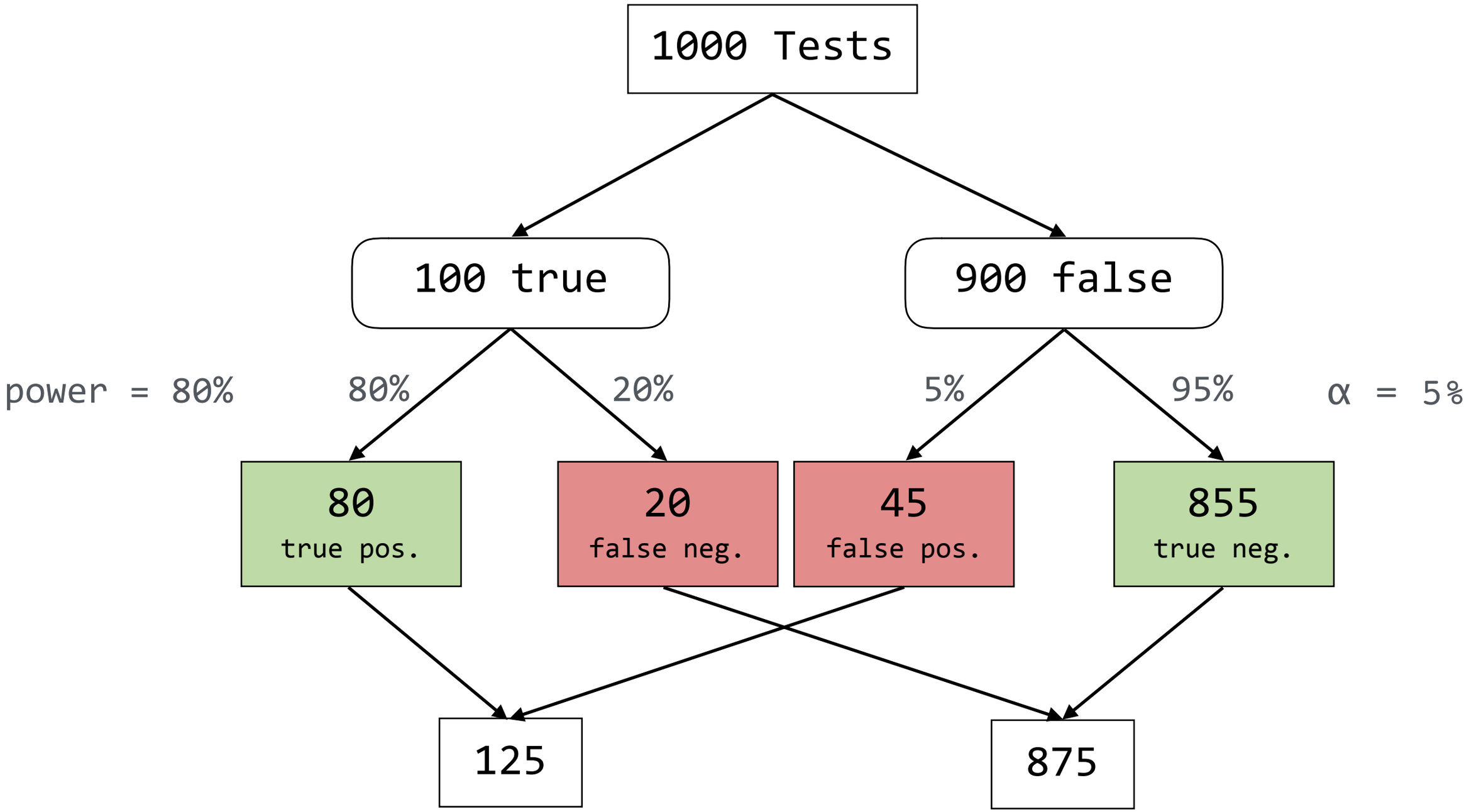
45

false pos.

POWER

false neg.

~ Optimal Circumstances!



64% published results are true

What are the circumstances?

The catalyst

Questionable Research Practices (QRPs)

Fraud

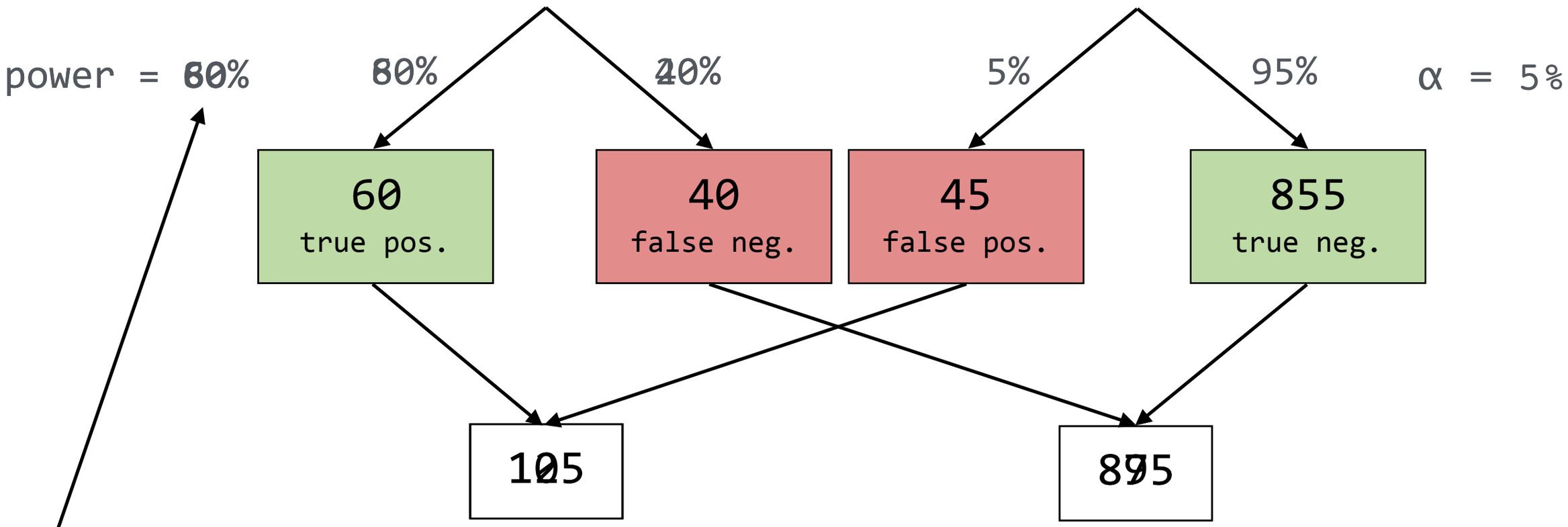
Questionable Research Practices (QRP)

Gold Standard Questionable Research Practices Fraud

low power
optional stopping
positive results
HARKing
cherry picking
p-hacking

John, Loewenstein, & Prellec (2012)

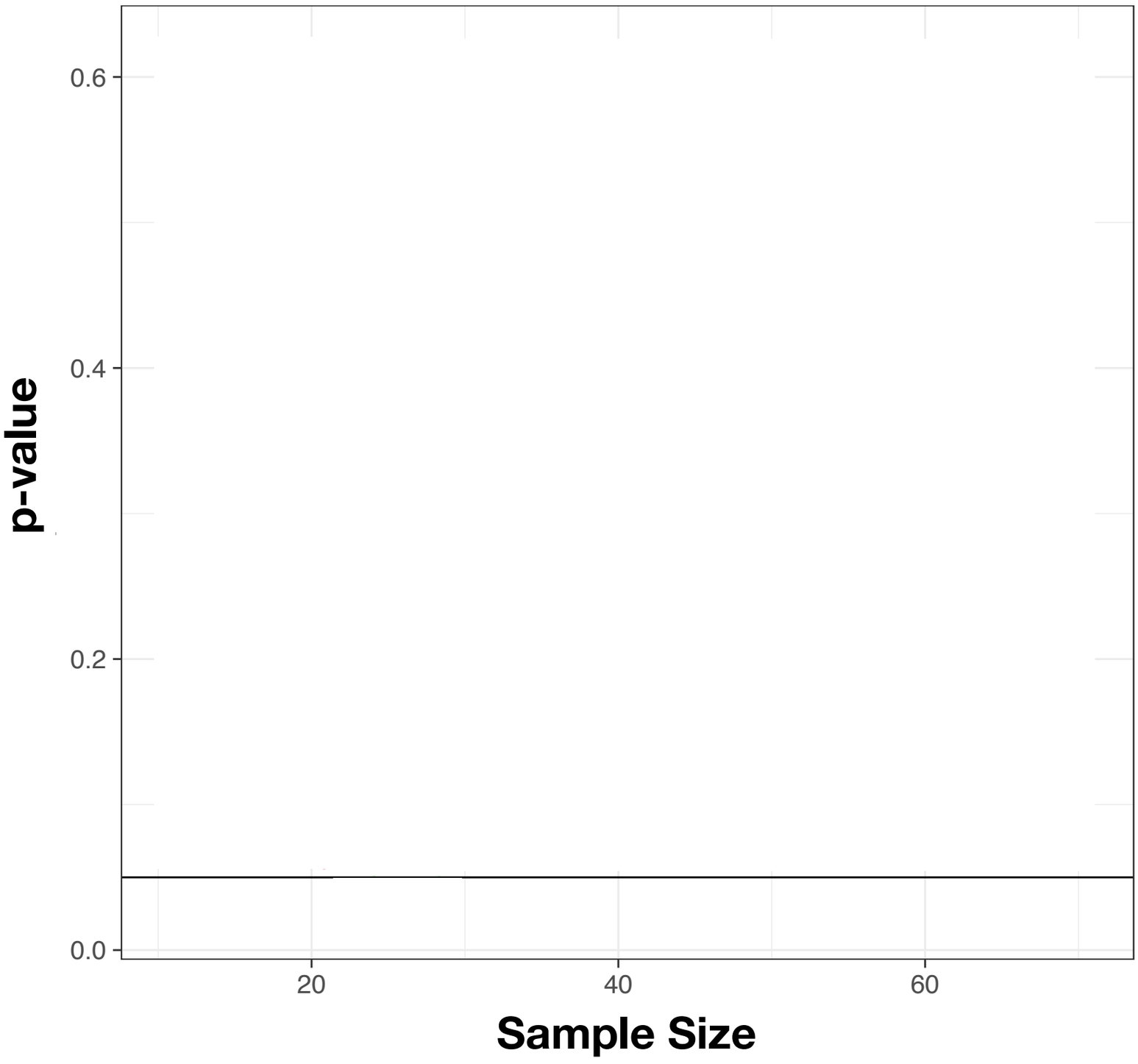
QRP 1: Low Power



Strategic Management Journal
Management International Review
Academy of Management Journal
Journal of International Business Studies
Journal of Marketing Research

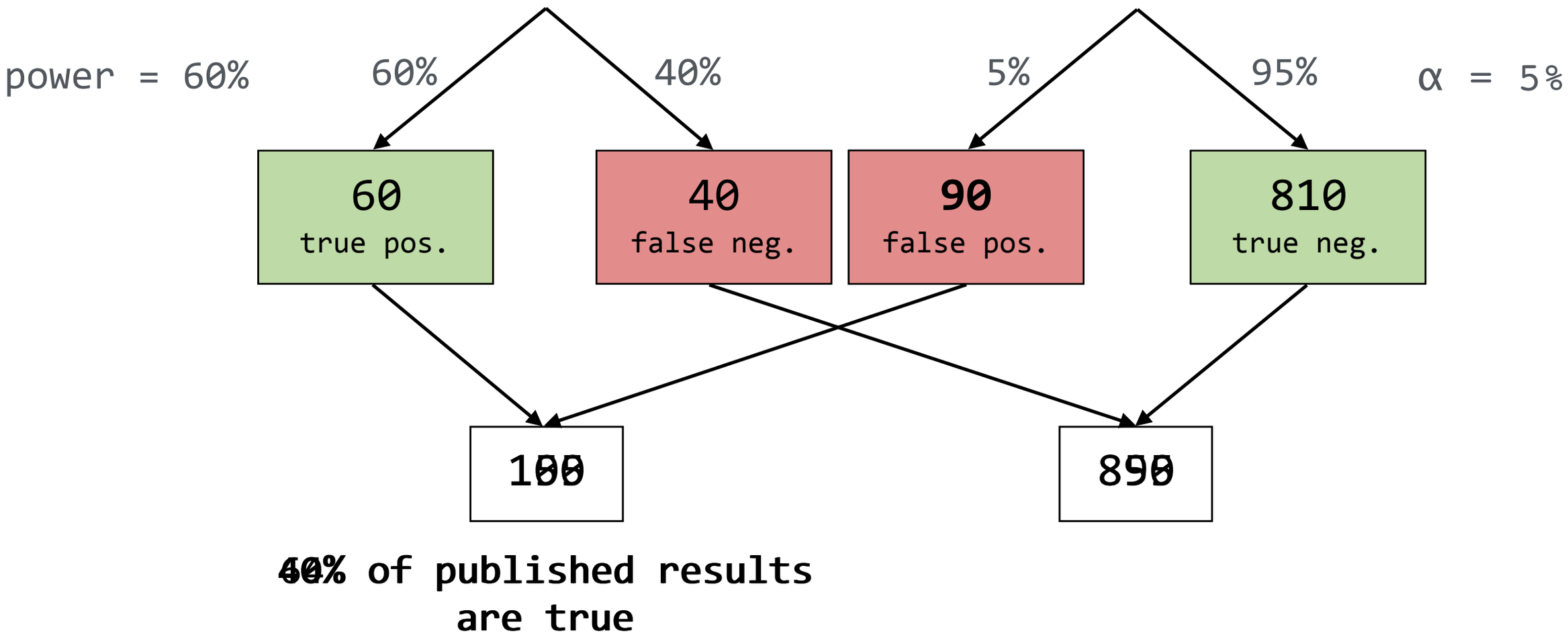
Brock (2003)

QRP 2: Researcher's degrees of freedom

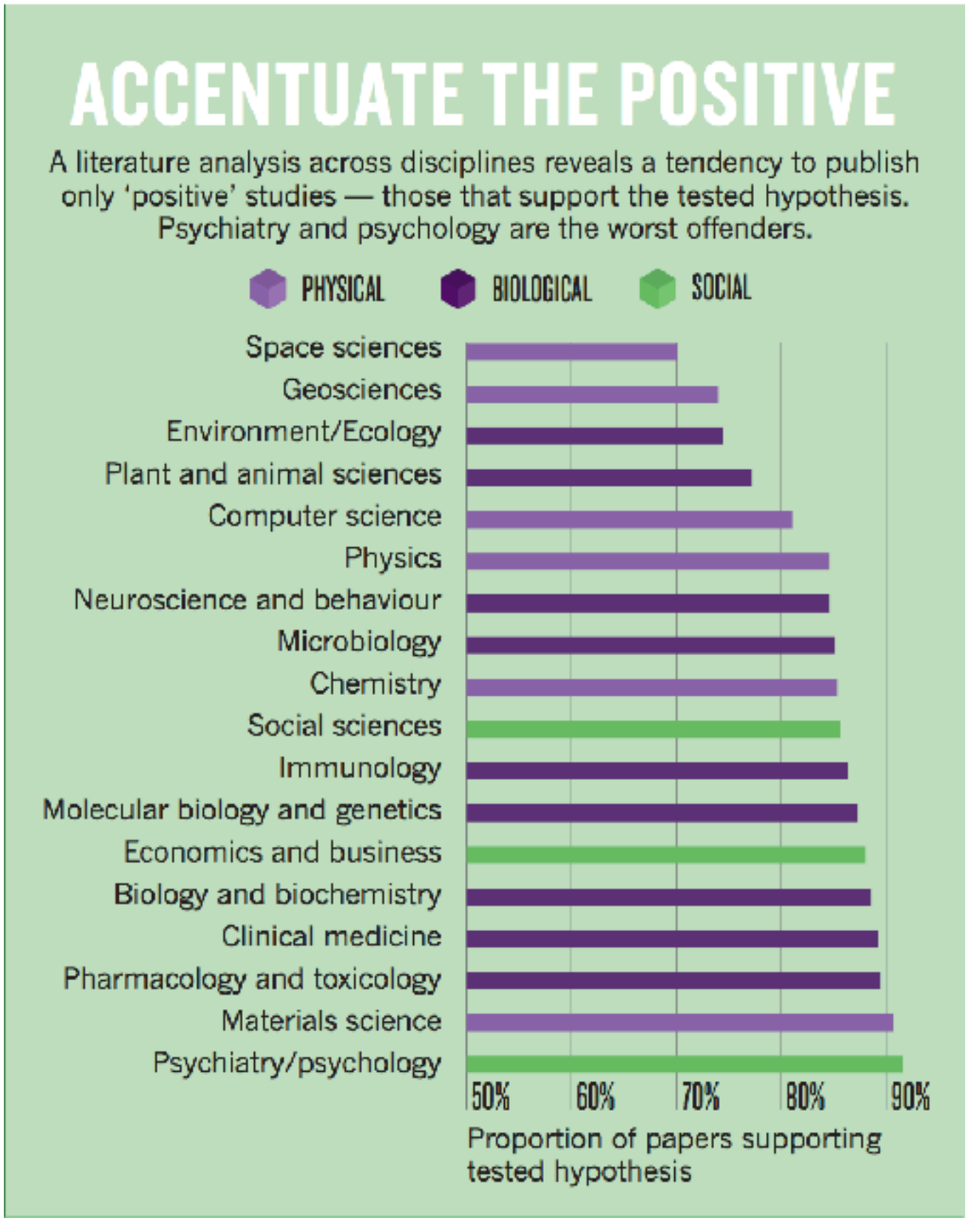


Simmons, Nelson, & Simonsohn (2011)

QRP 2: Researcher's degrees of freedom



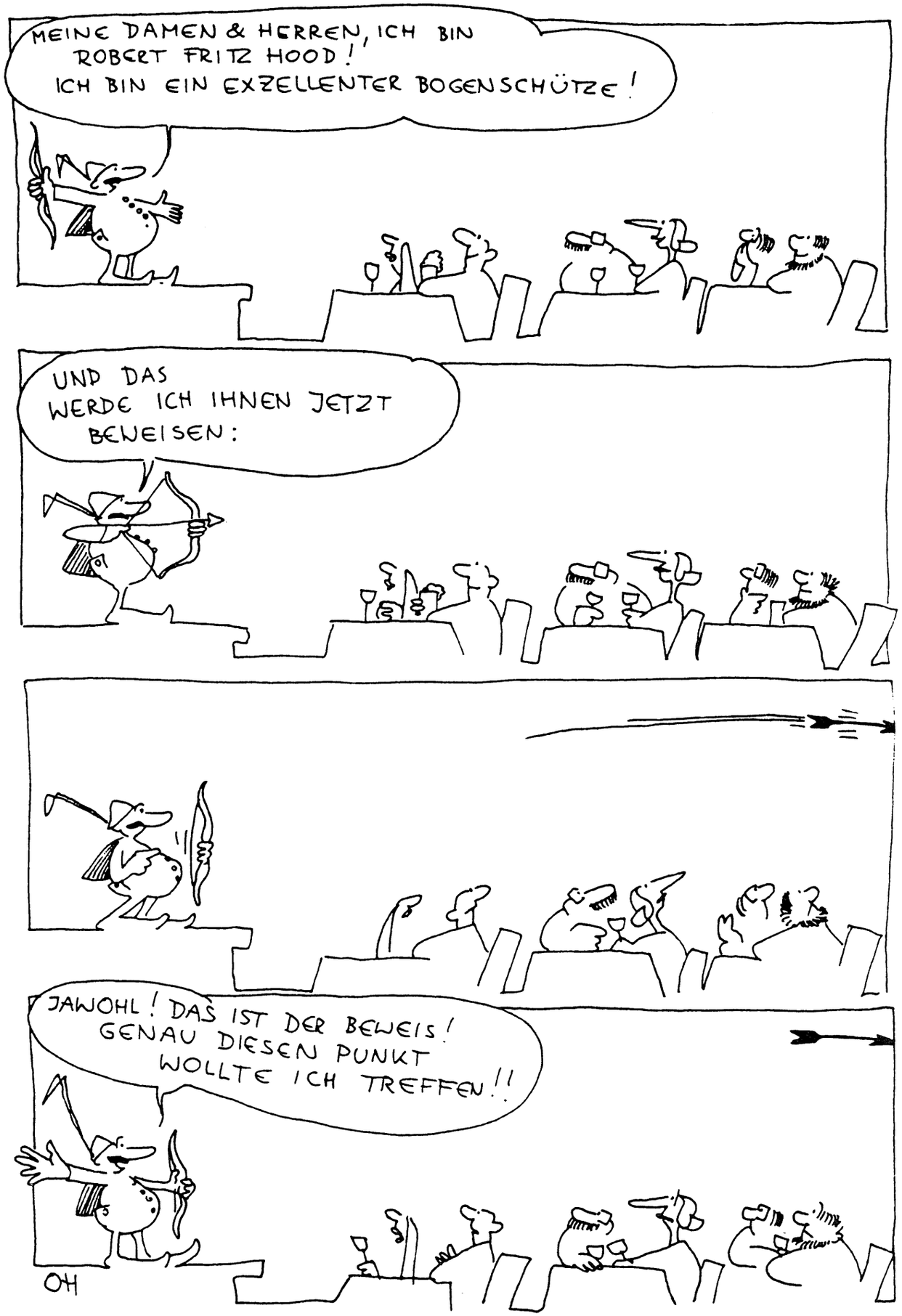
QRP 3: Positive results



Yong (2012)

QRP 4: HARKing

Hypothesizing
After the **R**esults
are **K**nown



Kerr (1998)

Replication

Publication bias

Publish paper

Hypotheses

HARKing

Interpret data

Plan study

Cherry picking

low
power

p-hacking

Cherry picking

selective
reporting

Analyse data

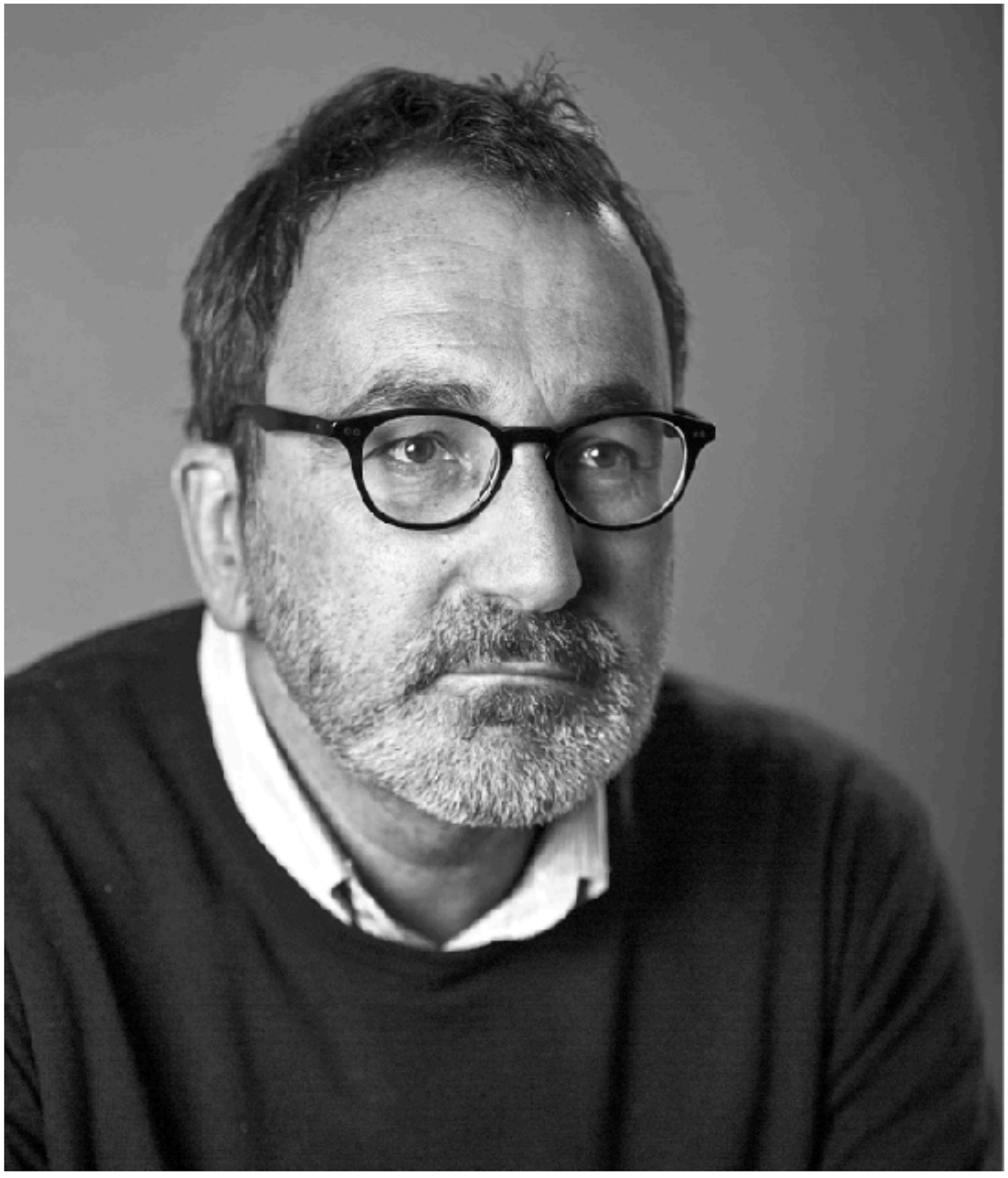
Collect data


Giro
CL

Published online 1 November 2011 | *Nature* **479**, 15 (2011) |
doi:10.1038/479015a

News

Report finds massive fraud at Dutch universities



Forged data in at least
55 papers and
10 dissertations

Callaway (2011); New York Times (2013)

Retraction Watch

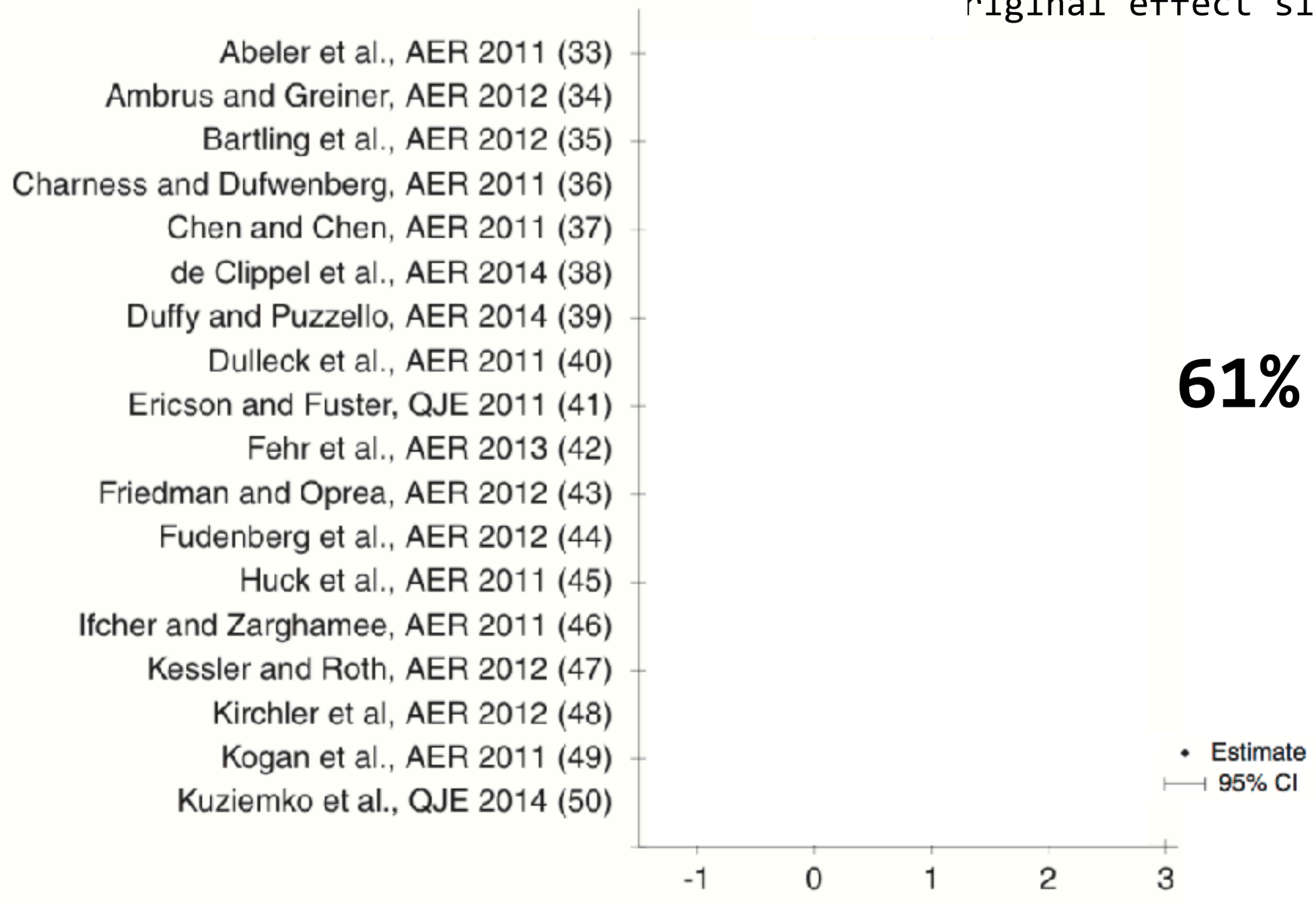
Researcher	Retraction years	Country	Field of study	Number of retractions
Joachim Boldt[1]	2010–2011	Germany	Anesthesiology	88
Adrian Maxim[2]	2007	USA	Electrical engineering	48
H. Zhong[3]	2010	China	Chemistry	43
Jon Hendrick Schön[4]	2002–2004	USA	Physics	33
T. Liu[3]	2010	China	Chemistry	29
Robert A. Slutsky[4]	1985–1987	USA	Cardiology	25
Scott S. Reuben[4]	2009–2010	USA	Anesthesiology	24
Naoki Mori[5]	2010–2011	Japan	Oncology	23
Friedhelm Herrmann[6]	1997–2003	Germany	Oncology	22
John R. Darsee[4]	1982–1984	USA	Cardiology	19
Pattium Chiranjeevi[7]	2008	India	Chemistry	19
Wataru Matsuyama[5]	2007–2010	Japan	Immunology	17
Suresh Radhakrishnan[8]	2010	USA	Immunology	15
M. Quik, G. Goldstein and collaborators	1993–1994	Canada	Physiology	15
Jon Sudbø[9]	2006–2007	Finland	Oncology	14

Grieneisen & Zhang (2012)

More bad news: Replikationen

Psychology

Replication in exonomics



Camerer et al. (2016)

Reproducibility Project: Psychology (RP:P)

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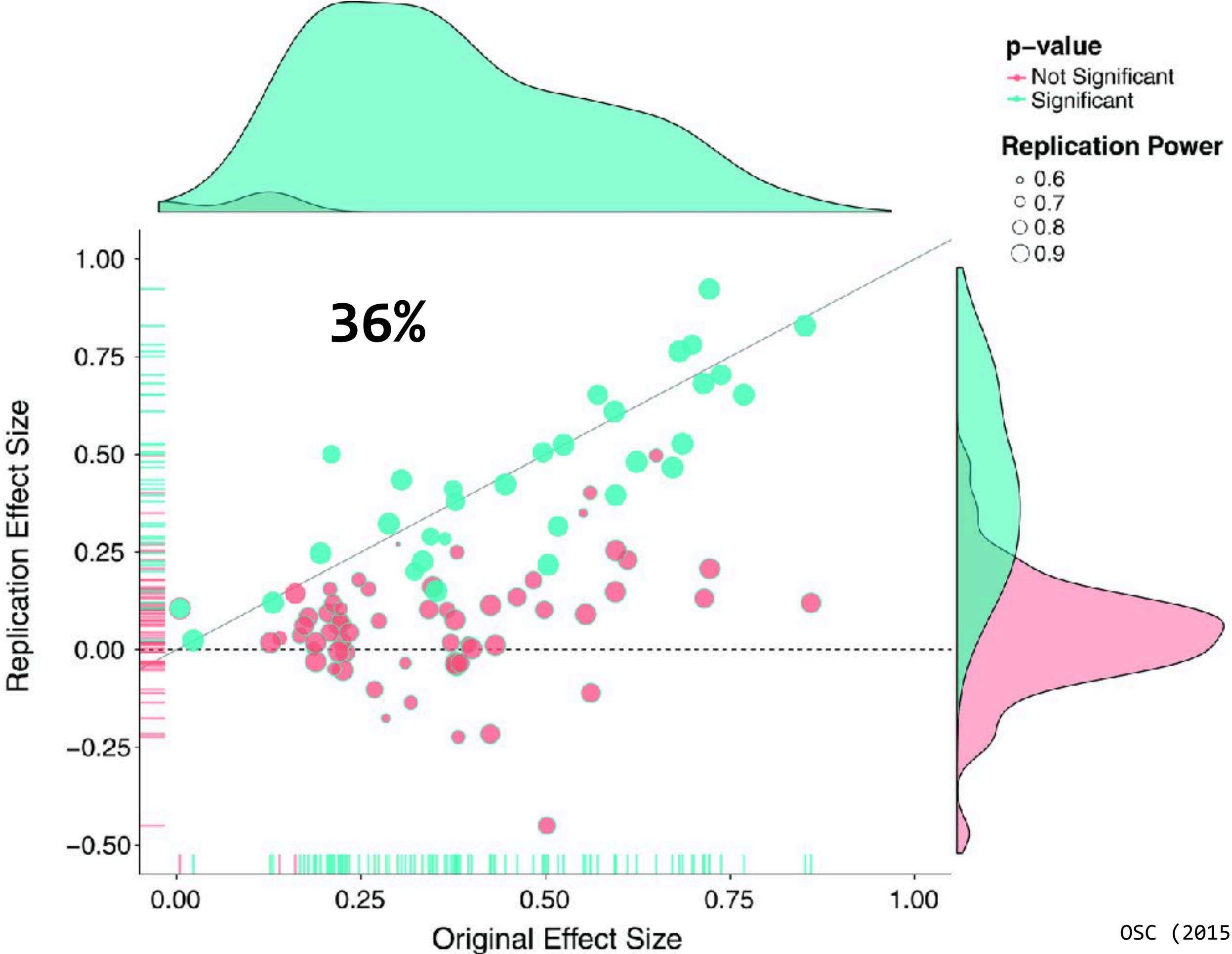
Reproducibility Project: Psychology (RP:P)

100 papers
Median Power = 95%
standardised protocol
feedback of original authors

OSC (2015)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Not Significant
Significant
Replication Power
0.6
0.7
0.8
0.9
36%
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
Replication Effect Size
0.00
0.25
0.50
0.75
1.00
Original Effect Size

OSC (2015)

AIM 2:
Unfuck psychological science

How do we do that?

1. Registered (Replication) Report (RRR)

Association for Psychological Science (2017)

2. Open Science (osf.io)

OPEN SCIENCE LEICHT GEMACHT

7 Schritte zu transparenter und zuverlässiger Forschung

1. Einen eigenen OSF-Account erstellen

Open Science Framework: (eine mögliche) Online-Plattform um den Forschungsprozess zu dokumentieren und transparent zu machen

- Auf **https://osf.io/** gehen
- Registrierung: Name, Email, Passwort
- Neues Projekt erstellen: 'My Projects' ➜ 'Create project' ➜ Titel geben➜ 'Create'
- Die URL des Projekts wird sich nicht mehr ändern ➜ kann ins Paper aufgenommen werden
- Für alle der folgenden Open Science (OS)-Aspekte nutzbar
- Wenn man bereit ist: Das Projekt von *Private* auf *Public* stellen

2. Eigene Studien präregistrieren

In einer Präregistrierung die Hypothesen, Methoden und Analysen vorab festlegen

- In OSF: 'Project overview' – 'registrations' – 'New registration'
- Template auswählen und ausfüllen
- Direkt oder später öffentlich machen (Embargo bis zu 4 Jahre)
- Präregistrierungen können…
  - knapp oder detailliert sein
  - vor/während/nach Datenerhebung erfolgen
  - konfirmatorische und auch explorative und offene Fragestellungen enthalten

3. Open Materials

Methoden und Materialen transparent und zugänglich machen

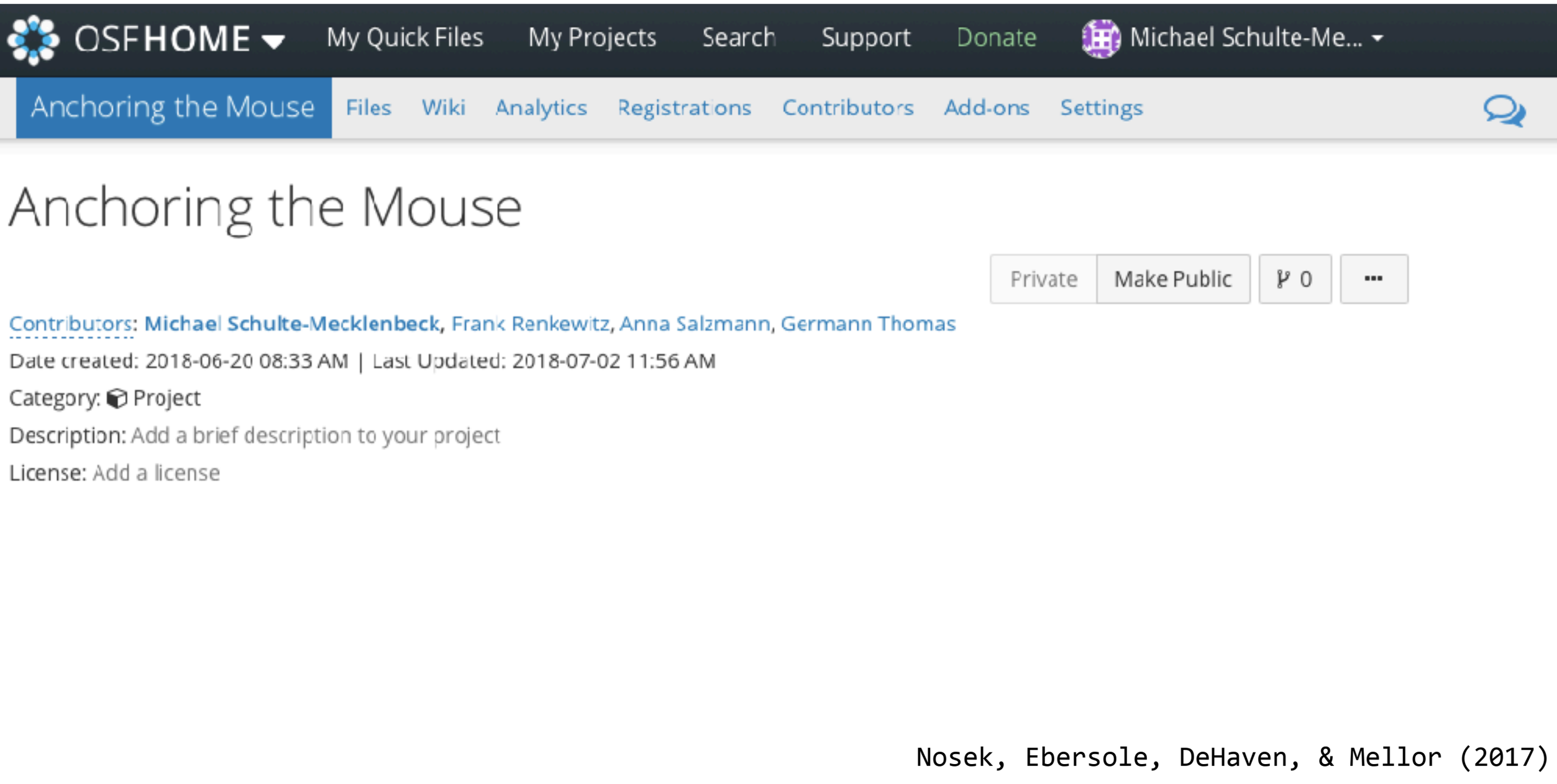
- Dokumente mit allen Abläufen, Methoden und Variablen im OSF-Projekt hochladen
- OSF-Link in Artikel integrieren
- Möglich sind einfache Listen bis detaillierte Codebücher
- Wann immer möglich: Originalfragebögen hochladen (Vorsicht bei urheberrechtlich geschütztem Material!)

4. Open Data

Forschungsdaten offen zugänglich machen

- In Einverständniserklärungen ankündigen
- Alle Primärdaten zur Verfügung stellen, die zur Reproduktion dieser Ergebnisse notwendig sind
- Anonymität sicherstellen (ggf. Variablen löschen, aggregieren, …)
- Codebuch aufbereiten
- Datendatei(en) und Codebücher im OSF-Projekt hochladen, Link in Artikel integrieren
- Daten zitierbar machen (doi)
- Vgl. DGPs-Empfehlungen zu offenen Daten: **http://bit.ly/dgpsdata**

3. Pre-Registration



Nosek, Ebersole, DeHaven, & Mellor (2017)

AIM 1:
Get to know (a bit of) process tracing

AIM 2:
Unfuck psychological science

TODOs

You will work on your tasks in 5 groups (see Groups.md)

Read papers

Introduce keynote speakers

Meet the Scientist session

Mousetracking study
plan, register, setup, run, analyse, present, write short report

Presentations will be on Saturday
10 + 3 minutes

Workshops

Pascal Kieslich

Mousetracking

Dirk Wulff

Anne Scheel
Replication

Eye Tracking
Stefan Hawelka

Keynotes

Neil Stewart

Ralph Hertwig

Susann Fiedler

Mirjam Jenny

Thanks to
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our keynote speakers
our support staff:
Brigitte Koch-Stockinger
Andreas Huttegger

Have fun!

@SchulteMi
@AntonKuehberger
#EADM2018