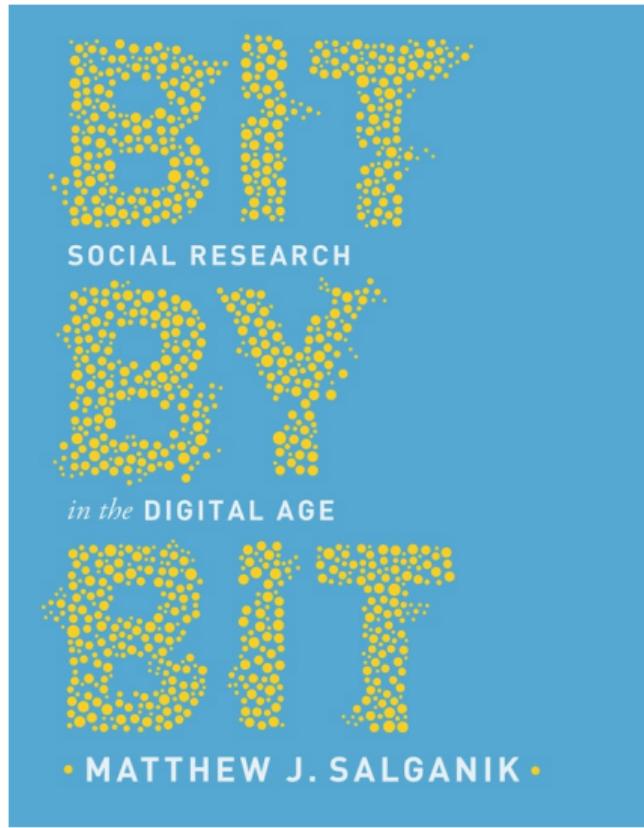


[Introduction to mass collaboration], [Human computation],
[Open call], [Distributed data collection],
[Fragile Families Challenge]

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- 1) Introduction
- 2) Observing behavior
- 3) Asking questions
- 4) Running experiments
- 5) Mass collaboration
- 6) Ethics
- 7) The future

mass collaboration

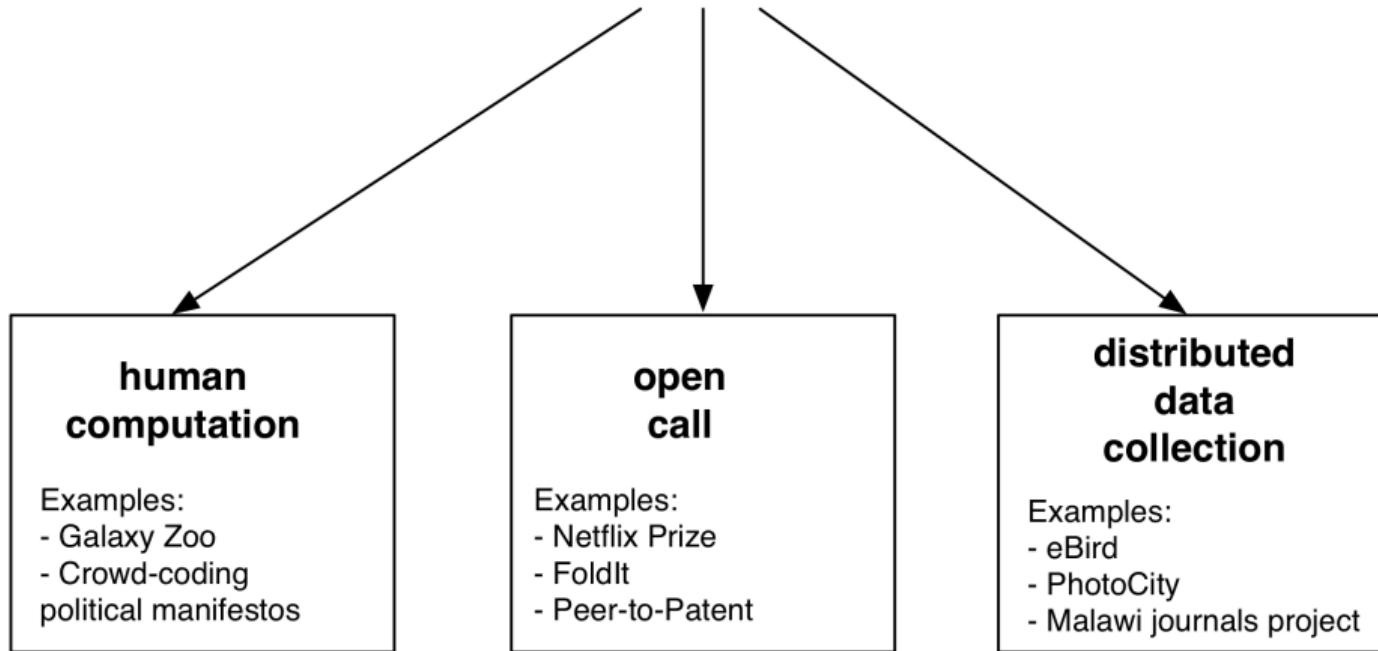


Fig 5.4 ([Salganik 2018](#))

mass collaboration

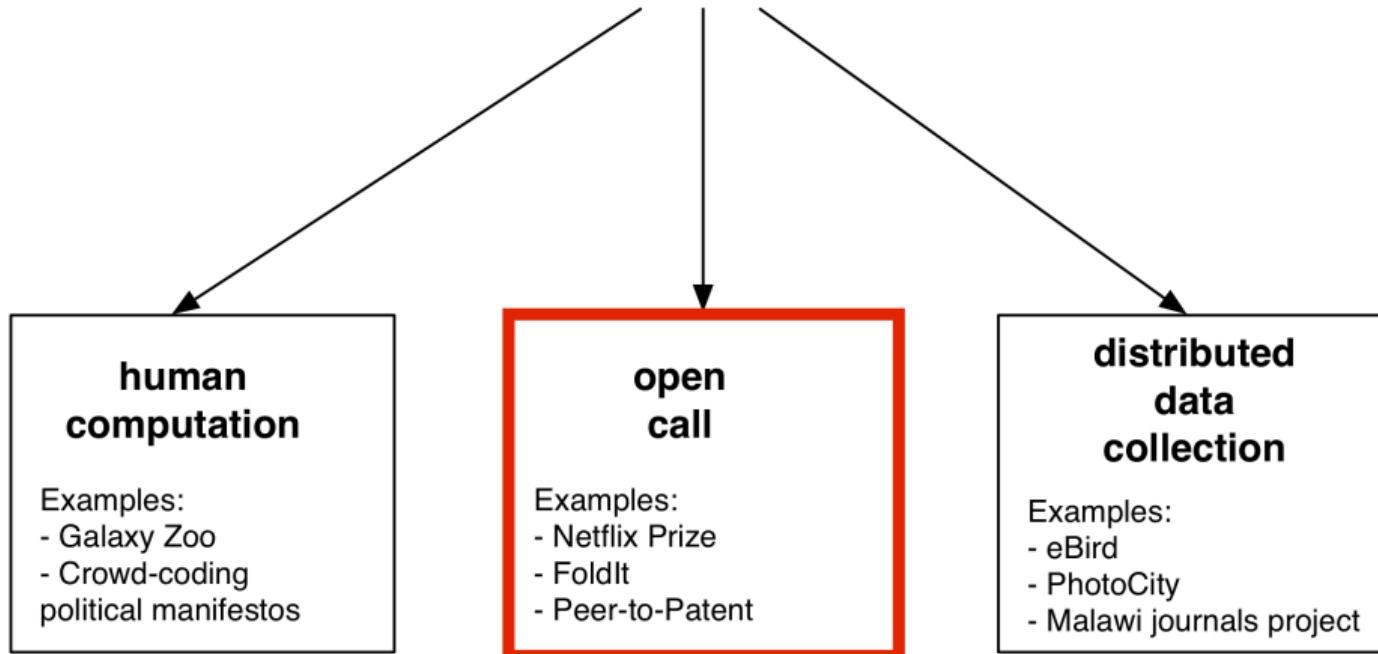


Fig 5.4 (Salganik 2018)

Measuring the Predictability of Life Outcomes with a Scientific Mass Collaboration

Matthew Salganik, Ian Lundberg, Alex Kindel, Sara McLanahan,
and the participants in the Fragile Families Challenge

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Initial sequencing and analysis of the human genome

International Human Genome Sequencing Consortium*

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Combined Measurement of the Higgs Boson Mass in pp Collisions at $\sqrt{s} = 7$ and 8 TeV with the ATLAS and CMS Experiments

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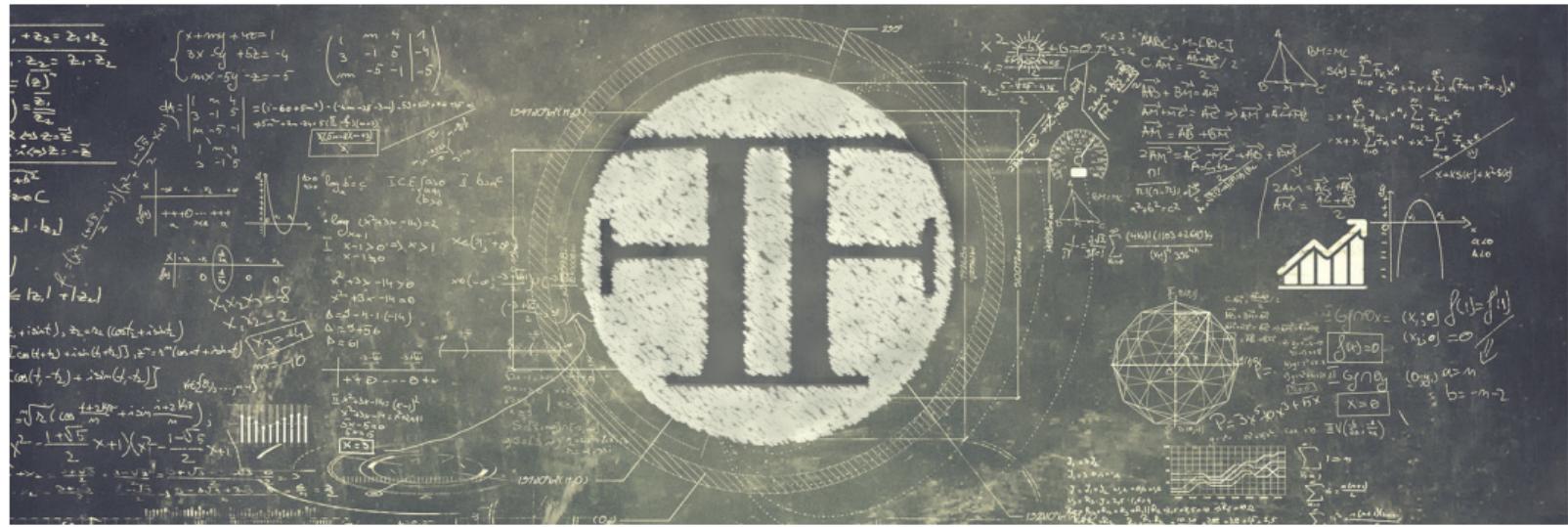
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Fragile Families Challenge

Life course researchers have:

- ▶ described social patterns
- ▶ theorized important factors
- ▶ estimated causal effects

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- ▶ described social patterns
- ▶ theorized important factors
- ▶ estimated causal effects

How well can we predict individual life outcomes?

$$\hat{y} \quad \& \quad \hat{\beta}$$

Mullainathan and Spiess (2017)

We should care about the predictability of social outcomes

We should care about the predictability of social outcomes

- ▶ Scientific reasons

We should care about the predictability of social outcomes

- ▶ Scientific reasons

- ▶ Basic social fact
- ▶ Discovery

We should care about the predictability of social outcomes

- ▶ Scientific reasons

- ▶ Basic social fact
- ▶ Discovery

- ▶ Policy reasons



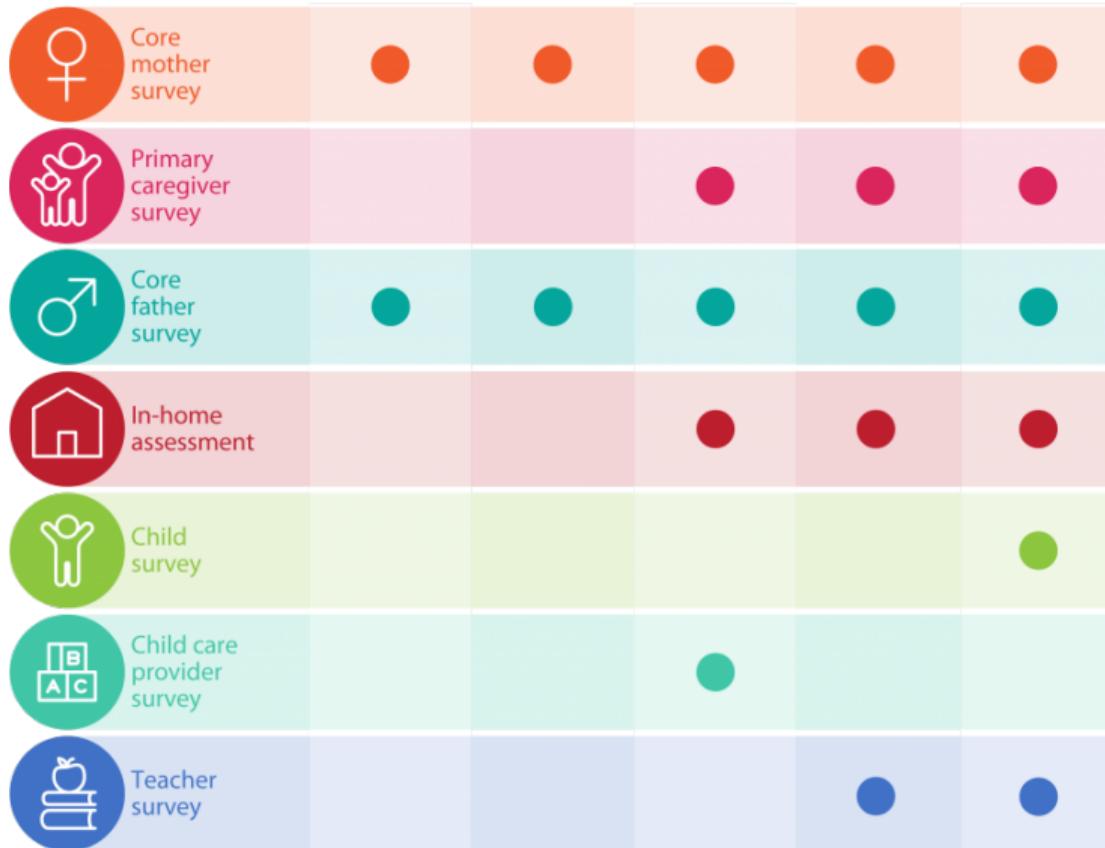
FF Fragile Families

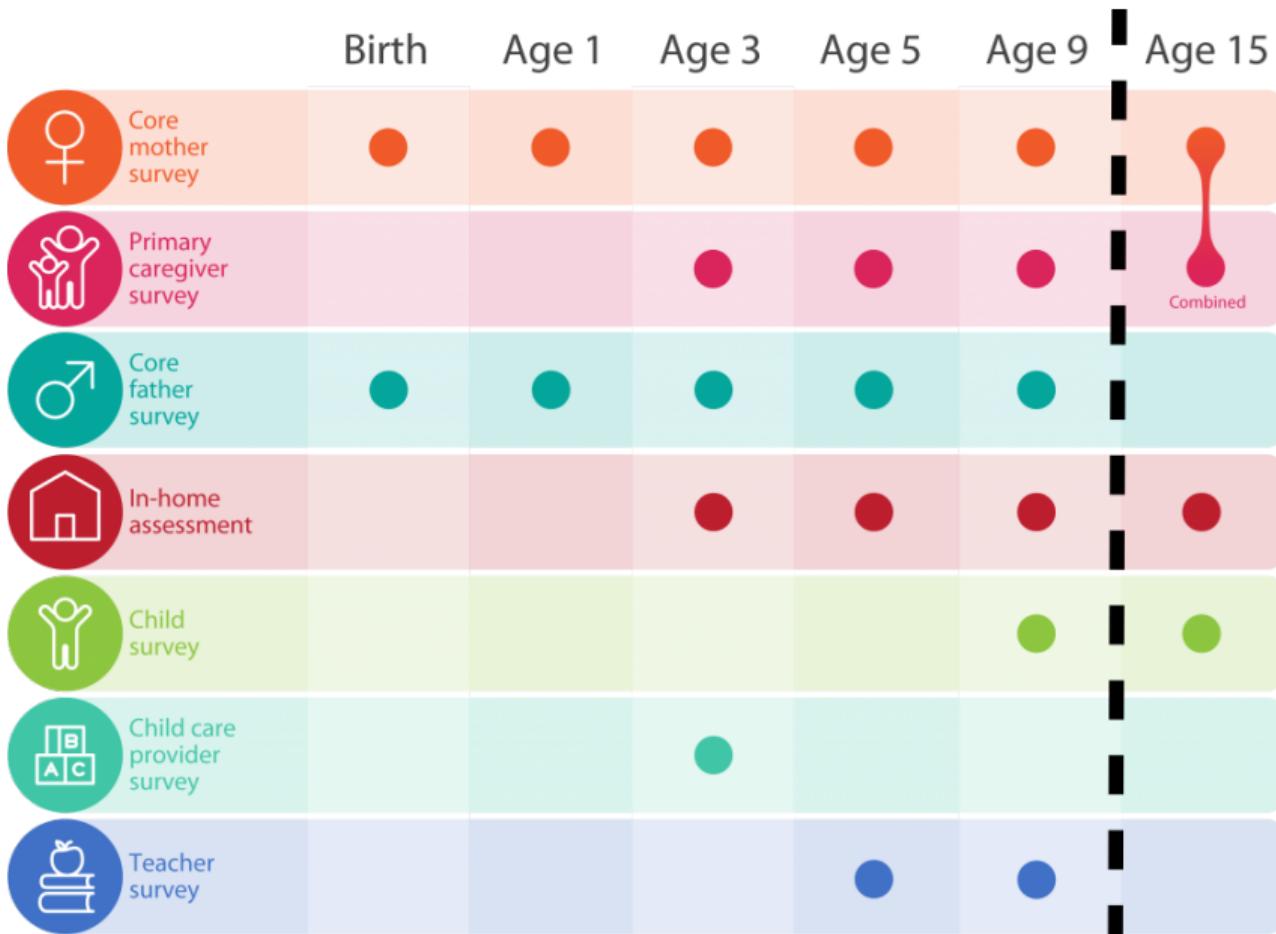
& Child Wellbeing Study
PRINCETON | COLUMBIA



- ▶ Birth cohort panel study
- ▶ ≈ 5,000 children born in 20 U.S. cities with an over-sample of non-marital births
- ▶ Followed from birth through age 15
- ▶ Already used in hundreds of papers and dozens of dissertations

Birth Age 1 Age 3 Age 5 Age 9

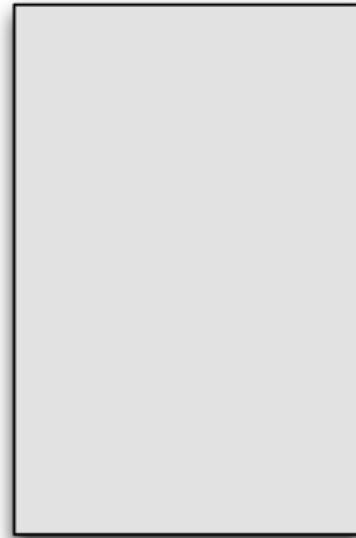




5,000 families

Birth to age 9
12,000 features

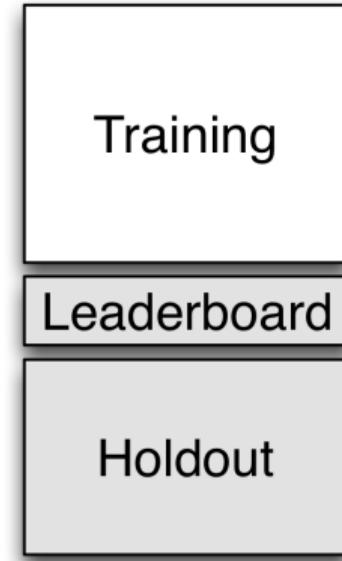
Age 15
1,500 features



4,242 families

12,942 features
birth to age 9

6 outcomes
age 15



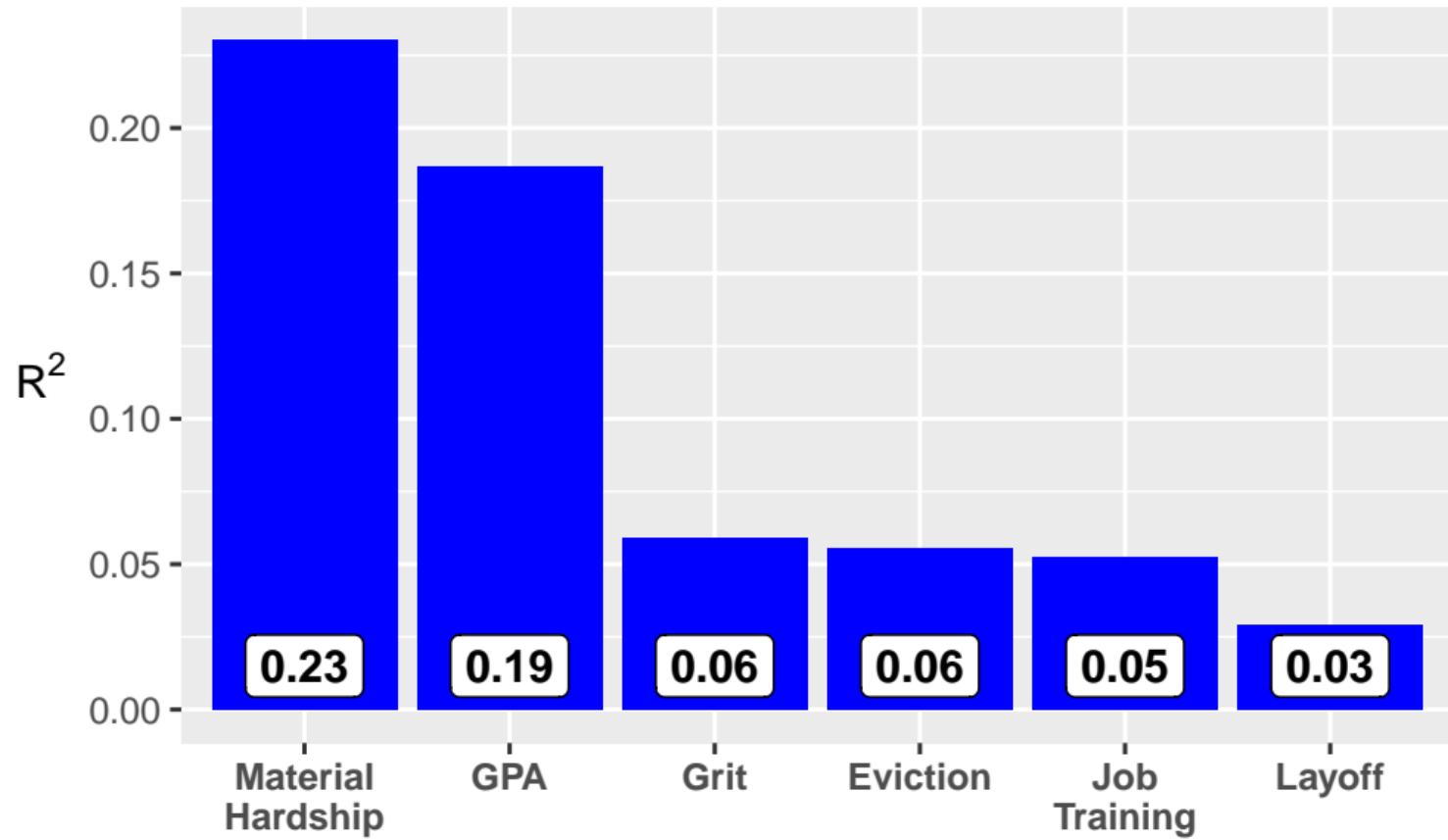
Outcomes

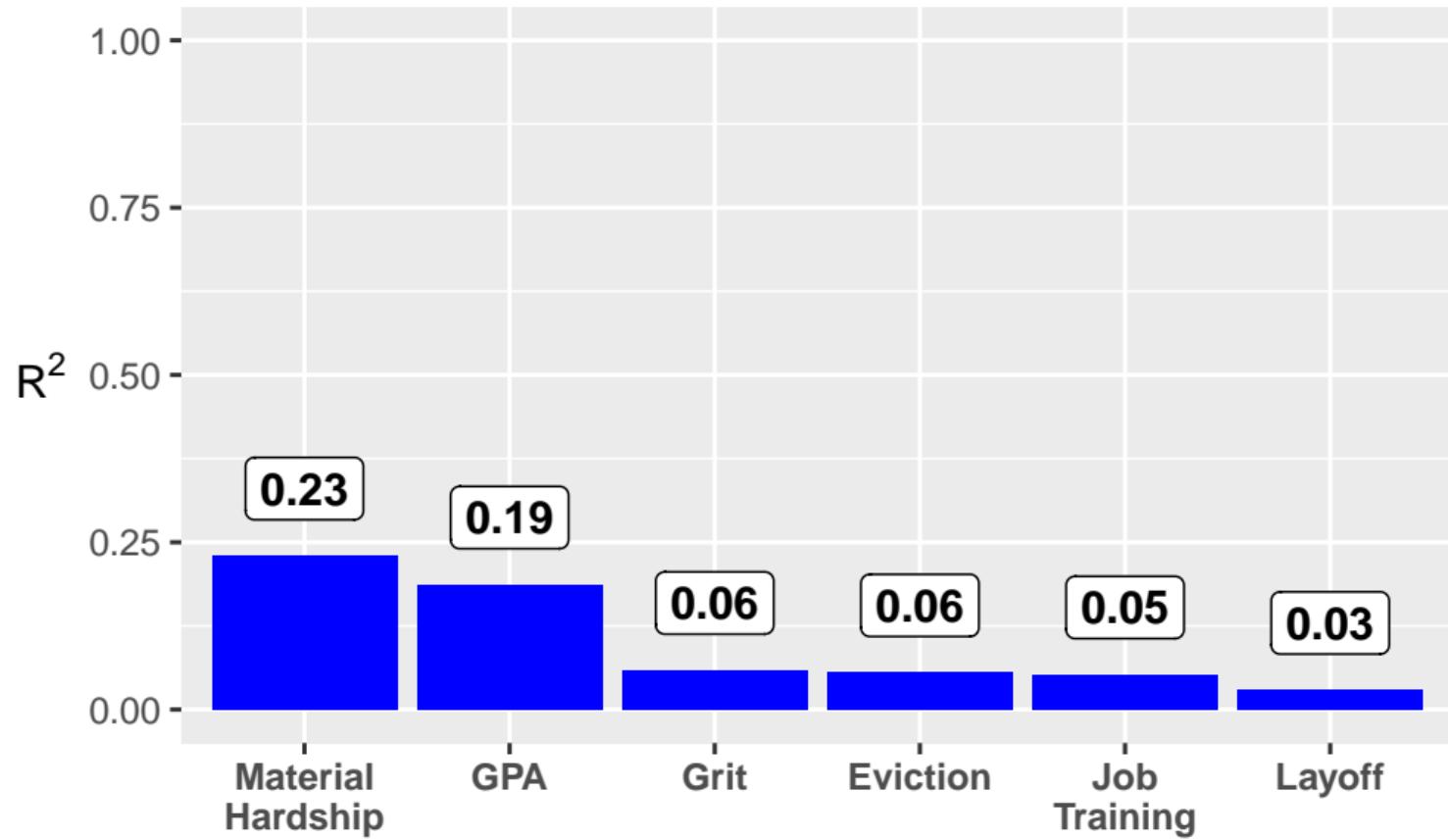
- ▶ Child: GPA (continuous), Grit (continuous)
- ▶ Household: Eviction (binary), Material hardship (continuous)
- ▶ Primary care giver: Job training (binary), Job loss (binary)

457 researchers applied to participate. Many worked in interdisciplinary teams.

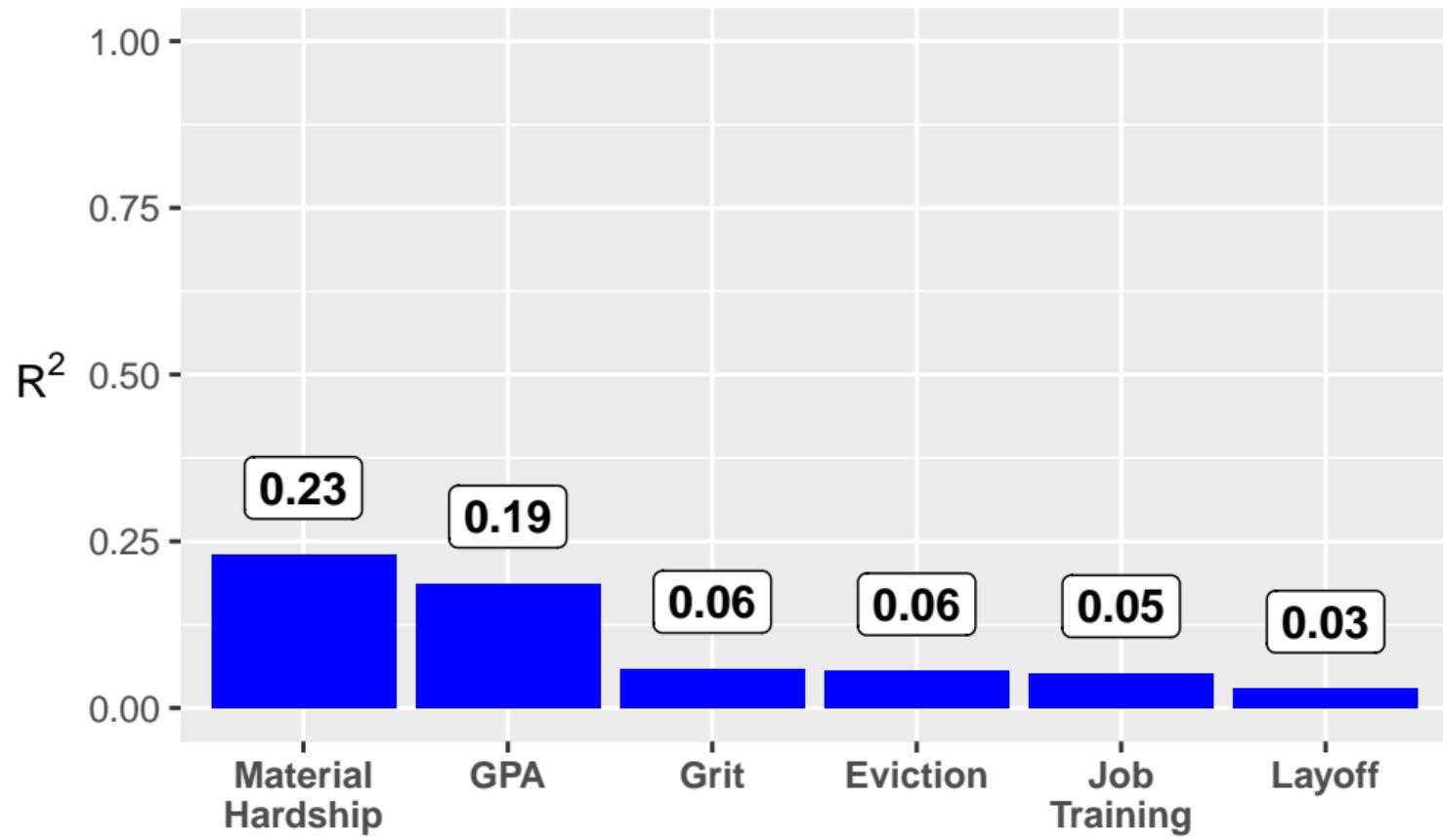
457 researchers applied to participate. Many worked in interdisciplinary teams. Using a large, high-quality social science dataset collected since birth and modern machine learning methods, how accurately can we predict outcomes from children, parents, and families?

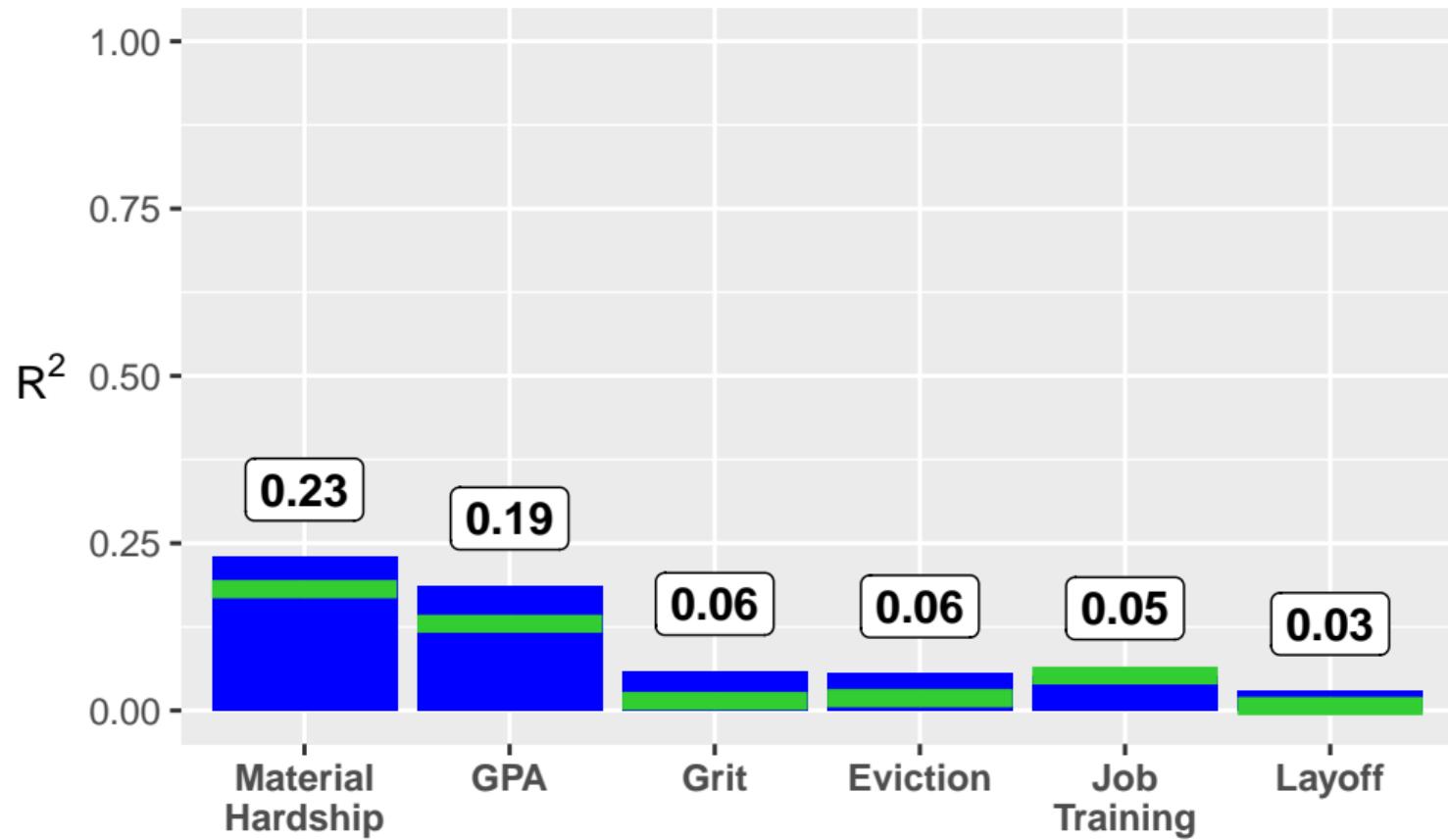
$$R_{holdout}^2 = 1 - \frac{\sum_{i \in holdout} (\hat{y}_i - y_i)^2}{\sum_{i \in holdout} (\bar{y}_{train} - y_i)^2}$$





Is this even better than a benchmark model?





Green line: 4 variable regression model

B

Material hardship

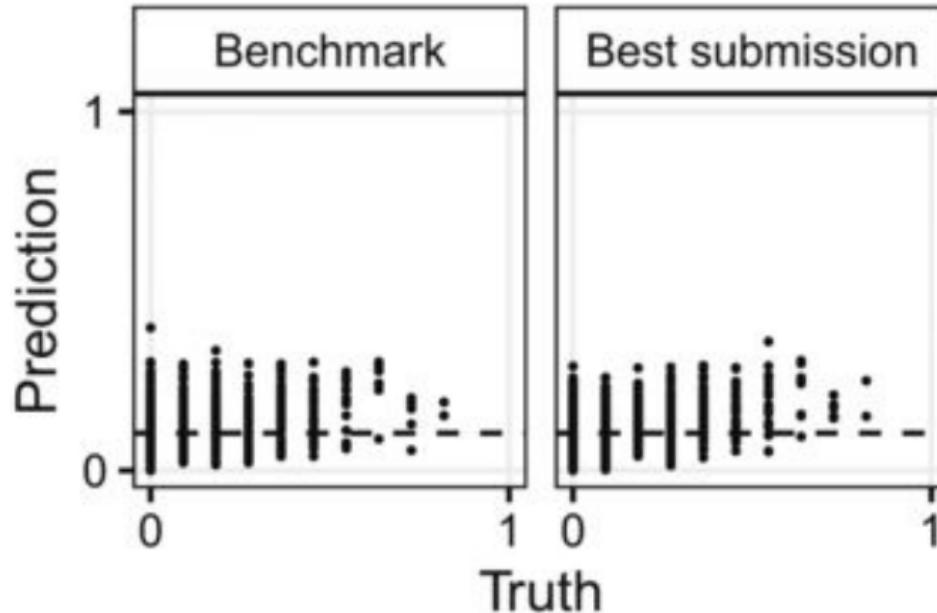


Fig 3, Salganik et al. (2020)

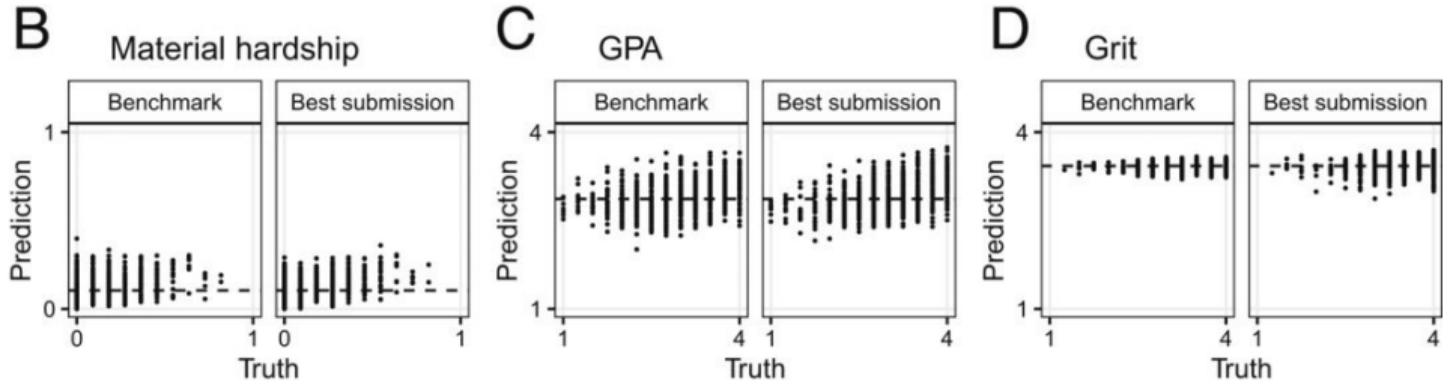


Fig 3, Salganik et al. (2020)

E Eviction

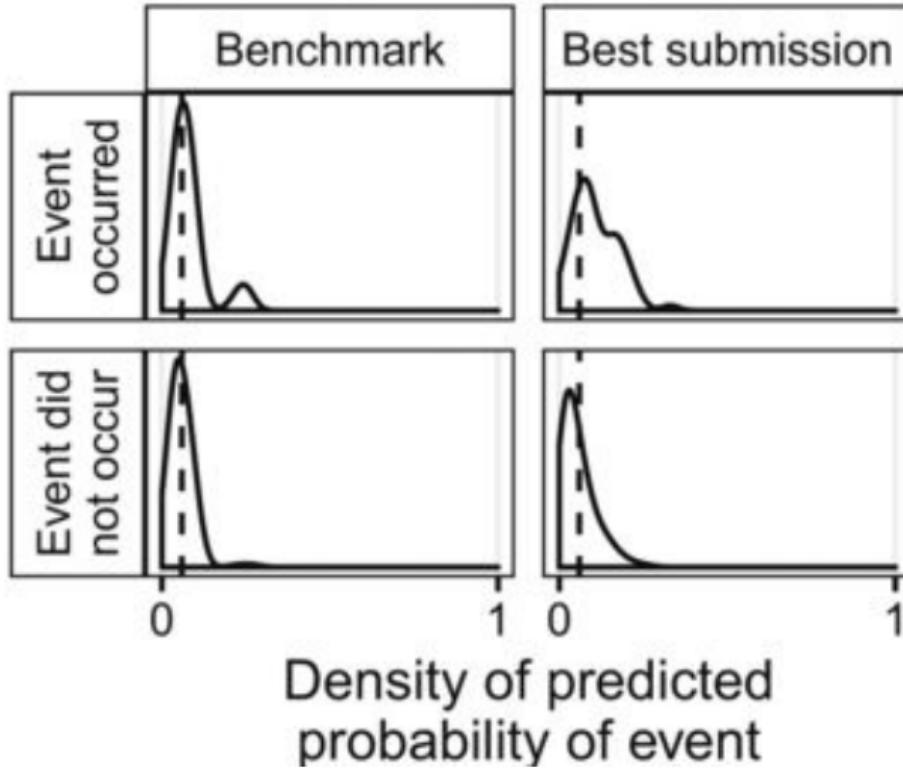
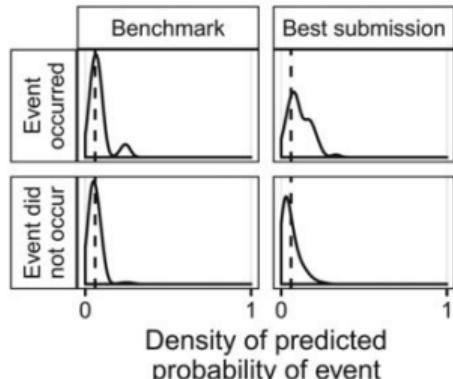
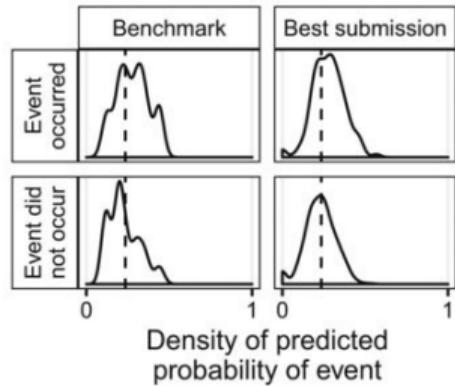


Fig 3, Salganik et al. (2020)

E Eviction



F Job training



G Layoff

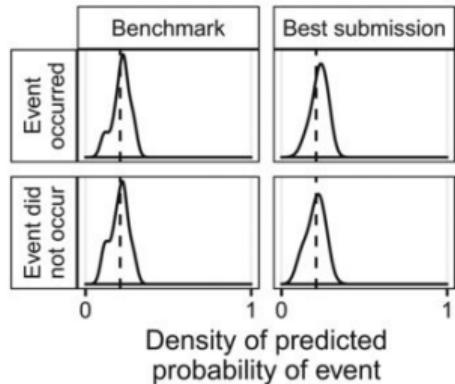


Fig 3, Salganik et al. (2020)

What can we learn looking at all the predictions?

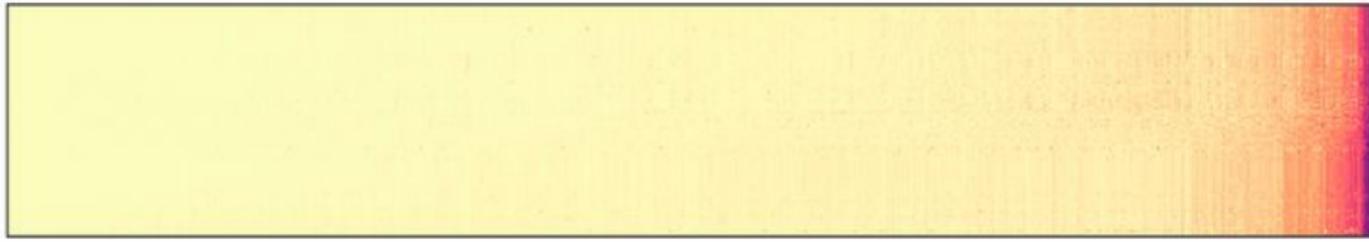
A

Material hardship

Squared error

0.0 0.1 0.2 0.3 0.4 0.5

Team



Family

Fig 4, Salganik et al. (2020)

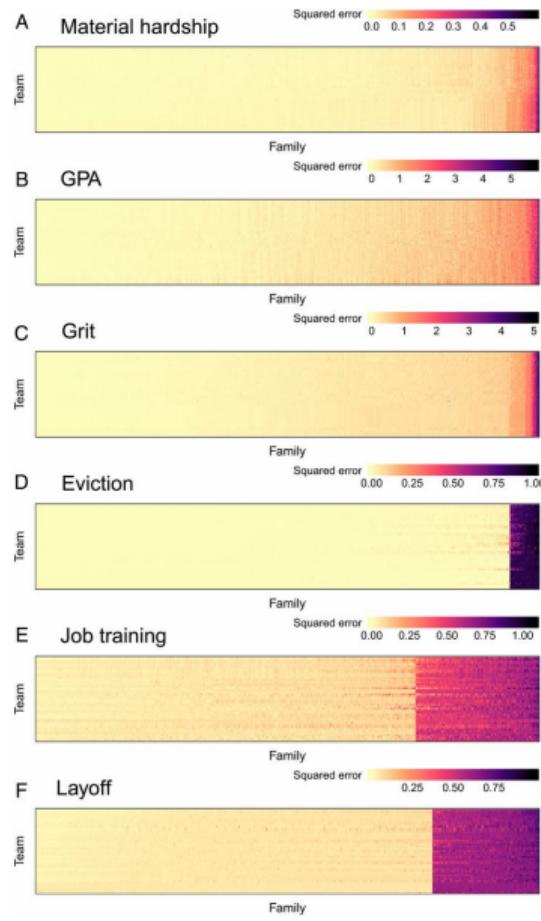


Fig 4, Salganik et al. (2020)

What do these results mean for policy makers?

- ▶ Machine learning is not magic

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- ▶ Transparent evaluation of any algorithm is needed

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- ▶ Transparent evaluation of any algorithm is needed
- ▶ Complex models may not outperform simple models

What do these results mean for researchers?

Researchers must reconcile an “understanding/prediction” paradox

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- ▶ We don't understand much

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- ▶ Prediction is not a good measure of understanding

Researchers must reconcile an “understanding/prediction” paradox

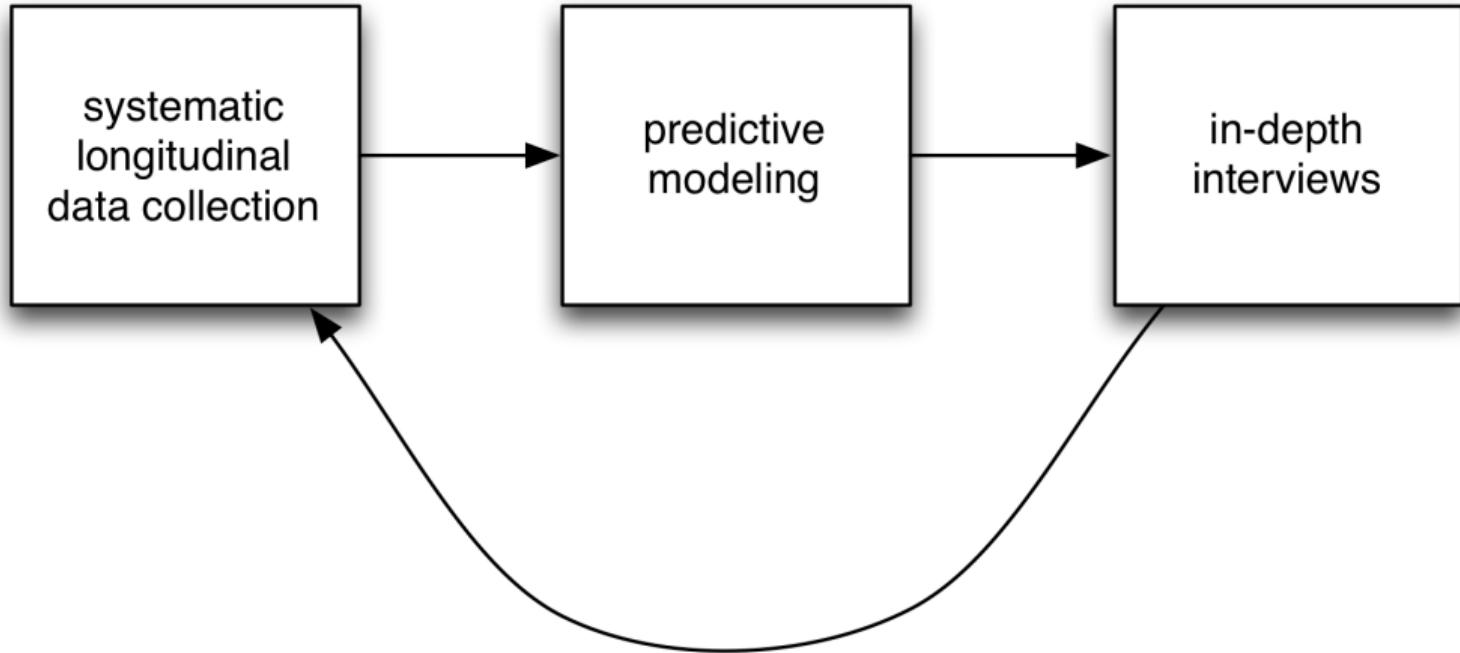
- ▶ We don't understand much
- ▶ Prediction is not a good measure of understanding
- ▶ Our current understanding is correct but incomplete

How can we expand our understanding?

How can we expand our understanding?

In-depth, semi-structured interviews

Dark matter interview team: Rachel M. Brown-Weinstock, Bobbi Brashear, Kristin Catena, Susan Clampet-Lundquist, Sophie Damas, Katie Donnalley, Kaitlin Edin-Nelson, Kathryn Edin, Alexus Fraser, Sarah Gold, Ashley Hyman, Daniel Kim, Ian Lundberg, Abigail MacLean, Collin “Ren” MacLean, Stefanie Mavronis, Timothy Nelson, Matthew Salganik, Naomi Shifrin, and Vicki Yang.



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^{tt} , 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}, Katriina 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^{ff}, Jonathan D. Tang^y, Emma Tsurkov^{gg}, Austin van Loon^{gg}, Onur Varol^{ggg,hhh} , Xiafei Wangⁱⁱ, Zhi Wang^{hhh,jjj}, Julia Wang^y, Flora Wang^{fff}, Samantha Weissman^y, Kirstie Whitaker^{kkk,lli}, 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, Dean Knox^z, Karen Levy^{ttt}, Arvind Narayanan^y, Brandon M. Stewart^a, Duncan J. Watts^{uuu,vvv,wwww} , and Sara McLanahan^{a,1}

<https://doi.org/10.1073/pnas.1915006117>

See also Garip (2020) "What failure to predict life outcomes can teach us"

<https://doi.org/10.1073/pnas.2003390117>

Special Collection of *Socius* about the Fragile Families Challenge

- ▶ 12 submitted manuscripts from Challenge participants (all with accompanying code and computing environment)

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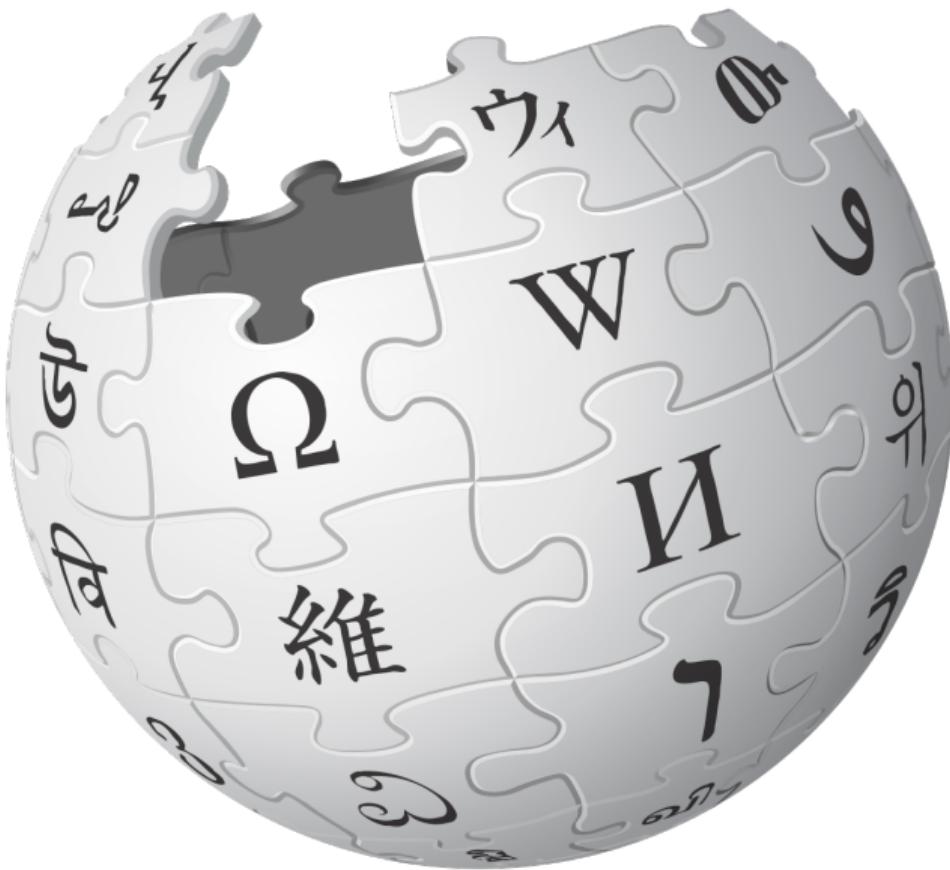
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 - ▶ “[Successes and struggles with computational reproducibility in the Fragile Families Challenge](#)” by Liu & Salganik

$$\hat{y} \quad \& \quad \hat{\beta}$$

Mullainathan and Spiess (2017)



[Introduction to mass collaboration], [Human computation],
[Open call], [Distributed data collection],
[Fragile Families Challenge]

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