



PreFer

Predicting Fertility data challenge

How predictable are fertility outcomes?

Introducing the PreFer data challenge and its potential for fertility research



Elizaveta Sivak



Understanding
fertility outcomes
by quantifying the
(un)predictable



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Eyra

the dreamteam

Tom Emery

Javier Garcia-Bernardo

Seyit Höcük

Kasia Karpinska

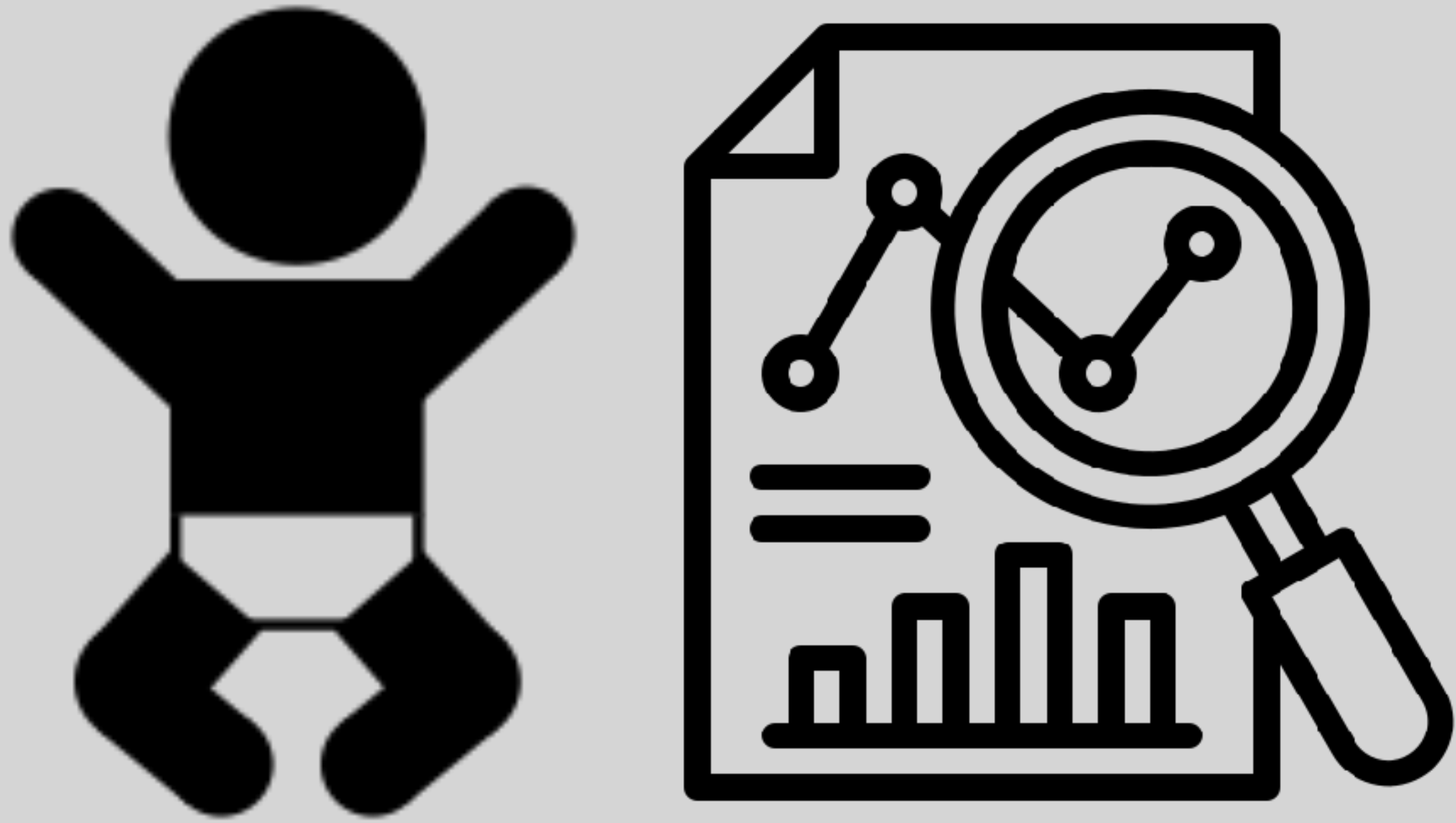
Angelica Maineri

Adriënne Mendrik

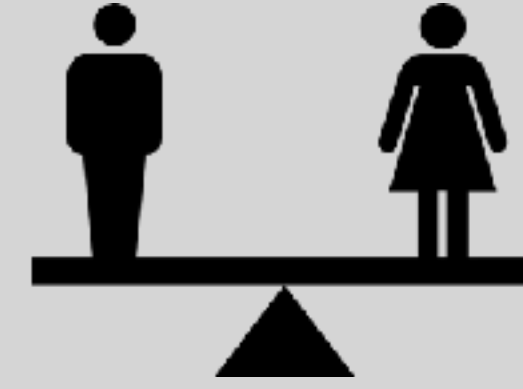
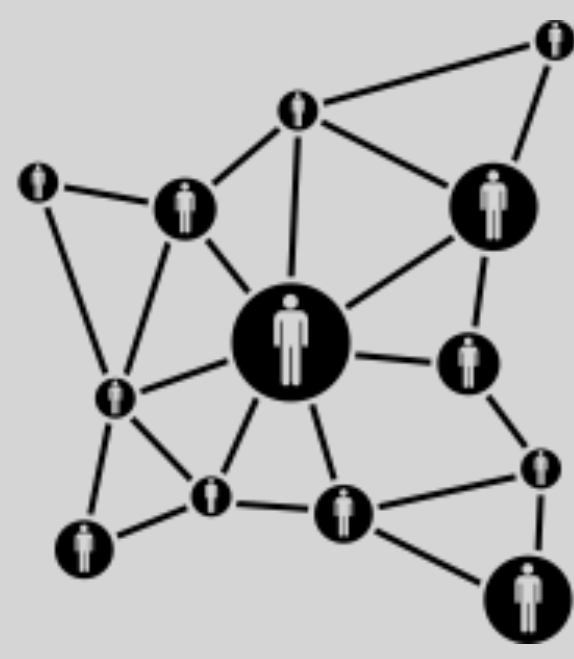
Joris Mulder

Malvina Nissim

Paulina Pankowska



Pre
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Predicting Fertility
data challenge



variables
explain
little

**Fewer
births
because of
study and
flexwork?**



“total effect on fertility ...
rather small

variables
explain
little

**Fewer
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surprising
patterns

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surprising
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Wealth, fertility and adaptive behaviour in industrial populations

Geert Dohet and Lander Kravitz

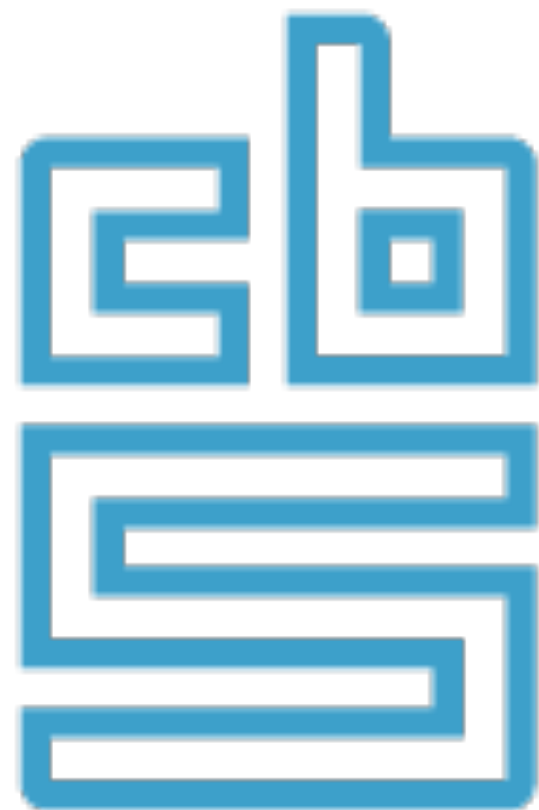
Department of Population Health, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK
Department of Psychology, University of Lethbridge, Lethbridge, Alberta T1K 3M4, Canada
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Abstract
The link of association between wealth and fertility in contemporary industrialized populations has often been used to question the value of an evolutionary perspective on human behaviour. Here, we first present the history of the debate, and the evolutionary implications for why wealth and fertility are negatively correlated in modern industrial societies. We suggest that the nature of the relationship between wealth and fertility varies as open questions because of the multi-faceted nature of wealth, and because existing cross-sectional studies are confounded with respect to how material wealth and fertility are linked. A literature review of longitudinal studies on wealth and fertility shows that the majority of these report positive effects of wealth, although levels of fertility seem to fall below theoretical world maximum levels. We propose that reproductive decision making reflects a complex interplay between individual and social factors that needs explicit evolutionary consideration, and highlight the role of resource scarcity on fertility decisions. We conclude by discussing whether the wealth-fertility relationship can inform us about the adaptiveness of modern fertility behaviour, and open up some research directions regarding evolutionary behaviour in humans.

1. Introduction
In an update to their classic formula presentation of 'rich get richer' (1), the authors of a recent paper (2) suggest that, in contemporary societies, there is a negative relationship between wealth and fertility (the number of children) that who close to a universal regularity (3). In 1988, Demography (4) argued similarly that wealth and fertility were decreasing in industrial societies, given that wealthier men did not father more offspring, despite higher mating success. These papers have been used to discontinue the 'initial theoretical problem of evolutionary' (5), an evolutionary theory account, but without an attempt to measure their fitness, then more resources should translate into a larger number of offspring, as seen in a range of pre-industrial populations (6,7). The lack of a positive relationship between resources and reproductive success also fits with the large-scale pattern of fertility decline in recent history, whereby lower children are born in more prosperous societies (8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18) (19) (20) (21) (22) (23) (24) (25) (26) (27) (28) (29) (30) (31) (32) (33) (34) (35) (36) (37) (38) (39) (40) (41) (42) (43) (44) (45) (46) (47) (48) (49) (50) (51) (52) (53) (54) (55) (56) (57) (58) (59) (60) (61) (62) (63) (64) (65) (66) (67) (68) (69) (70) (71) (72) (73) (74) (75) (76) (77) (78) (79) (80) (81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (98) (99) (100) (101) (102) (103) (104) (105) (106) (107) (108) (109) (110) (111) (112) (113) (114) (115) (116) (117) (118) (119) (120) (121) (122) (123) (124) (125) (126) (127) (128) (129) (130) (131) (132) (133) (134) (135) (136) (137) (138) (139) (140) (141) (142) (143) (144) (145) (146) (147) (148) (149) (150) (151) (152) (153) 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variables explain little

Fewer births because of study and flexwork?



total effect on fertility ... rather small



The pandemic delivered a surprise to Nordic countries: a baby boom. The long, dark winters may be great for making babies, but financial incentives play a bigger role.

surprising patterns

incomparable results

PHILOSOPHICAL TRANSACTIONS B. Wealth, fertility and adaptive behaviour in industrial populations. Review by Gert Stuber and Leslie Knapp. The link of association between wealth and fertility in contemporary industrialized populations has often been used to question the value of an evolutionary perspective on human behaviour.

ities, Part I. ities, Part II. Secondary database. and Models; Kappel Steen. The link of association between wealth and fertility in contemporary industrialized populations has often been used to question the value of an evolutionary perspective on human behaviour.

Population Review. Explaining the Associations of Education and Occupation with Childlessness: The Role of Expectations and Expectations in Women's Childless. From Some to None? Fertility Expectations of Permanently Childless Women. Children's Expectations and Children's Life Course. Introduction. The pandemic delivered a surprise to Nordic countries: a baby boom.

non-replicable results

Replication Crisis

PSYCHOLOGY

Estimating the reproducibility of psychological science

Open Science Collaboration*

ROYAL SOCIETY
OPEN SCIENCE

rsos.royalsocietypublishing.org

Research



Cite this article: Smaldino PE, McElreath R.
2016 The natural selection of bad science.

The natural selection of bad science

Paul E. Smaldino¹ and Richard McElreath²

¹Cognitive and Information Sciences, University of California, Merced, CA 95343, USA

²Department of Human Behavior, Ecology, and Culture, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

PES, 0000-0002-7133-5620; RME, 0000-

Check for updates

General Article

False-Positive Psychology: Undisclosed Flexibility in Data Collection and Analysis Allows Presenting Anything as Significant

Joseph P. Simmons¹, Leif D. Nelson², and Uri Simonsohn¹

¹The Wharton School, University of Pennsylvania, and ²Haas School of Business, University of California, Berkeley

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ASSOCIATION FOR
PSYCHOLOGICAL SCIENCE

Psychological Science
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DOI: 10.1177/0956797611417632
<http://pss.sagepub.com>

Replication (crisis) in Family Sociology / Demography?

Reasons unlikely

- ✓ *Strong methods*
- ✓ *Strong focus on representative data*
- ✓ *Less measurement error*
- ✓ *Open data*
- ✓ *Large N*
- ✓ *Often descriptive*

Reasons not unlikely

Replication (crisis) in Family Sociology / Demography?

Reasons unlikely

- ✓ *Strong methods*
- ✓ *Strong focus on representative data*
- ✓ *Less measurement error*
- ✓ *Open data*
- ✓ *Large N*
- ✓ *Often descriptive*

Reasons not unlikely

- ✗ *Non-experimental*
- ✗ *Correlational, but little causal inference*
- ✗ *Large N, yet star gazing*
- ✗ *Controlling at will*
- ✗ *Long reign linearity*

Predictability Crisis?



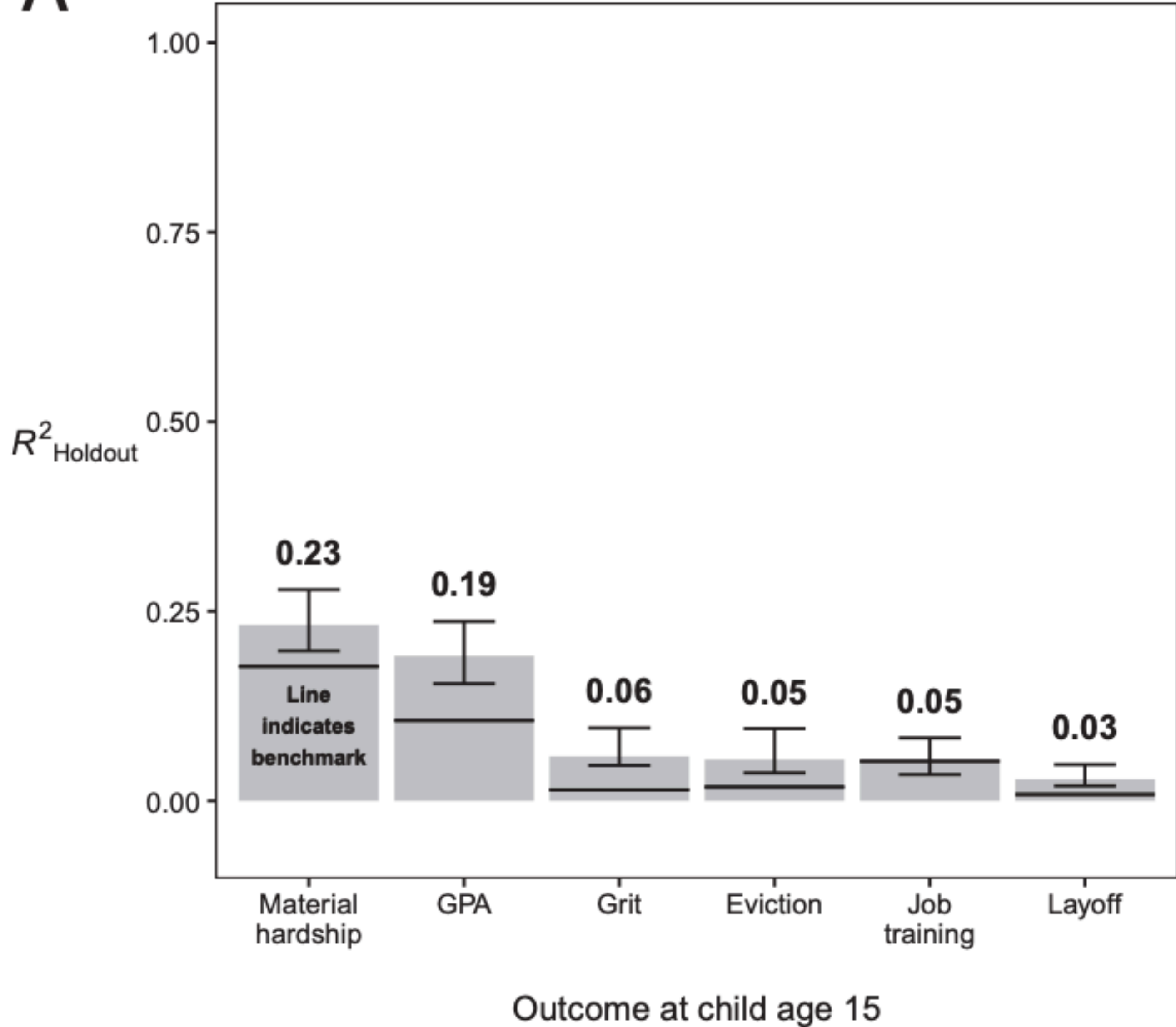
Measuring the predictability of life outcomes with a scientific mass collaboration

Matthew J. Salganik^{a,1}, Ian Lundberg^a, Alexander T. Kindel^a, Caitlin E. Ahearn^b, Khaled Al-Ghoneim^c, Abdullah Almaatouq^{d,e}, Drew M. Altschul^f, Jennie E. Brand^{b,g}, Nicole Bohme Carnegie^h, Ryan James Comptonⁱ, Debanjan Datta^j, Thomas Davidson^k, Anna Filippova^l, Connor Gilroy^m, Brian J. Goodeⁿ, Eaman Jahani^o, Ridhi Kashyap^{p,q,r}, Antje Kirchner^s, Stephen McKay^t, Allison C. Morgan^u, Alex Pentland^e, Kivan Polimis^v, Louis Raes^w, Daniel E. Rigobon^x, Claudia V. Roberts^y, Diana M. Stanescu^z, Yoshihiko Suhara^e, Adaner Usmani^{aa}, Erik H. Wang^z, Muna Adem^{bb}, Abdulla Alhajri^{cc}, Bedoor AlShebli^{dd}, Redwane Amin^{ee}, Ryan B. Amos^y, Lisa P. Argyle^{ff}, Livia Baer-Bositis^{gg}, Moritz Büchi^{hh}, Bo-Ryehn Chungⁱⁱ, William Eggert^{jj}, Gregory Faletto^{kk}, Zhilin Fan^{ll}, Jeremy Freese^{gg}, Tejomay Gadgil^{mm}, Josh Gagné^{gg}, Yue Gaoⁿⁿ, Andrew Halpern-Manners^{bb}, Sonia P. Hashim^y, Sonia Hausen^{gg}, Guanhua He^{oo}, Kimberly Higuera^{gg}, Bernie Hogan^{pp}, Ilana M. Horwitz^{qq}, Lisa M. Hummel^{gg}, Naman Jain^x, Kun Jin^{rr}, David Jurgens^{ss}, Patrick Kaminski^{bb,tt}, Areg Karapetyan^{uu,vv}, E. H. Kim^{gg}, Ben Leizman^y, Naijia Liu^z, Malte Möser^y, Andrew E. Mack^z, Mayank Mahajan^y, Noah Mandell^{ww}, Helge Marahrens^{bb}, Diana Mercado-Garcia^{qq}, Viola Mocz^{xx}, Katariina Mueller-Gastell^{gg}, Ahmed Musse^{yy}, Qiankun Niu^{ee}, William Nowak^{zz}, Hamidreza Omidvar^{aaa}, Andrew Or^y, Karen Ouyang^y, Katy M. Pinto^{bbb}, Ethan Porter^{ccc}, Kristin E. Porter^{ddd}, Crystal Qian^y, Tamkinat Rauf^{gg}, Anahit Sargsyan^{eee}, Thomas Schaffner^y, Landon Schnabel^{gg}, Bryan Schonfeld^z, Ben Sender^{fff}, Jonathan D. Tang^y, Emma Tsurkov^{gg}, Austin van Loon^{gg}, Onur Varol^{ggg,hhh}, Xiafei Wangⁱⁱⁱ, Zhi Wang^{hhh,jjj}, Julia Wang^y, Flora Wang^{fff}, Samantha Weissman^y, Kirstie Whitaker^{kkk,ill}, Maria K. Wolters^{mmm}, Wei Lee Woonⁿⁿⁿ, James Wu^{ooo}, Catherine Wu^y, Kengran Yang^{aaa}, Jingwen Yin^{ll}, Bingyu Zhao^{ppp}, Chenyun Zhu^{ll}, Jeanne Brooks-Gunn^{qqq,rrr}, Barbara E. Engelhardt^{y,ii}, Moritz Hardt^{sss}, Dean Knox^z, Karen Levy^{ttt}, Arvind Narayanan^y, Brandon M. Stewart^a, Duncan J. Watts^{uuu,vvv,wwww}, and Sara McLanahan^{a,1}

data challenge:
predicting life outcomes
based on ~6000 variables by
160 teams
both theory- & data-driven

A

Best submission for each outcome



Predictability Crisis?

“

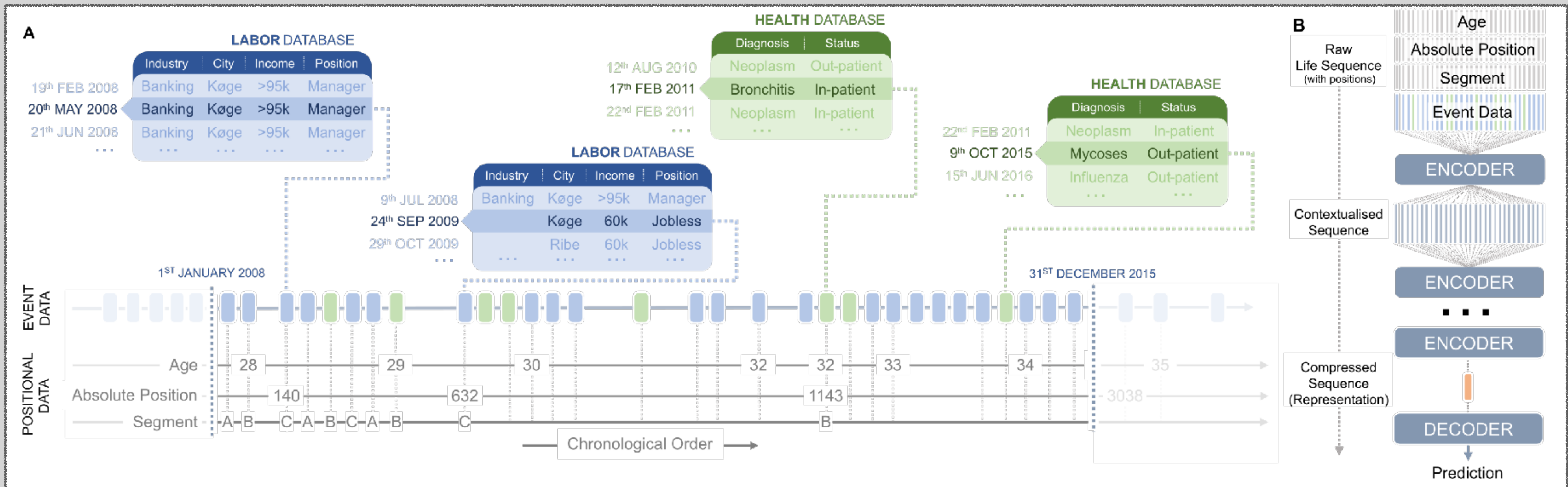
Social scientists studying the life course must find a way to reconcile a widespread belief that understanding has been generated by these data—as demonstrated by more than 750 published journal articles using the Fragile Families data with the fact that the very same data could not yield accurate predictions of these important outcomes.

Using Sequences of Life-events to Predict Human Lives

Germans Savcisens, Tina Eliassi-Rad, Lars Kai Hansen, Laust Hvas Mortensen, Lau Lilleholt, Anna Rogers, Ingo Zettler, and Sune Lehmann

June 6, 2023

“ we show that accurate individual predictions are indeed possible



Prediction

a shift towards **prediction**
leads to a more reliable
and useful social science

out-of-sample predictive ability:

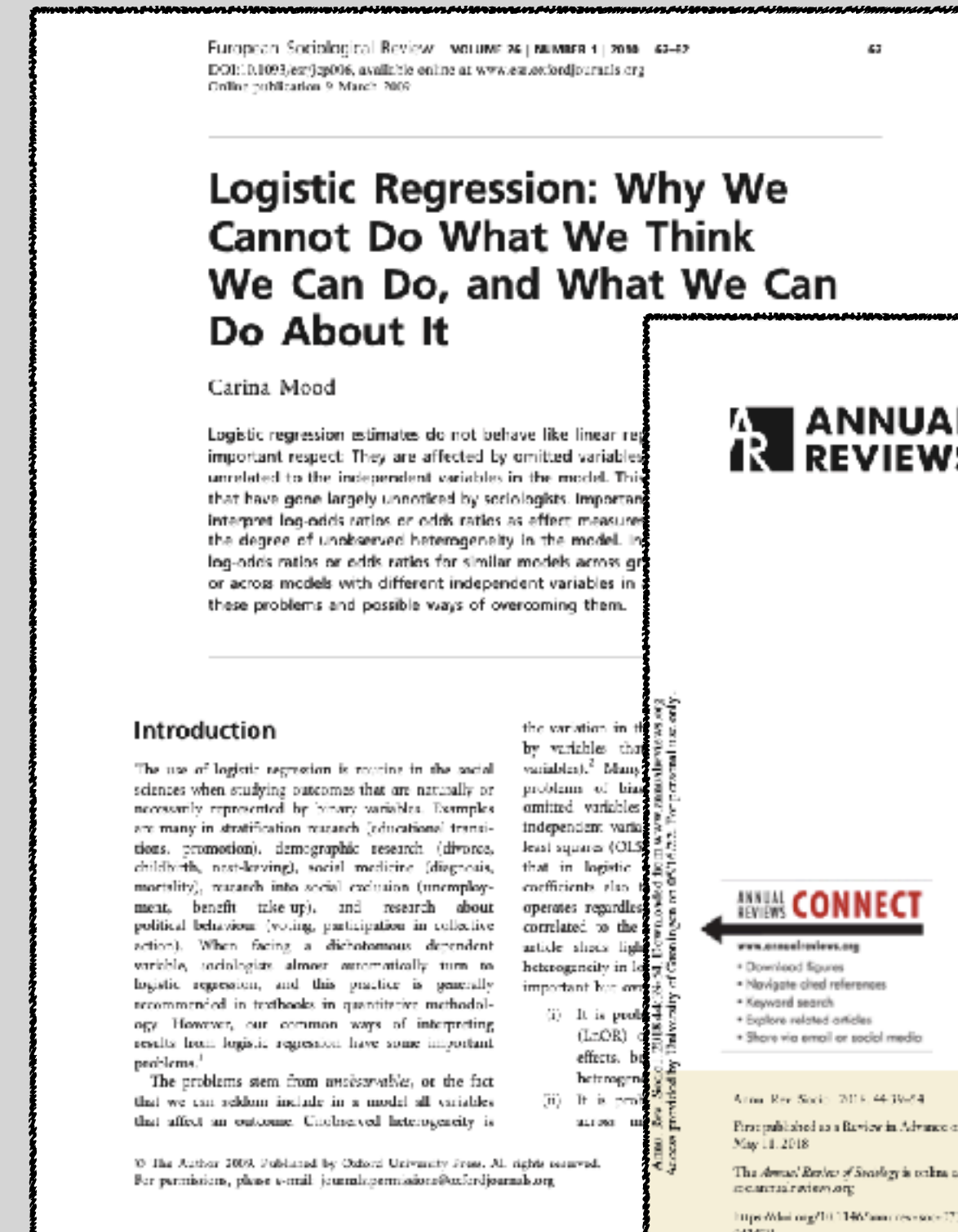


clear measure of
effect size



out-of-sample predictive ability

- ✓ *is easy(ier) to understand*
- ✓ *can be compared across analytical techniques*
- ✓ *can be compared across models*
- ✓ *is less gameable*



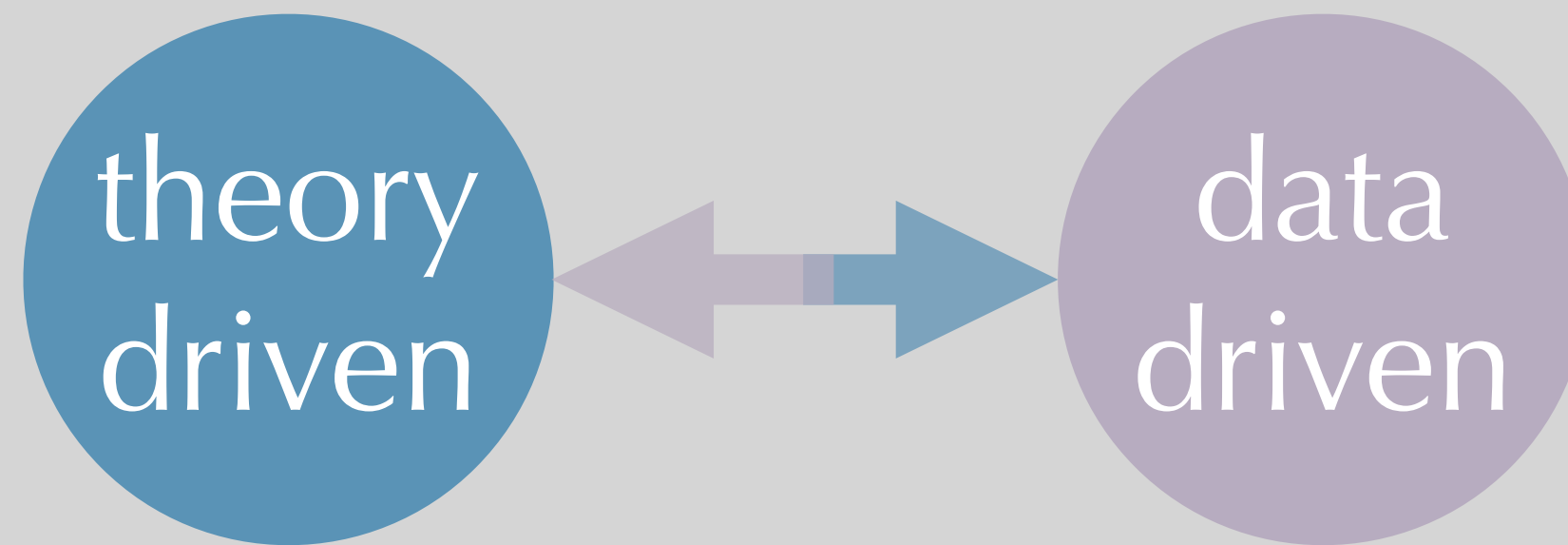
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facilitates dialogue
theory- and data-
driven models

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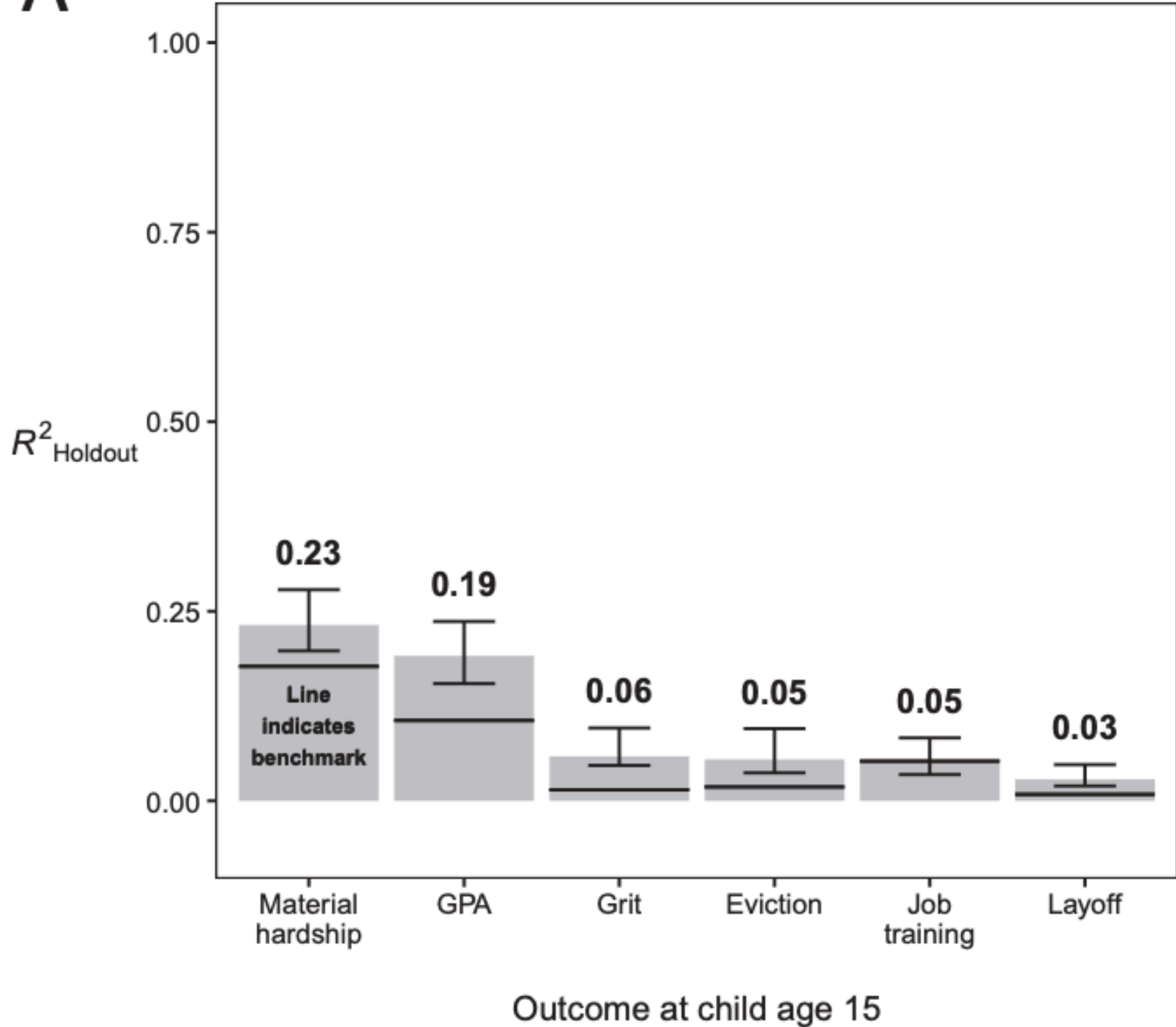
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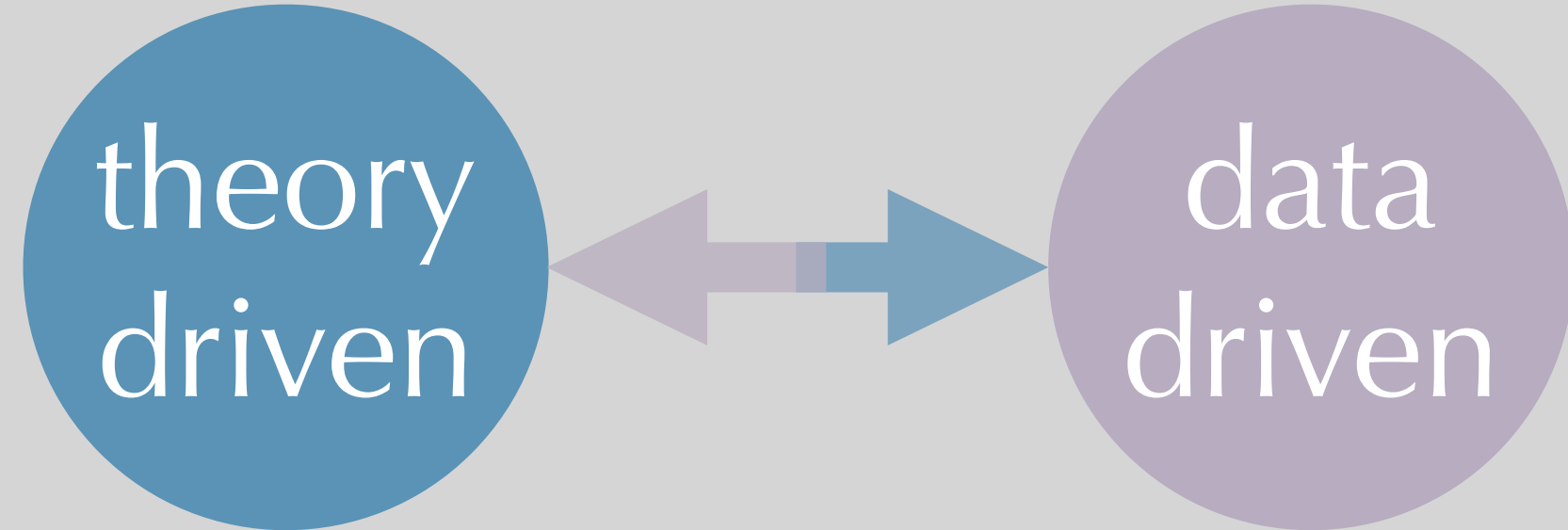
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out-of-sample predictive ability:



clear measure of effect size



facilitates dialogue theory- and data-driven models



measure of distance theory and practice



out-of-sample predictive ability
is a measure of how useful
our theory is in the real world

Articles

Journal of
peace
RESEARCH

**The perils of policy by p-value: Predicting
civil conflicts**

Michael D Ward

Department of Political Science, Duke University

Brian D Greenhill

Department of Political Science, University of Washington

Kristin M Bakke

Department of Political Science, University College London

Journal of Peace Research
47(4) 363–375
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DOI: 10.1177/0022343309356491
jpr.sagepub.com



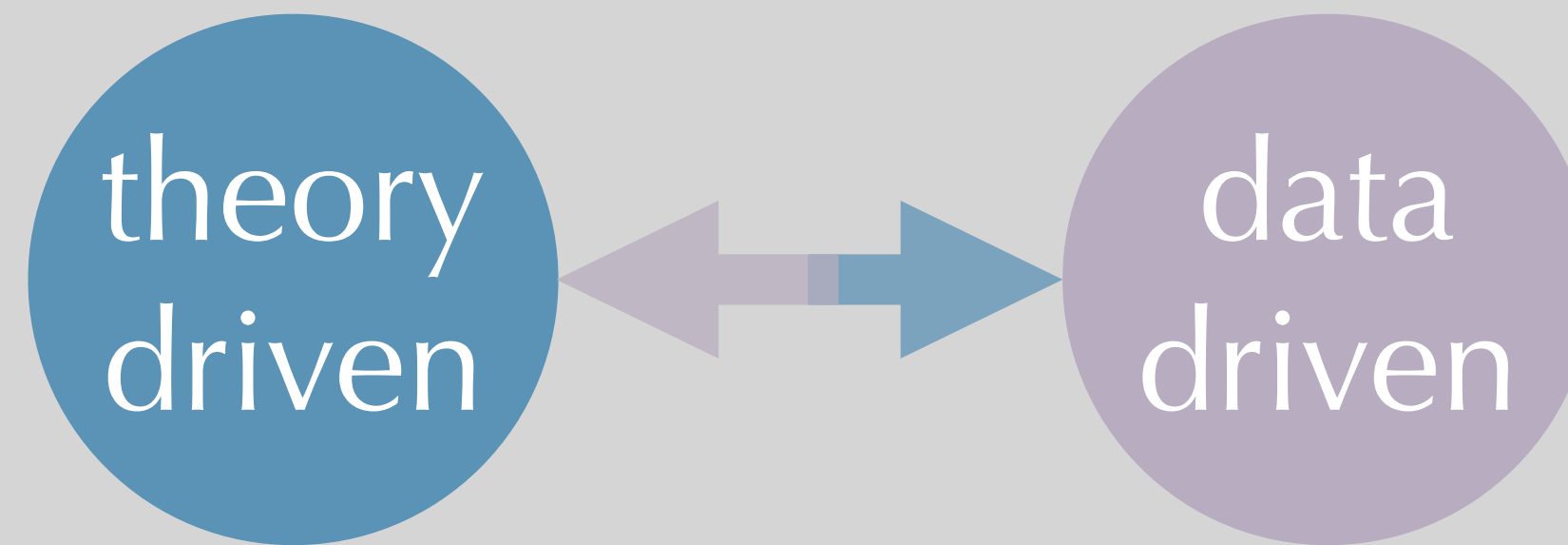
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facilitates dialogue
theory- and data-
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measure of distance
theory and practice


data challenge







theory
driven

data
driven

theory- and data-driven teams
engage in common task
using common data
and common metric

🕒 **Active Competitions** Hotness ▾ 

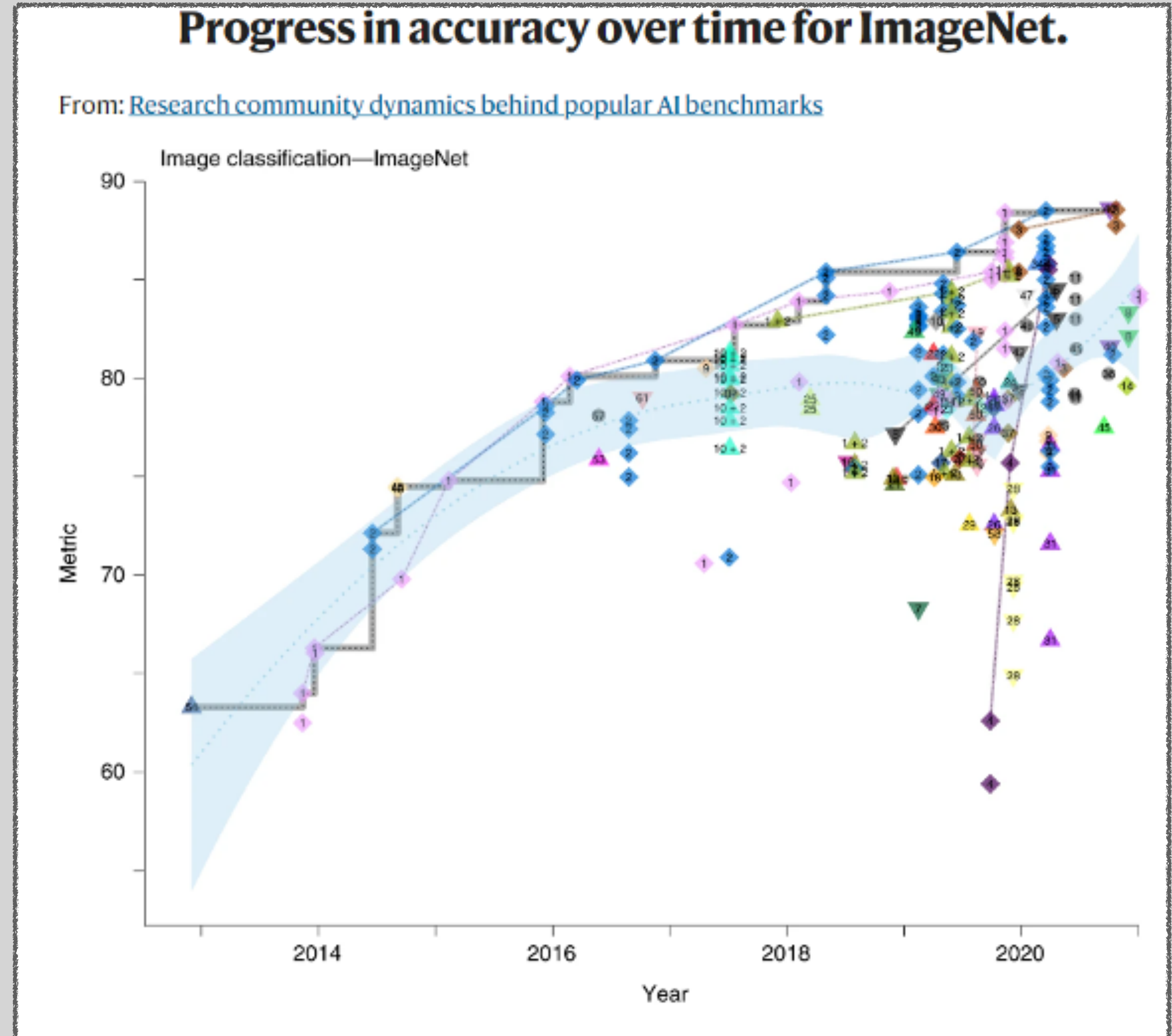
Competition	Prize	Time Left
 Google AI4Code – Understand Code in... Predict the relationship between co... Featured Code Competition · 166 Teams	\$150,000	3 months to go
 JPX Tokyo Stock Exchange Prediction Explore the Tokyo market with your ... Featured Code Competition · 983 Teams	\$63,000	2 months to go
 U.S. Patent Phrase to Phrase Matching Help Identify Similar Phrases in U.S. ... Featured Code Competition · 1258 Teams	\$25,000	a month to go
 Foursquare - Location Matching Match point of interest data across ... Featured Code Competition · 489 Teams	\$25,000	2 months to go

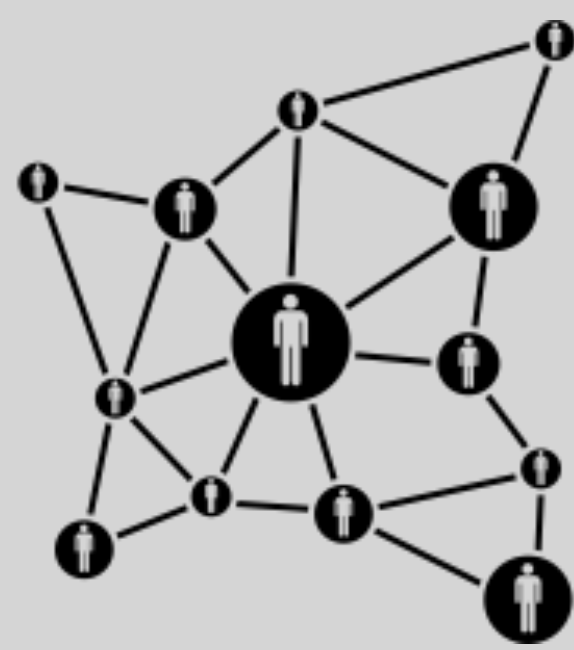
“secret sauce of data science
Donoho, 2015

Prediction Benchmarks

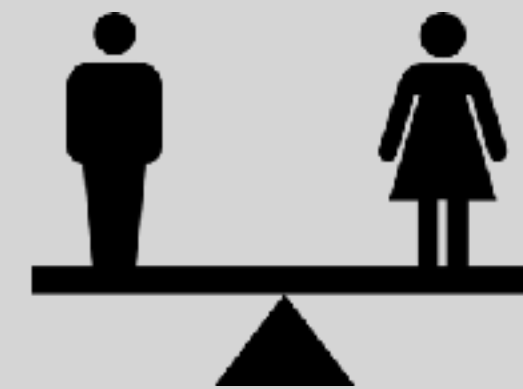
“Progress usually comes from many small improvements; a change of 1% can be a reason to break out the champagne

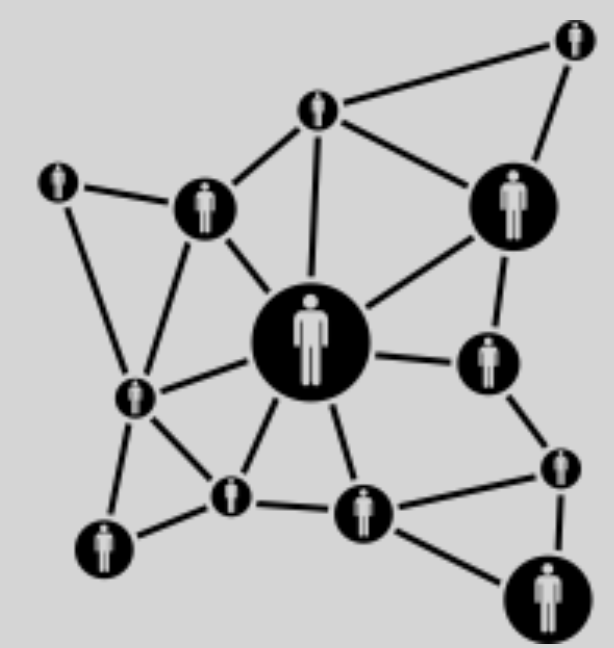
Liberman, 2012



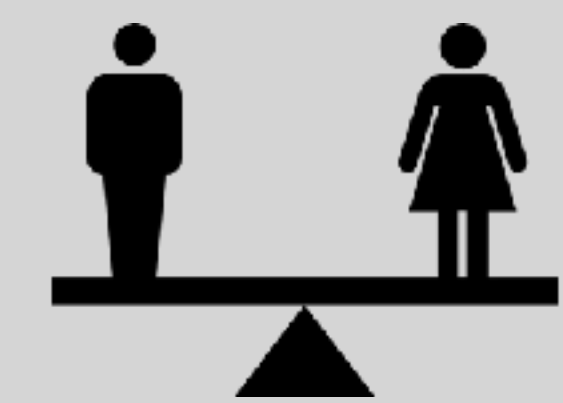


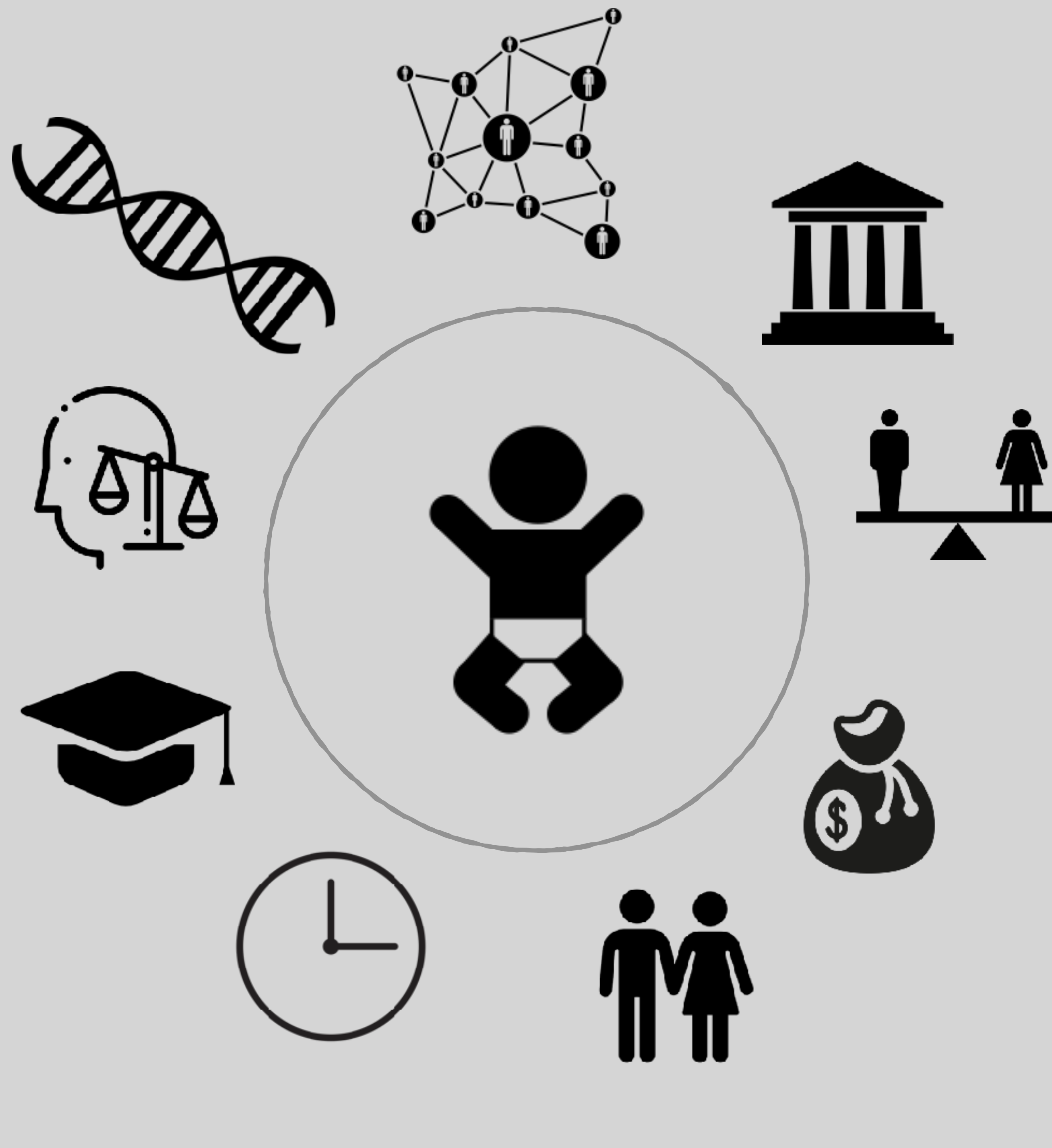
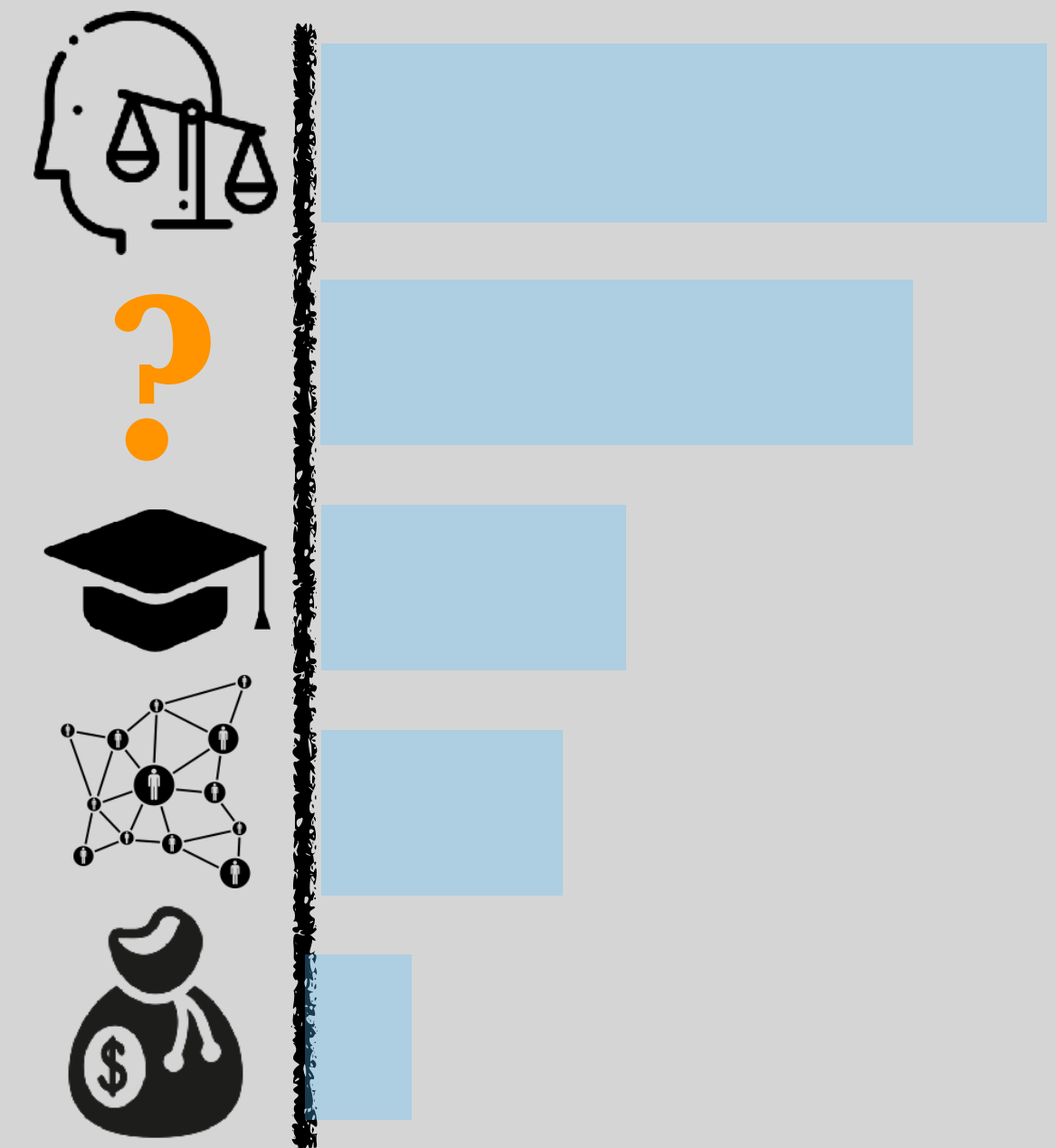
...%?



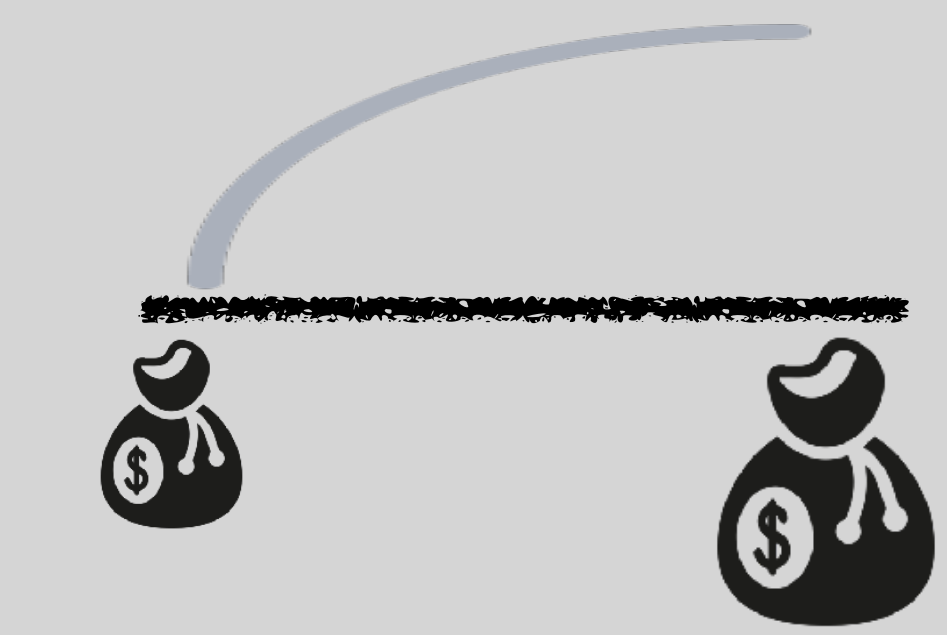


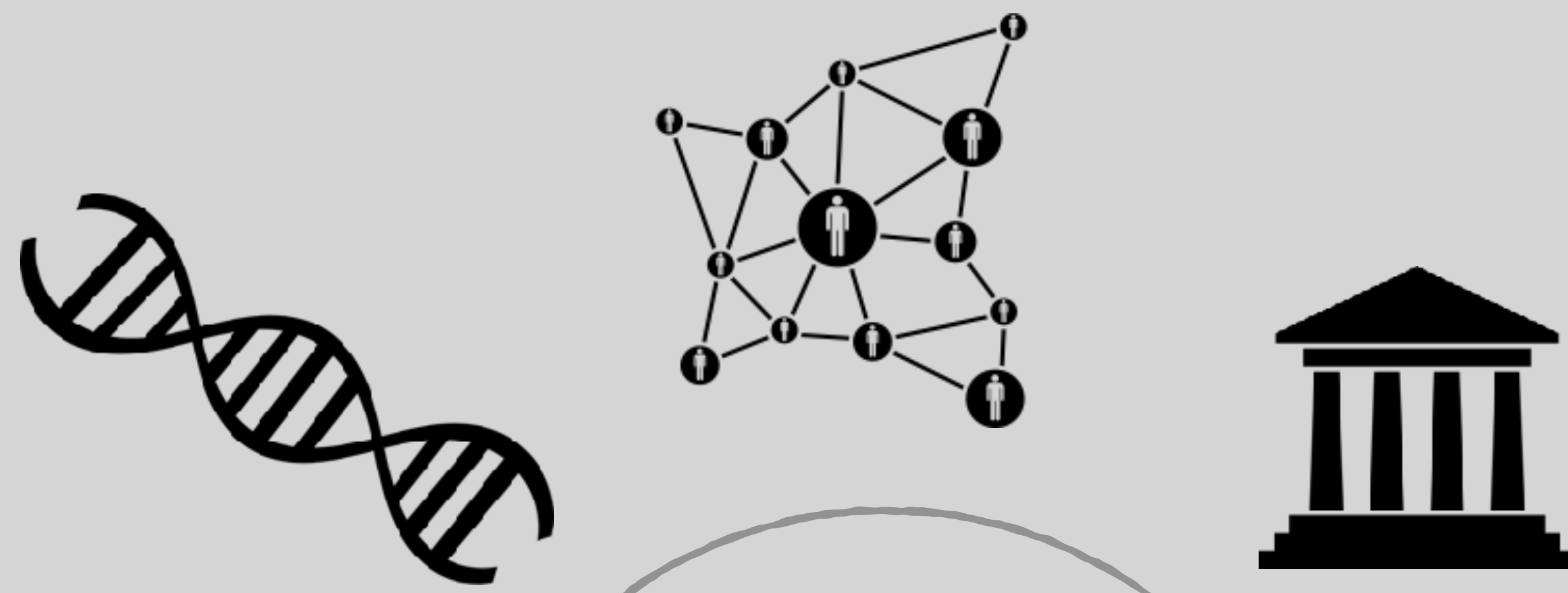
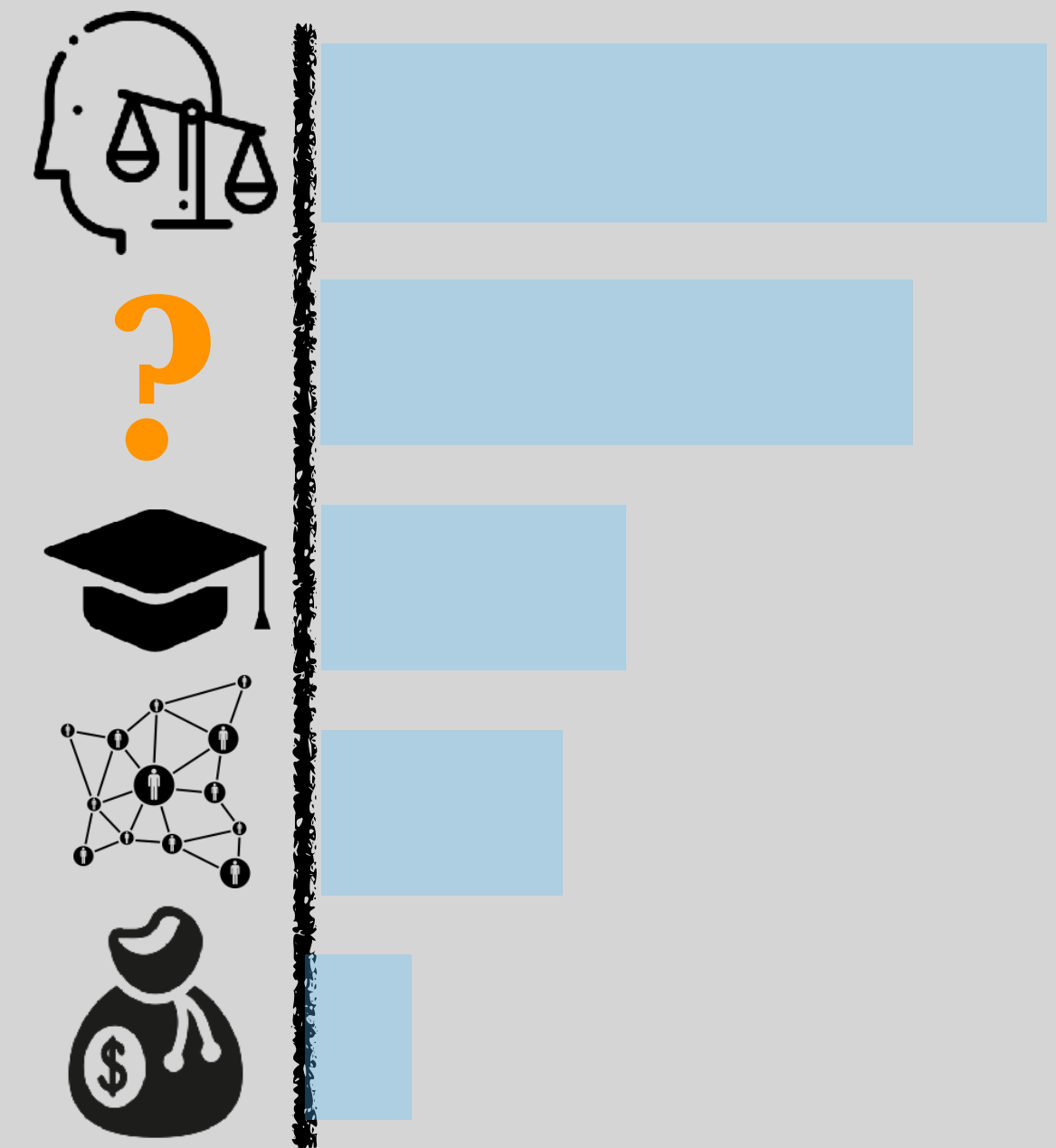
...%?



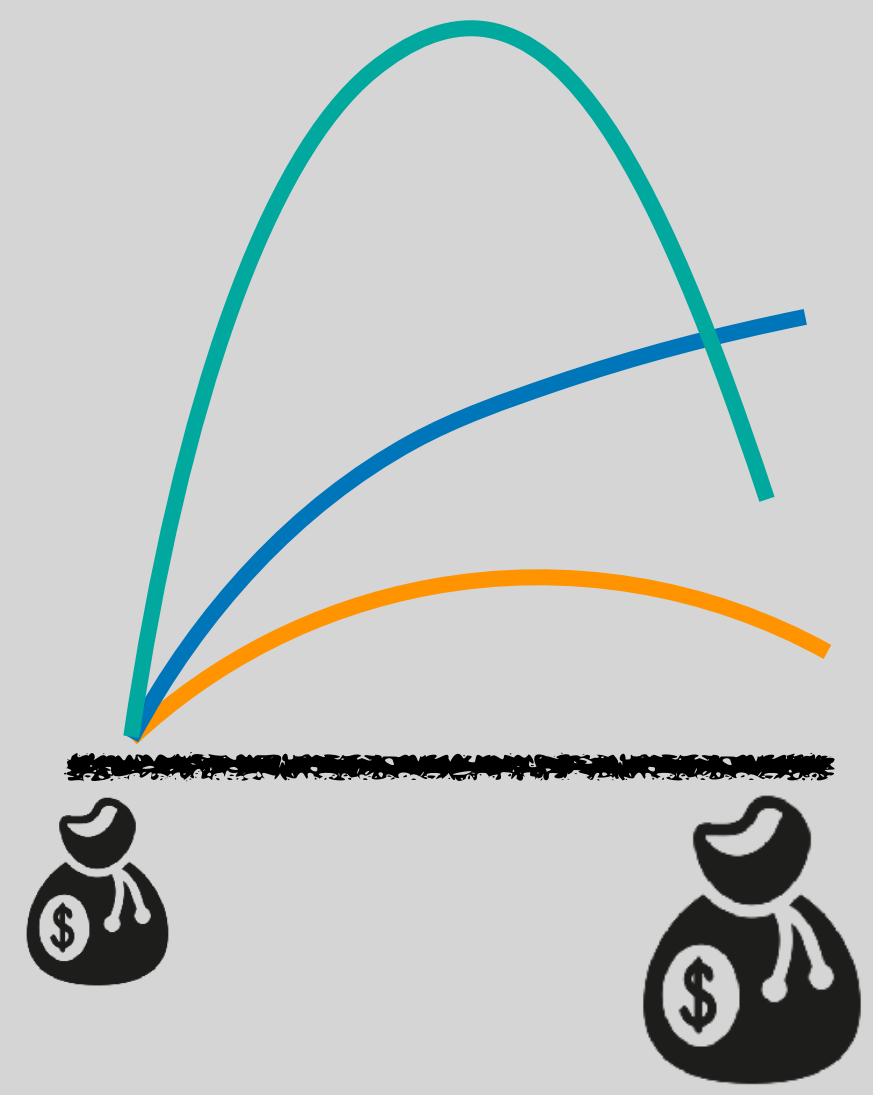
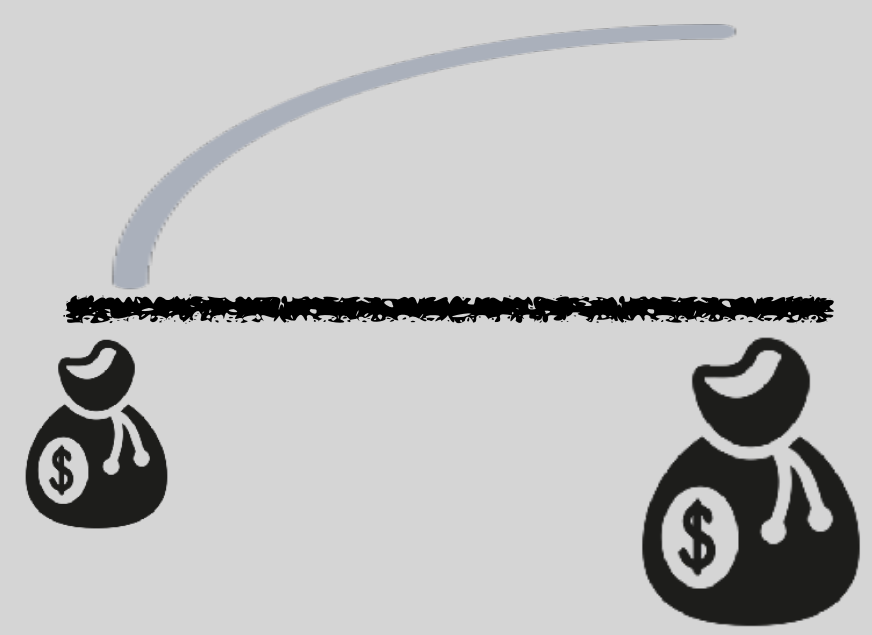


...%?





...%?





**Predicting Fertility
data challenge**



Predicting Fertility data challenge

theory- and data-driven teams
engage in common task
using common data
and common metric

Common Task



To predict who will have a child in the next three years

**Outcome
['21-'23]**

Background data
[data from 1995/2007
up to 2020]
[ages 18-45]

70%

TRAIN

30%

**HOLD-
OUT**

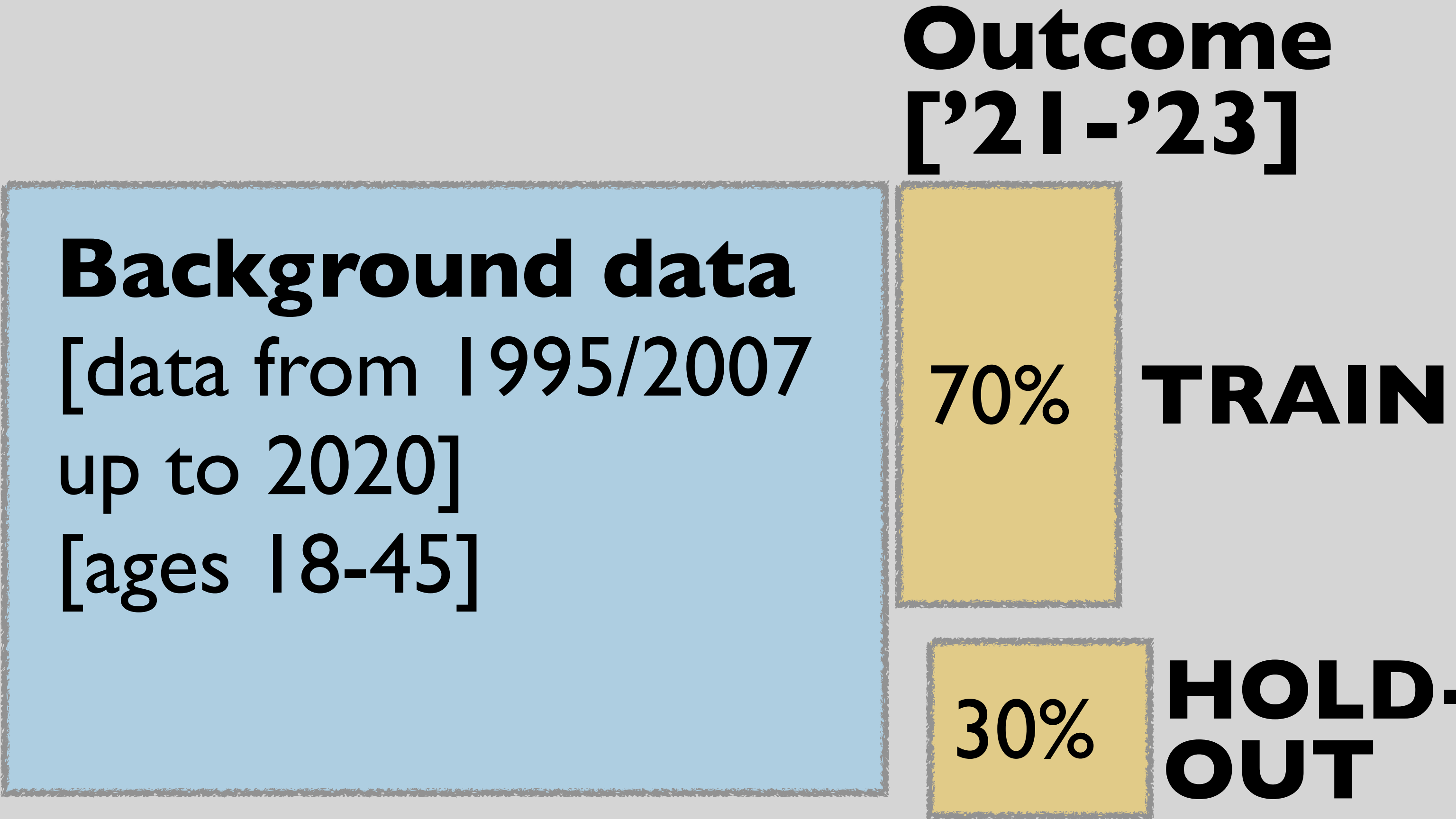
Common Task

Rationale

- ✓ **Difficult!**
[minimal policy-relevant test]
- ✓ **Parity-specific**
- ✓ **Data availability**
[longer prediction timespan means fewer background data]



To predict who will have a child in the next three years



Common Data

1



LISS panel

panel survey [2007 - current]

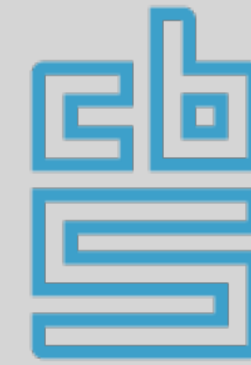
~1200 cases

‘objective’ and ‘subjective’ measures

15 waves x 10 core surveys

1000s variables

2



Social Statistics Netherlands

register data [1995 - current]

6 milion cases

‘objective’ measures

100s variables

(10000s variables?)

Common Data

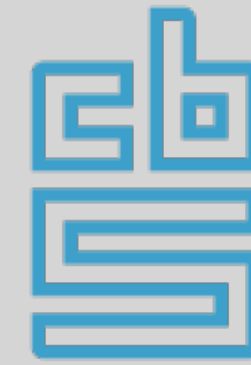
1



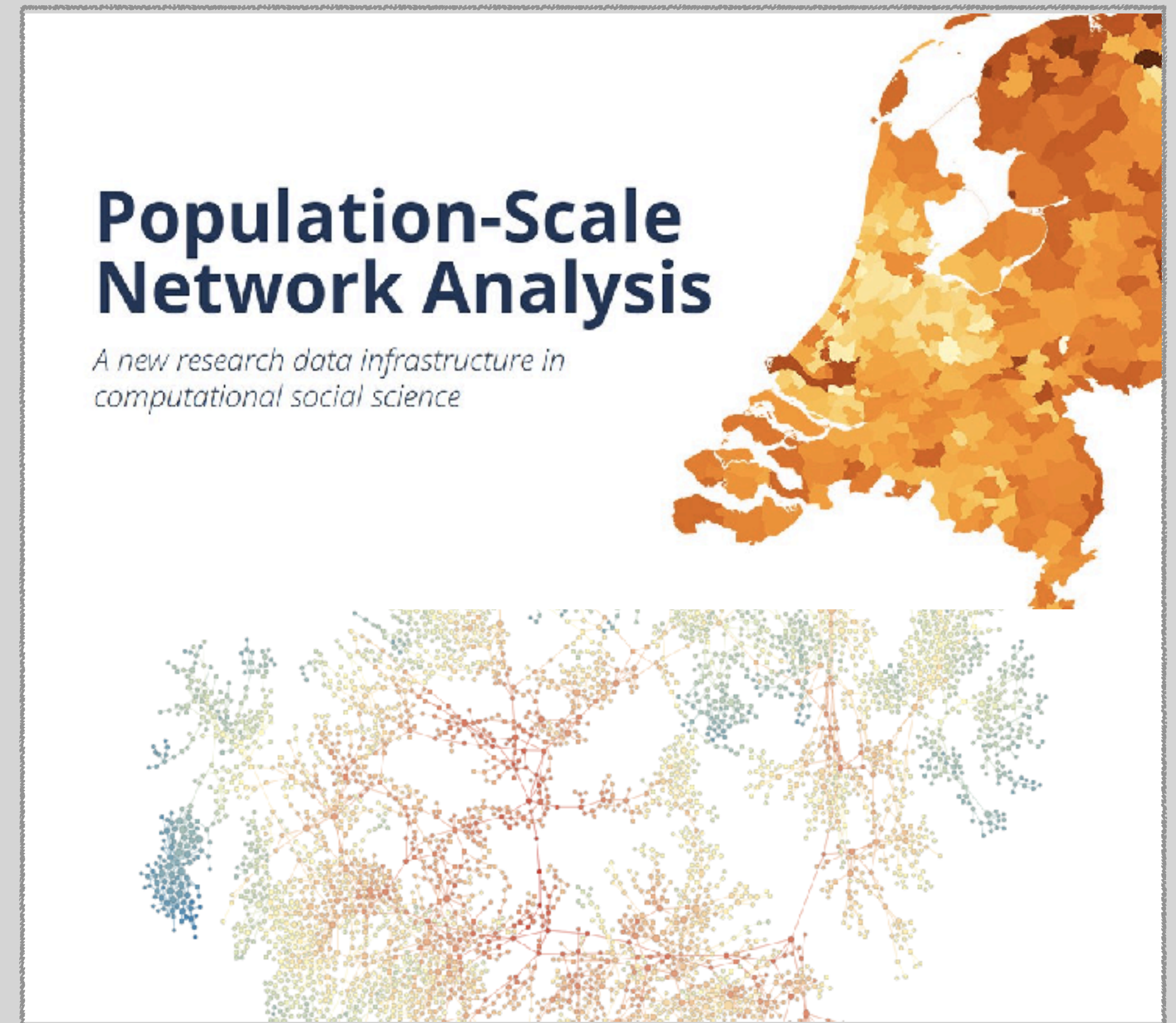
LISS panel

Background variables
Health
Religion and Ethnicity
Social Integration and Leisure
Family and Household
Work and Schooling
Personality
Politics and Values
Economic Situation:
Assets, Income, Housing

2



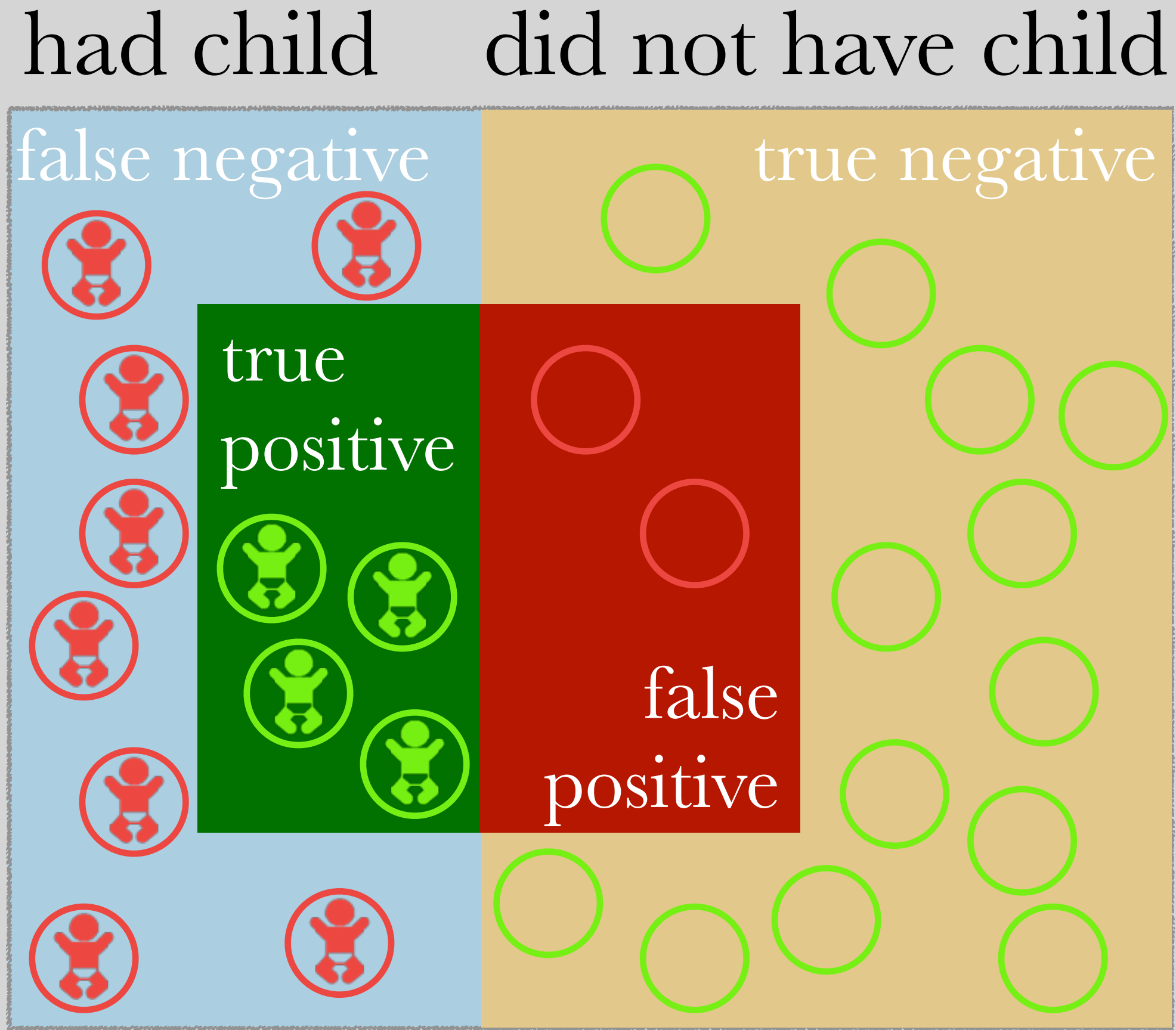
Social Statistics Netherlands




Common Metric: F1

precision = $\frac{\text{green bar}}{\text{green bar} + \text{red bar}}$ among those predicted to have child, % who had child

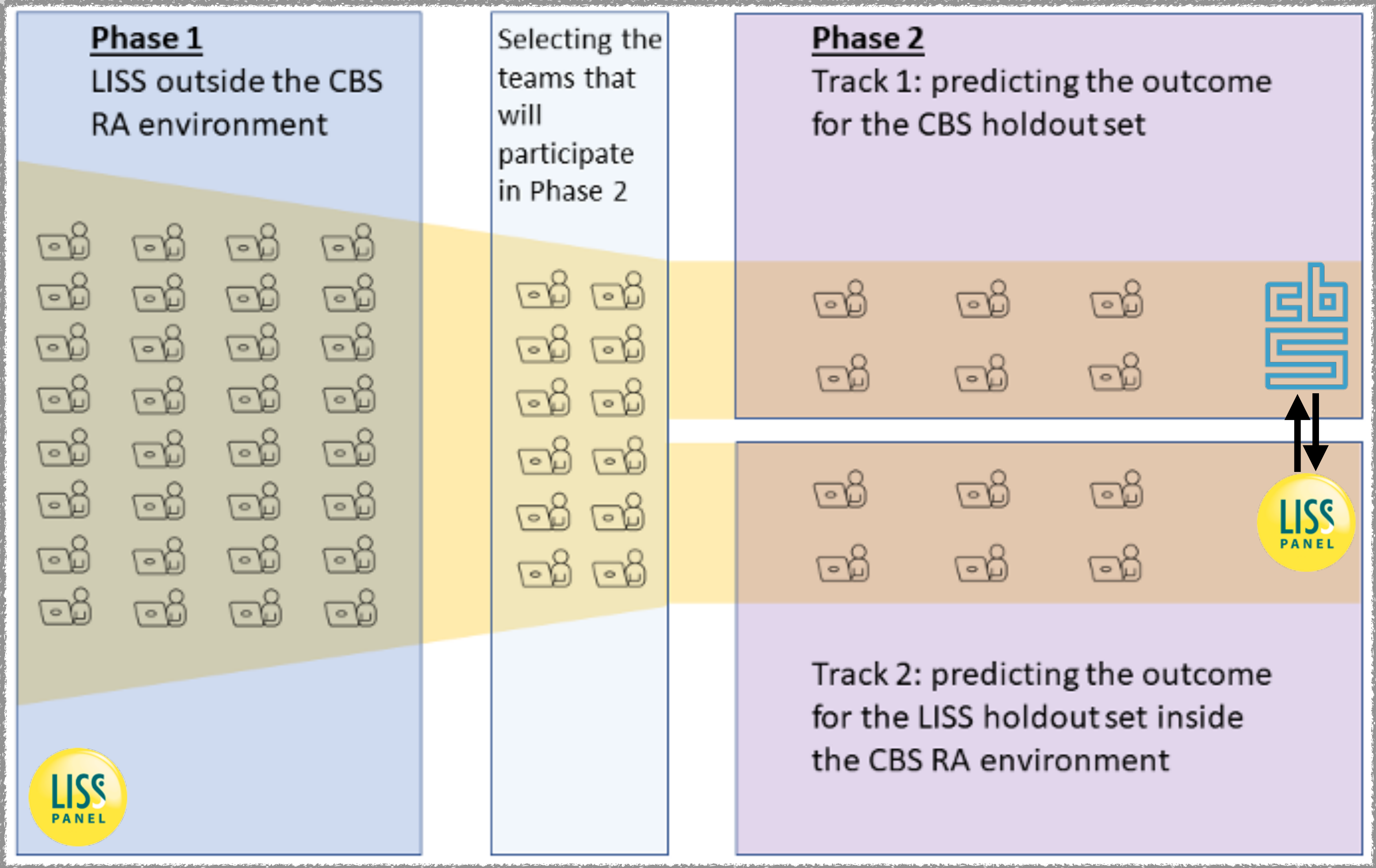
recall = $\frac{\text{green bar}}{\text{light blue bar} + \text{green bar}}$ among those who had child, % predicted to have child



harmonic mean of precision and recall:

 $F1 = 2 \frac{\text{precision} \cdot \text{recall}}{\text{precision} + \text{recall}}$

Overview



Evaluation criteria:

- ✓ F1 score [3 winners]
- ✓ Qualitative criteria [2 winners]
 - innovativeness: novel approach from social- or data science
 - improving understanding: what have we learned about fertility



DETAILS ABOUT THE CHALLENGE



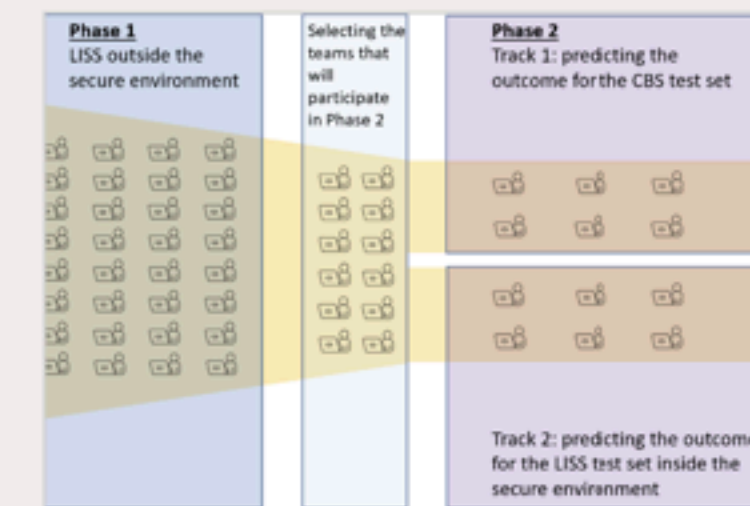
The goal and research questions

The goal of the data challenge is to assess the current predictability of individual-level fertility and improve our understanding of fertility behaviour.



Data

PreFer uses two datasets: the LISS panel and Dutch population registries data.



Phases of the challenge

The challenge includes two phases.



Evaluation and winners

Evaluation criteria and determining the winners.



Submission

Description of the submission process.




Special issue and community paper

Results will be published in a community paper and in a special issue of a journal.

Timeline

January-March 2024	April-May 2024	June-September 2024	October 2024	2024 - 2025
Application	Phase 1	Phase 2	Evaluation	Analysis
Sign up to get notified when the application opens	Predict the outcome for the LISS holdout set	Predict the outcome for the LISS holdout set or/and CBS holdout set inside CBS RA	Evaluating the submissions and announcing the winners	Analyzing submitted methods, preparing publications

select winner phase 1 & teams for phase 2



Who Can Participate?

1



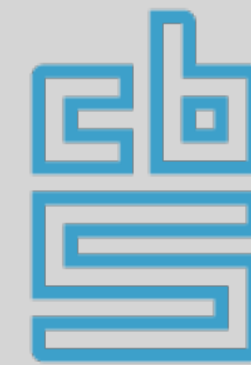
LISS panel

No restrictions, but:

Access after data agreement

Data on your own computer

2



Social Statistics Netherlands

Restricted access

Only after vetting procedure

Remote secure environment

No uploads/downloads possible

Only available from within
European Union + selected
countries

Why Participate?



✓ eternal glory

✓ talk at and paid-for-trip to conference in exotic Netherlands

✓ publish paper [special issue]

✓ contribute to fertility research / computational social science

✓ work with amazing data

✓ test your ML skills and favourite algorithms

✓ students: learn new skills

✓ use in/for teaching



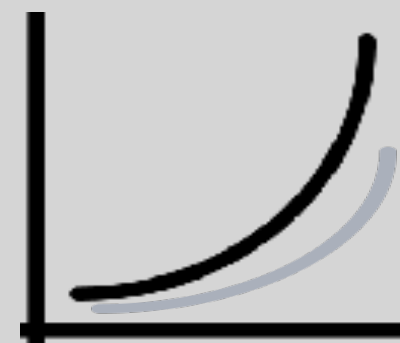
What Can We Learn?

Science

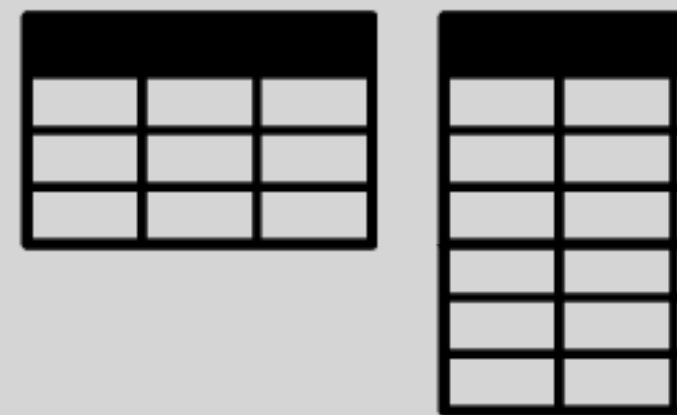
Establish predictive ability
and set benchmarks



Novel understanding through
e.g. non-linearity, interactions



Scale versus scope,
long versus wide



“subjective” versus
“objective” measures



transfer learning

1+1=3

success further in the future

2025?

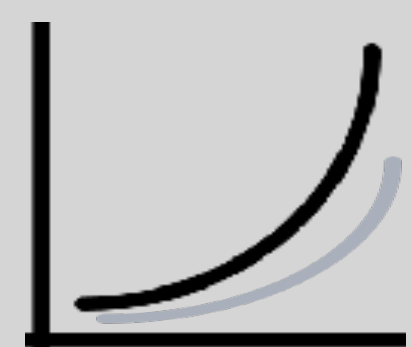
What Can We Learn?

Science

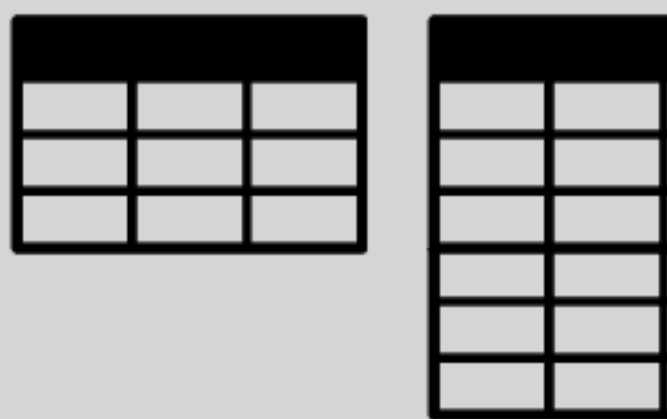
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transfer learning

1+1=3

success further in the future

2025?

Policy

Debate on using intentions
in forecasting



Quantifying unmet needs



Pre Fer



Predicting Fertility data challenge

- ✓ Be a part of a unique data challenge
- ✓ Contribute to fertility research & computational social sciences
- ✓ Publish research
- ✓ Work with amazing data:
 - LISS panel
 - Dutch population registries

SIGN UP HERE!



preferdatachallenge.nl
g.stulp@rug.nl