

The Economics and Behavioral Economics of Privacy

Alessandro Acquisti

Carnegie Mellon University

NIST Privacy in the Digital Age Lecture Series, December 8 2014

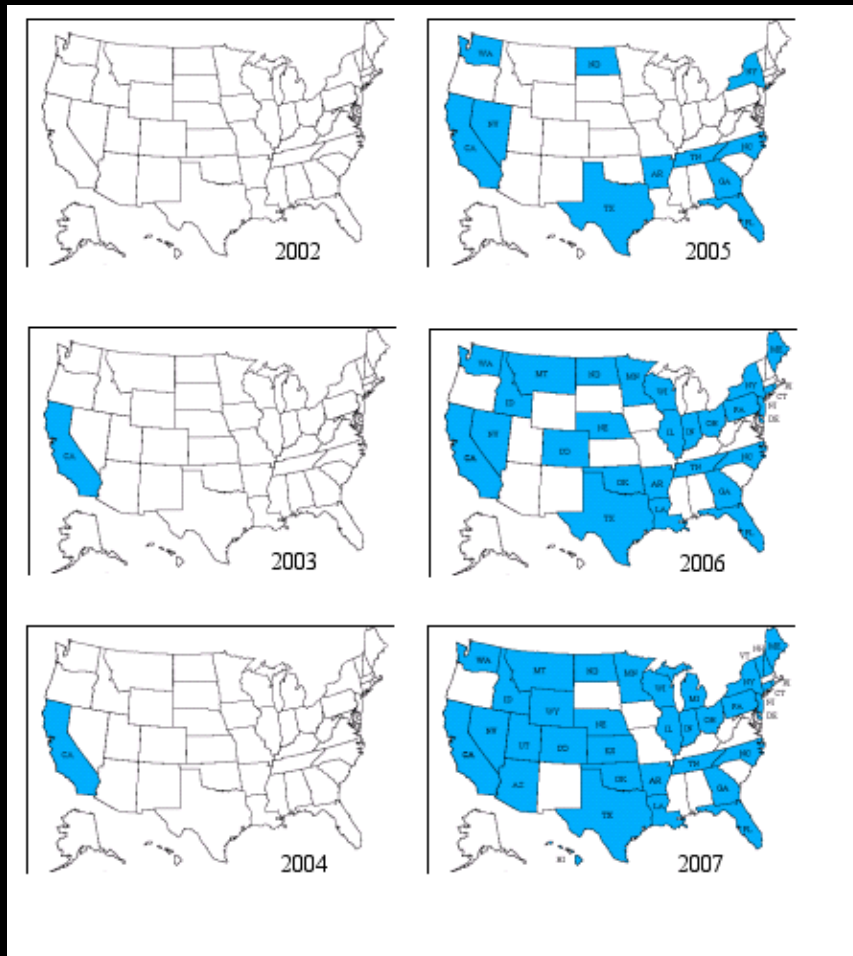
- The economics of privacy
- The behavioral economics of privacy
- Privacy in online social networks

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The economics of privacy



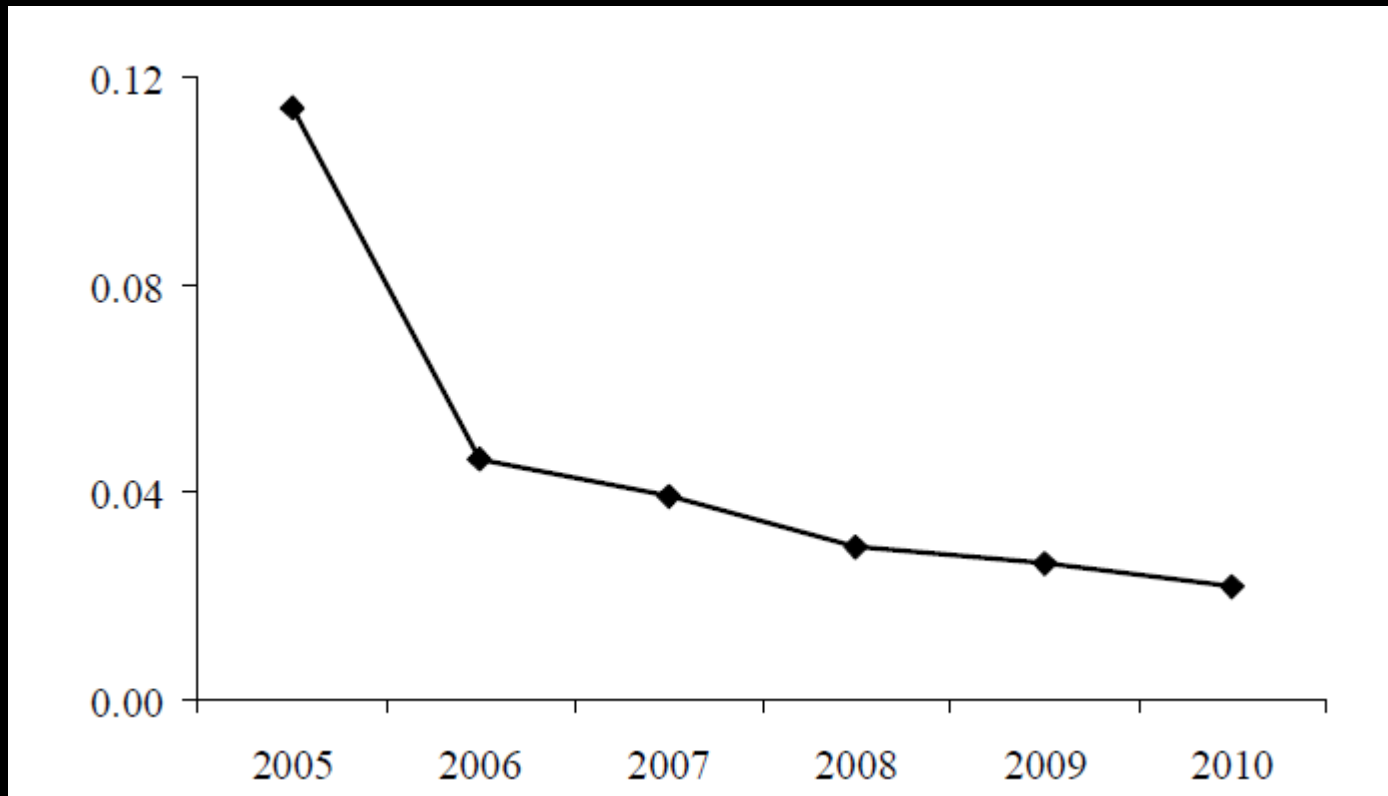
The impact of breach disclosure laws on ID theft



- Average reduction of ID theft due to disclosure laws: 6%

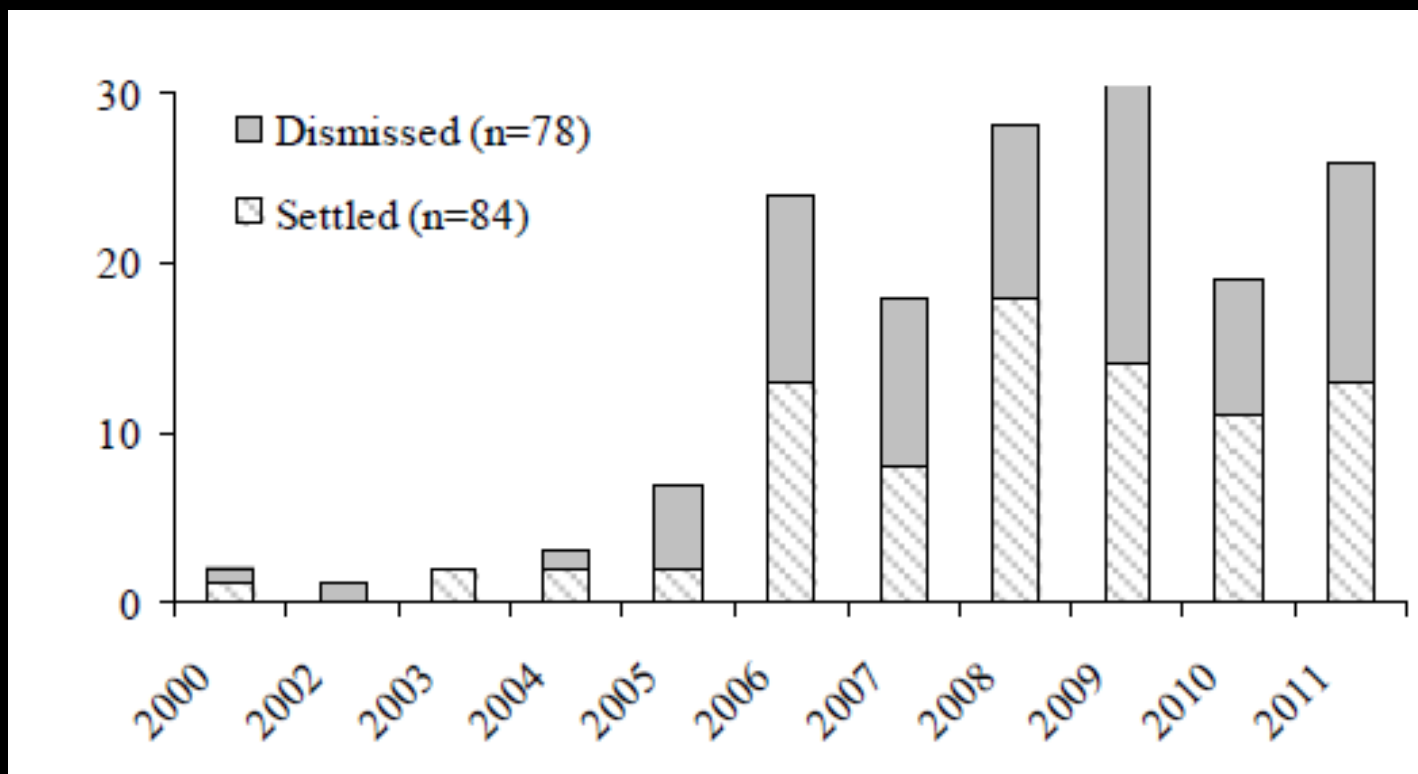
"Do Data Breach Disclosure Laws Reduce Identity Theft?," Sasha Romanosky, Rahul Telang, and Alessandro Acquisti. *Journal of Policy Analysis and Management*, 2011

Empirical analysis of data breach litigation



Ratio of lawsuits over breaches

"Empirical Analysis of Data Breach Litigation," Sasha Romanosky, David Hoffman, Alessandro Acquisti.
Journal of Empirical Legal Studies, 2014.



Dismissed vs. Settled lawsuits

"Empirical Analysis of Data Breach Litigation," Sasha Romanosky, David Hoffman, Alessandro Acquisti.
Journal of Empirical Legal Studies, 2014.

Probability of **lawsuit higher**
when:

- greater number of records compromised
- evidence of actual harm (financial loss)
- data required heightened level of protection (e.g. CCN, medical, financial)
- breach caused by improper disclosure of information

Probability of **settlement higher**
when:

- plaintiffs claim to suffer actual (financial) harm
- class is certified
- surprisingly, statutory damages not found to drive settlement

"Empirical Analysis of Data Breach Litigation," Sasha Romanosky, David Hoffman, Alessandro Acquisti.
Journal of Empirical Legal Studies, 2014.

SAMPLE JOHN DOE CV & GRANTS

UNIVERSITY OF PENNSYLVANIA - SCHOOL OF MEDICINE
Curriculum Vitae

John Doe, M.D., Ph.D.

Date: Month_year

Office Address: 1234 Maloney Building
Hospital of the University of Pennsylvania
Philadelphia, PA 19104-4283

If you are not a U.S. citizen please indicate the type of visa you have:
(If applicable)

Visa type or Permanent Resident status

Education:

1988	B.S.	Yale University (English)
1992	M.D.	University of Pennsylvania
1994	Ph.D.	University of Pennsylvania (Physiology)

Postgraduate Training and Fellowship Appointments:

1994-1995	Intern in Medicine, Temple Hospital, Philadelphia
1995-1996	Resident in Medicine, Graduate Hospital, Philadelphia
1997-1999	Fellowship, Pulmonary Diseases, Hospital of the University of Pennsylvania, Philadelphia

Military Service:

1996-1997	U.S. Public Health Service, Tuberculosis Control Section, Philadelphia
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Faculty Appointments:

1999-2008	Assistant Professor of Medicine, Department of Medicine University of Pennsylvania School of Medicine
2008-present	Associate Professor of Medicine, Department of Medicine University of Pennsylvania School of Medicine

Hospital and Administrative Appointments:

1999-present	Assistant Chief, Pulmonary Division, Department of Medicine, University of Pennsylvania School of Medicine
2001-2005	Chief, Pulmonary Function Laboratory, Department of Medicine, University of Pennsylvania School of Medicine
2005-present	Director, Inhalation Therapy, University of Pennsylvania School of Medicine

Other Appointments:

1999-present	Senior Fellow, Leonard Davis Institute, University of Pennsylvania School of Medicine
1999-present	Faculty Member, Cell and Molecular Biology Graduate Group, University of Pennsylvania



John Doe

Washington, District of Columbia (Washington D.C. Metro Area) | Staffing and Recruiting

Join LinkedIn and access John Doe's full profile.

As a LinkedIn member, you'll join 200 million other professionals who are sharing connections, ideas, and opportunities. And it's free! You'll also be able to:

- See who you and **John Doe** know in common
- Get introduced to **John Doe**
- Contact **John Doe** directly

[View full profile](#)

John Doe's Overview



Recommendations **4 people** have recommended John
Connections **500+** connections

Name Search:

Search for people you know from over 200 million professionals already on LinkedIn.

First Name Last Name
Example: **John Doe**

Viewers of this profile also viewed...

-  **Joanne Piscopo**
Sr. Account Manager/Recruiter in...
-  **Joseph rasoori**
recruiter at Airmc Inc
-  **Gary Calka**
Owner, R&T ASSOCIATES
-  **Donny Soucy**
Senior Technical Recruiter at Kinetix...
-  **Meredith Skiados**
-  **Kelly Mahler**
Sr. Recruiter at SA Technologies Inc.
-  **Ewelina Wanczycki**
Account Manager at SA Technologies Inc.

Timeline
Image

Profile Image

Name

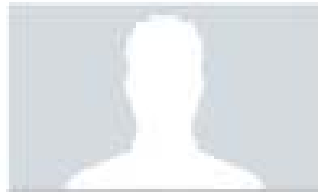
Personal
Information

Close ended
fields (e.g.,
Likes)

Open ended
fields (e.g.,
status
updates)

Friends





MUSLIM



CHRISTIAN

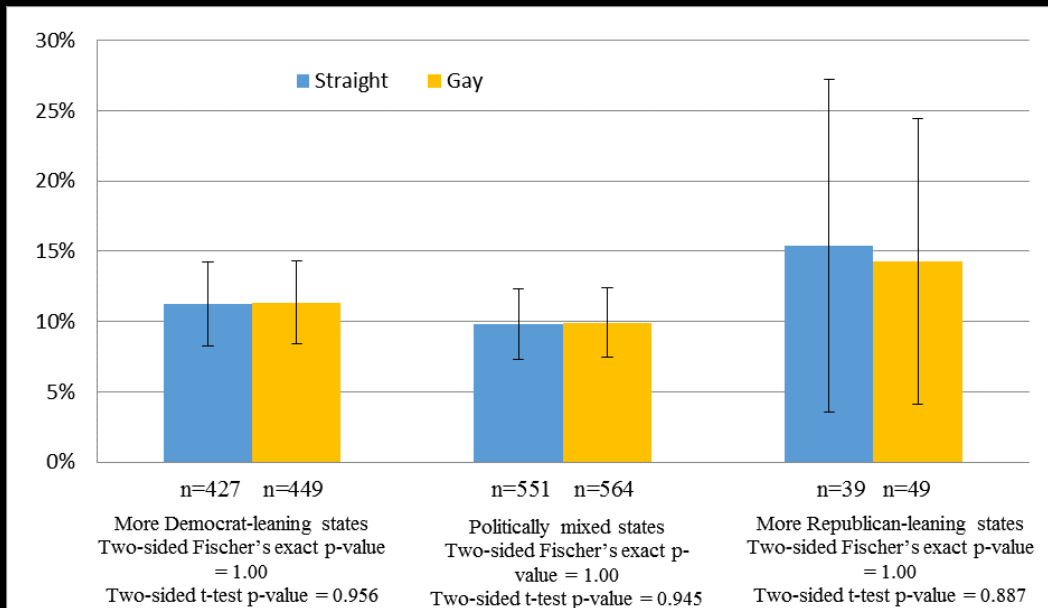


GAY

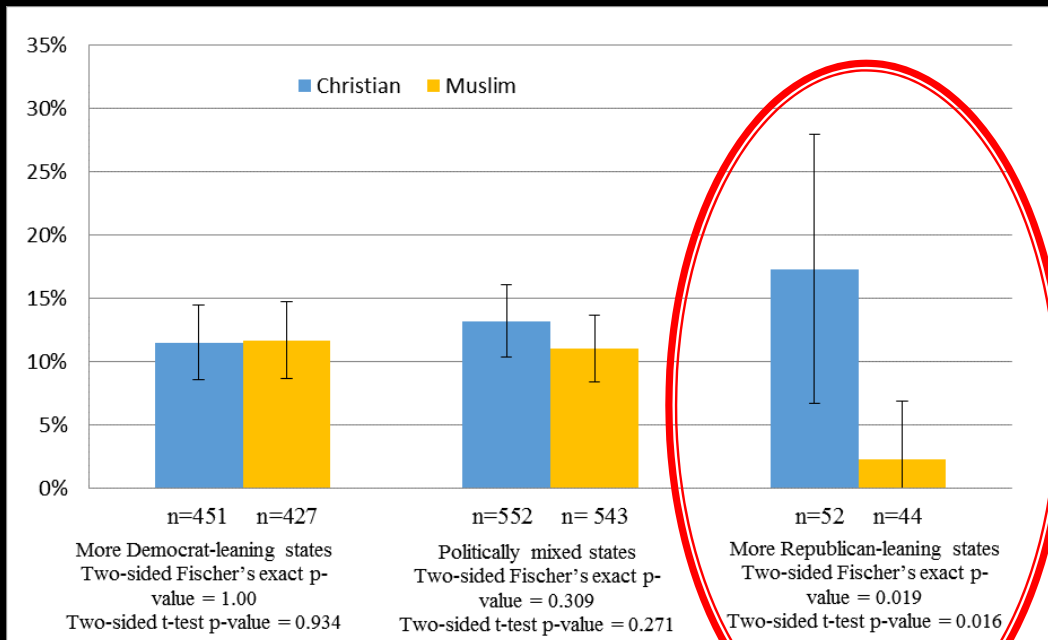


STRAIGHT

Callback rates



Callback rates



"An Experiment in Hiring Discrimination via Online Social Networks,"
Alessandro Acquisti and Christina Fong, work in progress (available at SSRN).



The “behavioral economics” of privacy

- Asymmetric information
- Bounded rationality
- Cognitive and behavioral biases

What is privacy worth?



\$10

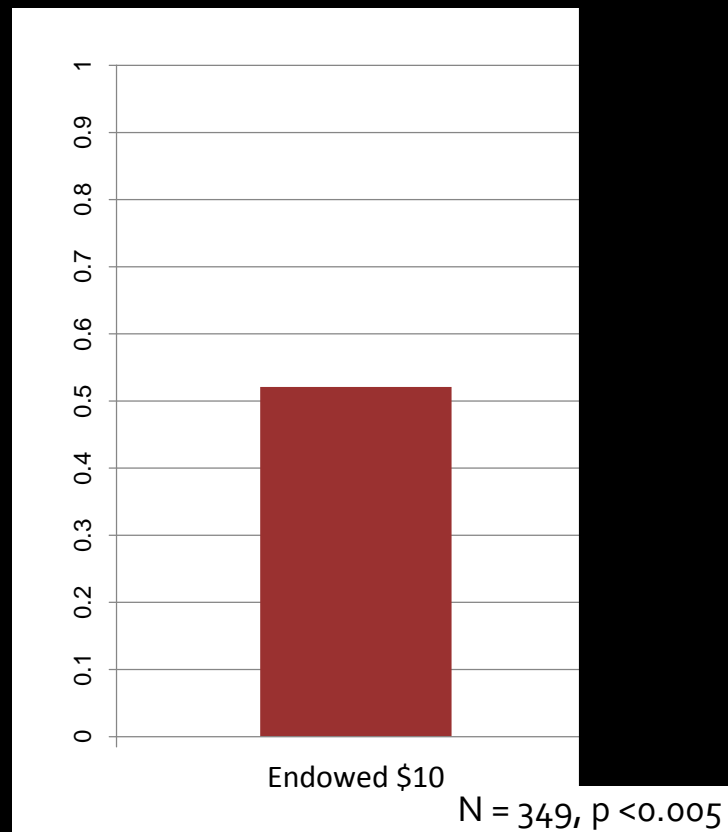
Anonymous



\$12


Tracked

Percentage choosing \$10 card



"What is Privacy Worth?," Alessandro Acquisti, Leslie John, and George Loewenstein.
Journal of Legal Studies, 2013.

Will consumers pay for privacy?



poster

Search Engine: ☐ Google ☒ Yahoo! **Preference Level:**

■■■■ [Privacy Report](#) [Decorate with Framed Posters, Art Prints & Photography from Barewalls.com](#)
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Online store for posters and prints of movies, actors, sports, music, and other subjects.
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“The effect of online privacy information on purchasing behavior: An experimental study,” Tsai, Egelman, Cranor, Acquisti. *Information Systems Research*, 2011.





Condition 1

No information



Duracell Alkaline Battery, AA, 8/PK

Duracell Coppertop Alkaline AA Batteries Long-life alkaline batteries provide the best, longest power source. Recommended for use in smoke alarms, flashlights, lanterns, calculators, pagers, cameras, recorders, radios, CD players

www.ccvsoftware.com/c/product.html?record@56119



\$14.45 (w/shipping)

Duracell AA8 DURACELL - Alkaline Batteries Value Packs

Duracell AA8 DURACELL Alkaline Battery Value Packs...

discountofficeitems.zoovy.com/product/DURMN15RT12Z



\$14.60 (w/shipping)

Duracell Alkaline Battery Value Packs

Duracell AA8 DURACELL Alkaline Battery Value Packs DURACELL AA ALKALINE BATTERY - 8 PACK Cardboard card for peg hook 8 pack Specifications Weight 0.45 lbs Length 4.5 inches Width 3.75 inches Height 1 inches Manufactures Web site www.duracell.com

www.instawares.com/Coppertop-Alkaline-Lithium-Bat...



\$14.80 (w/shipping)

Duracell Coppertop Alkaline AA Batteries

Long-life alkaline batteries provide the best, longest power source. Recommended for use in smoke alarms, flashlights, lanterns, calculators, pagers, cameras, recorders, radios, CD players, medical equipment, toys and electronic games. Dependable after seven years of storage.

www.officequarters.com/product.php/item/DUR-MN1500B8...



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Condition 2

Irrelevant information



Duracell Alkaline Battery, AA, 8/PK

Duracell Coppertop Alkaline AA Batteries Long-life alkaline batteries provide the best, longest power source. Recommended for use in smoke alarms, flashlights, lanterns, calculators, pagers, cameras, recorders, radios, CD players

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Handicap
Accessibility

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Accessibility

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\$15.14 (w/shipping)

Condition 3

Privacy information



Privacy premium:
\$0.69 (or about 5%)

Duracell Alkaline Battery, AA, 8/PK

Duracell Coppertop Alkaline AA Batteries Long-life alkaline batteries provide the best, longest power source. Recommended for use in smoke alarms, flashlights, lanterns, calculators, pagers, cameras, recorders, radios, CD players

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Duracell AA8 DURACELL - Alkaline Batteries Value Packs

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Duracell Alkaline Battery Value Packs

Duracell AA8 DURACELL Alkaline Battery Value Packs DURACELL AA ALKALINE BATTERY - 8 PACK Cardboard card for peg hook 8 pack Specifications Weight 0.45 lbs Length 4.5 inches Width 3.75 inches Height 1 inches Manufactures Web site www.duracell.com

www.instawares.com/Coppertop-Alkaline-Lithium-Bat... [Privacy Policy](#)

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Duracell Coppertop Alkaline AA Batteries

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\$14.45 (w/shipping)



\$14.60 (w/shipping)



\$14.80 (w/shipping)

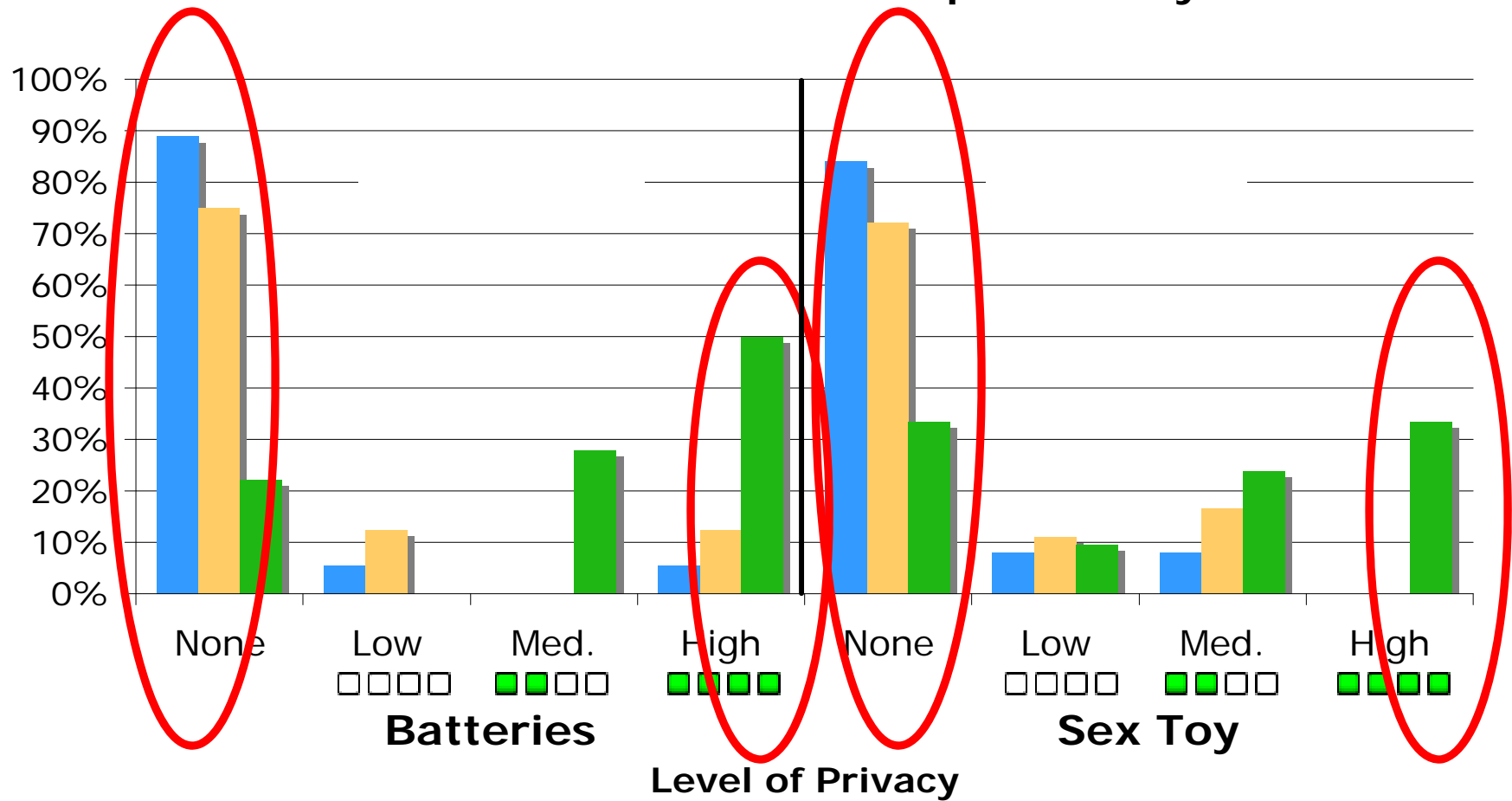


\$15.14 (w/shipping)

Results

% Purchases by Level of Privacy

■ No Information ■ Handicap ■ Privacy



So: How do we balance data sharing and privacy protection?

Transparency and control

Sufficient vs. Necessary conditions

Sufficient vs. **Necessary** conditions

Not Sufficient

Control

Privacy and paradox of Control

Privacy and paradox of Control

Control :: Privacy

+

Privacy and paradox of Control

Control :: Privacy

—

Study on Ethical Behavior

IMPORTANT: All answers are voluntary. By answering a question, you agree to give the researchers permission to publish your answer.

	Yes	No
1. Are you married?	<input type="radio"/>	<input type="radio"/>
2. Have you ever been fired by your employer?	<input type="radio"/>	<input type="radio"/>
3. Have you ever stolen anything (e.g.: from a shop, a person)?	<input type="radio"/>	<input type="radio"/>
4. Have you ever used drugs of any kind (e.g.: weed, heroin, crack)?	<input type="radio"/>	<input type="radio"/>
5. Have you ever lied about your age?	<input type="radio"/>	<input type="radio"/>
6. Have you ever had cosmetic surgery?	<input type="radio"/>	<input type="radio"/>
7. Have you ever done any kind of voluntary service?	<input type="radio"/>	<input type="radio"/>
8. Have you ever had sex in a public venue (e.g.: restroom of a club, airplane)?	<input type="radio"/>	<input type="radio"/>
9. Have you ever made a donation to a non-profit organization?	<input type="radio"/>	<input type="radio"/>
10. Do you have any permanent tatoos?	<input type="radio"/>	<input type="radio"/>

Close

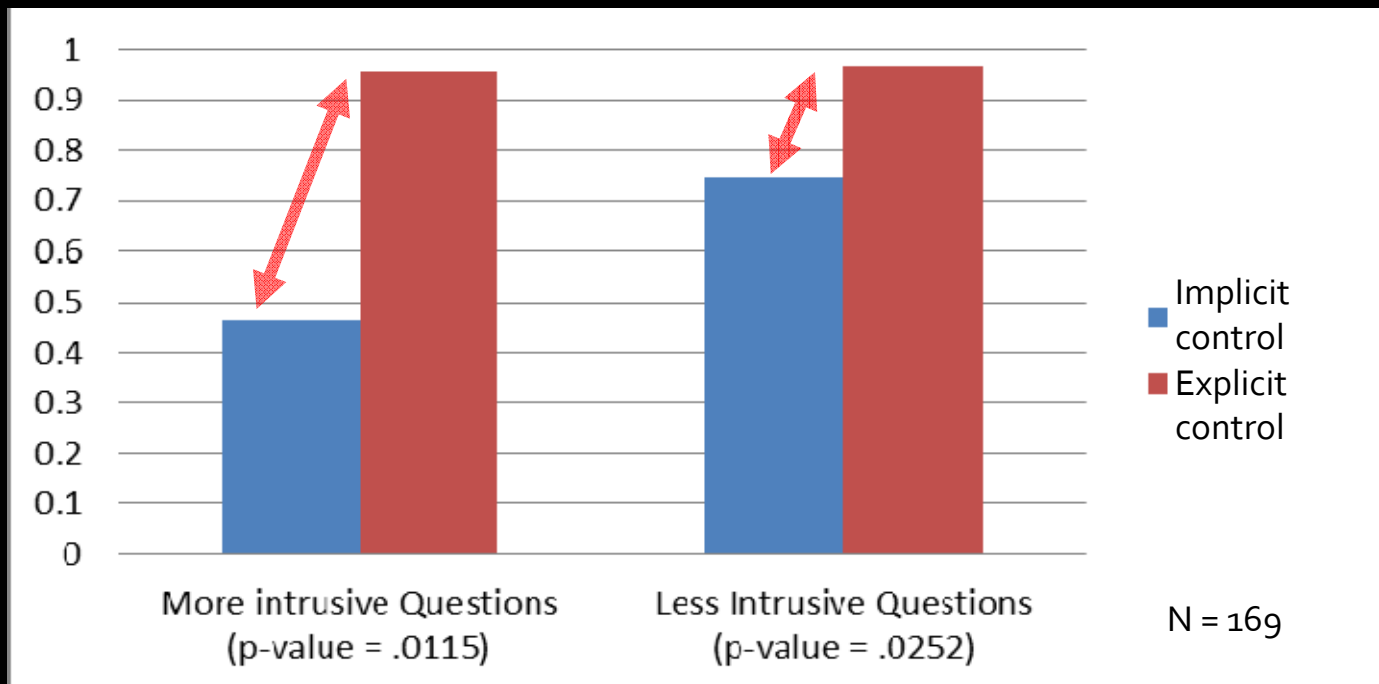
Study on Ethical Behavior

IMPORTANT: All answers are voluntary. In order to give the researchers permission to publish your answer to a question, please check the corresponding box.

	Publication permission	Yes	No
1. Are you married?	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>
2. Have you ever been fired by your employer?	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>
3. Have you ever stolen anything (e.g.: from a shop, a person)?	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>
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9. Have you ever made a donation to a non-profit organization?	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>
10. Do you have any permanent tatoos?	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>

Close

Response (and publication rates



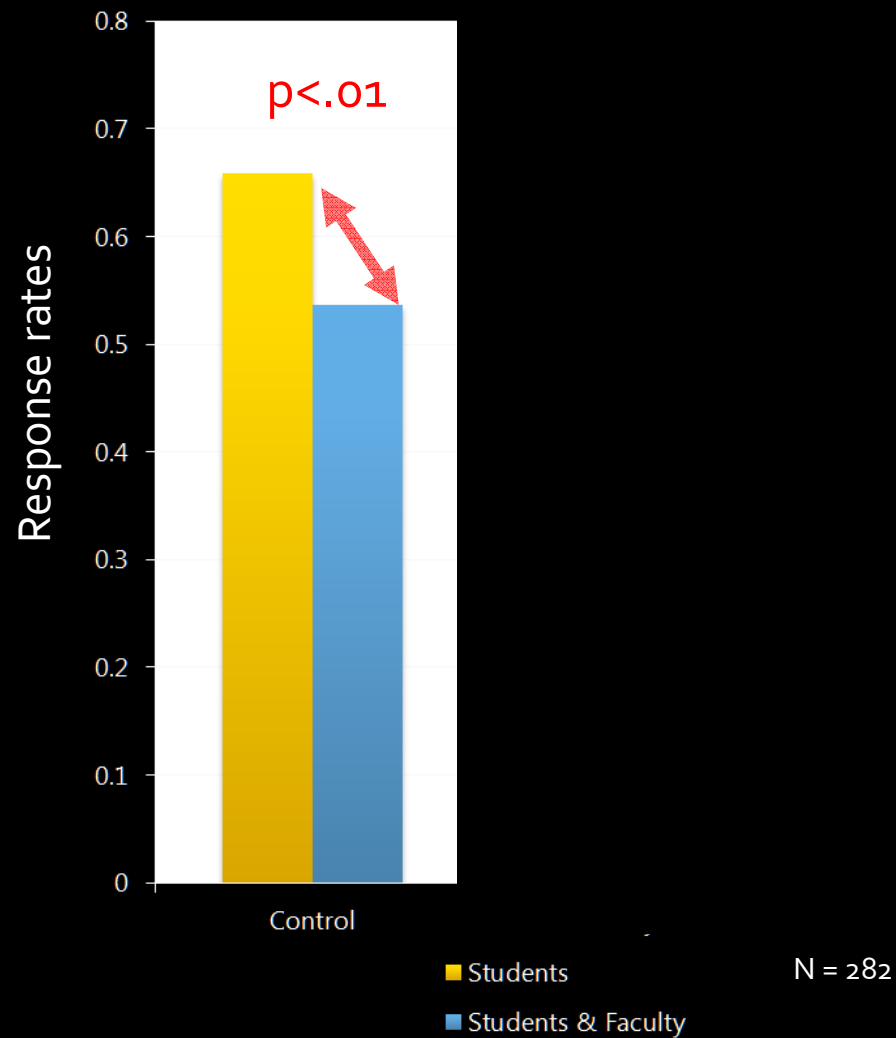
"Misplaced Confidences: Privacy and the Control Paradox," Laura Brandimarte, Alessandro Acquisti, and George Loewenstein. *Social Psychological and Personality Science*, 2013

Transparency

The limits of Transparency

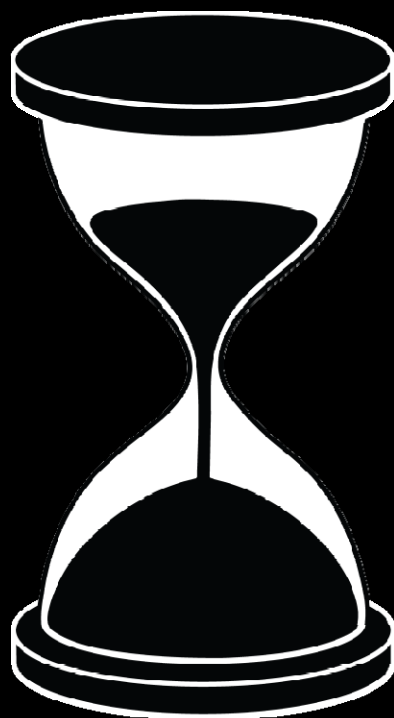


The limits of Transparency



"Sleights of Privacy," Idris Adjerid, Alessandro Acquisti, Laura Brandimarte, and George Loewenstein. *SOUPS*, 2013

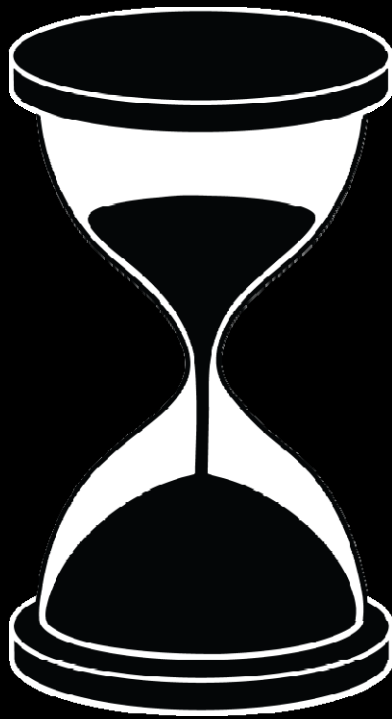






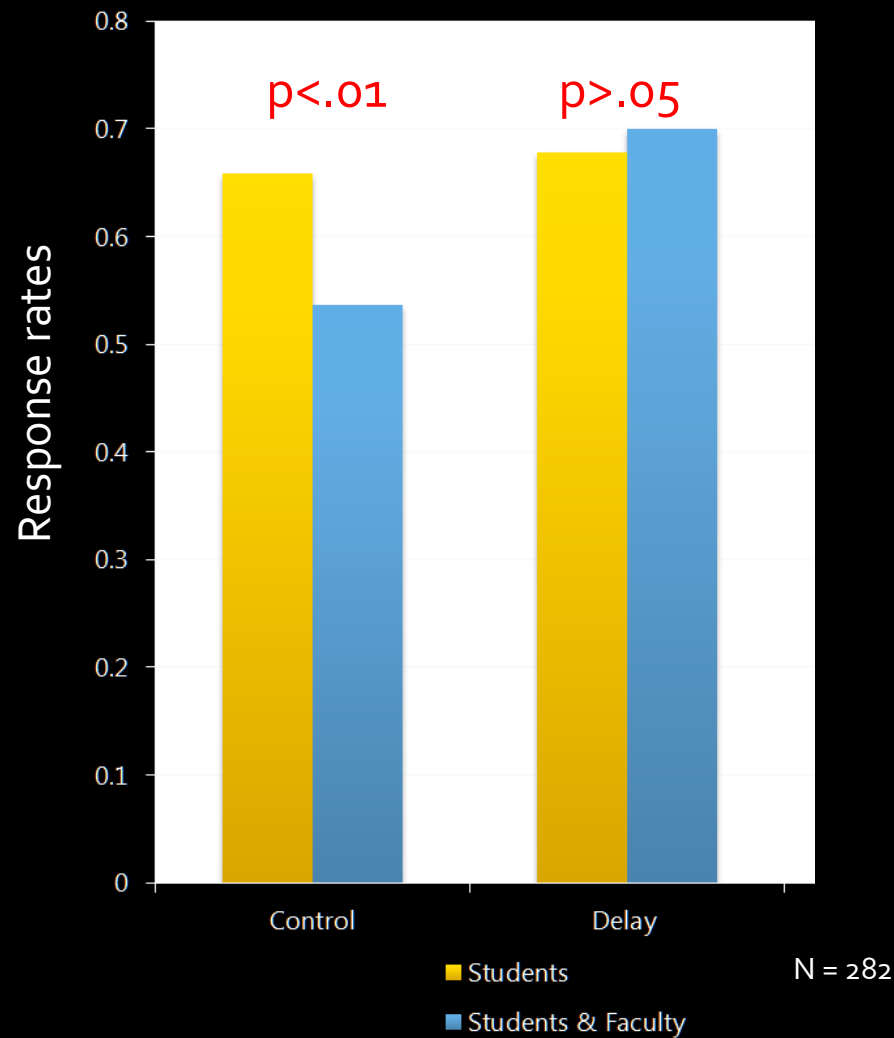
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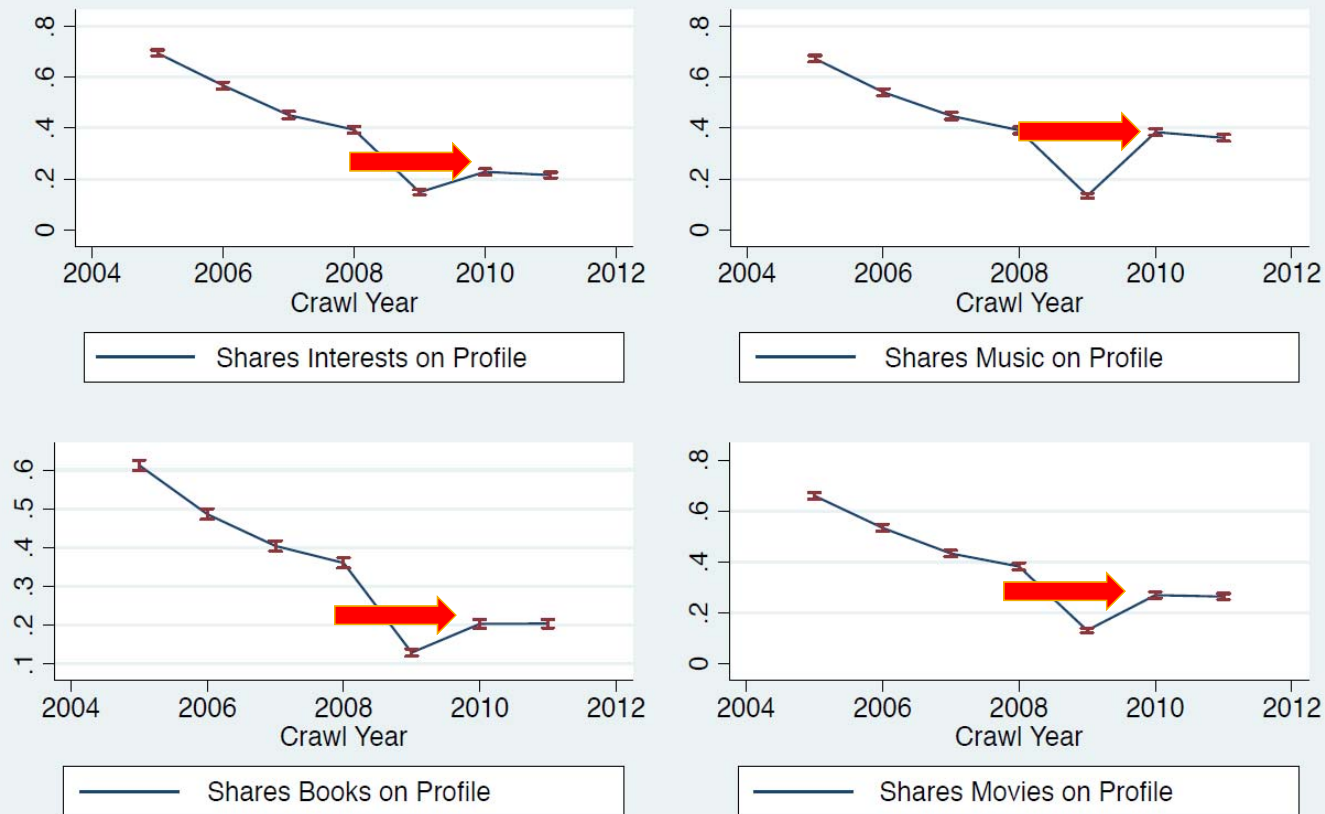
The limits of Transparency



"Sleights of Privacy," Idris Adjerid, Alessandro Acquisti, Laura Brandimarte, and George Loewenstein. *SOUPS*, 2013

Privacy and disclosure behavior on Facebook over time

Interest Information Disclosure Trends 2005-2011



Arithmetic means with 95% CI

"Silent Listeners," Fred Stutzman, Ralph Gross, and Alessandro Acquisti.
Journal of Privacy and Confidentiality, 2012

Implications

1. Making users feel more in control of their data can lead to their sharing more sensitive information with more strangers (overconfidence)
2. Even very simple and accessible disclosures/privacy notices can be strategically framed to produce variable (and sometimes arbitrary) amounts of disclosure
3. Privacy behavior is context dependent and “malleable”
4. Privacy behaviors have economics consequences for data holders and data subjects

Solutions?

- Self-regulation (i.e., market-based approaches)?
- Regulation?
- “Better” information?
- User interventions?
- Soft (asymmetric) paternalism, or “nudges”?

For more information

- Google/Bing: economics privacy
- Visit: <http://www.heinz.cmu.edu/~acquisti/economics-privacy.htm>
- Email: acquisti@andrew.cmu.edu