

Learning from the People: Responsibly Encouraging Adoption of Contact Tracing Apps

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COVID App Adoption Project

Learning from the people to
build ethical adoption of COVID-19 apps

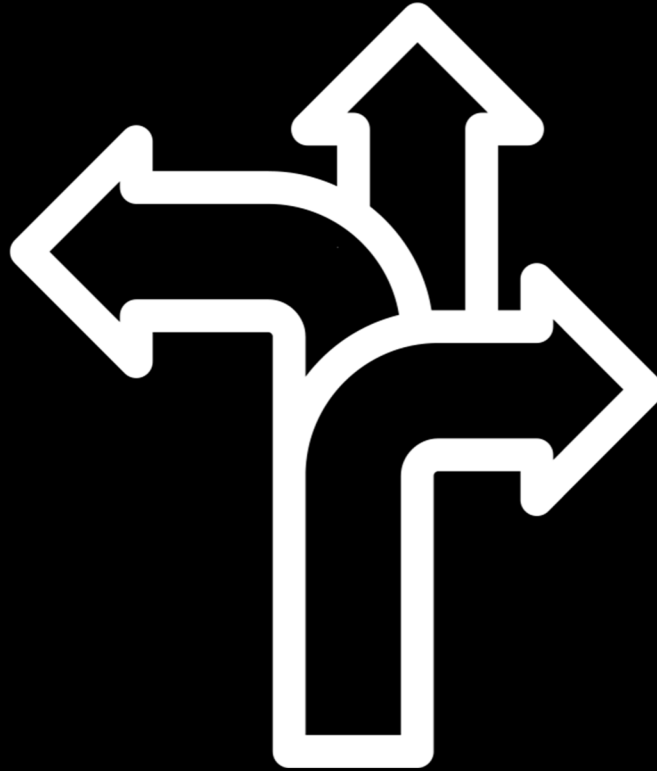
Collaborators:

- **Oshrat Ayalon (MPI-SWS)**
- **John Dickerson (University of Maryland)**
- **Samuel Dooley (University of Maryland)**
- **Dan Goldstein (Microsoft Research)**
- **Eszter Hargittai (University of Zurich)**
- **Jake Hofman (Microsoft Research)**
- **Gabriel Kaptchuk (Boston University)**
- **Dana Turjeman (University of Michigan)**

Computational problems require constant decision-making



Which features are fair to use?



What data should be used & which features prioritized?

Typically: experts set best practices

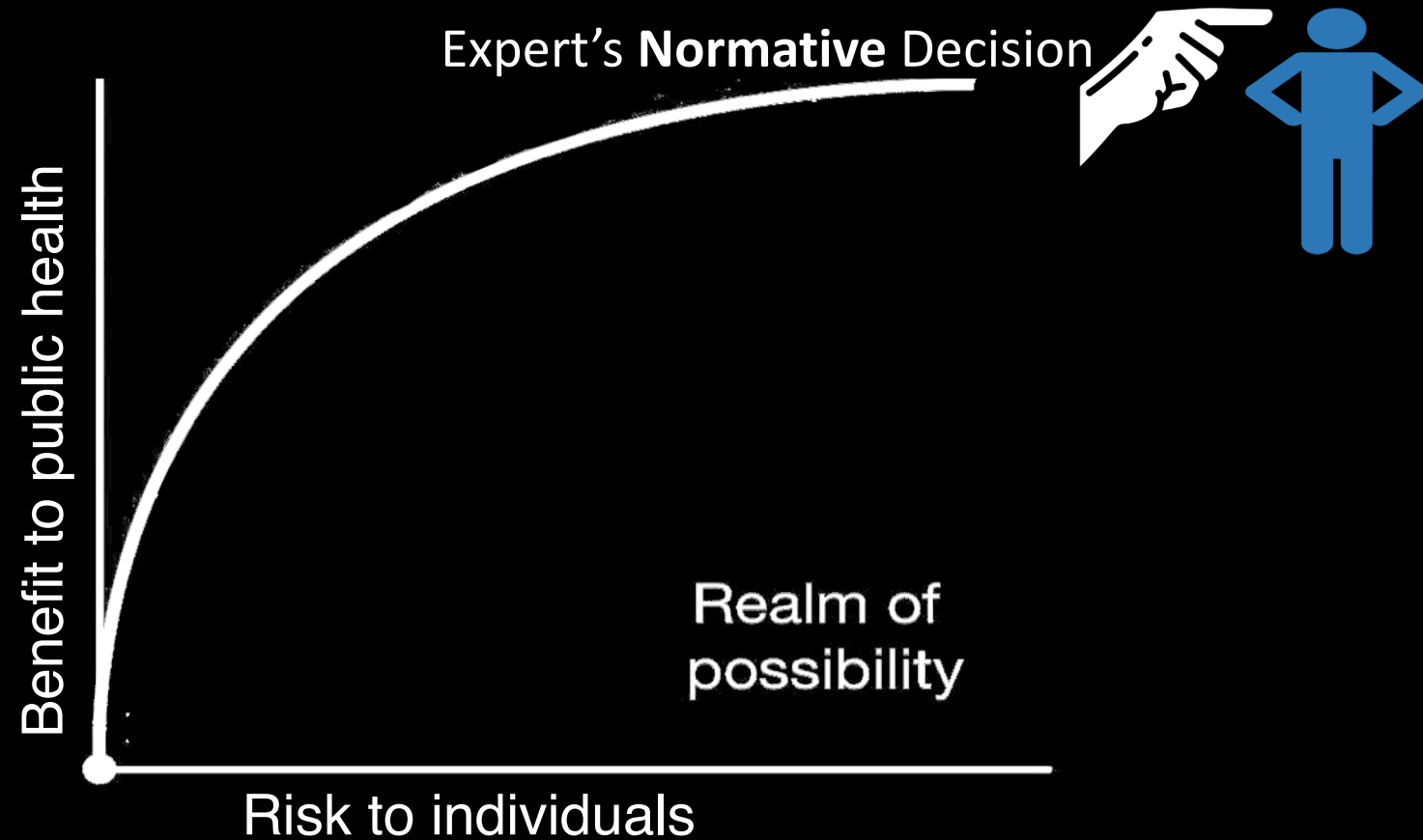


Which features are fair to use?



What data should be used & which features prioritized?

Experts trade off costs and benefits



Inspiration figure credit:

Privacy, ethics, and data access: A case study of the Fragile Families Challenge. Lundberg, I., Narayanan, A., Levy, K., and Salganik, M.J.

Experts do not always agree on best practices



A computer program used for bail and sentencing decisions was labeled biased against blacks. It's actually not that clear.

By Sam Corbett-Davies, Emma Pierson, Avi Feller and Sharad Goel
October 17, 2016

Coronavirus: Why experts disagree so strongly over how to tackle the disease

10 April 2020, by Alyson Nicholds

The future of artificial intelligence: two experts disagree

July 17, 2017 6.50am BST

Will AI take over the world or lead to a bright future for humanity? Shutterstock/PHOTOCREO Michal Bednarek

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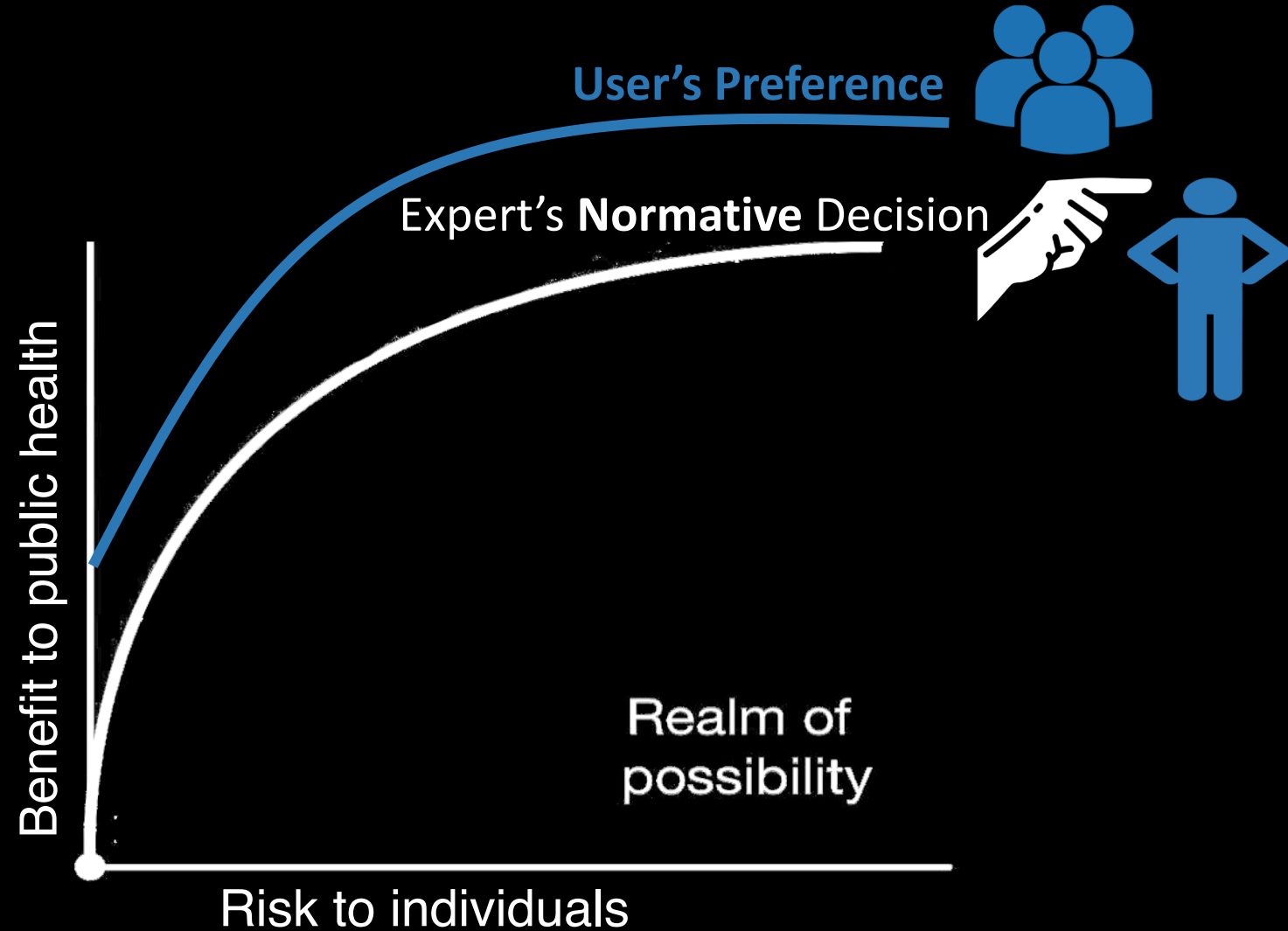
Facebook 203

Artificial intelligence (AI) promises to revolutionise our lives, drive our cars, diagnose our health problems, and lead us into a new future where thinking machines do things that we're yet to imagine

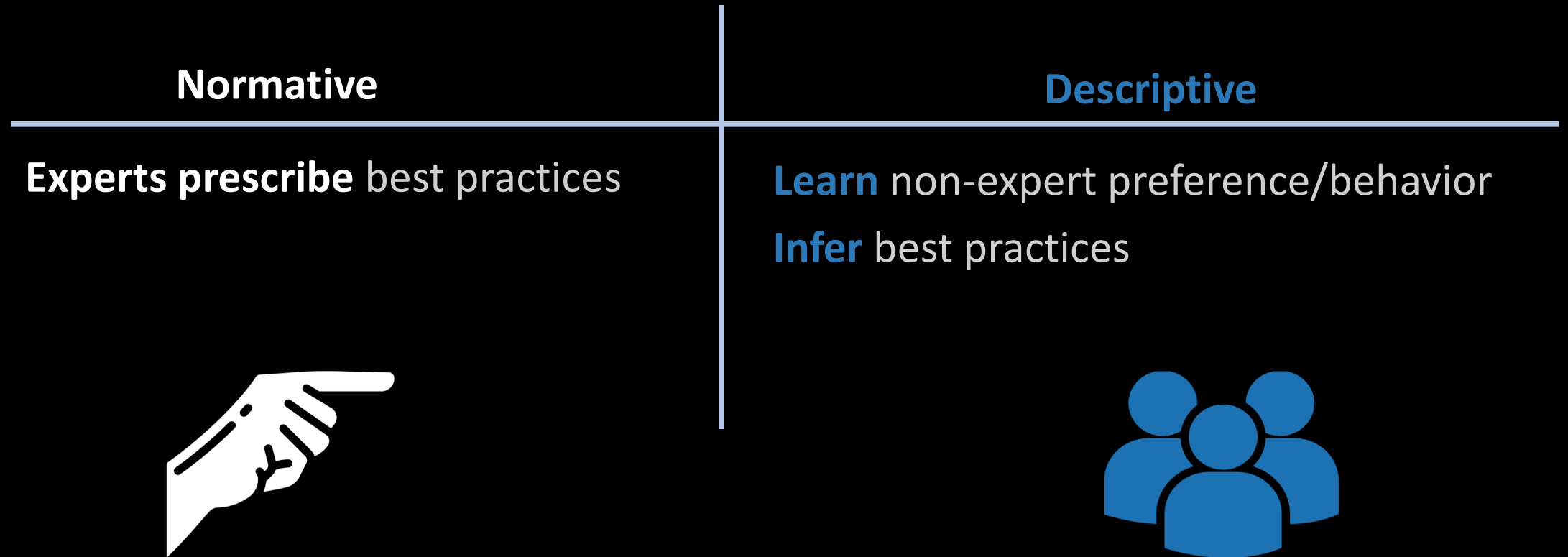
Which fe

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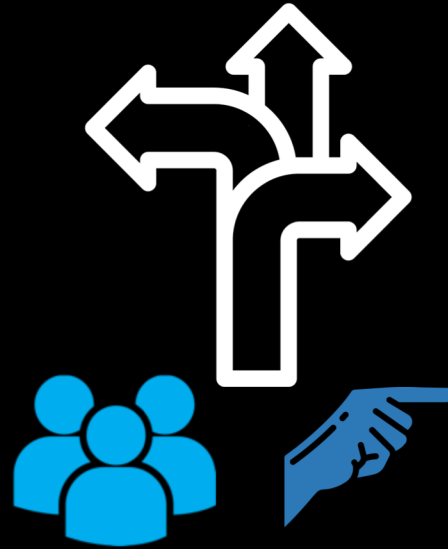
More importantly, users and experts may disagree



This disagreement is a classic tension in moral philosophy



Descriptive ethics approaches to developing technology



Explore descriptive solutions
to computational problems:
Identify ideal / acceptable functionality
from citizen preferences & behavior

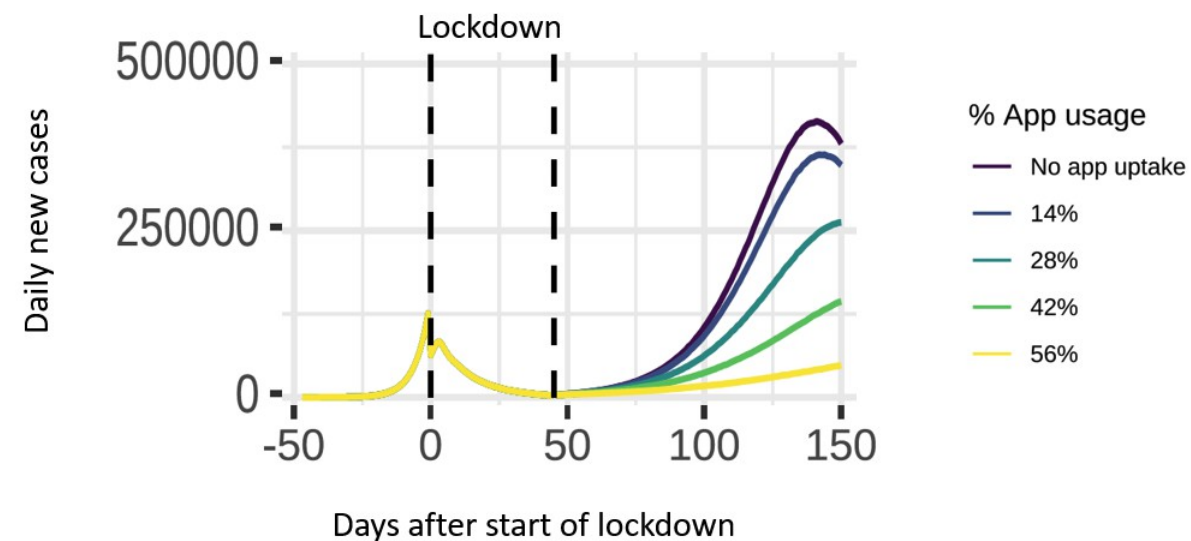
This talk: applying descriptive ethics to increase adoption of COVID19 apps



Contact tracing

Benefit of contact tracing apps scales quadratically with the number of users

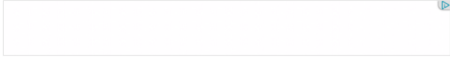
Adoption matters



<https://www.research.ox.ac.uk/Article/2020-04-16-digital-contact-tracing-can-slow-or-even-stop-coronavirus-transmission-and-ease-us-out-of-lockdown>



Channels ▾ Events ▾ Newsletters Special Issue: AI and Surveillance Deals Search



Mobile



European scientists and researchers raise privacy concerns over coronavirus contact tracing apps



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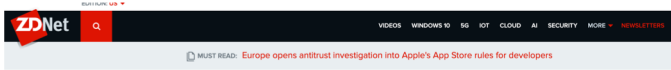
SHOT OVERSEAS SECURITY 04.08.2020 10:35 AM

Clever Cryptography Could Protect Privacy in Covid-19 Contact-Tracing Apps

Researchers are racing to achieve the benefits of location-tracking without the surveillance.

EFF Warns COVID-19 Tracing Apps Pose Cybersecurity, Privacy Risks

Google, Apple, and others are racing to develop contract tracing apps to help individuals determine potential COVID-19 exposures, but EFF warns the tech may put privacy and cybersecurity at risk.



MUST READ: Europe opens antitrust investigation into Apple's App Store rules for developers

Coronavirus contact-tracing apps: What are the privacy concerns?

Special smartphone apps could help to reduce the spread of COVID-19, but such moves could also have profound implications for individual privacy in the long term.

Menu Sign Up

POPULAR SCIENCE

HEALTH

Can smartphone apps track COVID-19 without violating your privacy?

Experts focused on ensuring apps protected user privacy

Let's get potential users to tell us how to get them to adopt

01

Identify adoption considerations

02

Use descriptive approaches to predict adoption

03

Leverage findings to improve adoption through changes to app design & marketing

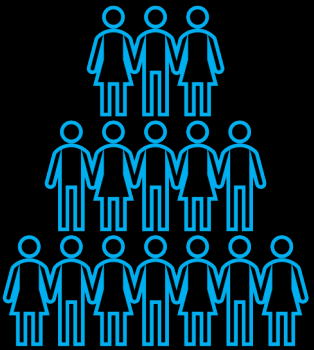
We started by using a series of carefully constructed online surveys to identify American's adoption considerations



Closed-answer questions
regarding willingness to install



Open-answer descriptions of
reasoning for install intent



Panel-based online surveys quota sampled to ensure respondent demographics
match those of the U.S. census on age, race, gender, education & income

Many possible inputs to COVID19 adoption decisions; privacy is necessary, but may not be sufficient



Benefits



Provider



Privacy



Mobile costs



Accuracy



Architecture:
Security & Agency

Redmiles, E.M. *User Concerns & Tradeoffs in Technology-Facilitated Contact Tracing*.
ACM Digital Government

Hargittai, E., Redmiles, E.M., Vitak, J., and Zimmer, M. *Americans' Willingness to Adopt a COVID-19 Tracking App: The Role of App Distributor*.

First Monday

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The
New York
Times

SCIENTIFIC
AMERICAN.

WIRED

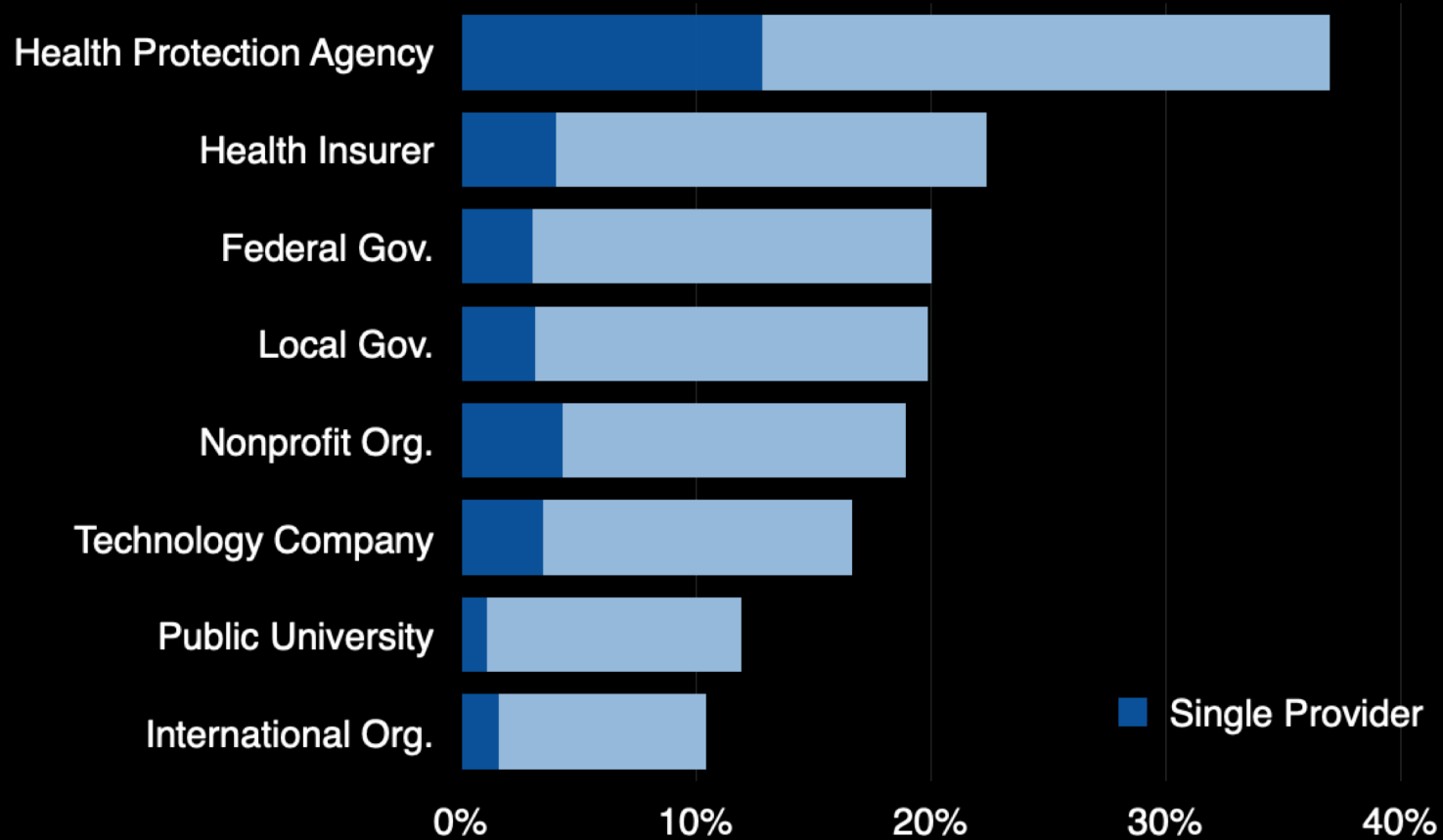
the
cyberwire



PathCheck Foundation

California
Health Care
Foundation

Provider influences willingness to install; public health agencies are preferred but not universally



89% of respondents reported wanting a COVID19 app for information, to protect themselves, and/or to protect others



Stay informed about COVID19

"I want to keep updated on any recent outbreaks or any important instructions pertaining to my health and safety."

"I want to know exactly what is going on with no interruptions"



Protect the Public / Support the Fight

"I want to do my part to help stop the pandemic"

"If it serves the public good and helps get us past this pandemic, I'm all for it"

"It would be a small step in fighting Covid-19."

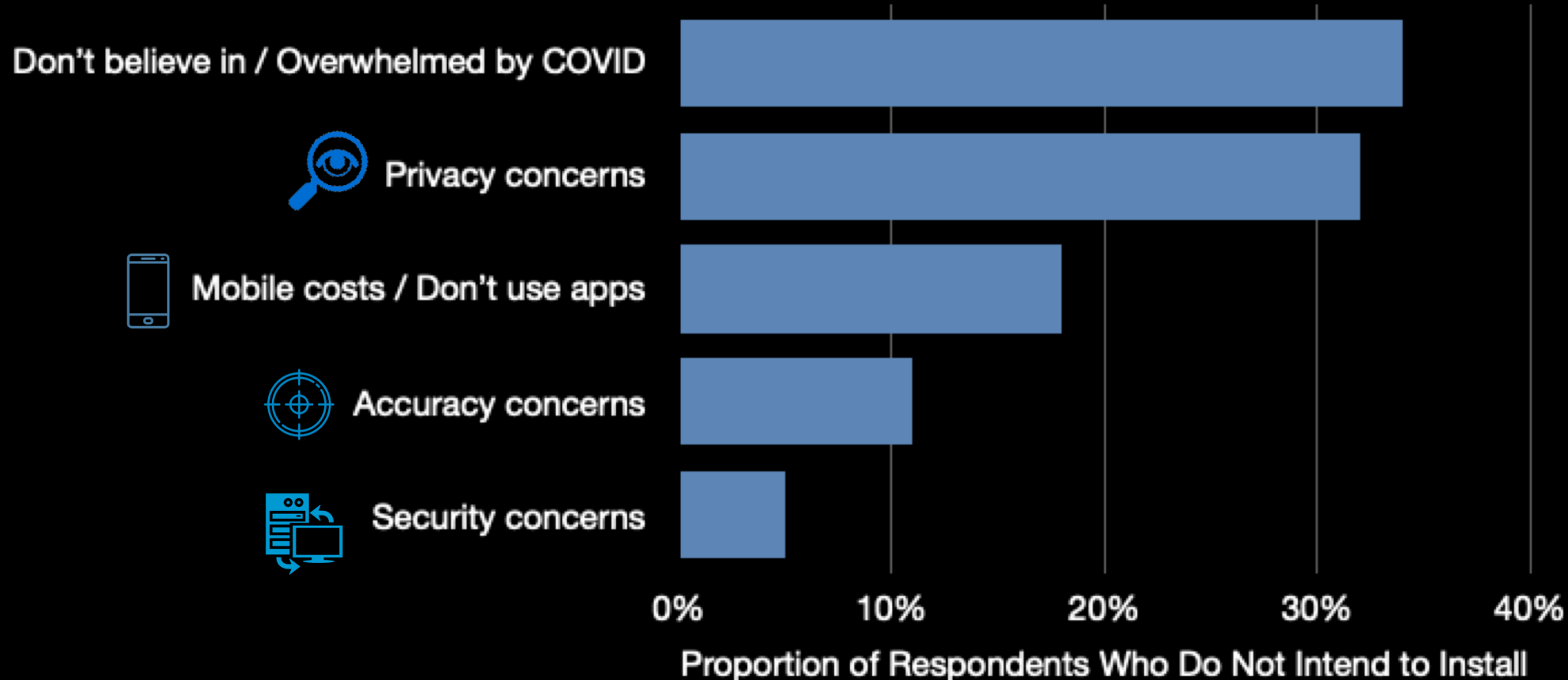


Protect me / my loved ones

"If it keeps my and my family safer then I would [install]."

"If its for my own safety I would [install] it"

Those who don't want to install are concerned about privacy, accuracy, costs & necessity



Which of these considerations matter *most*?



Benefits



Provider



Privacy



Mobile costs



Accuracy



**Architecture:
Security & Agency**

We used conjoint analyses to identify the most important considerations in COVID19 app adoption intent

Imagine that there is a mobile phone app intended to help combat the coronavirus in the U.S.

Different apps have different benefits and risks and may collect different types of information about you.



Please look carefully at the options below. Each column represents an app with different attributes that will be designed and distributed by a health protection agency. Assume both apps are equally popular. Which one would you choose?

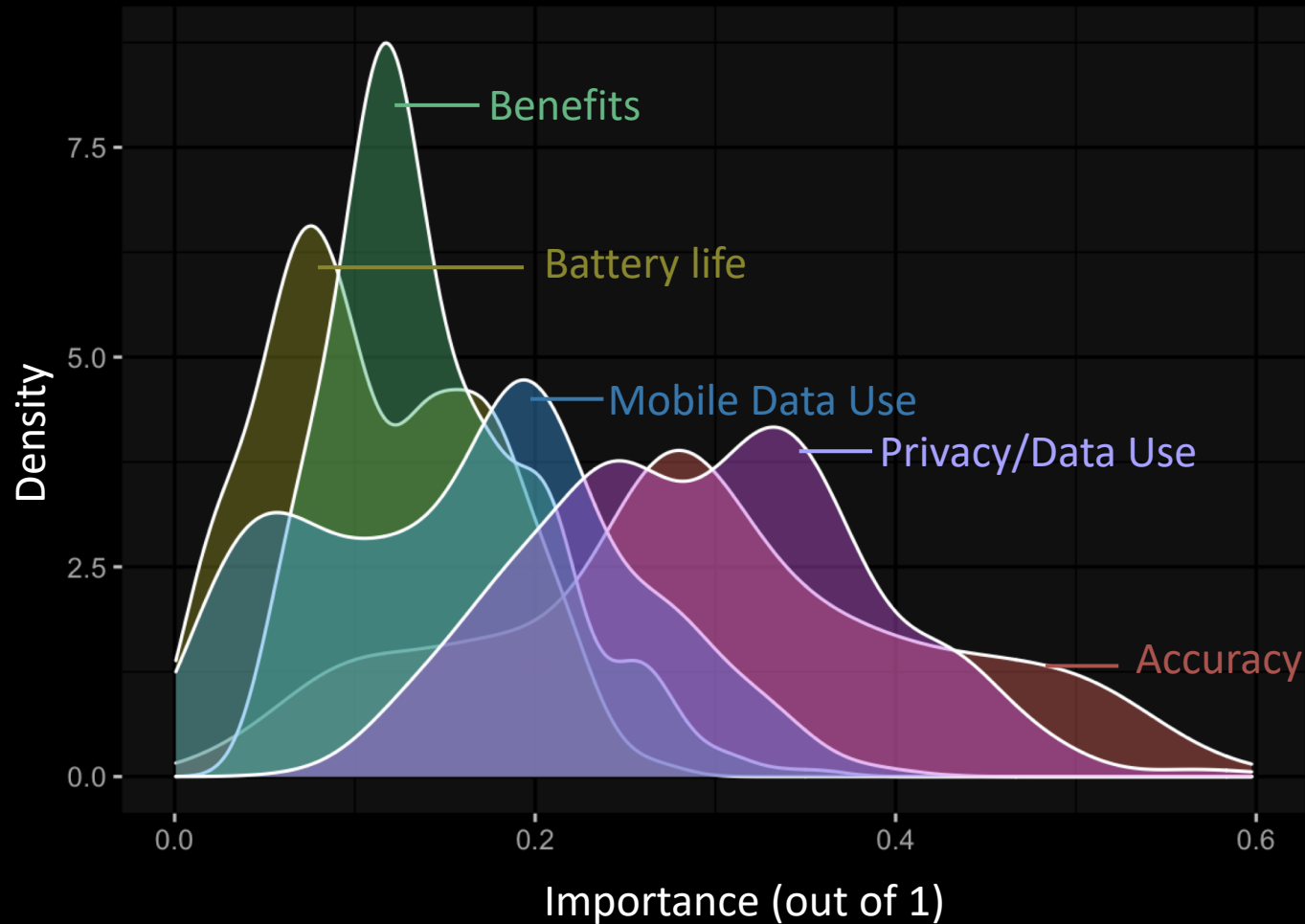


(5 of 6)

	Option 1	Option 2
App accuracy	Detects 90 out of 100 exposures to Coronavirus	Detects 99 out of 100 exposures to Coronavirus
Mobile data	Uses 300 MB (0.3GB) of your data plan every month	Doesn't use mobile data
Battery life	Phone battery lasts 1 hour shorter than usual	Doesn't drain phone's battery
Information that could be revealed	No risks	Someone could know where you've been
What information is collected	No information is collected	Information about your location
Benefits	Reduce the number of people infected with coronavirus	Alert you if you have been exposed to someone who has coronavirus, without revealing your or their identity
Where information is stored	No information is collected	Only on your device
	Select	Select

Option 3
NONE: I wouldn't choose any of these.
Select

Accuracy & privacy among the most important factors in American's intent to install COVID19 apps



For the average American surveyed, intent to install COVID19 app depends on:

29% Privacy / Data Use considerations

29% Accuracy considerations

16% Mobile data use considerations

14% App benefits considerations

11% Battery life considerations

But, everyone does not value these attributes equally

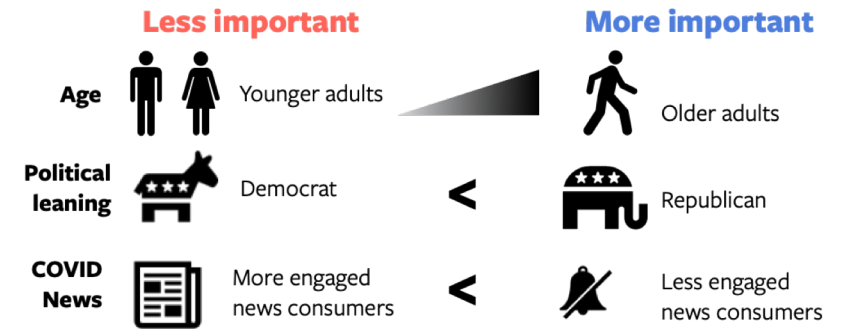
Democrats focus on accuracy; Republicans on privacy

Younger adults: benefits & accuracy; Older adults: privacy & mobile costs

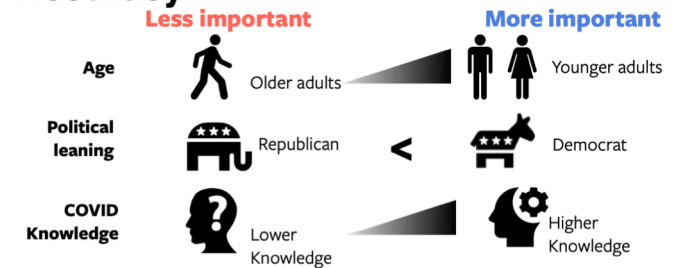
More engaged COVID19 news consumers: benefits; Less engaged: privacy

More knowledgeable about COVID19 more focus on accuracy

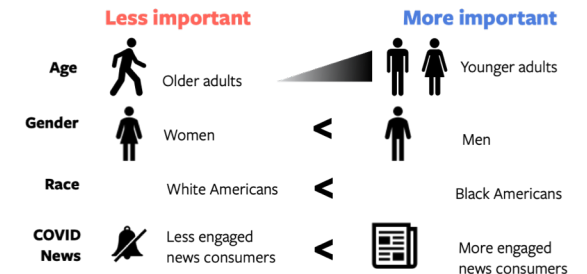
Privacy Risks



Accuracy



Benefits



Mobile Costs



Linear regression models; significant $p < 0.05$

How good is good enough? Can we predict when adoption intent is sufficiently high to release?

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Leverage findings to improve adoption through changes to app design & marketing

How good is good enough? Can we predict when adoption intent is sufficiently high to release?

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Identify adoption considerations

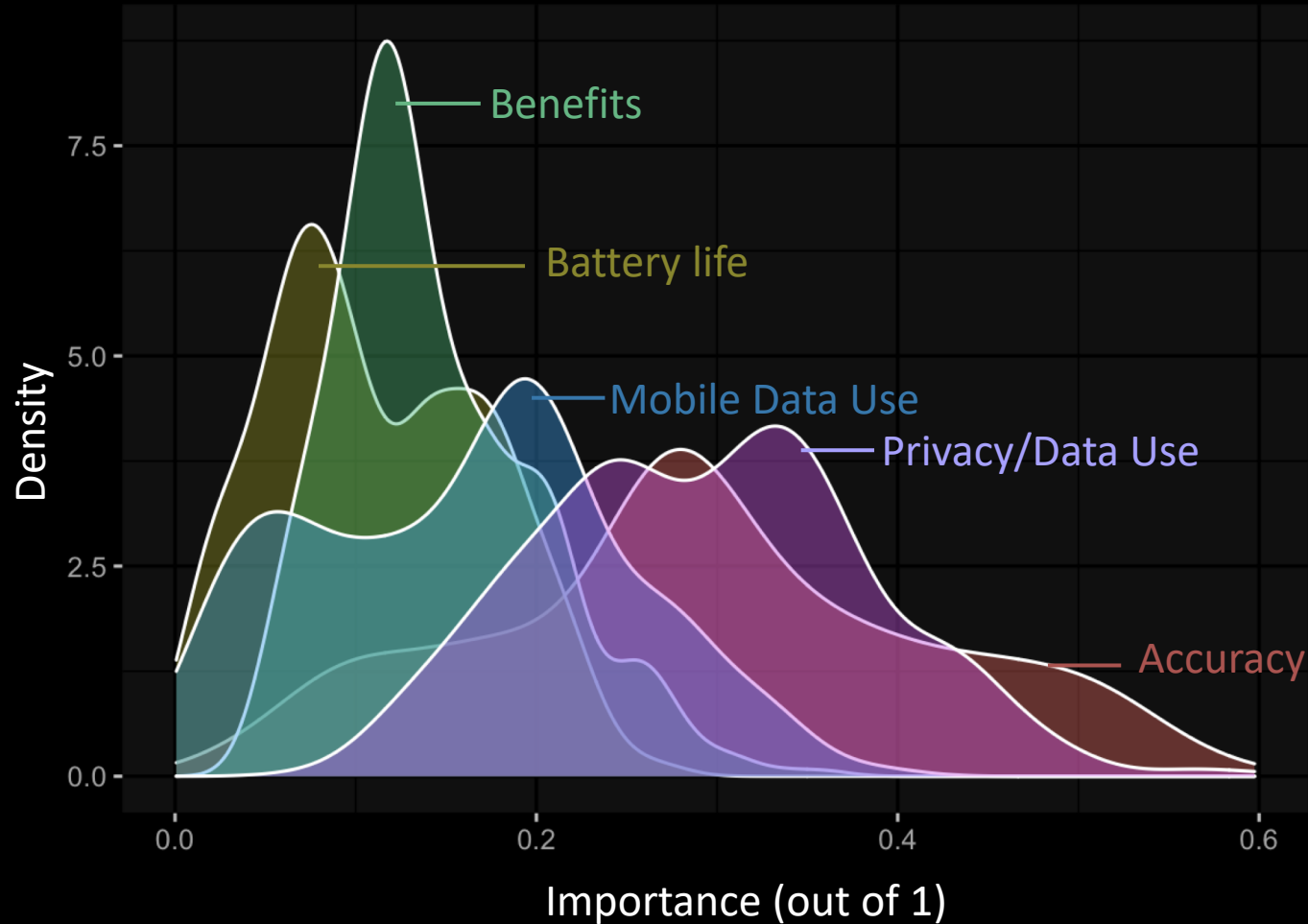
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How private does a COVID19 app have to be? How accurate?



For the average American surveyed, intent to install COVID19 app depends on:

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29% Accuracy considerations

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11% Battery life considerations

Does *amount* of
privacy and
accuracy predict
adoption intent?

How good is
good enough?

Surveyed nearly 4,000 crowd workers; Predict adoption intent given quantified privacy/accuracy



False Negatives

Implicit assessment of
privacy perception



Willingness to adopt
given concrete FN rate



False Positives

Implicit assessment of
privacy perception



Willingness to adopt
given concrete FP rate



Privacy

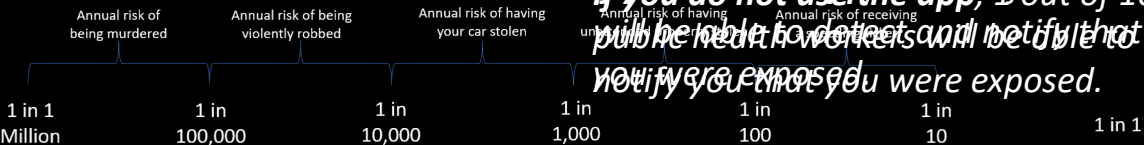
Explicit statement of
privacy risk



Willingness to adopt
given concrete FN rate

P out of 1000 people who use this app will have this information compromised

Studies show that despite best attempts to protect the data of those who use this app, some people may have information about who they have been near compromised and used for purposes other than the fight against coronavirus. Please indicate on the chart below how many app users you think will have this information compromised over the next year.



Imagine that you are exposed to someone who has coronavirus 100 times over the next year. If you do not use the app, 1 out of 100 times you are exposed to someone who has coronavirus. If you use the app, 1 out of 100 times the app will correctly notify you every time that you were exposed (100 out of 100 times). The app will also incorrectly notify you an additional FP times, when you were not actually exposed.

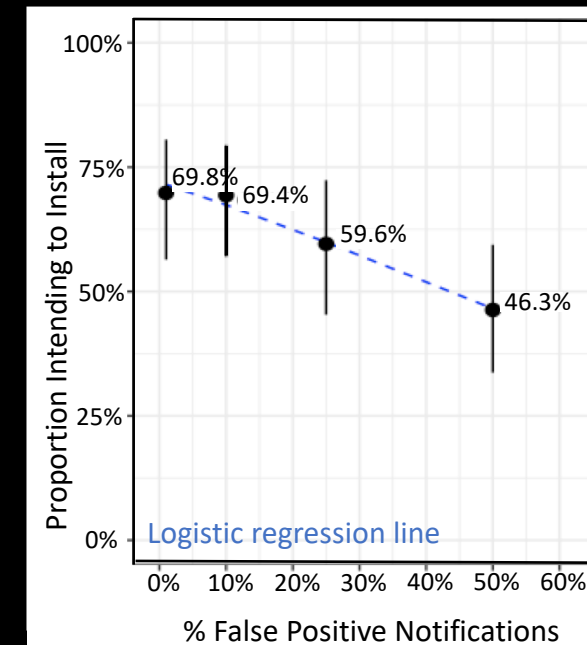
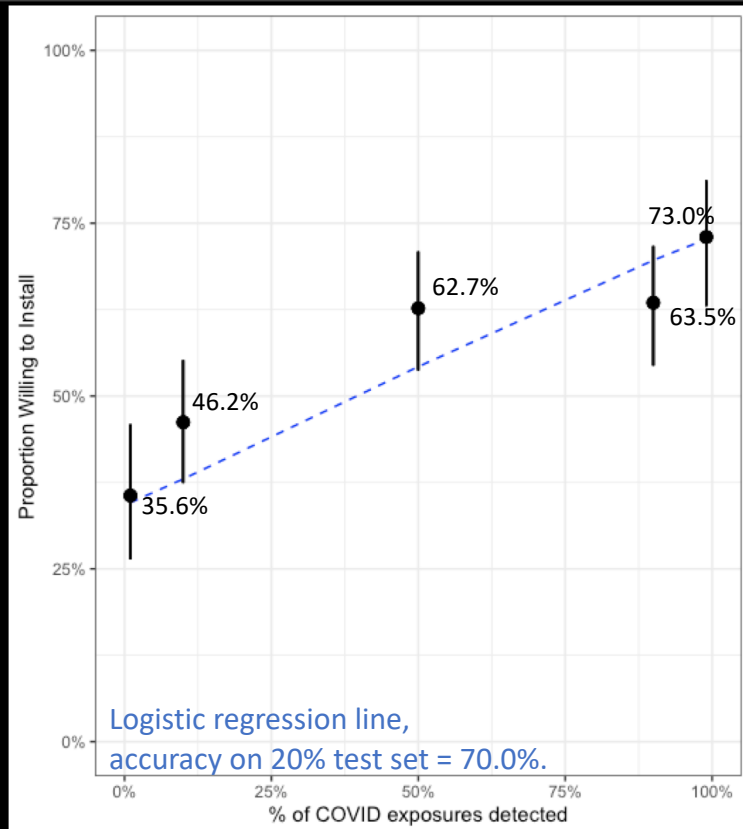
Would you install this app?

The app is not perfect. If you use the app, the app will correctly notify you every time that you were exposed (100 out of 100 times). The app will also incorrectly notify you an additional FP times, when you were not actually exposed.

Would you install this app?

How good is good enough?

Ideal: 50%+ sensitivity & fewer than 10% false positives



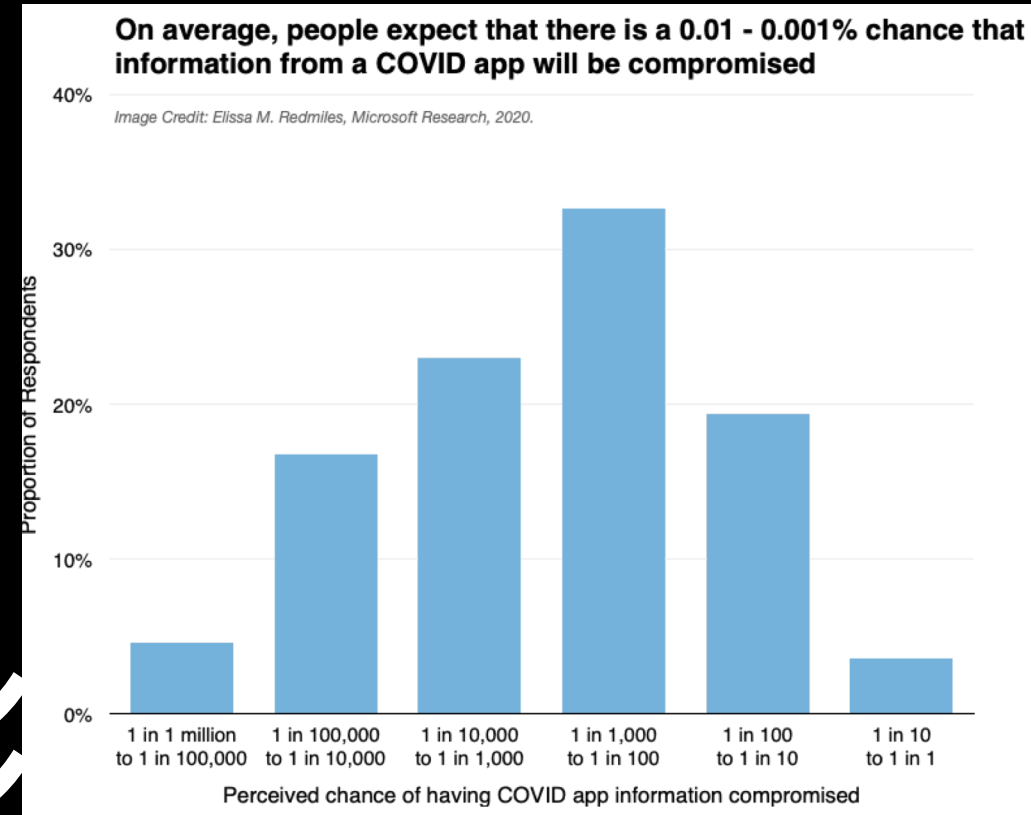
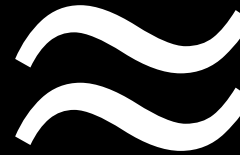
Privacy expectations both improve prediction accuracy & influence behavioral intent



People have a-priori privacy risk expectations
risk quantity influences adoption intent



Intended adoption rate when just
asked about false negative rate
with implicit privacy assumption



and made explicit up front

Next: using what people tell us to improve adoption

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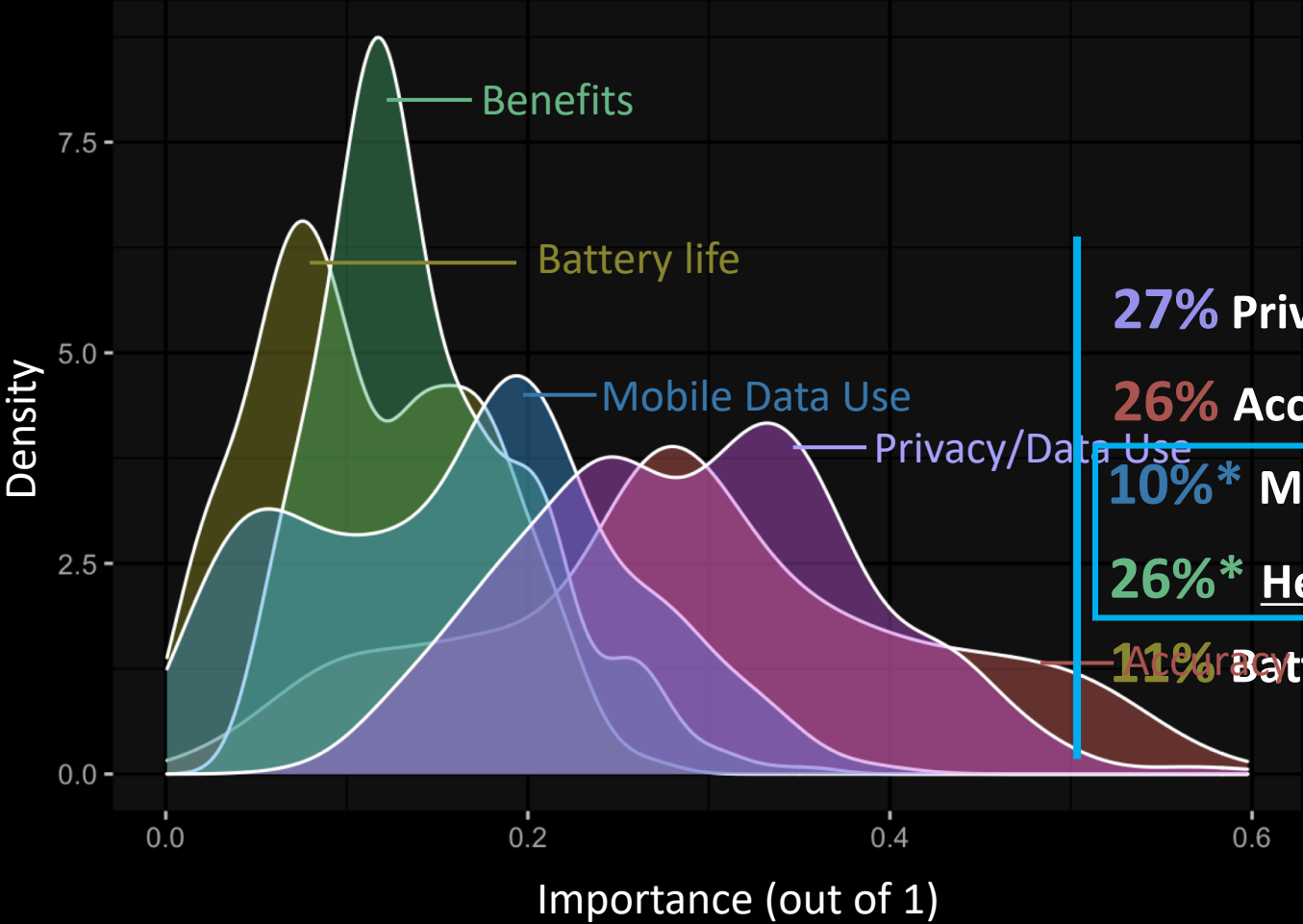
03

Leverage findings to improve adoption through changes to app design & marketing

But wait!
Just pay people
to adopt!



No: Incentives change *what* people will adopt but not *how many* will adopt



For the average American surveyed, intent to install COVID19 app depends on:

27%	Privacy / Data Use	29%	Privacy / Data Use	25%	Privacy / Data Use
26%	Accuracy	29%	Accuracy	25%	Accuracy
10%*	Mobile data use	16%	Mobile data use	10%*	Mobile data use
26%*	Health care benefits	14%	App benefits	23%*	Health care benefits
11%	Battery life	11%	Battery life	13%*	Battery life

Next: using what people tell us to improve adoption

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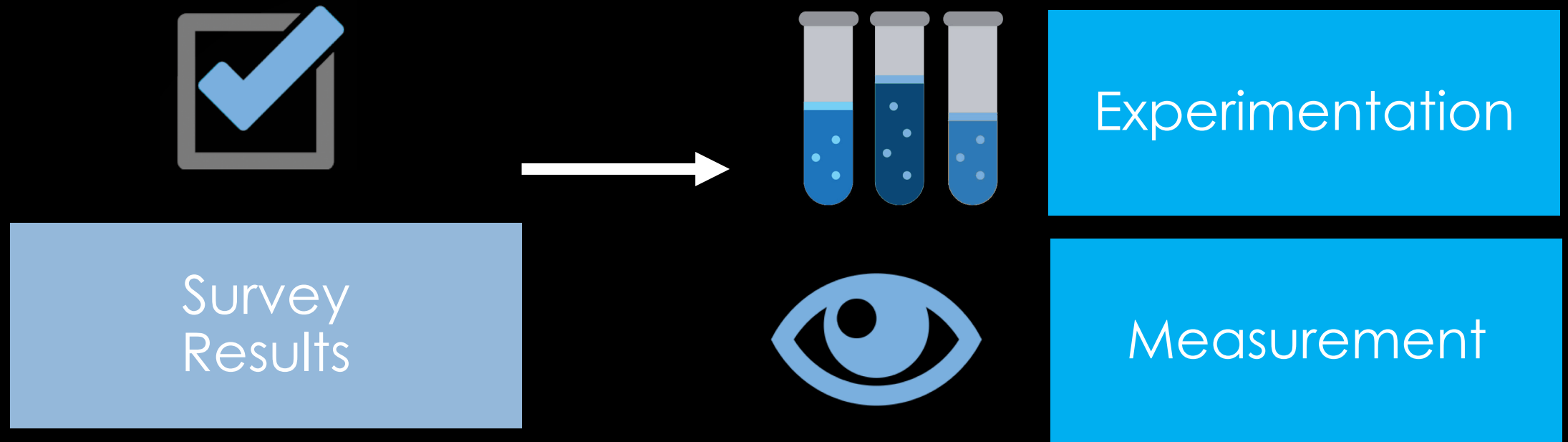
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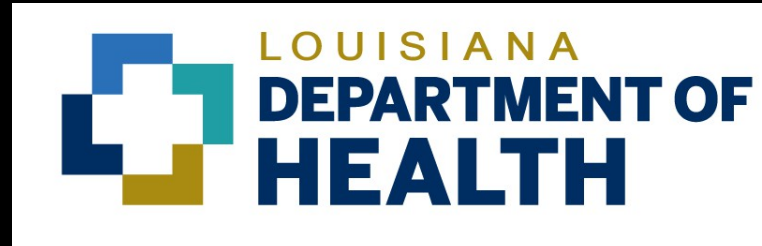
These results are being used directly in the marketing of COVID19 apps in multiple jurisdictions



Case Study:

Randomized, controlled field study (n=7,010,271)
advertising the State of Louisiana's COVID app

Randomized, controlled field study (n=7,010,271) advertising the State of Louisiana's COVID app



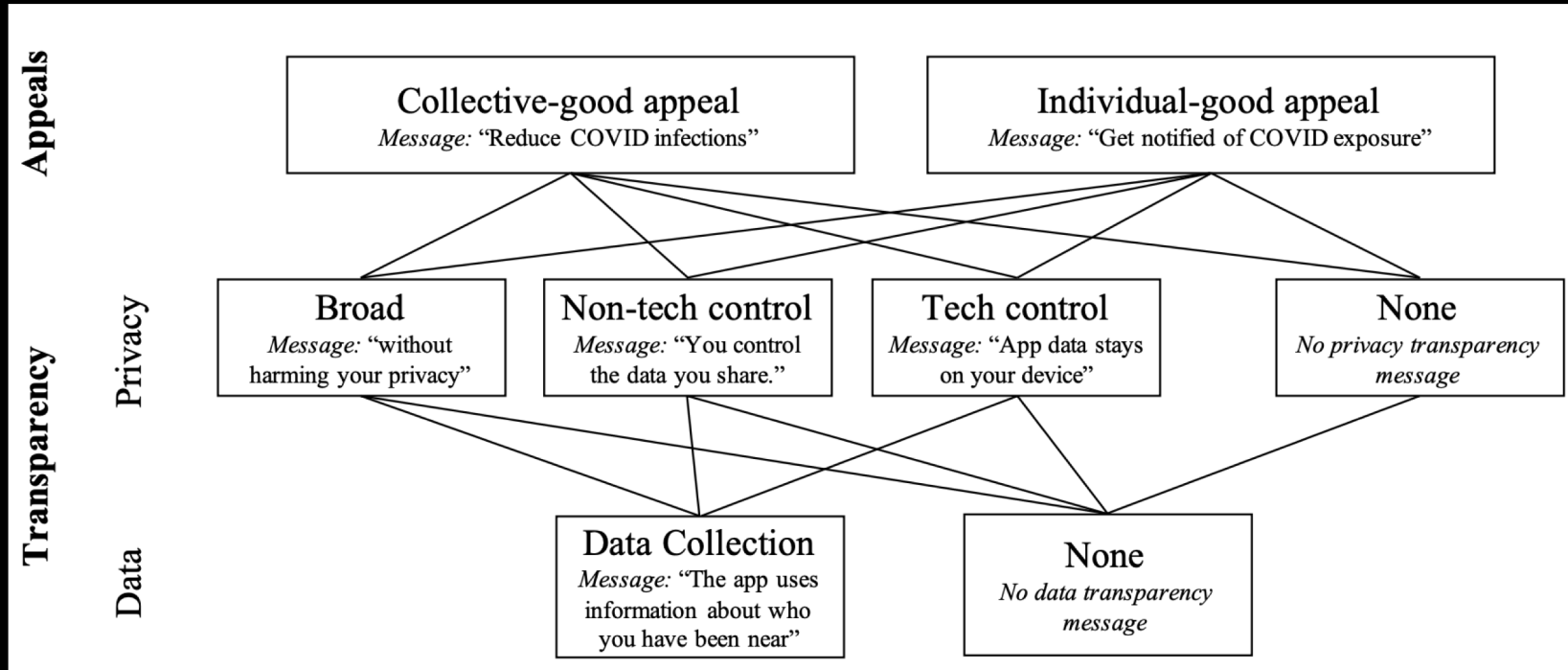
Dooley, S., Turjeman, D., Dickerson, J.P., and Redmiles, E.M. *Field Evidence of the Effects of Pro-sociality and Transparency on COVID-19 App Attractiveness*.

ACM CHI 2022.  Best Paper Honorable Mention. Preprint: <https://osf.io/preprints/socarxiv/gm6js/>

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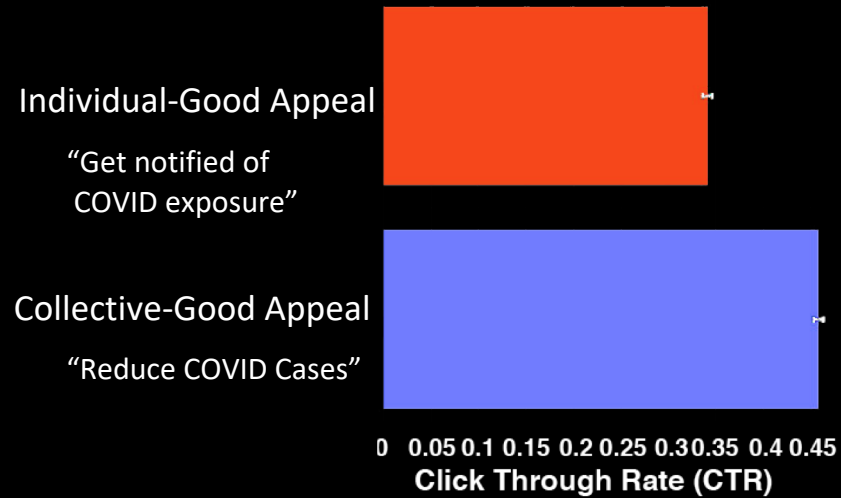


14 messages evaluating the effect of benefits-framing & transparency about privacy + data collection

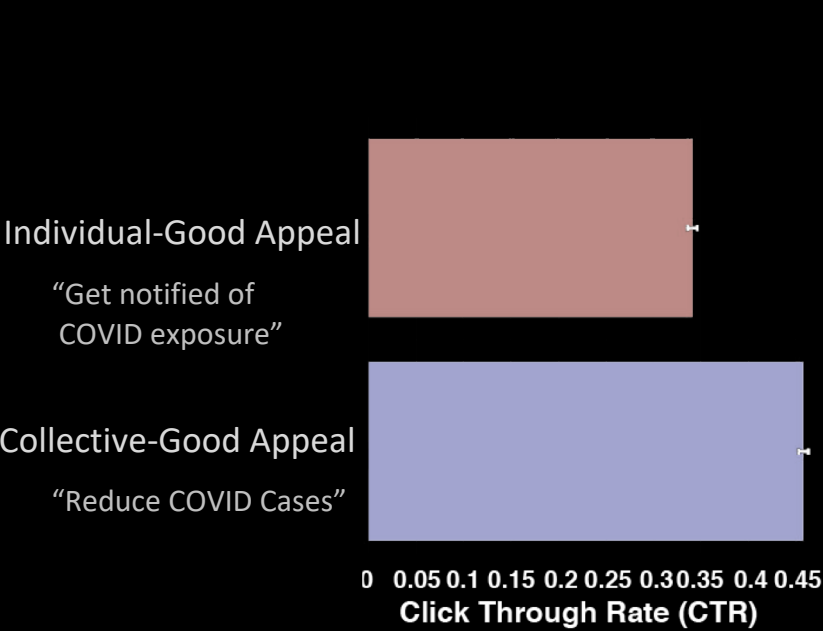


Testing the impact of tailored messaging addressing adoption considerations in the wild

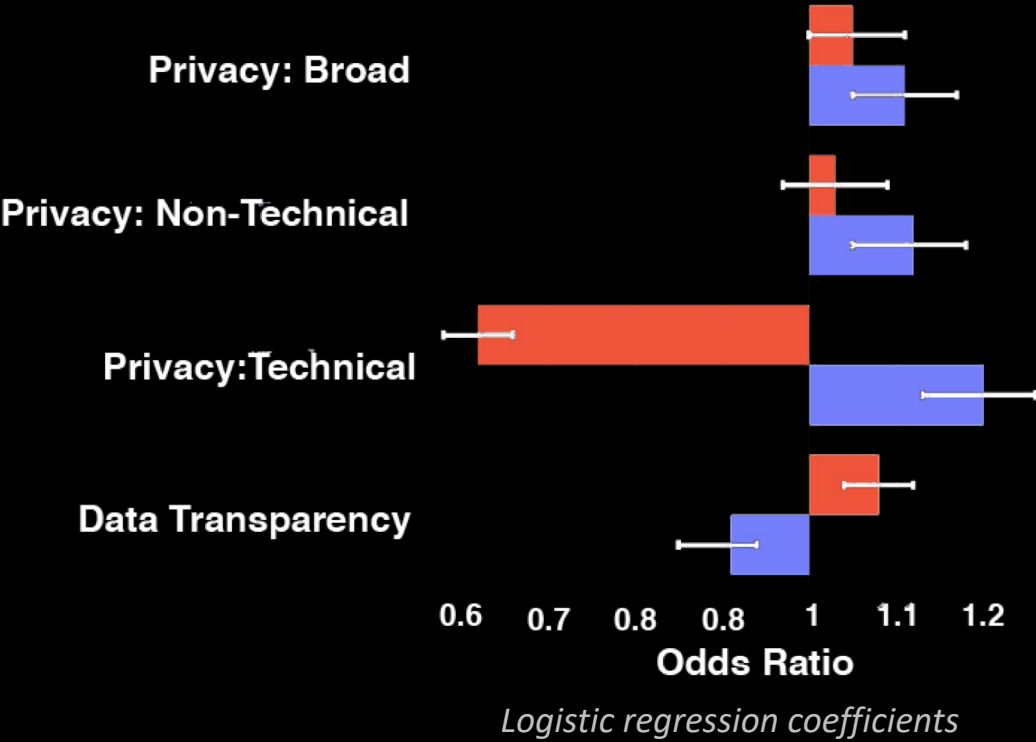
Finding 1: Collective-goods appeals are significantly more effective at encouraging adoption



Finding 2: Privacy and data transparency effects are moderated by appeal framing



Finding 1: Collective-goods appeals are significantly more effective at encouraging adoption





Provider



Privacy



Accuracy



Arc
Di

**Responsible data use is not just about privacy,
it's about providing tech that respects user preferences**

covidoptionproject.mpi-sws.org

