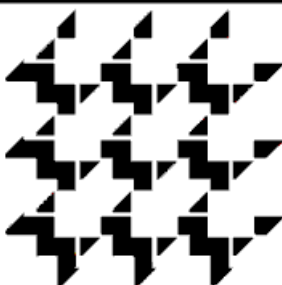


PRIVACY IN TODAY'S WORLD

Rebecca Wright
Rutgers University

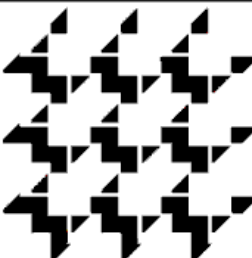
www.cs.rutgers.edu/~rebecca.wright

CRA-W Undergraduate Town Hall
April 18, 2017



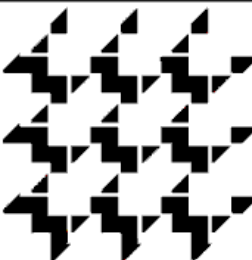
About Me

- Undergraduate double major in computer science and math at Columbia.
- PhD in computer science at Yale.
- Research scientist in AT&T Labs and Bell Labs for 7 years.
- Associate professor and then professor at Stevens Institute of Technology for 5 years.
- Joined Rutgers in 2007.



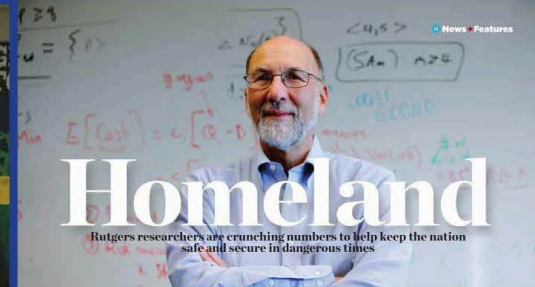
About Me

- Professor, Computer Science
- Director, DIMACS
- Research area: security and privacy
- DIMACS: integrative research and education center for discrete math, computing theory, related fields, and their multidisciplinary applications of benefit to society.





Douglass-SAS-DIMACS CS Living-Learning Community



Homeland

Rutgers researchers are crunching numbers to help keep the nation safe and secure in dangerous times.



DIMACS Advisory Board



REU



PS-Future



REU in Prague



REU in Prague



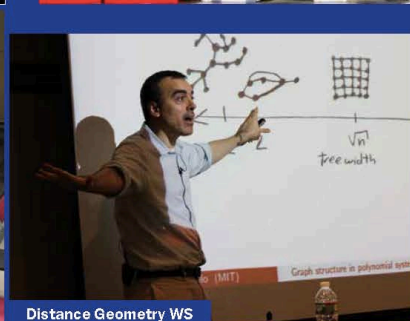
DIMACS Staff



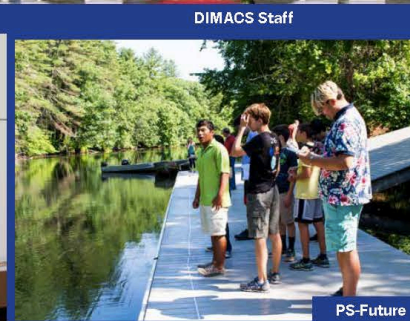
DDCC at CONNECT 2016



DDCC



Distance Geometry WS



PS-Future



AltF WS



Diversity in Tech Caucus



Bayesian, Frequentist & Fiducial WS



Wash, Inc 2016

WS in Senegal on Ebola



Crypto Interactions WS



REU at IBM

Today's Cyber Landscape

The Cloud



Web browsers and other apps



Smartphones and tablets



Social networking



Embedded computing and Internet of Things

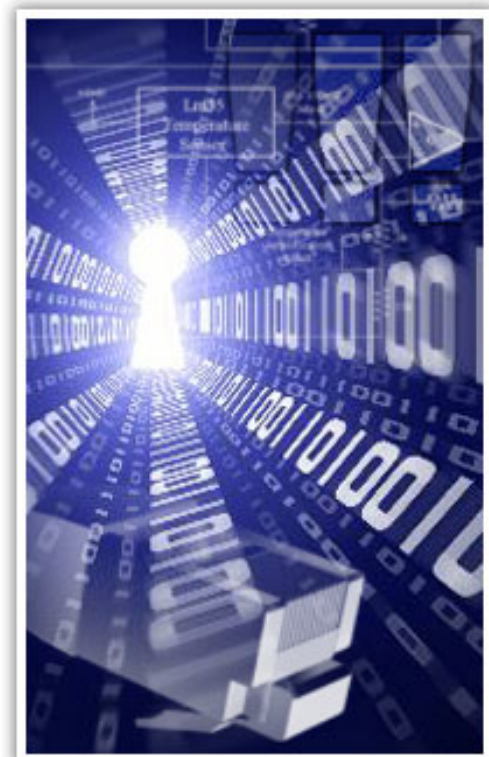


WIRELESS IMPLANTABLE MEDICAL DEVICES



Securing Cyberspace

- The cyber threat has evolved to reflect the increased importance and extensiveness of cyber activities:
 - hobbyists and those seeking notoriety or status
 - profit-seeking criminals (identity theft, spam)
 - organized crime, cyber espionage (intellectual property, government intelligence)
 - cyber warfare and cyber terrorism
- Cyber security is a multidisciplinary endeavor requiring advances in computer science and engineering, public policy, psychology, criminology, and more.



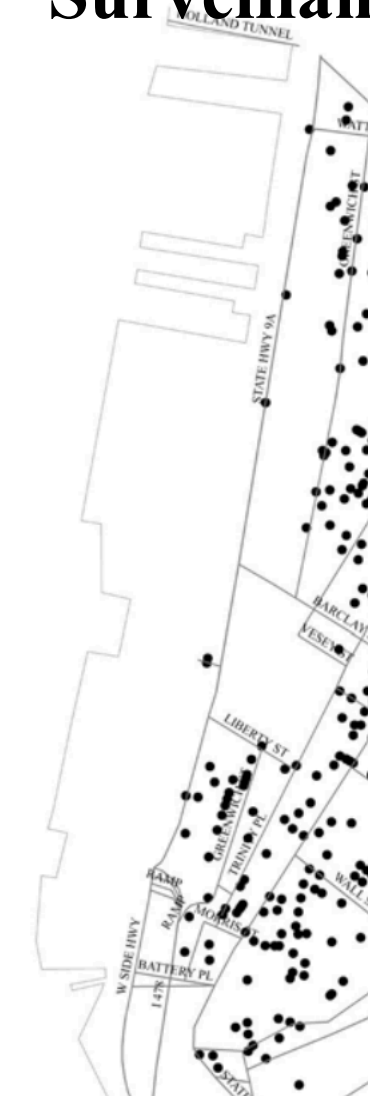
Data and Tracking

Surveillance cameras



Data and Tracking

Surveillance cameras



Newly Obtained Records Reveal Extensive Monitoring of E-ZPass Tags Throughout New York



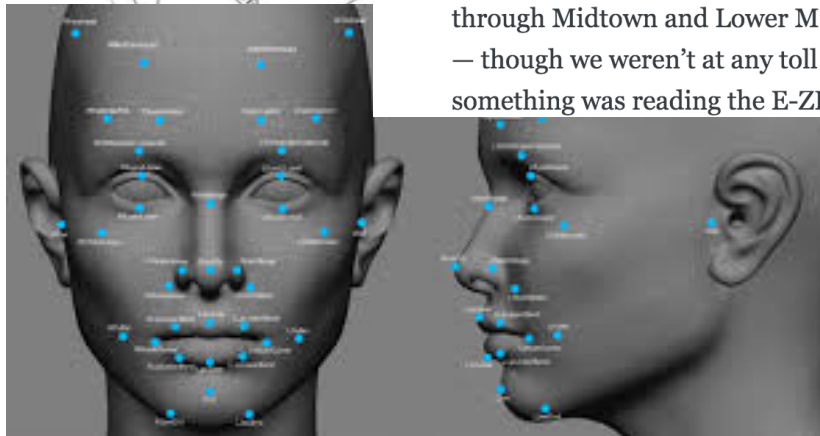
By [Mariko Hirose](#), Staff Attorney, NYCLU

APRIL 24, 2015 | 1:00 PM



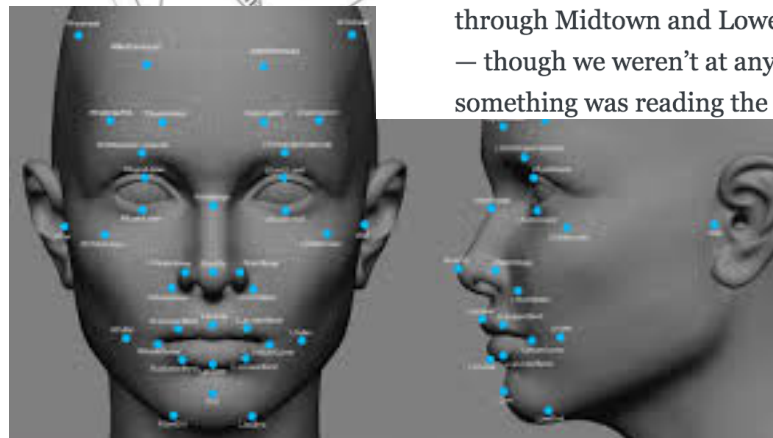
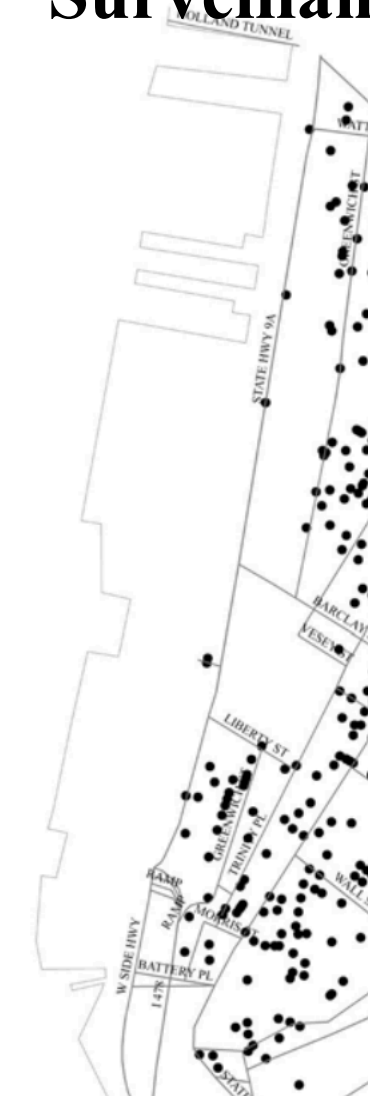
New documents obtained by the New York Civil Liberties Union reveal that wireless E-ZPass tollbooth transponders are being read routinely throughout New York City to systematically collect location data about drivers.

At the NYCLU, we were surprised when we first heard this might be happening. In late 2013, NYCLU staff went on a car ride with a privacy activist who designed a cow-shaped device that mooed every time it detected signals on the same frequency that E-ZPass readers use. I listened as the cow mooed its way through Midtown and Lower Manhattan — though we weren't at any toll plaza — something was reading the E-ZPass



Data and Tracking

Surveillance cameras



Newly Obtained Records Reveal Extensive Monitoring of E-ZPass Tags Throughout New York



By [Mariko Hirose](#), Staff Attorney, NYCLU

APRIL 24, 2015 | 1:00 PM



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Ad Tracking

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Washington, DC

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New York, NY

📶 Murray Hill | Report | Change Station ▾

Forecast

History

Calendar

Rain / Snow

Health

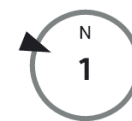
Elev 98 ft 40.75 °N, 73.98 °W | Updated 3 sec ago



Scattered
Clouds

60.8 °F

Feels Like 60.8 °F



Wind Variable
Gusts 8.0 mph

Tomorrow is forecast to be **WARMER** than today.

Today

High 68 | Low 50 °F

0% Chance of Precip.

Yesterday

High 57.7 | Low 48.4 °F

Precip. 0 in

Pressure

29.9 in

Visibility

10.0 miles

Clouds

Scattered Clouds 11000 ft

Dew Point

35 °F

Humidity

38%

Rainfall

0.11 in

Snow Depth

Not available.

Sun & Moon

5:45 am

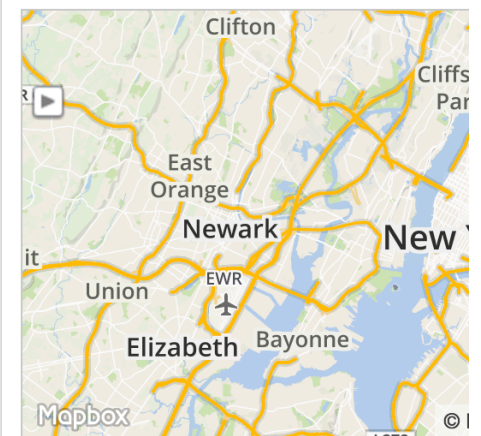
7:59 pm

Waxing Crescent,
7% visible

METAR KNYC 090051Z AUTO 00000KT 10SM SCT110
15/M02 A2989 RMK A02 SLP111 T01501022 \$

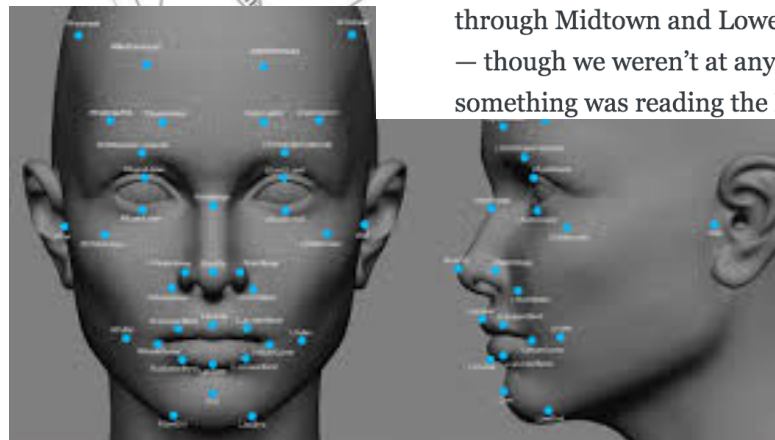
Radar

Satellite



Data and Tracking

Surveillance cameras



Newly Obtained Records Reveal Monitoring of E-ZPass Tags T



By [Mariko Hirose](#), Staff Attorney, NYCLU

APRIL 24, 2015 | 1:00 PM



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Ad Tracking



Recent Cities
New York, NY Washington, DC

New York, NY

Murray Hill | Report | Charts

Forecast History Calendar

Elev 98 ft 40.75 °N, 73.98 °W | Updated



Scattered Clouds

60.0

Feels Like

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Today

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0% Chance of Precip.

Yesterday

High **57.7** | Low **48.4** °F

Precip. 0 in

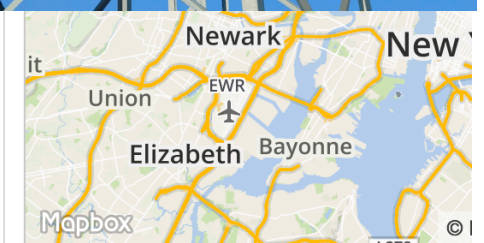
Sun & Moon

5:45 am

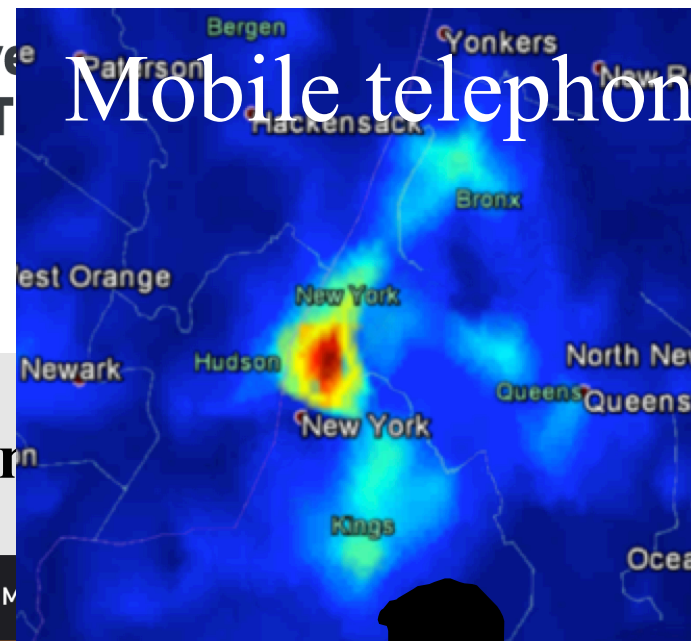
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Waxing Crescent,
7% visible

METAR KNYC 090051Z AUTO 00000KT 10SM SCT110
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Mobile telephone data



Data and Tracking

Surveillance cameras

Social networking

Newly Obtained Records Reveal Monitoring of E-ZPass Tag



By [Mariko Hirose](#), Staff Attorney, NYCLU

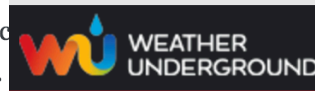
APRIL 24, 2015 | 1:00 PM



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Ad Tracking



Recent Cities
New York, NY Washington, DC

New York, NY

Murray Hill | Report

Forecast History Calendar

Elev 98 ft 40.75°N, 73.98°W | Updated



Scattered Clouds

60.0°

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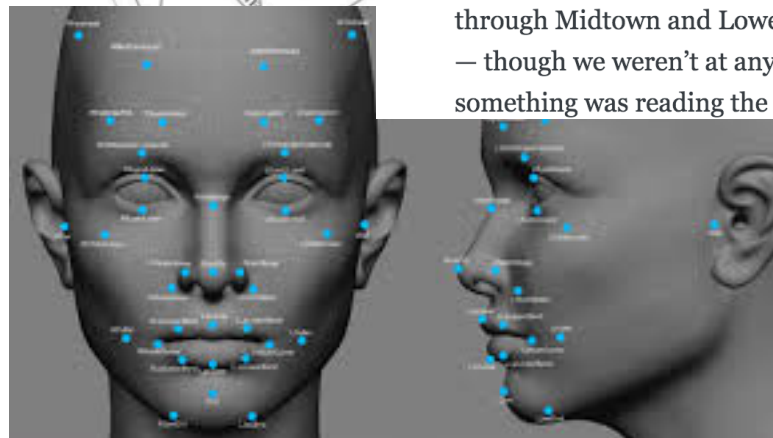
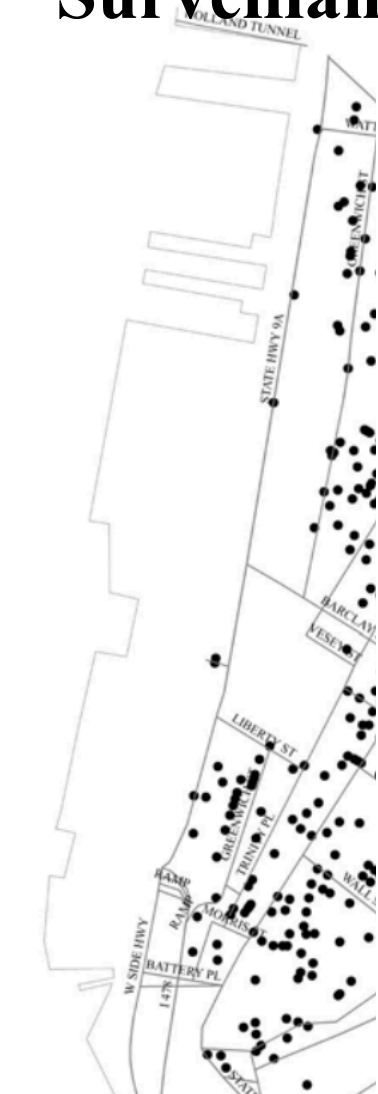
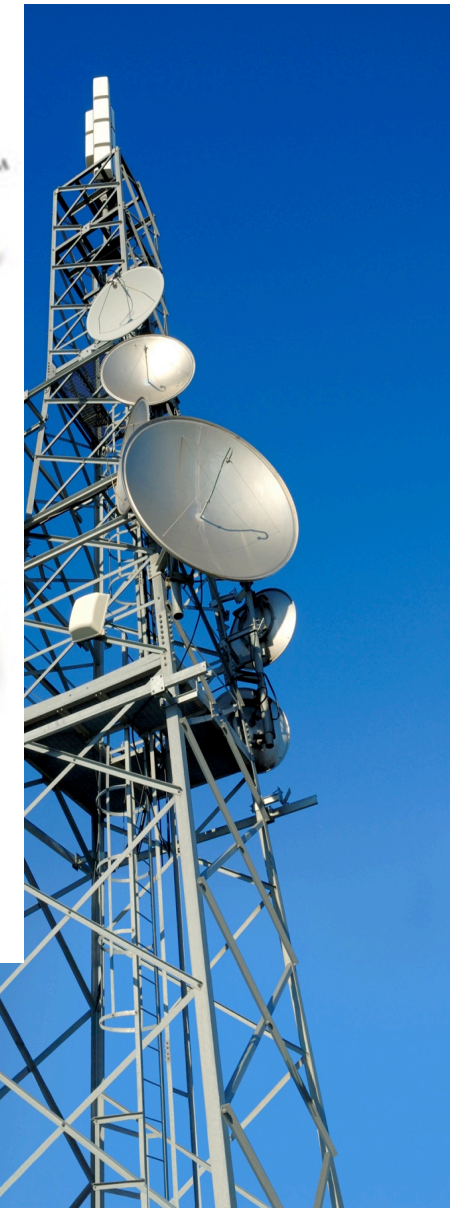
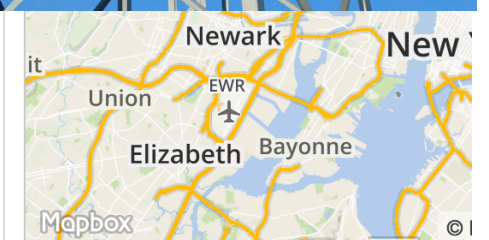
Sun & Moon

5:45 am

7:59 pm

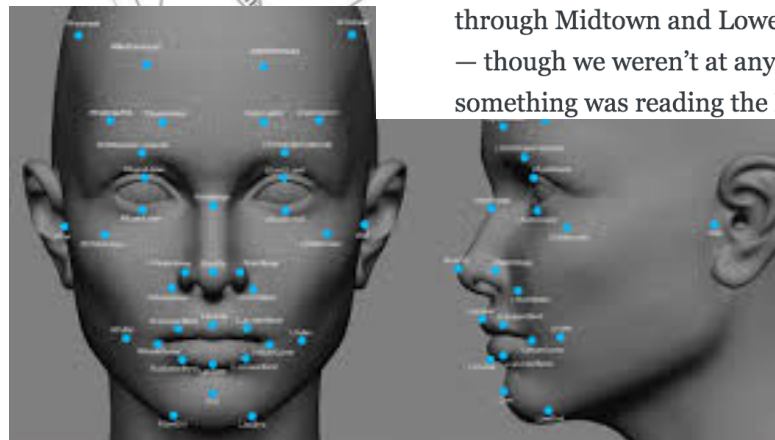
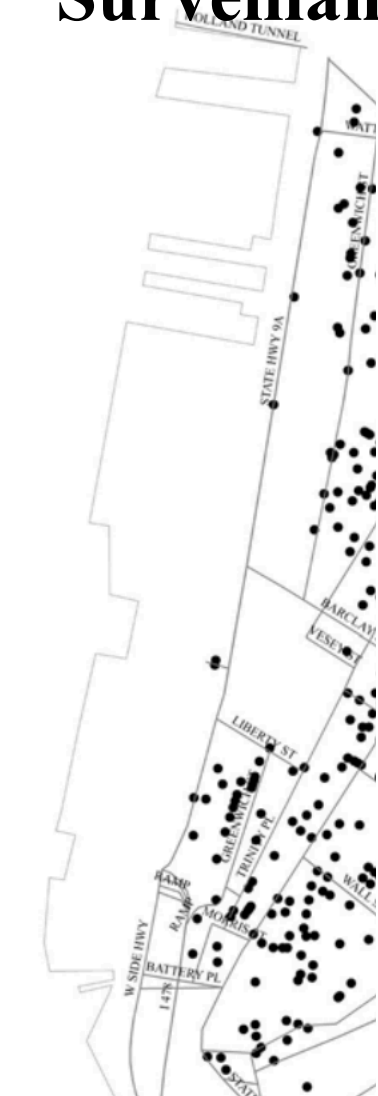
Waxing Crescent,
7% visible

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Data and Tracking

Surveillance cameras



Newly Obtained Records Reveal Monitoring of E-ZPass Tag



By [Mariko Hirose](#), Staff Attorney, NYCLU

APRIL 24, 2015 | 1:00 PM



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Ad Tracking



Recent Cities
New York, NY Washington, DC

New York, NY

Murray Hill | Report

Forecast History Calendar

Elev 98 ft 40.75°N, 73.98°W | Updated



Scattered Clouds

60°

Feels Like

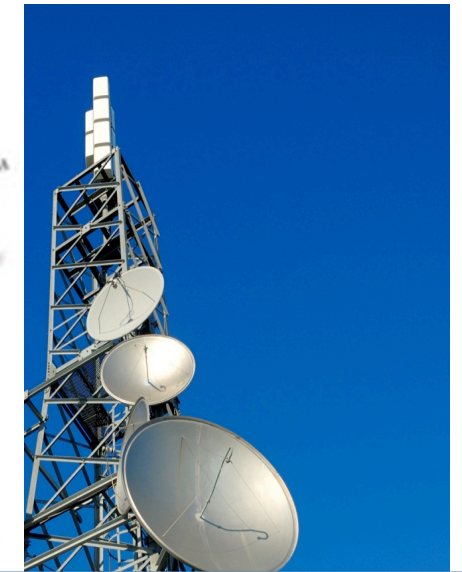
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Social networking



Embedded computing and Internet of Things

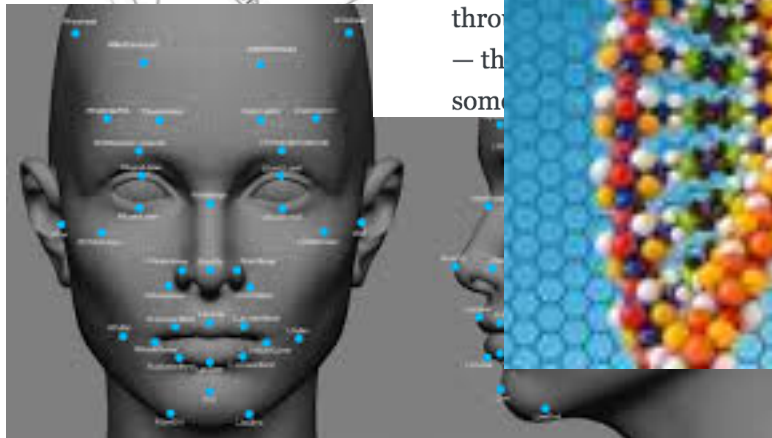
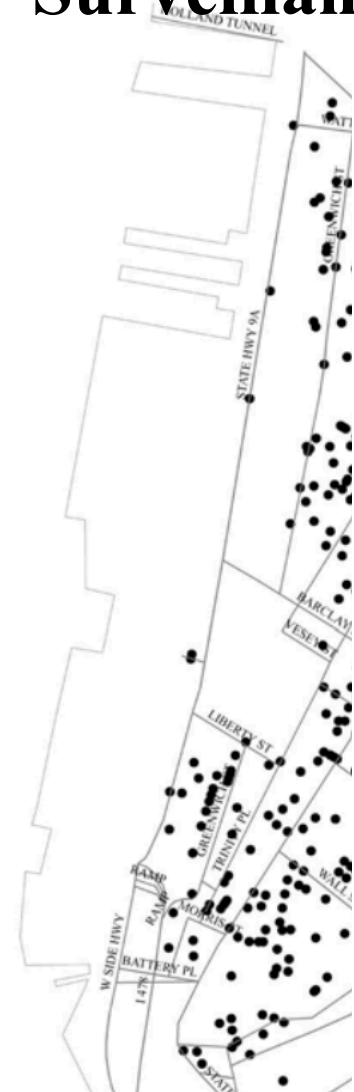


WIRELESS IMPLANTABLE MEDICAL DEVICES



Data and Tracking

Surveillance cameras



Newly Obtained Records R Monitoring of E-ZPass Tag



By [Mariko Hirose](#), Staff Attorney, NYCLU

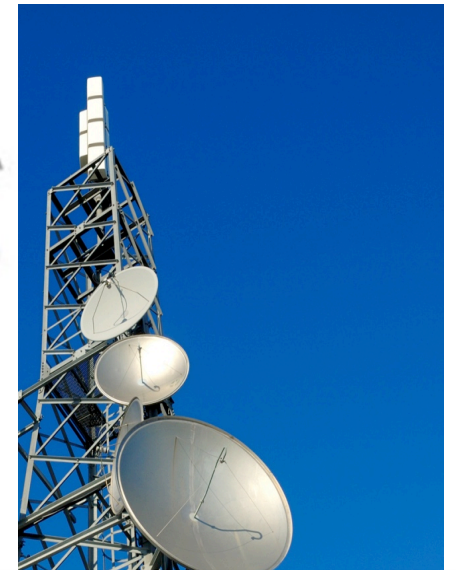
APRIL 24, 2015 | 1:00 PM



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Social networking



g and Internet of Things



Genetic Testing



Privacy



- Privacy means different things to different people, to different cultures, and in different contexts.
- Appropriate uses of data:
 - What is appropriate?
 - Who gets to decide?
 - What if different stakeholders disagree?
- Simple approaches to “anonymization” don’t work in today’s world where many data sources are readily available.
- Some good solutions can be obtained for some specific notions of privacy.

Do People Care About Privacy?

- Many people say they care about privacy, but their actions don't always match that.
- There is a cost to having good privacy and security practices, and the benefits of them may not be immediately apparent.
- Companies often prefer to be able to exploit customer data than to provide privacy.
- Privacy breaches can have financial costs as well as social or emotional ones.

Privacy Categories

- Privacy unconcerned:
 - have little concern giving their personal information to businesses or to government, don't see the need for privacy-protecting legislation, and can't be bothered to debate privacy issues.
- Privacy pragmatists:
 - weigh the benefits against the risks of providing personal information before deciding if they have a privacy concern.
- Privacy fundamentalists:
 - place very high value on their right to privacy, reject the need for consumers to supply personal data to businesses, reject the notion that consumers want to trade their personal information for personalization, and are in favor of strong legislation to protect privacy.

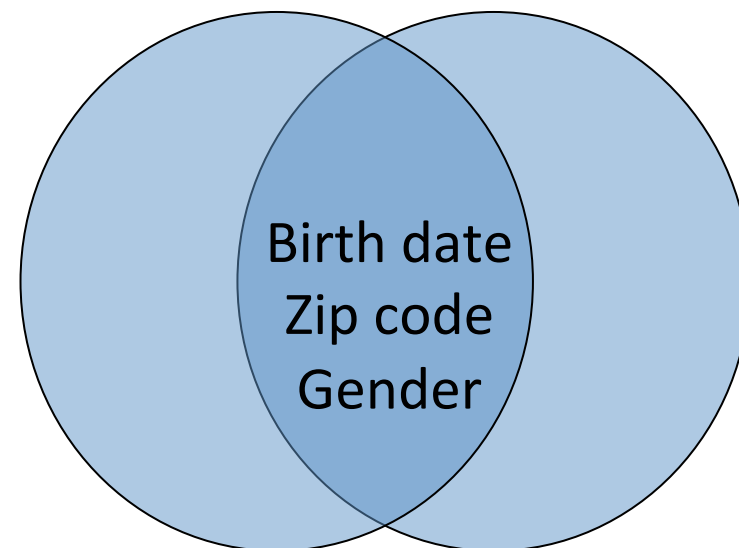
Poll Q1: Which One Are You?

- A. **Privacy unconcerned:** have little concern giving personal information to businesses or to government, don't see the need for privacy-protecting legislation, can't be bothered to debate privacy issues.
- B. **Privacy pragmatist:** weigh the benefits against the risks of providing personal information before deciding if they have a privacy concern.
- C. **Privacy fundamentalist:** place very high value on their right to privacy, reject the need for consumers to supply personal data to businesses, in favor of strong legislation to protect privacy.

Deidentification and Reidentification

- Many privacy policies and solutions are based on the concept of “personally identifiable information” (PII).
- However, this concept is not robust in the face of today’s realities.
- **Sweeney**: 87% of the US population can be uniquely identified by their date of birth, 5-digit zip code, and gender.

“Innocuous”
database
with names.

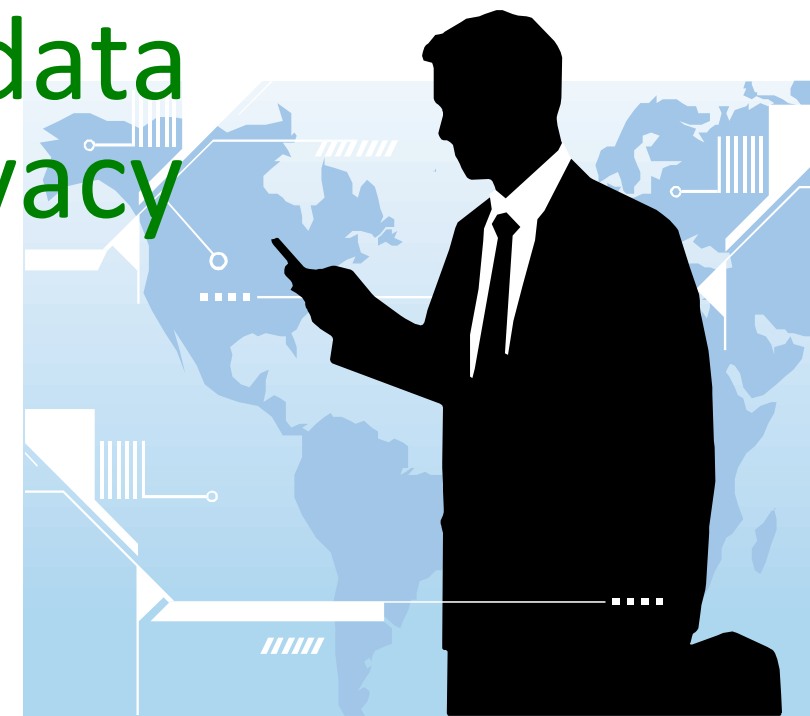


Allows complete or partial
reidentification of individuals in
sensitive database.

- **AOL search logs released August 2006**: user IDs and IP addresses removed, but replaced by unique random identifiers. Some queries provide information about who the querier is, others give insight into the querier’s mind. **Many more examples since.**

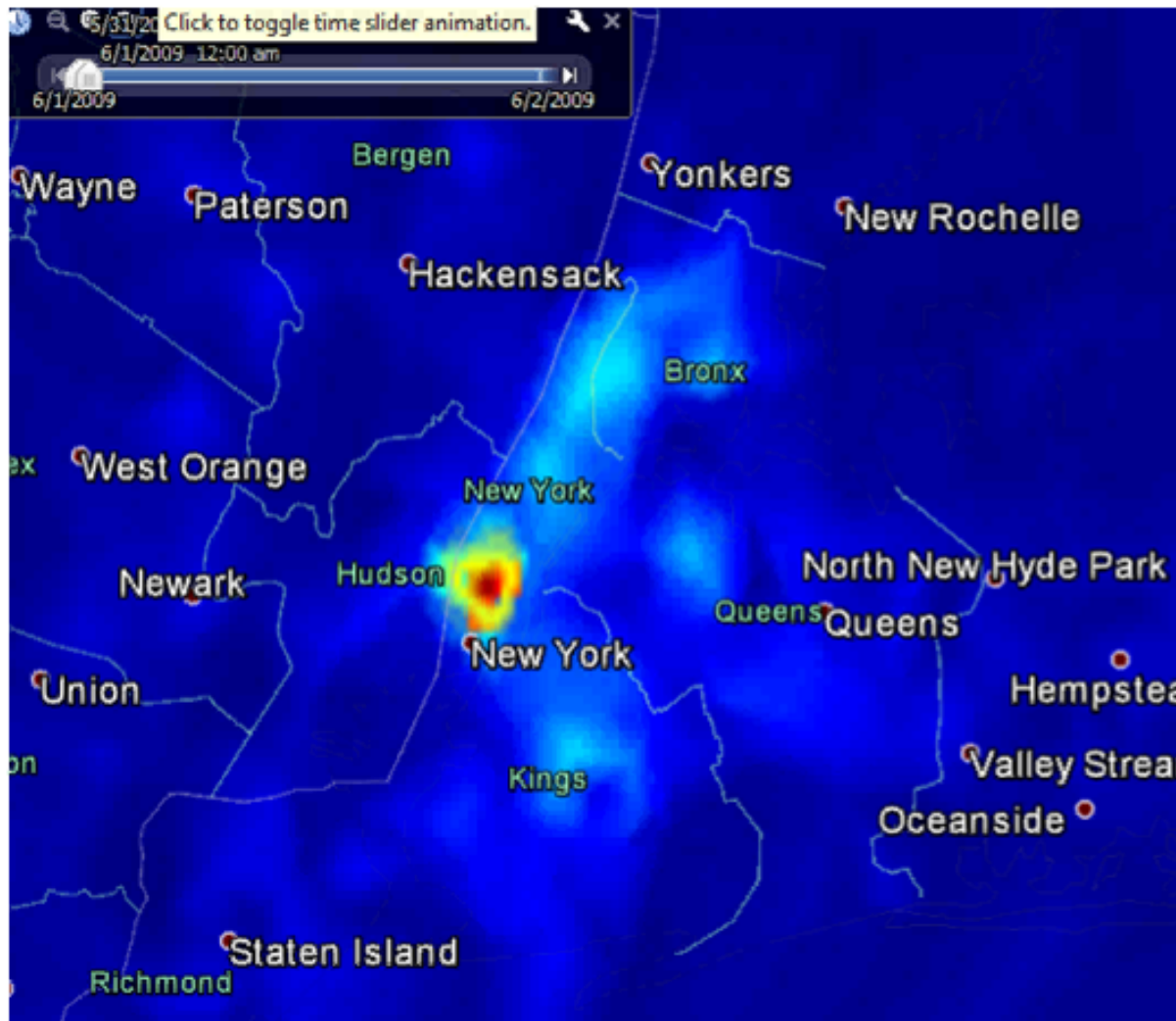
My Research: Human Mobility Modeling

- Human mobility models have many applications in a broad range of fields
- Goal: Realistically model how large populations move within different metropolitan areas
- Solution: Use mobile phone data while ensuring individual privacy

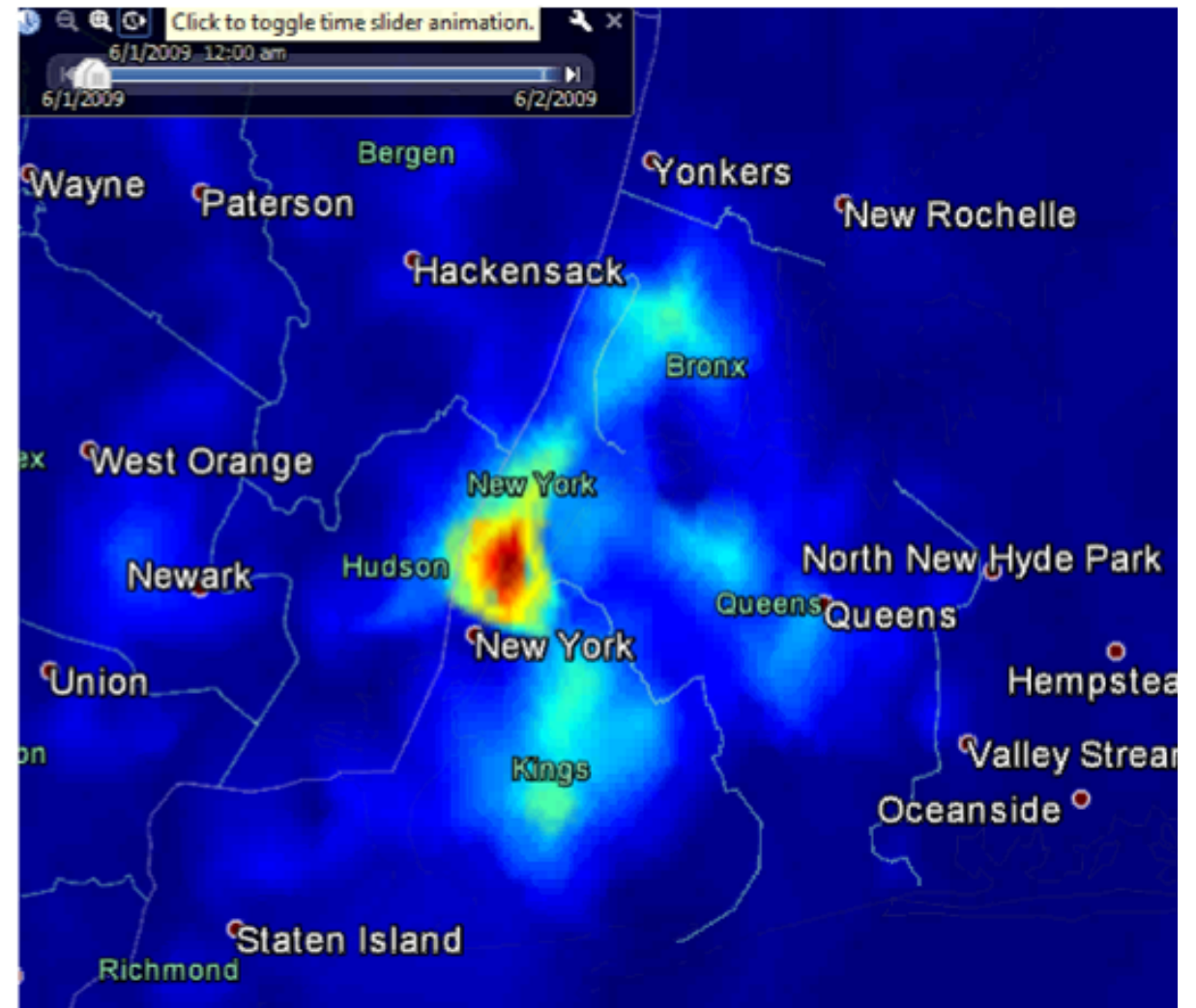


real data vs. DP-WHERE

Typical weekday in the NY metropolitan area

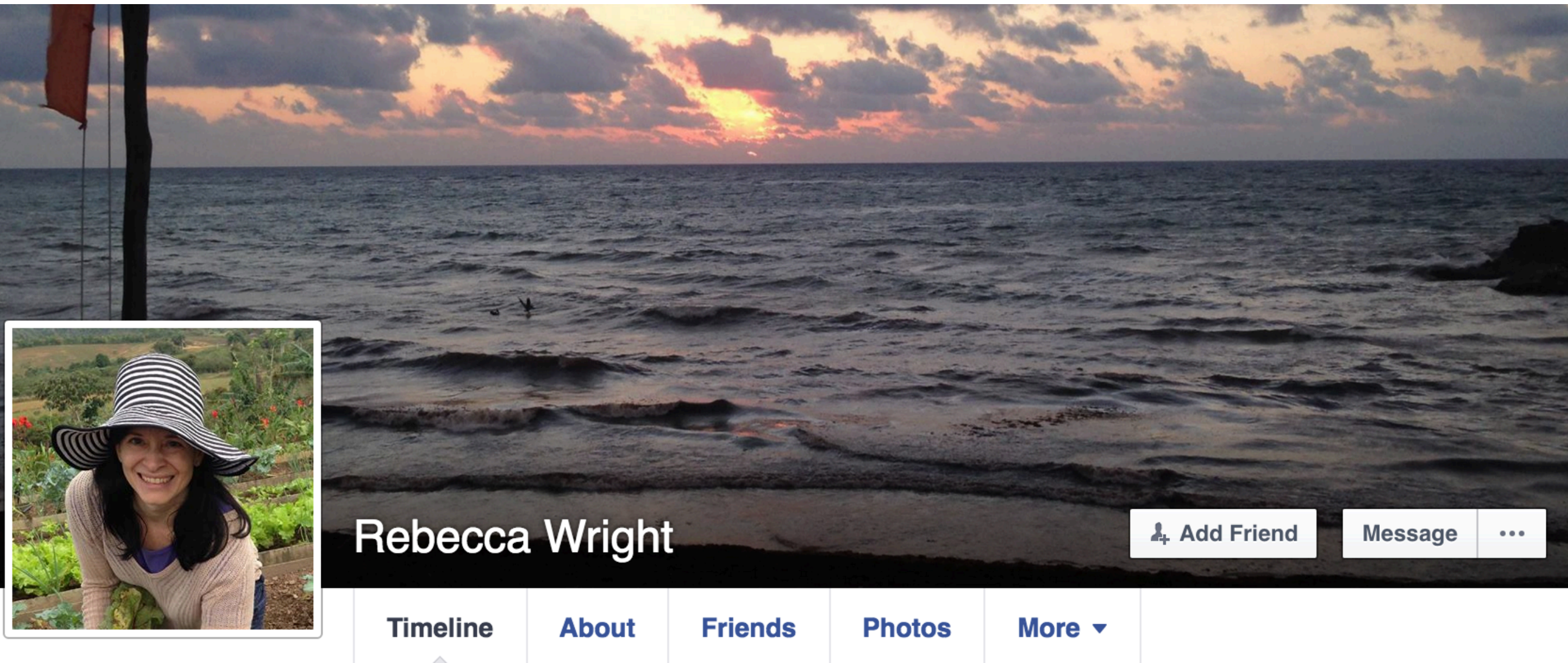


real data



DP-WHERE synthetic data

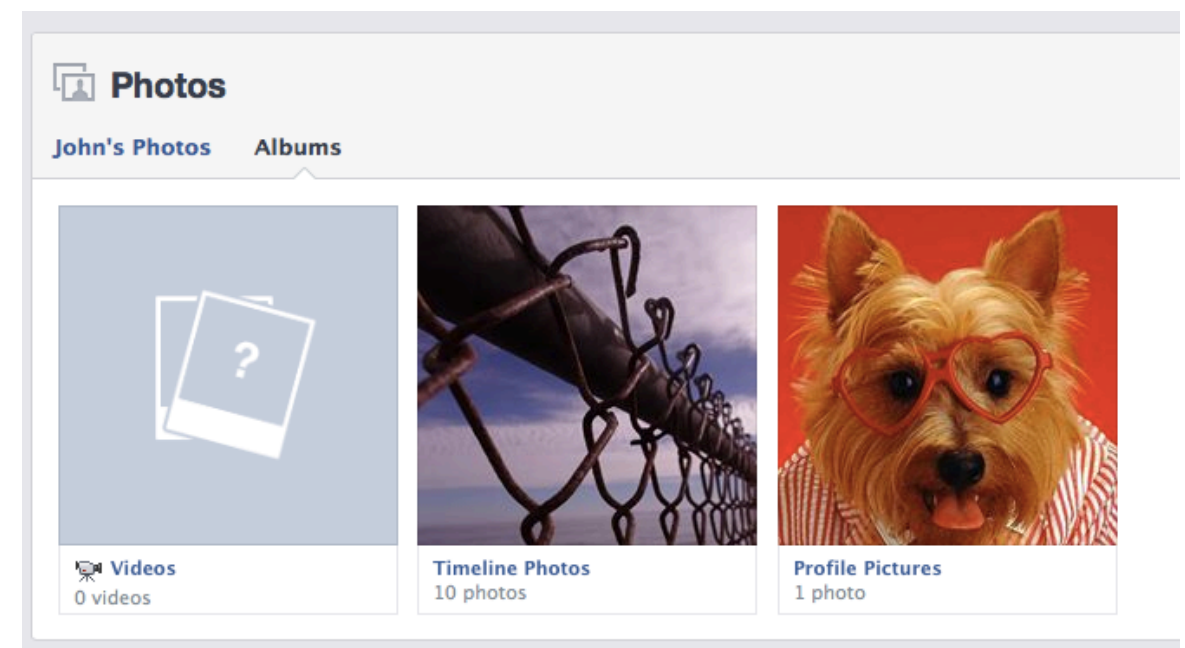
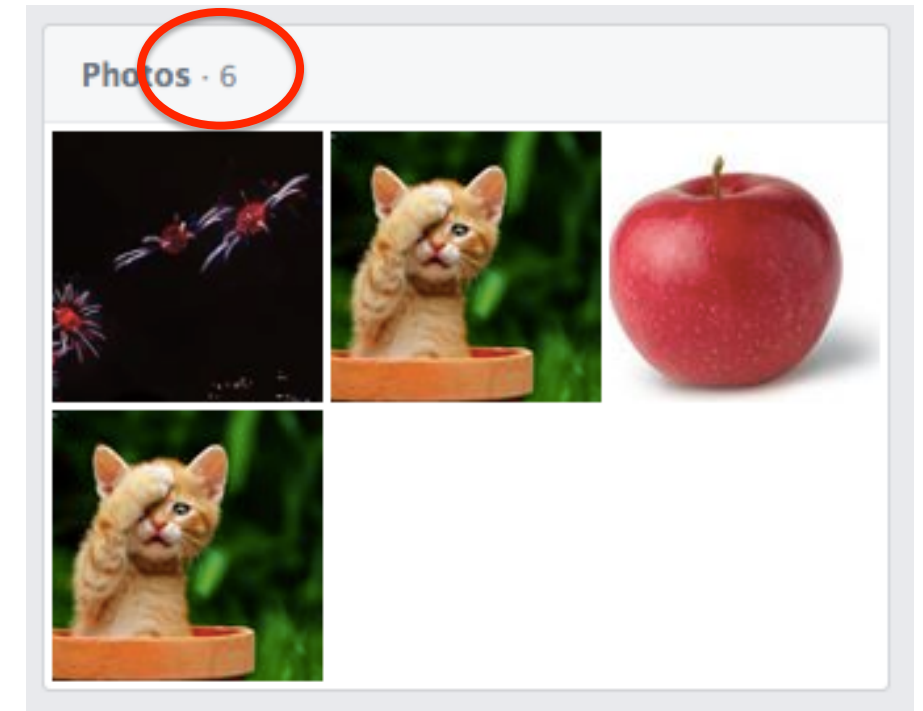
My Research: Facebook



- Settings provide users with some control over who can see what. But they can be confusing and sometimes lead to unexpected results.

Side Channels

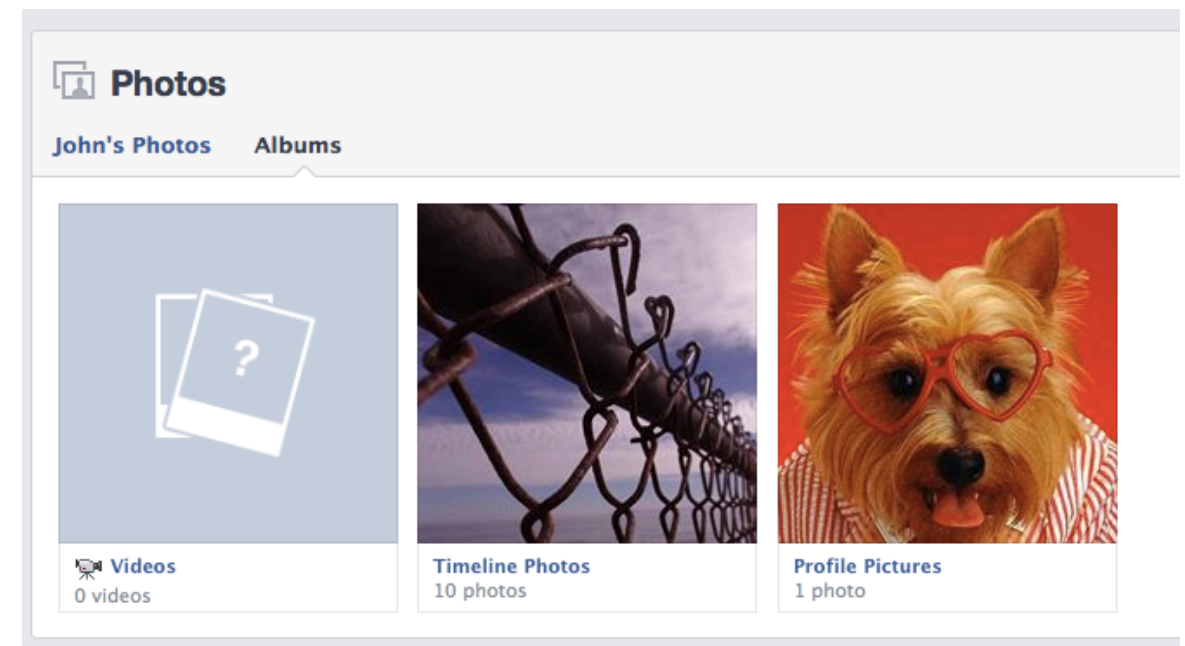
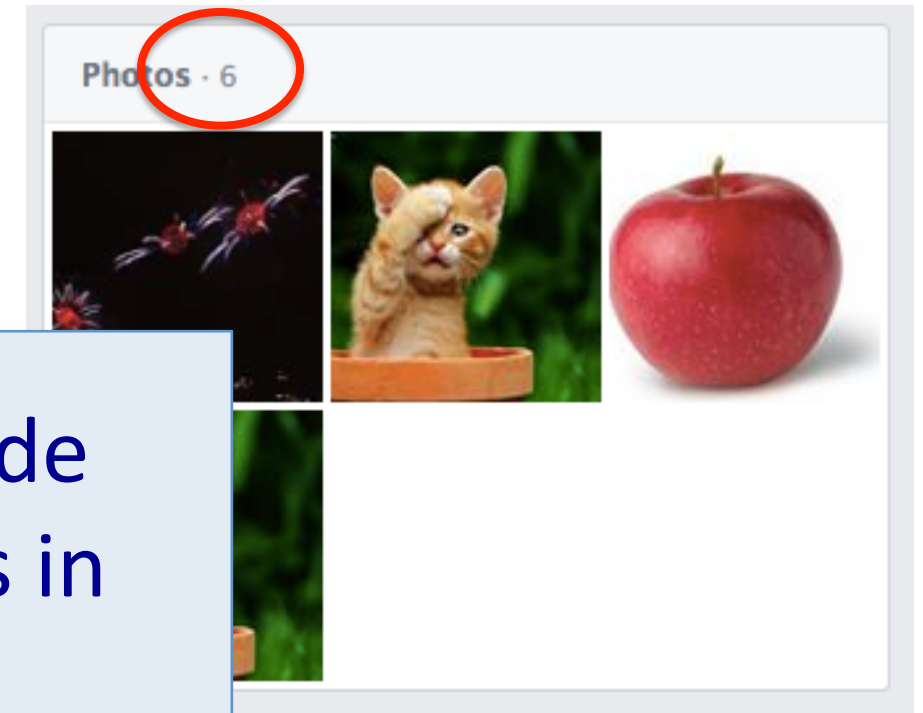
- Example: John has a photo album with 6 photos in it.
- John's photos are generally visible to his friends, but he sets two of those photos not to be visible to Denise.
- When Denise views the album, she sees the photo album with a count of 6 photos, but actually sees only four photos.
- Denise can infer that John has hidden two photos from her.



Side Channels

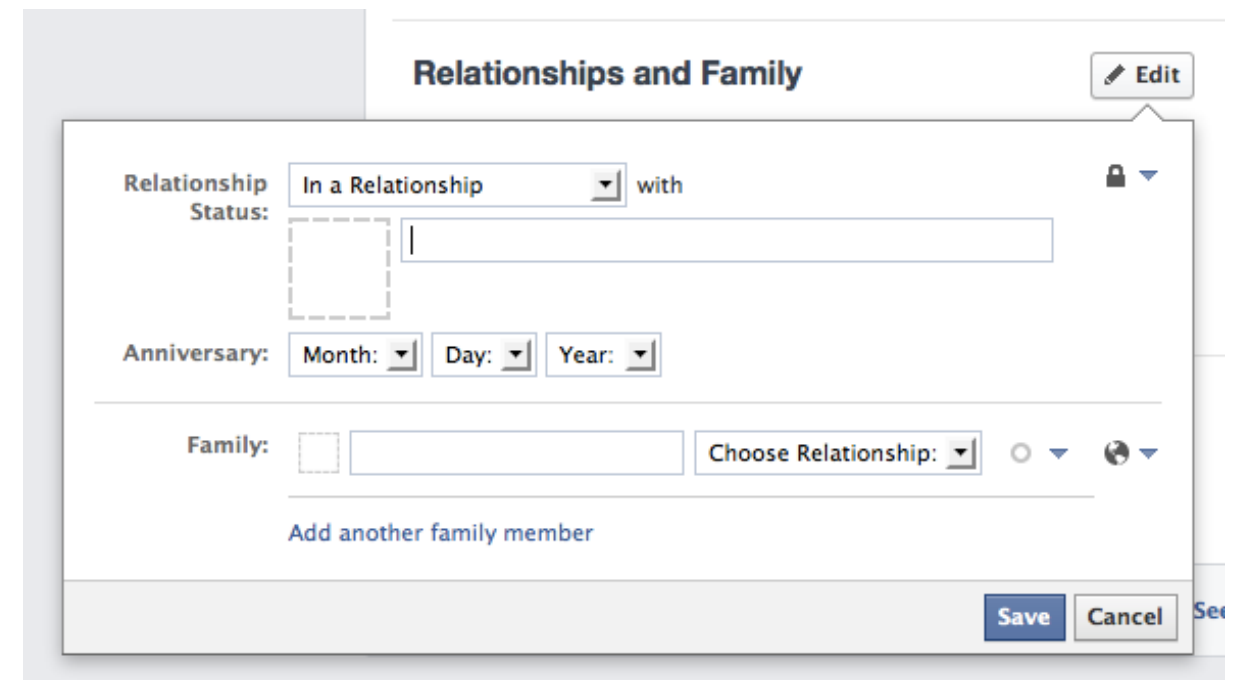
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We identified 11 side channels of 4 types in Facebook.

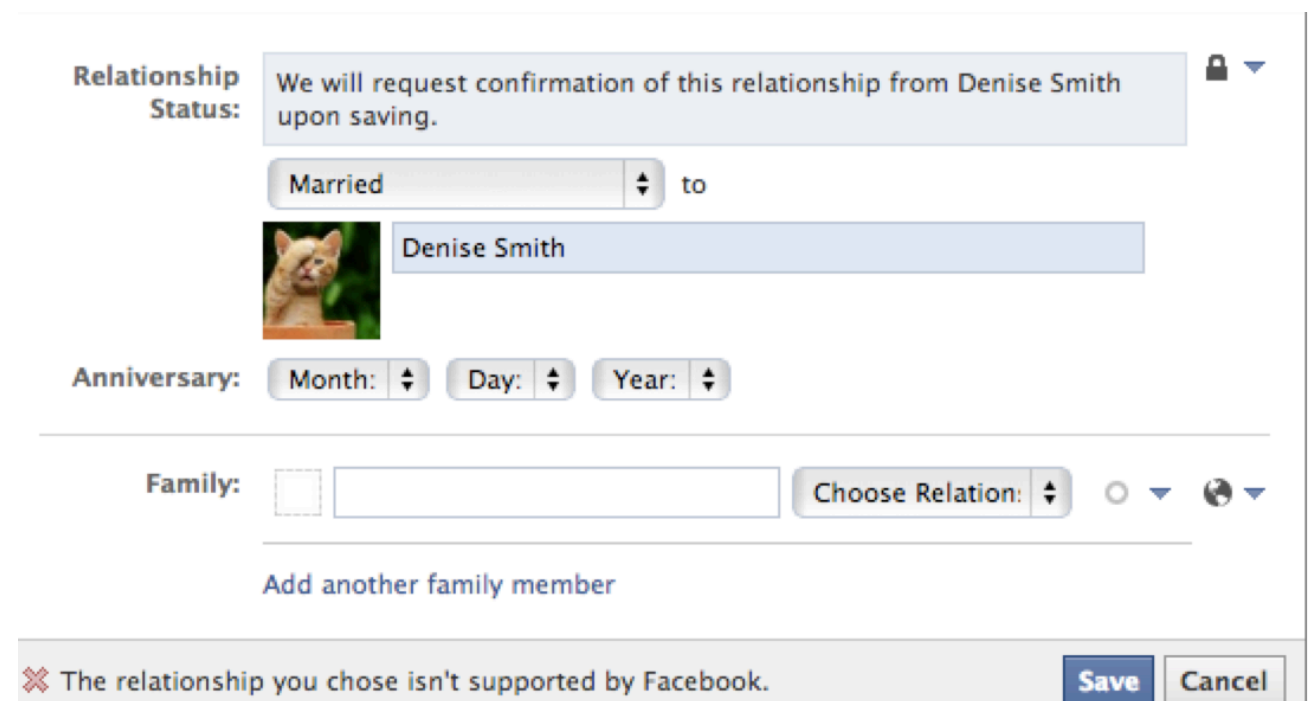


Side Channels: Relationships

- Relationship status can be used as a query to find out if someone else has an existing relationship status, even if that status is private.



This screenshot shows the 'Relationships and Family' settings dialog on Facebook. The 'Relationship Status' is set to 'In a Relationship' with a dropdown arrow. Below it is a dashed box for a profile picture and a text input field for the name. The 'Anniversary' section has dropdowns for 'Month', 'Day', and 'Year'. The 'Family' section has a dashed box for a profile picture, a text input field for the name, and a 'Choose Relationship' dropdown. There are also radio buttons for privacy settings. At the bottom, there is a link to 'Add another family member' and 'Save' and 'Cancel' buttons.



This screenshot shows the same 'Relationships and Family' settings dialog, but with an error message. The 'Relationship Status' is set to 'Married' and the name is 'Denise Smith'. A message box says: 'We will request confirmation of this relationship from Denise Smith upon saving.' Below the name is a small profile picture of a cat. The 'Anniversary' section has dropdowns for 'Month', 'Day', and 'Year'. The 'Family' section has a dashed box for a profile picture, a text input field for the name, and a 'Choose Relation' dropdown. At the bottom, there is a link to 'Add another family member' and 'Save' and 'Cancel' buttons. A red error message at the bottom says: 'The relationship you chose isn't supported by Facebook.'

Survey Results: Tagging

- We asked survey participants who could see what in a variety of scenarios.
 - 67% at least answered one scenario incorrectly
 - 20% answered all scenarios correctly

“I have noticed on some posts that people liked them that were not my friends. It ended up being if I tagged a friend then all their friends could see the post. It is annoying sometimes.”

“If he can see it on John’s and he can’t see it on Denise’s then he will know he is blocked.”

Survey Results: Tagging

- Several comments suggested uncertainty:

“I’m not sure about this one, but with the settings I would assume no.”

- Some indicated they thought a side channel scenario was not a privacy problem:

“It was made public by the author.”

“Because the person who originally posted it intended for it to be viewable on his page, I think he should have the right to post it. This is why I hate the myriad of permissions. You need to expect that people might post things to/about you from time to time.”

- And some indicated that they thought it was:

“Denise has a right to set her account any way she wants. No one has a right to her private information.”

“Since John’s post was public and he is a friend, then Lance should be allowed to see the post, but not that Denise was tagged.”

Poll Q2: Have you ever been surprised to learn that someone could see some of your information/posts/etc. on a social media site that you thought they couldn't see?

- A. Yes, this happens to me all the time!
- B. Yes, this has happened to me on occasion.
- C. I use social media, but no, this has never happened to me.
- D. I don't use social media.



Conclusions

- Today's technology creates huge opportunities for value, but also for security breaches and privacy invasion.
- Emerging privacy models and techniques have the potential to “unlock” the value of data for more uses while protecting privacy.
 - biomedical data, location data, social network data, search data, etc.
- Insights gained lead to more informed choices and better system design.
- Thinking about users, uses, and usability is critical.
 - Includes recognizing that different parties have different goals and values.
- Technology, policy, and education must work together.

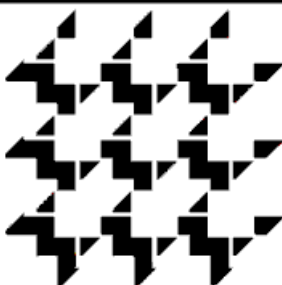


GETTING INVOLVED IN CS EXTRA-CURRICULAR ACTIVITIES

Rebecca Wright
Rutgers University

www.cs.rutgers.edu/~rebecca.wright

CRA-W Undergraduate Town Hall
April 18, 2017



CS Extra-Curricular Activities

- Various opportunities are available on and off campus to engage in computer science-related extra-curricular activities:
 - Clubs (undergrad CS students, women in computing, Cyberdefense competition groups, programming contest teams, outreach clubs, and more)
 - Hackathons
 - Outreach to local K-12 schools
 - May or may not be focused on women and other under-represented groups
 - Volunteer or paid opportunities to help community groups set up web site, data processing scripts, or other coding tasks.
 - Connect with outside programs such as Girls Who Code.

CS Extra-Curricular Activities

- Though not necessarily considered “extra-curricular activities”, additional opportunities include:
 - CS summer internships
 - CS research (summer or during the school year)
- Note: Internships and research opportunities are both discussed in other CRA-W virtual undergraduate town halls.

Poll Q3: Are you involved in a CS-related club or other CS extra-curricular activity?

- A. Yes.*
- B. Not yet, but I want to learn how to become involved.
- C. No, and I'm not sure I am interested.

*Let us know the name of the clubs/extra-curricular activities, by submitting via the Q&A box.

Benefits

- Be part of a community of others with similar interests.
- Explore computing and its excitement beyond the classroom.
- Can allow you to help others, or develop your leadership skills, or learn new CS concepts and skills, and more.
- Studies have found that students become involved in campus life, whether through friendship networks, clubs or sports, are more likely to graduate.
- Looks good on a resumé, can be a conversation starter in an interview.

How to Get Involved

- Look for flyers around your department.
- Ask other students what CS-related clubs or activities they are involved in.
- No club at your school for what you want to do? Create it!



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