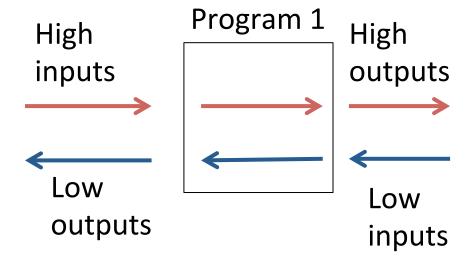
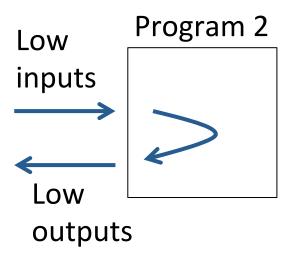
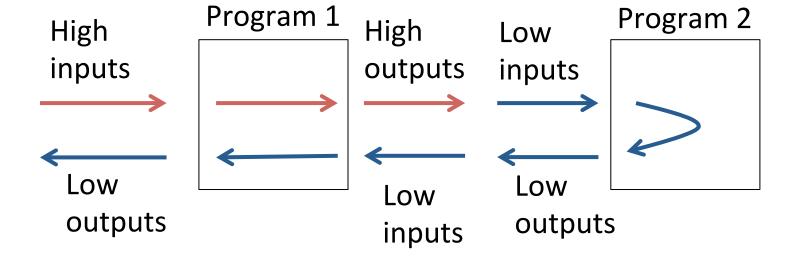
# Privacy and Composition (Part 2)

Michael Carl Tschantz
International Computer Science Institute

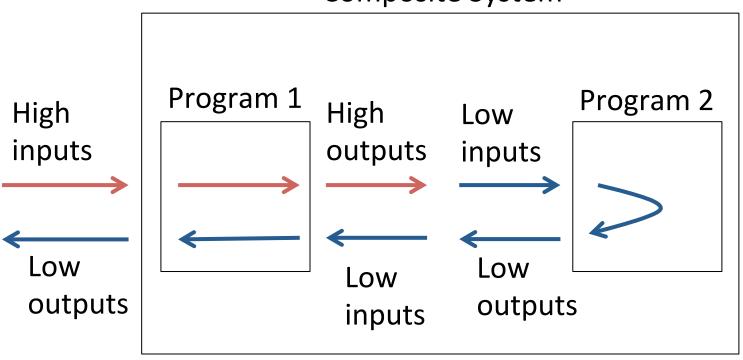


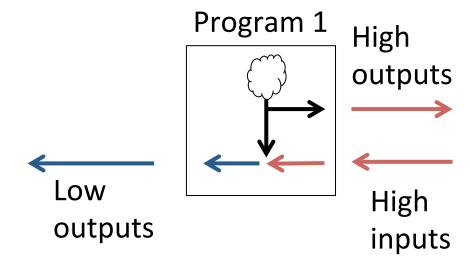


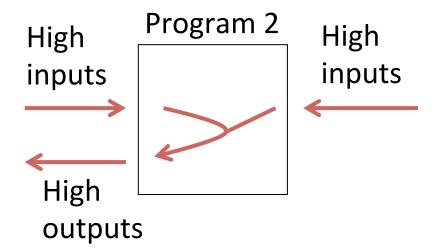


# Failure of Composition



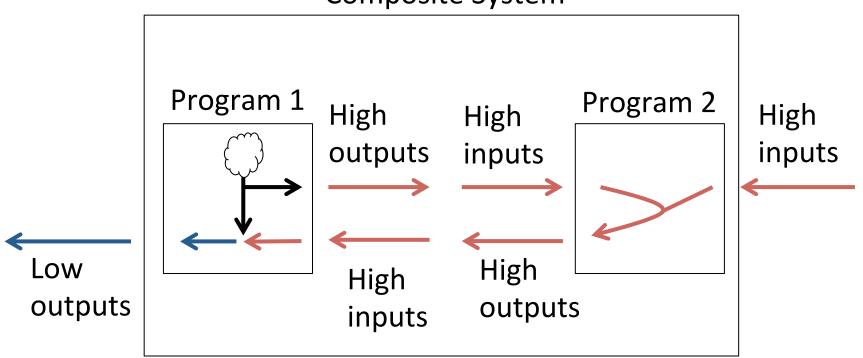






# Failure of Composition

**Composite System** 



## Noninterference Compositional and Not

Feedback

Not in general

Cascade (sequential)

Yes

Product (parallel)

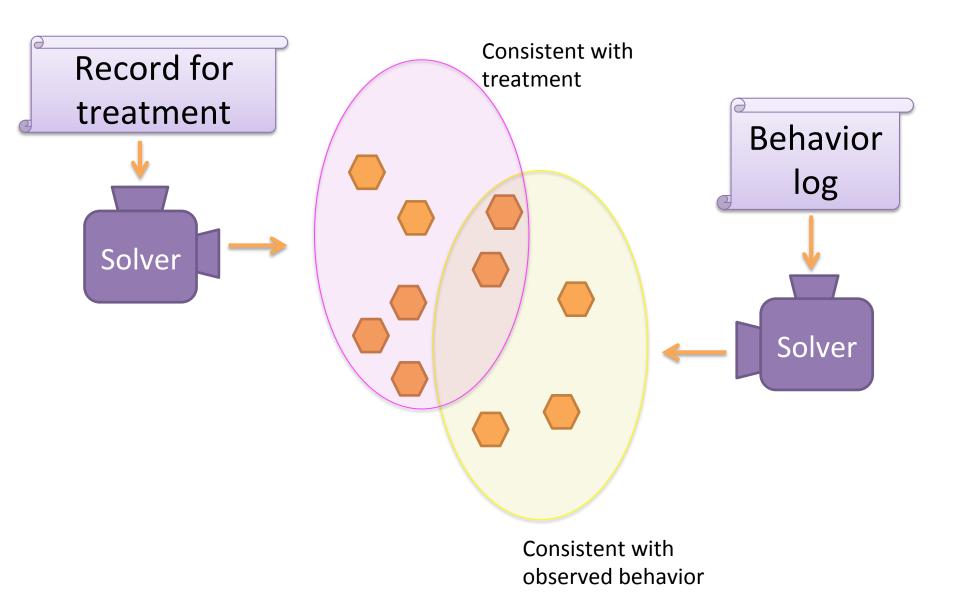
Yes

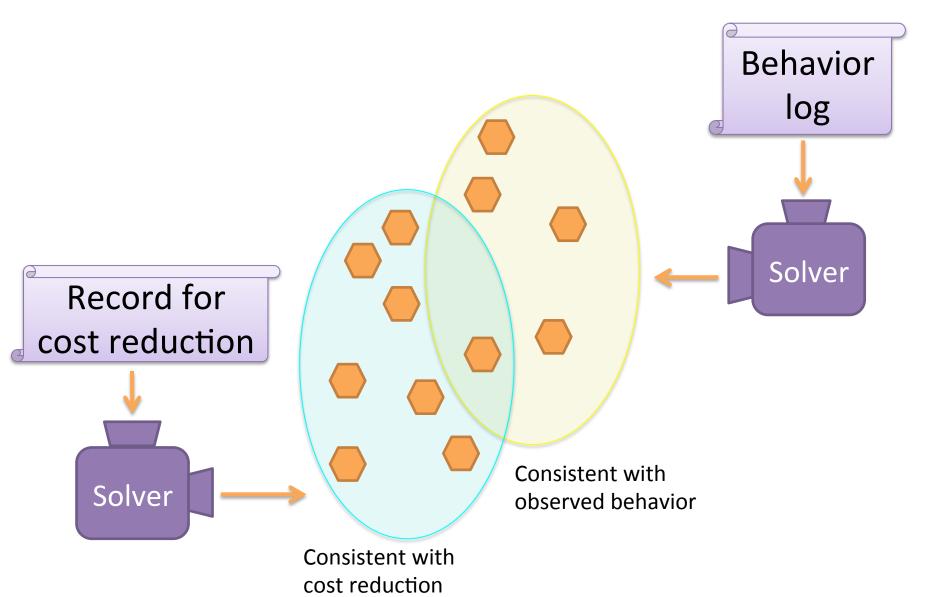
## Purpose Restrictions in Privacy Policies

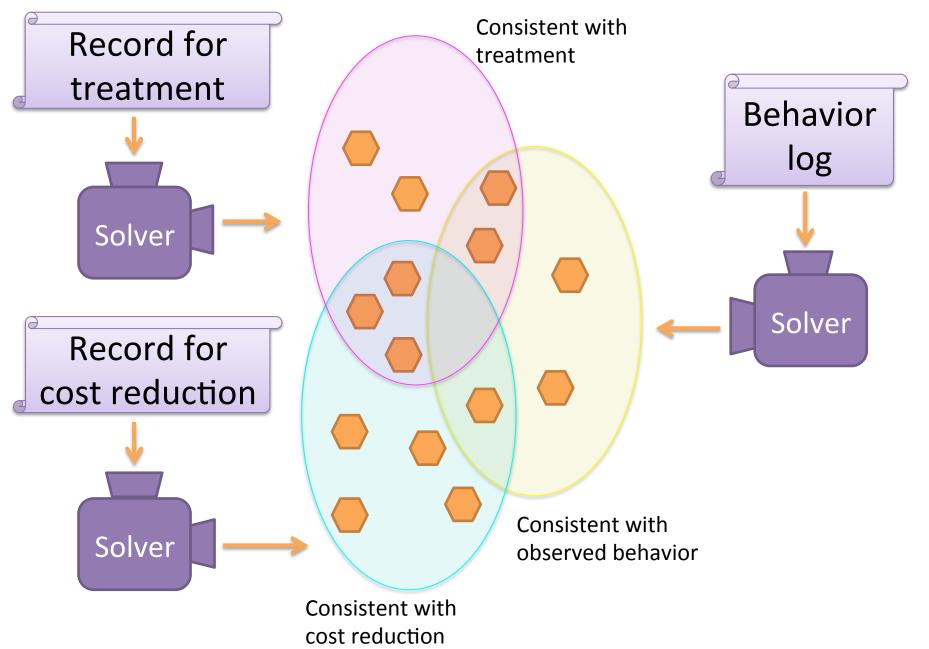
 Yahoo!'s practice is not to use the content of messages [...] for marketing purposes.

 By providing your personal information, you give [Social Security Administration] consent to use the information only for the purpose for which it was collected.

# Auditing Purpose Obeyed restriction Auditee's Inconclusive behavior **Environment** Violated Model 11





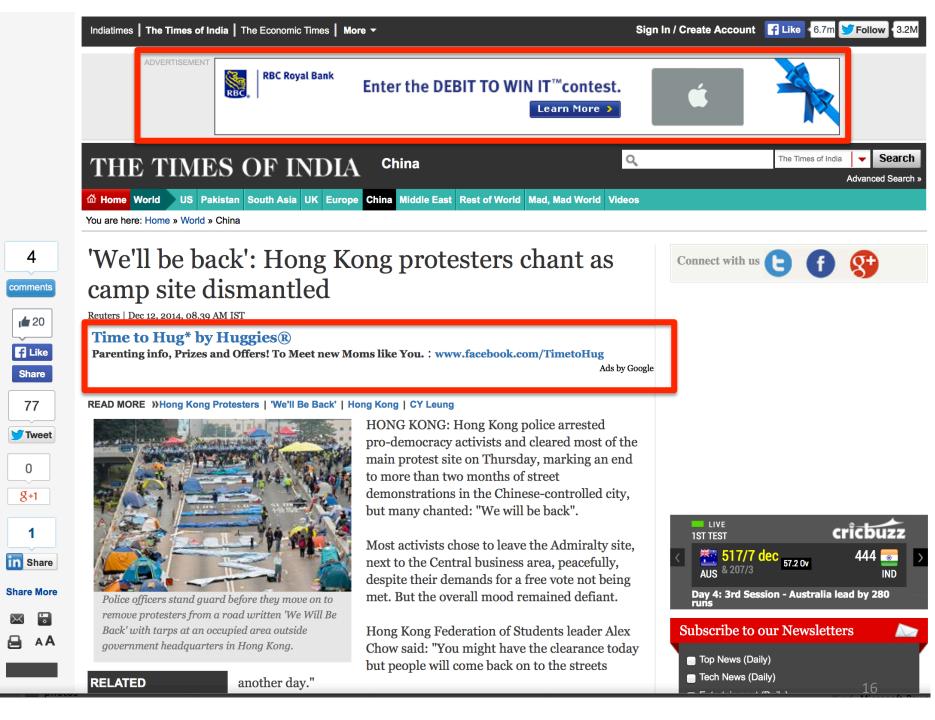


# Purpose Compositional and Not

Simultaneous No

Parallel Yes

Sequential Yes

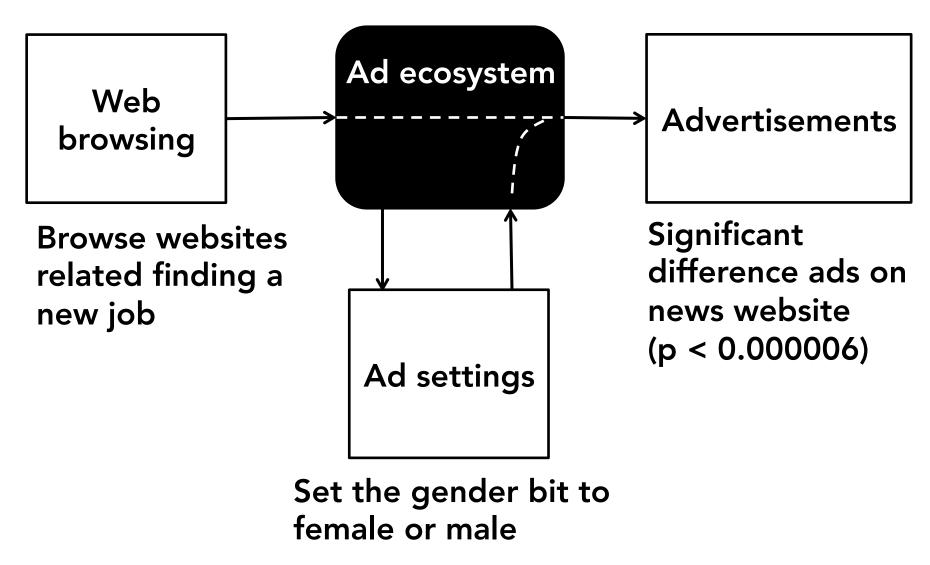


#### Settings for Google ads

Ads enable free web services and content. These settings help control the types of Google ads you see.

	Ads on Google	Google ads across the web ③
	Search	Google ads across the web YouTube
Gender	N/A	Female Edit Based on the websites you've visited
Age	N/A	25-34 Edit Based on the websites you've visited
Languages	N/A	English Edit  Based on the websites you've visited
Interests	N/A	Air Travel, and 30 more Edit Based on the websites you've visited
Opt-out settings	You've opted out of <i>interest-based</i> ads on Google.  Opt in to <i>interest-based</i> ads on Google	Opt out of interest-based Google ads across the web

#### Discrimination



### Discrimination Explanation

#### Female Group

Jobs (Hiring Now) www.jobsinyourarea.co 45 vs. 8

4Runner Parts Service www.westernpatoyotaservice.com 36 vs. 5

Criminal Justice Program www3.mc3.edu/Criminal+Justice 29 vs. 1

#### Male Group

\$200k+ Jobs - Execs Only careerchange.com 311 vs. 1816

Find Next \$200k+ Job careerchange.com
7 vs. 36

Become a Youth Counselor www.youthcounseling.degreeleap.com 0 vs. 310

## Out Bided on Women but Not Men

<b>Bids for Females</b>	Bids for Males
\$7 Makeup	
\$5 Dress	
\$4 Job	\$4 Job
\$2 Hair Salon	
\$1 Car	\$1 Car

## Who's to Blame?

- Career coaching service: place same bids for females and males
- Other advertisers: place bids on females for products that cater only to women
- Google: show the highest bid

## References

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- [Dwork, McSherry, Nissim & Smith, 2006] Cynthia Dwork, Frank Mcsherry, Kobbi Nissim and Adam Smith. Calibrating Noise to Sensitivity in Private Data Analysis. Theory of Cryptography Conference. 2006.
- [Garg, Jia & Datta, 2011] D. Garg, L. Jia and A. Datta. Policy Auditing over Incomplete Logs: Theory, Implementation and Applications. Proceedings of 18th ACM Conference on Computer and Communications Security. 2011.
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- [Tschantz, Datta & Wing 2012] Michael Carl Tschantz, Anupam Datta and Jeannette M. Wing. Formalizing and Enforcing Purpose Restrictions in Privacy Policies. Proceedings of the 2012 IEEE Symposium on Security and Privacy. 2012. 176-190.
- [Tschantz 2012] Michael Carl Tschantz. Formalizing and Enforcing Purpose Restrictions. Ph.D. Dissertation. School of Computer Science, Carnegie Mellon University. CMU-CS-12-117. 2012.
- [Datta, Tschantz & Datta 2015] Amit Datta, Michael Carl Tschantz and Anupam Datta. Automated Experiments on Ad Privacy Settings: A Tale of Opacity, Choice, and Discrimination. Proceedings on Privacy Enhancing Technologies (PoPETs). 2015.