

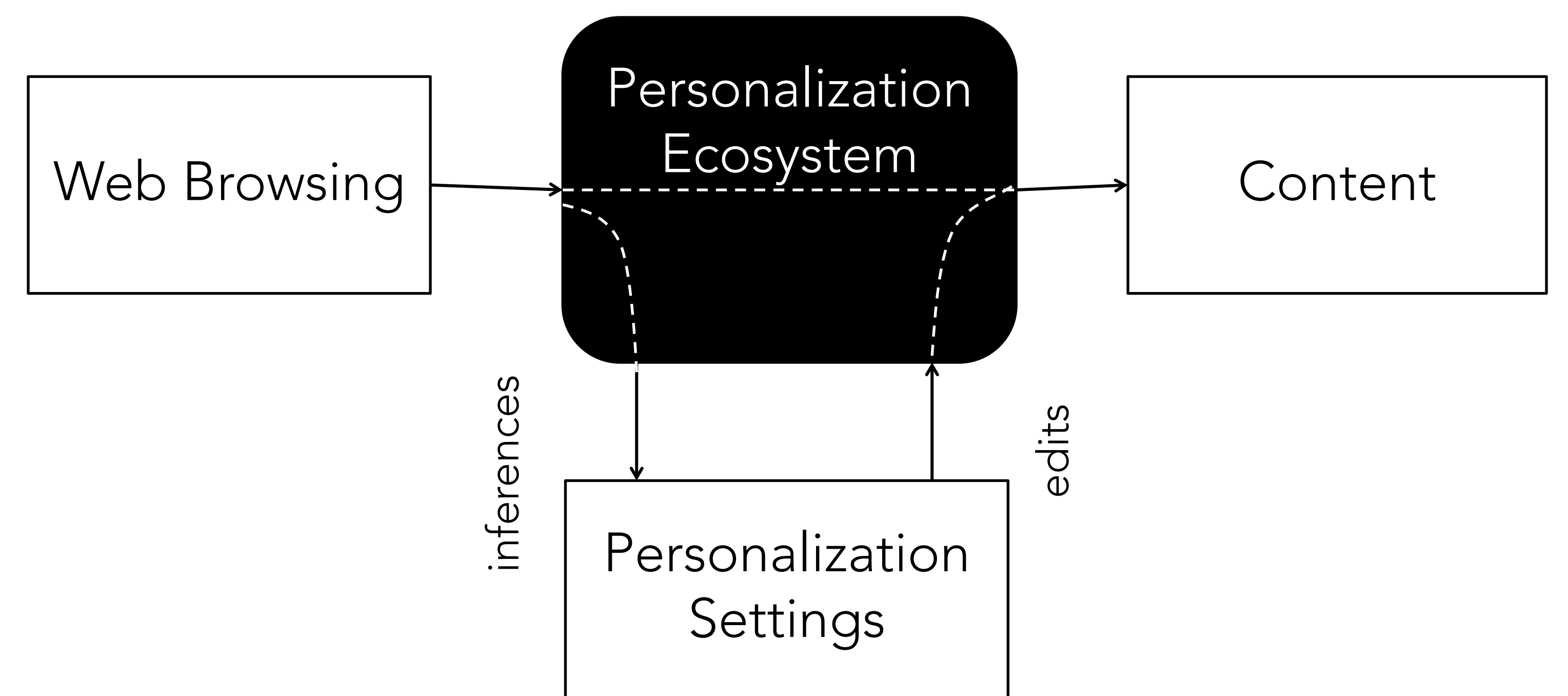
# Information Flow Experiments to study Online Personalization

Amit Datta, Michael Tschantz\*, Anupam Datta  
Carnegie Mellon University, \*International Computer Science Institute

## Motivation and Contributions

- Formally study online personalization in ads and news articles.
- Find statistically significant results without making unreasonable assumptions about output distributions.
- Demonstrate causal effects in personalization.
- In particular, we try to answer the following questions:
  - Google Ad Ecosystem
    - Can personalized ads be **discriminatory**?
    - Are Ad Settings **transparent**?
    - Do Ad Settings provide users with **choice**?
  - Google News
    - Do personalization settings provide users with **choice**?
    - Are 'Suggested for you' stories personalized?
    - Is there any unexpected personalization?
- We develop AdFisher, a tool for running Information Flow Experiments. It is freely available at [github.com/tadatitam/info-flow-experiments](https://github.com/tadatitam/info-flow-experiments)

## Information Flow Experiments



## Experimental Findings

### Discrimination in Google Ads

#### Top ads for male group

\$200k+ Jobs - Execs Only	<a href="http://careerchange.com">careerchange.com</a>
Find Next \$200k+ Job	<a href="http://careerchange.com">careerchange.com</a>
Become a Youth Counselor	<a href="http://www.youthcounseling.degreeleap.com">www.youthcounseling.degreeleap.com</a>
CDL-A OTR Trucking Jobs	<a href="http://www.tadivers.com/OTRJobs">www.tadivers.com/OTRJobs</a>
Free Resume Templates	<a href="http://resume-templates.resume-now.com">resume-templates.resume-now.com</a>

#### Top ads for female group

Jobs (Hiring Now)	<a href="http://www.jobsinyourarea.co">www.jobsinyourarea.co</a>
4Runner Parts Service	<a href="http://www.westernpatoyotaservice.com">www.westernpatoyotaservice.com</a>
Criminal Justice Program	<a href="http://www3.mc3.edu/Criminal+Justice">www3.mc3.edu/Criminal+Justice</a>
Goodwill - Hiring	<a href="http://goodwill.careerboutique.com">goodwill.careerboutique.com</a>
UMUC Cyber Training	<a href="http://www.umuc.edu/cybersecuritytraining">www.umuc.edu/cybersecuritytraining</a>

### Opacity in Ad Settings

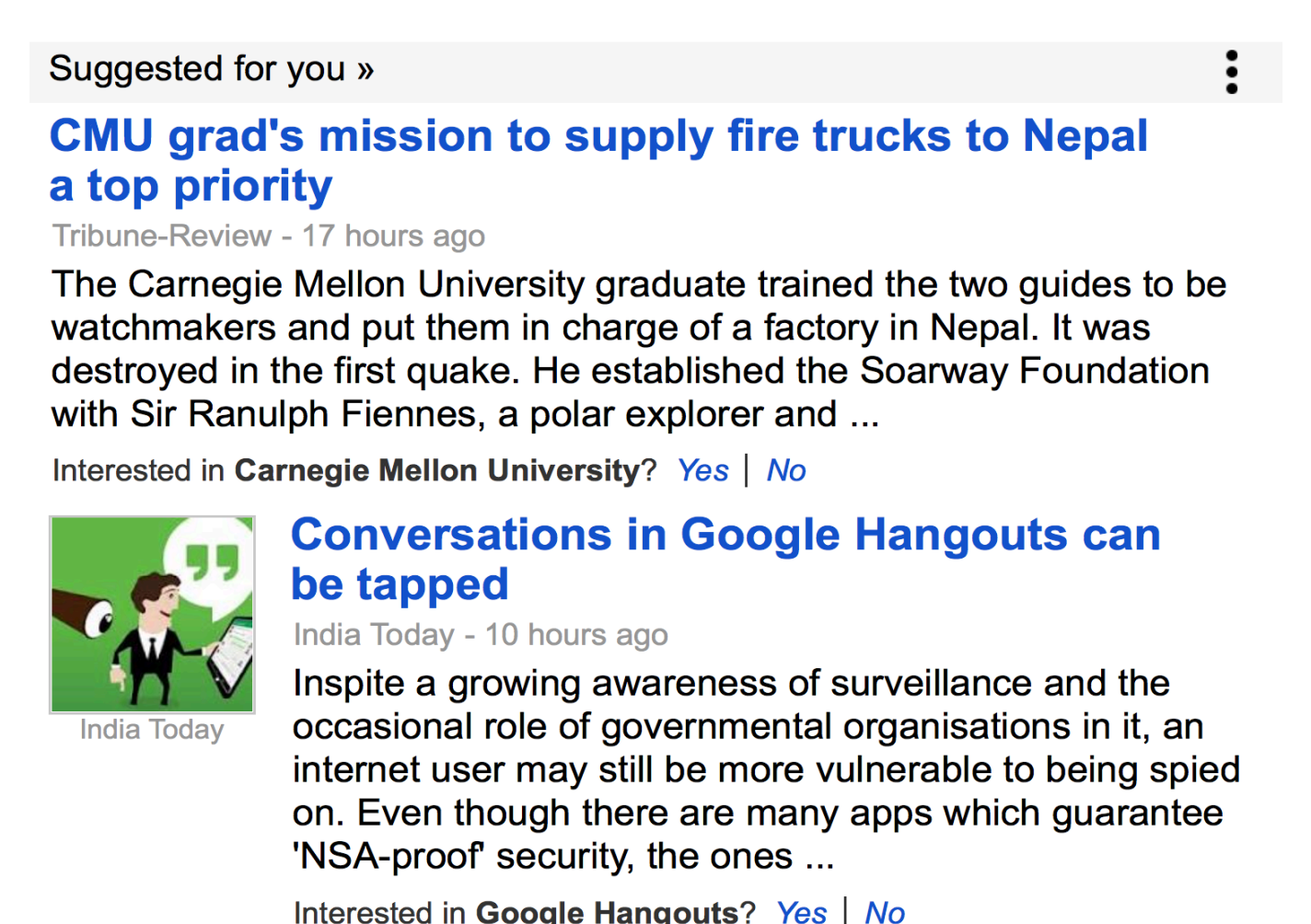
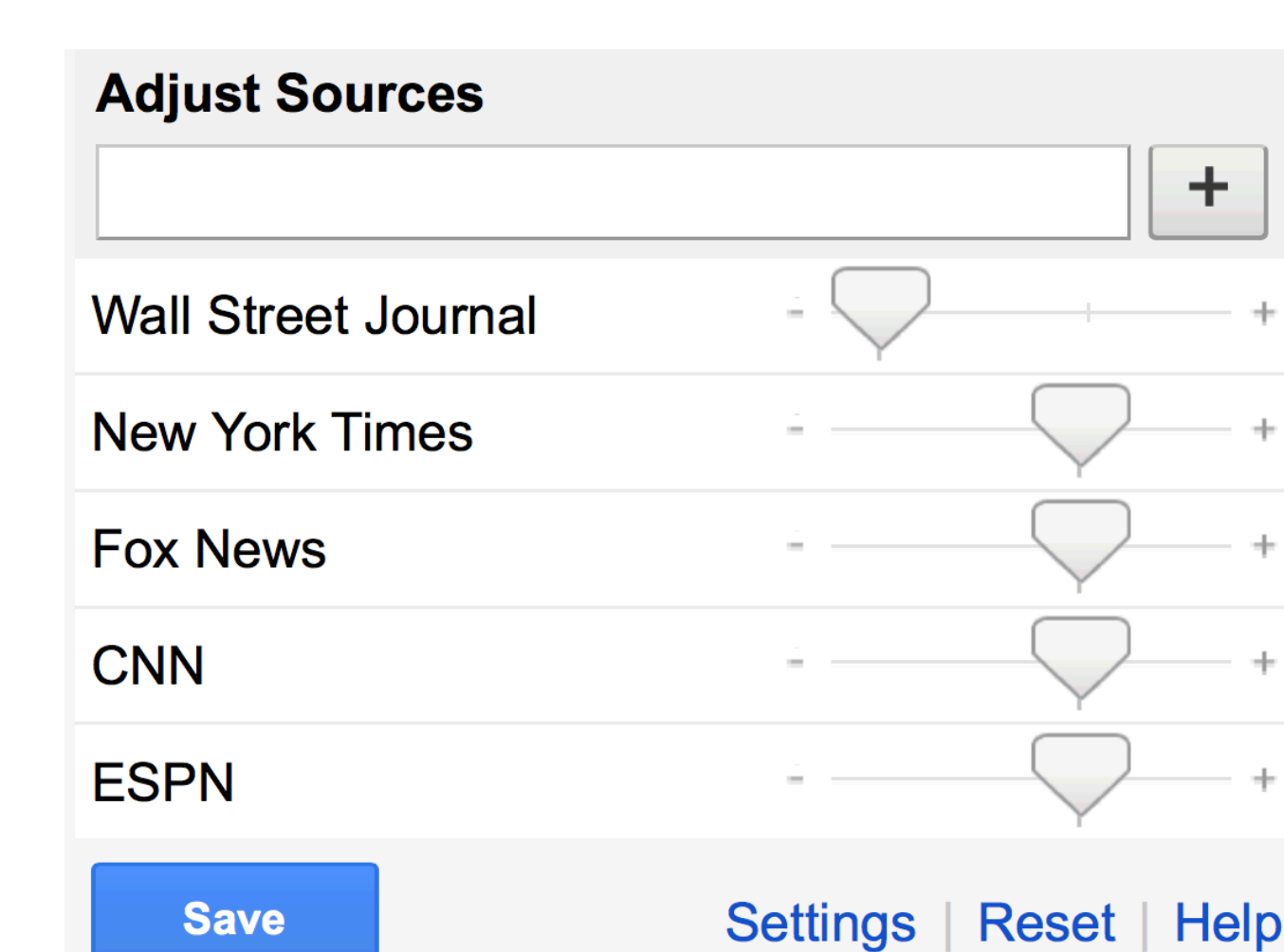
#### Top ads for group visiting substance abuse webpages

The Watershed Rehab	<a href="http://www.thewatershed.com/Help">www.thewatershed.com/Help</a>
Watershed Rehab	<a href="http://www.thewatershed.com/Rehab">www.thewatershed.com/Rehab</a>
The Watershed Rehab	Ads by Google
Veteran Home Loans	<a href="http://www.vamortgagecenter.com">www.vamortgagecenter.com</a>
CAD Paper Rolls	<a href="http://paper-roll.net/Cad-Paper">paper-roll.net/Cad-Paper</a>

Ad Settings respect user **choice**. Opting out of behavioral ads, and removing inferred interests had the desired effect.

News personalization settings also respect user **choice**. Adjusting news sources led to expected outcomes.

Google search activity affects 'Suggested for you' stories, but no evidence of personalization otherwise.

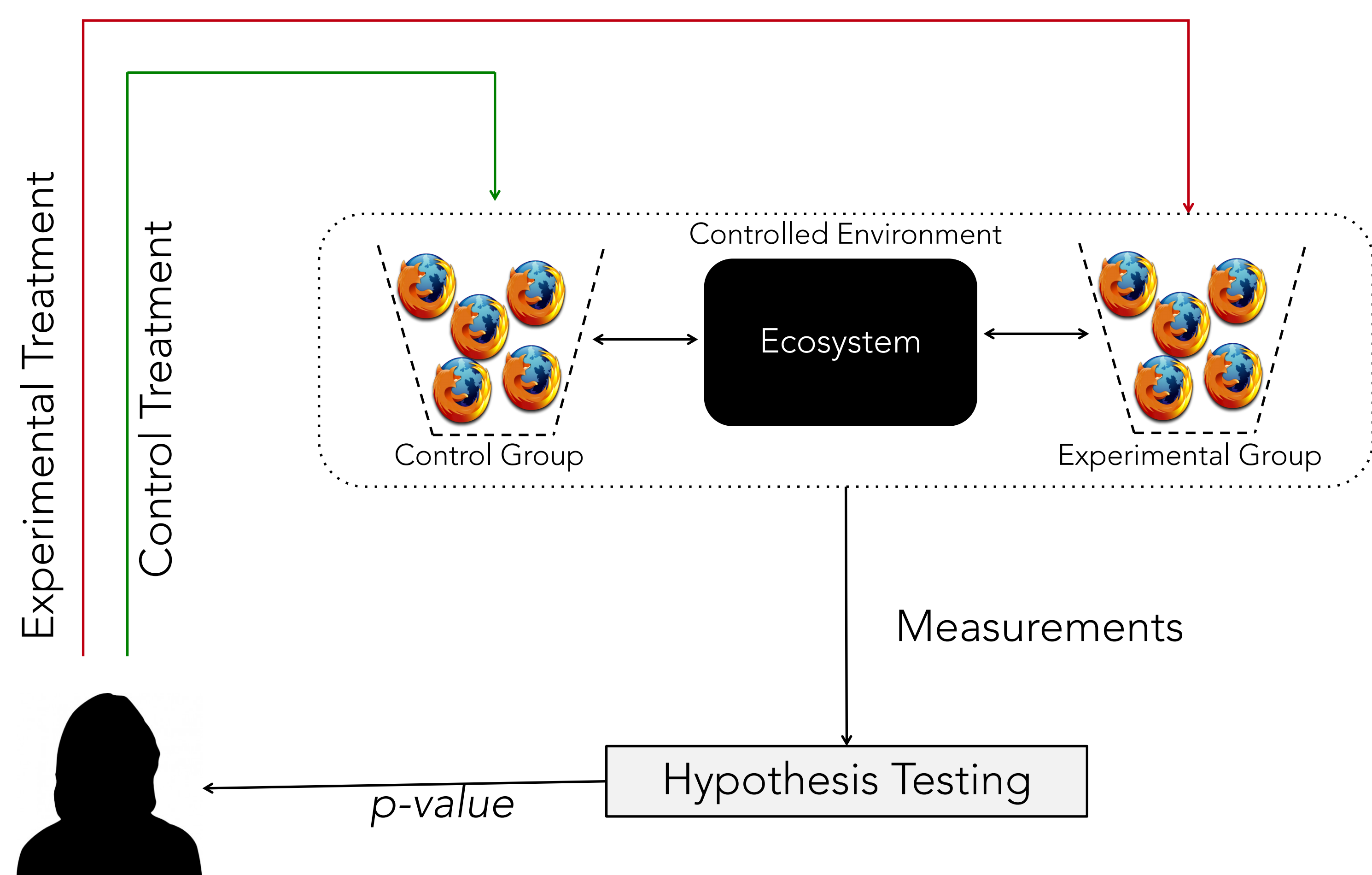


Amit Datta, Micheal Tschantz, Anupam Datta. Automated Experiments on Ad Privacy Settings: A Tale of Opacity, Choice, and Discrimination. (PETS 2015)

Micheal Tschantz, Amit Datta, Anupam Datta, Jeannette Wing. A Methodology for Information Flow Experiments. (CSF 2015)

## Methodology

### Randomized Controlled Trials



### Blocked Randomized Controlled Trials

