UbiComp is About Context

Who are you?

Are you buying this?

Where are you?

Where are your friends?

Where are you going?

What are you eating?

UbiComp is About Context

What are you doing?

Are you exercising?

Who are you with?

What do you want?

Are you asleep?

Who do you want?

WHAT IS
BLENDR?

Blendr is a social networking experience unlike any other. Using your mobile device's location-based technology, you can connect with others nearby with similar interests, hobbies, profession and much more. Discover the world around you: make friends, and build connections and explore your surroundings. Blendr makes it easy to take that first step.

Grindr. It's a guy thing.

Grindr is the largest all male location-based mobile network tool for Android, iPhone, iPod touch, iPad and BlackBerry.

Location-Based Dating Apps

Who do you want?

Smart Phones are Great Sensors of Context

Sensing Context

& Smartphones

Sensors:

- Accelerometer
- Camera
- Microphone
- GPS
- The Internet
- …

Sensing Context

& Smartphones

Sensor:

- Accelerometer (motion)

Inferred Context:

- Are you driving?
- How much did you exercise today?
- Did you get enough sleep last night?
- Is the phone in your pocket?
- ...

Sensors:

- **Accelerometer**
- **Camera**
- **Microphone**
- **GPS**
- **The Internet**
- **...**

Sensing Context

& Smartphones

Sensor:

- Camera

Inferred Context:

- Who are you with?
- Is it daytime?
- Are you on vacation?
- Are you out at a bar?
- ...

Sensors:

- Accelerometer
- Camera
- Microphone
- GPS
- The Internet
- ...

Sensing Context

& Smartphones

Sensor:

- Microphone

Inferred Context:

- What kind of place are you at?
- Is it crowded there?
- Are you at a movie theatre?
- Are you in an argument?
- Is the phone in your pocket?
- Who are you with?
- What are you saying?
- ...

Sensors:

- Accelerometer
- Camera
- **Microphone**
- GPS
- The Internet
- ...

Sensing Context

& Smartphones

Sensor:

- GPS (location sensing)

Inferred Context:

- Where are you?
- Who are you with?
- What are you doing?
- Where are you going?
- Are you stuck in traffic?
- Are you late for work?
- What is your routine?
- Where did you sleep last night?
- ...

Sensors:

- Accelerometer
- Camera
- Microphone
- **GPS**
- The Internet
- ...

Sensing Context

& Smartphones

Sensor:

- The Internet

Inferred Context:

- Who are you?
- Who are your friends?
- Who are your family?
- Who is your spouse?
- Where did you grow up?
- What places are near by?
- What is your schedule?
- ...

Sensors:

- Accelerometer
- Camera
- Microphone
- GPS
- **The Internet**
- ...

Location

Why is location important?

Why is location important?

- A great deal of contextual information can be derived just by observing a user's location.
- Entire industries are being built and reshaped around location
  - local deals (Groupon, living social), location sharing, local search, location-based ads, urban computing and "smart city" applications, ...

Location, Location, Location

& Smartphones

Who are your friends?

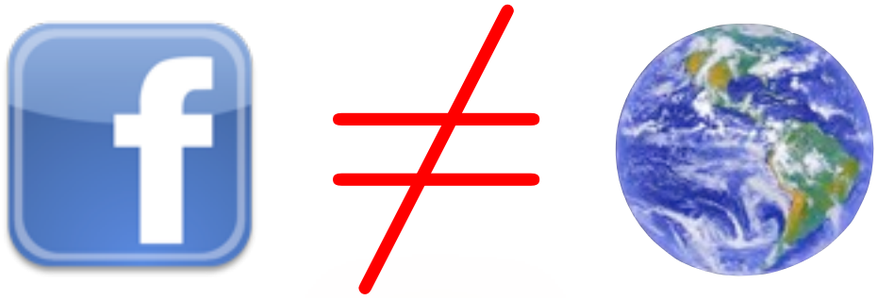
Bridging the Gap Between Physical Location and Online Social Networks

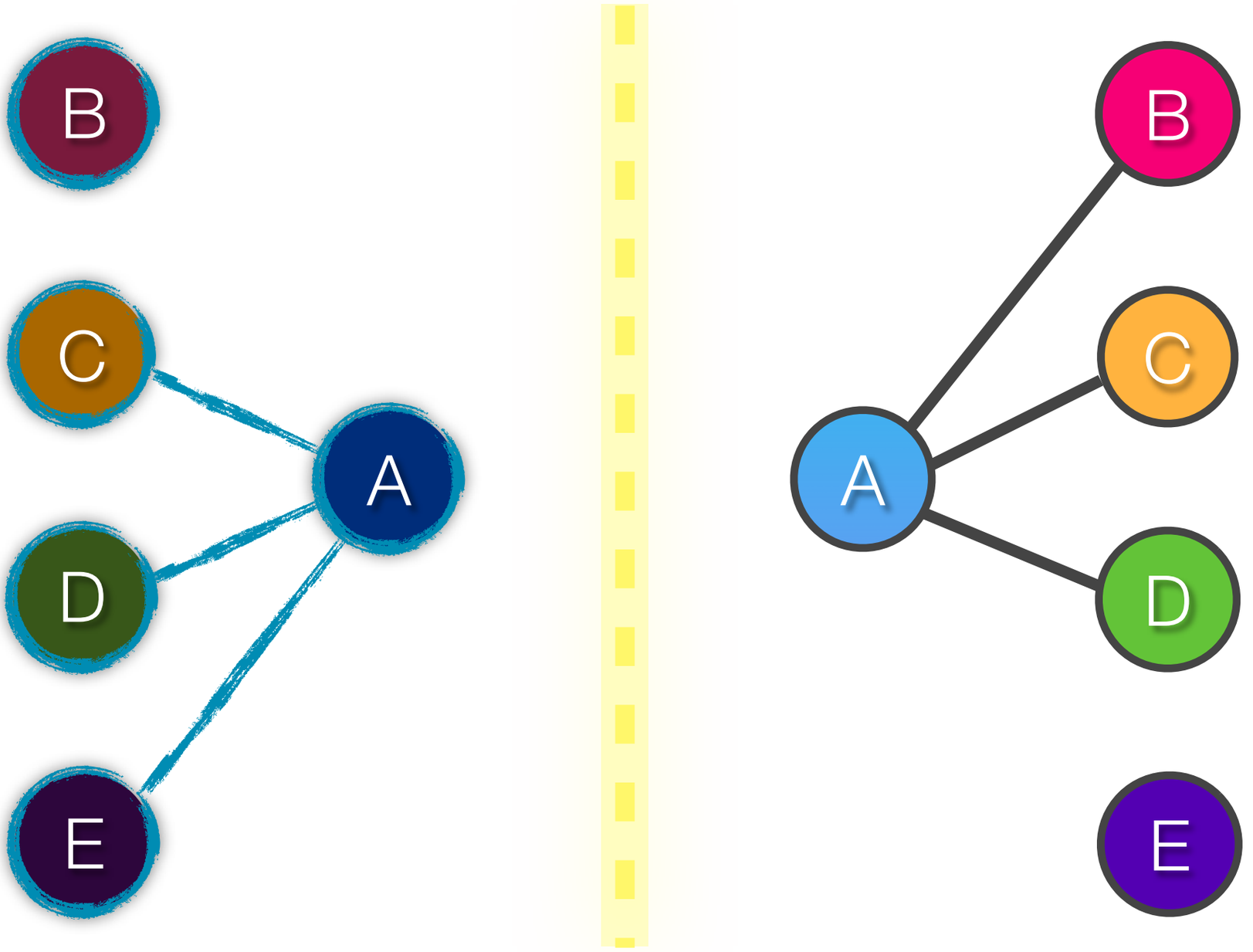
2010 Conference on Ubiquitous Computing

Justin Cranshaw
Norman Sadeh
Jason Hong
Niki Kittur
Eran Toch

Bridging the Gap Between Physical Location and Online Social Networks

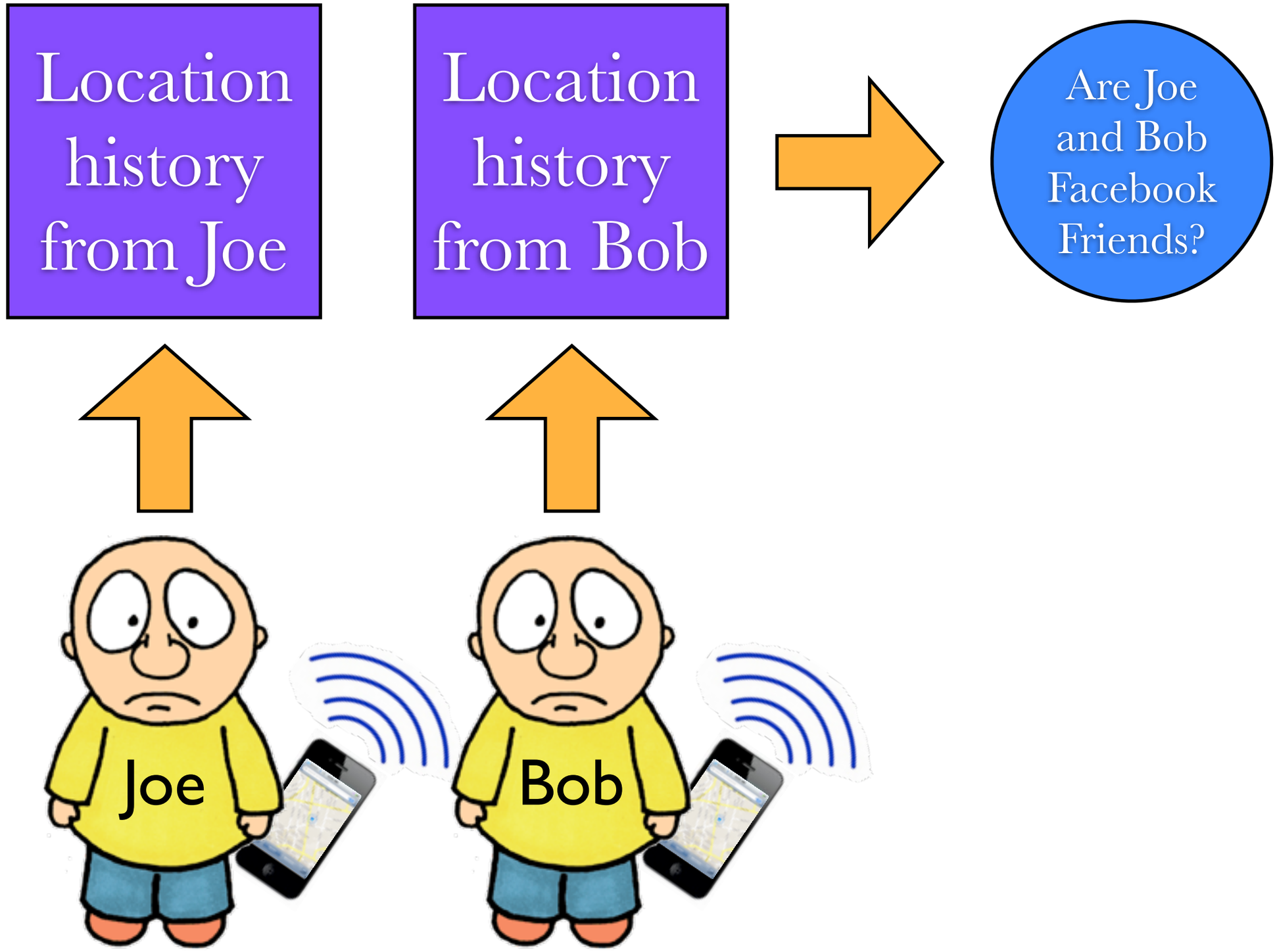
The purpose of this work is to explore the relationships between online social networks, and the real world mobility patterns of their users.





We wanted to understand how the network of interactions on Facebook differs from the network of real world interactions.

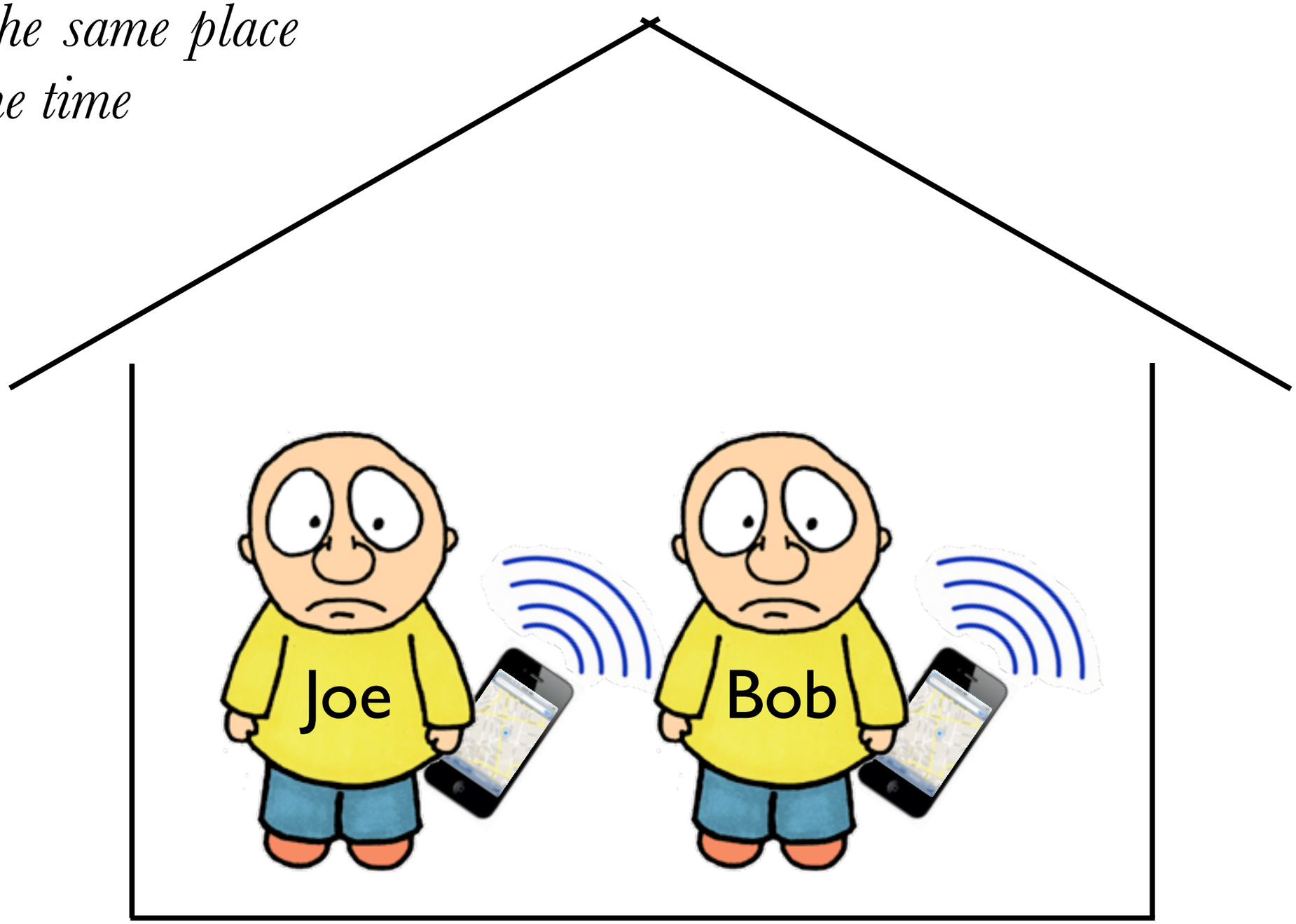
- We studied location data from over 200 Pittsburgh residents.
- Some were continuously tracked via smart phones
- Others' locations were approximated more discretely via their laptop usage.
- We compared their collected location histories with data collected from their Facebook accounts.



One of the questions we address in this work

Co-Locations

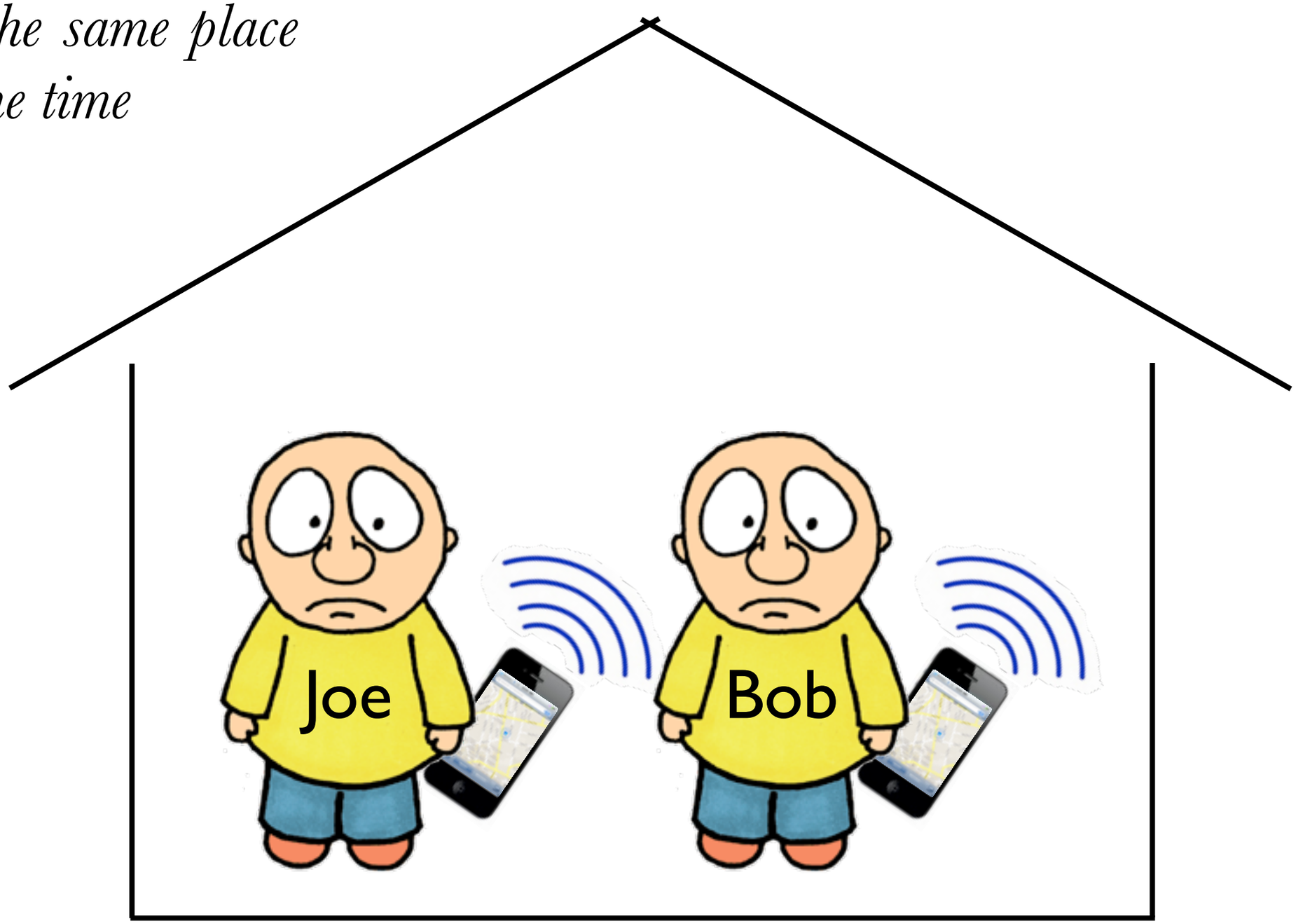
being in the same place
at the same time



We approach the problem in a very natural way. We look at the history of co-locations between Joe and Bob.

Co-Locations

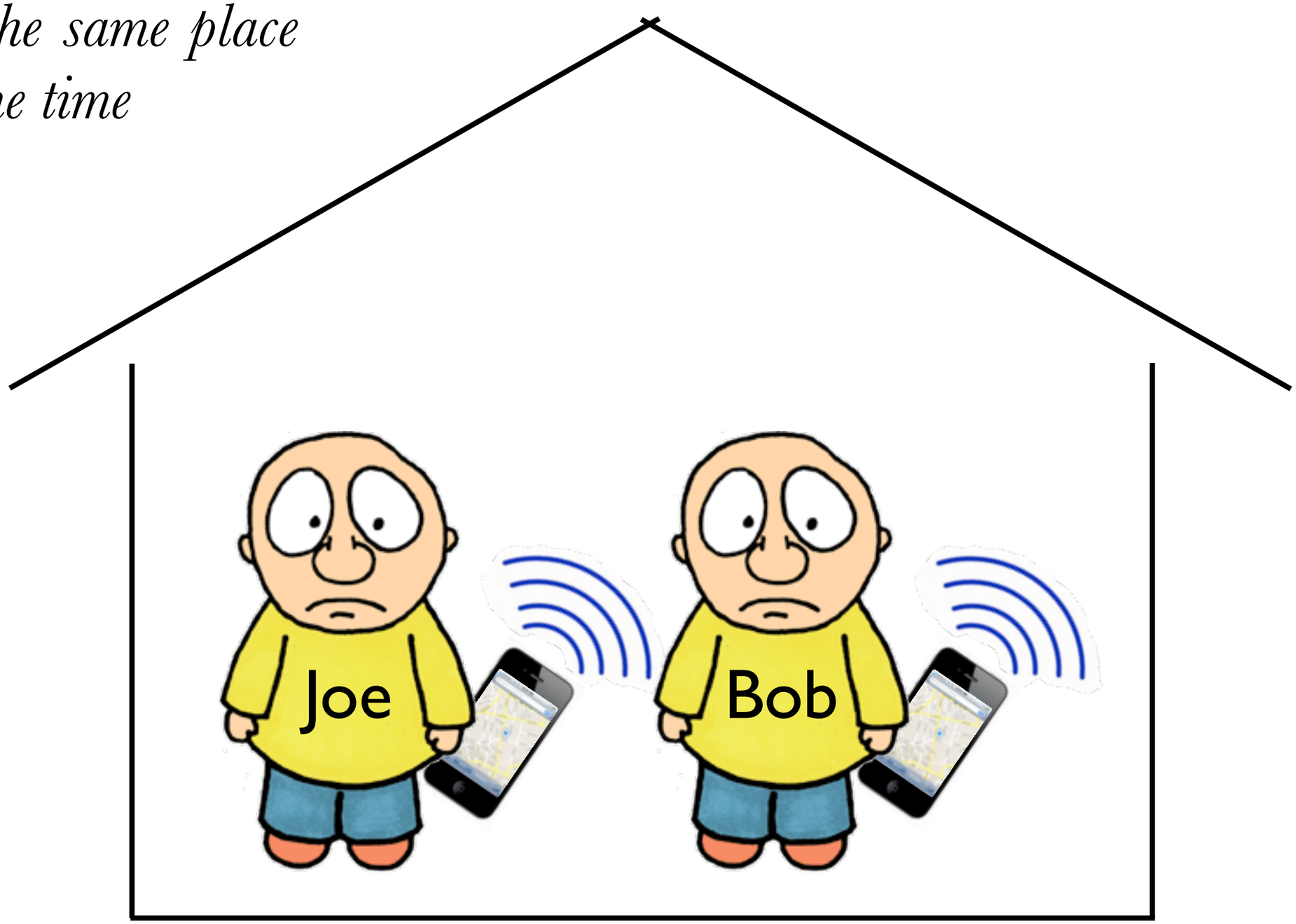
being in the same place
at the same time



However, even with the history of co-locations between users, it's still highly non-trivial to predict affinity.

Co-Locations

being in the same place
at the same time

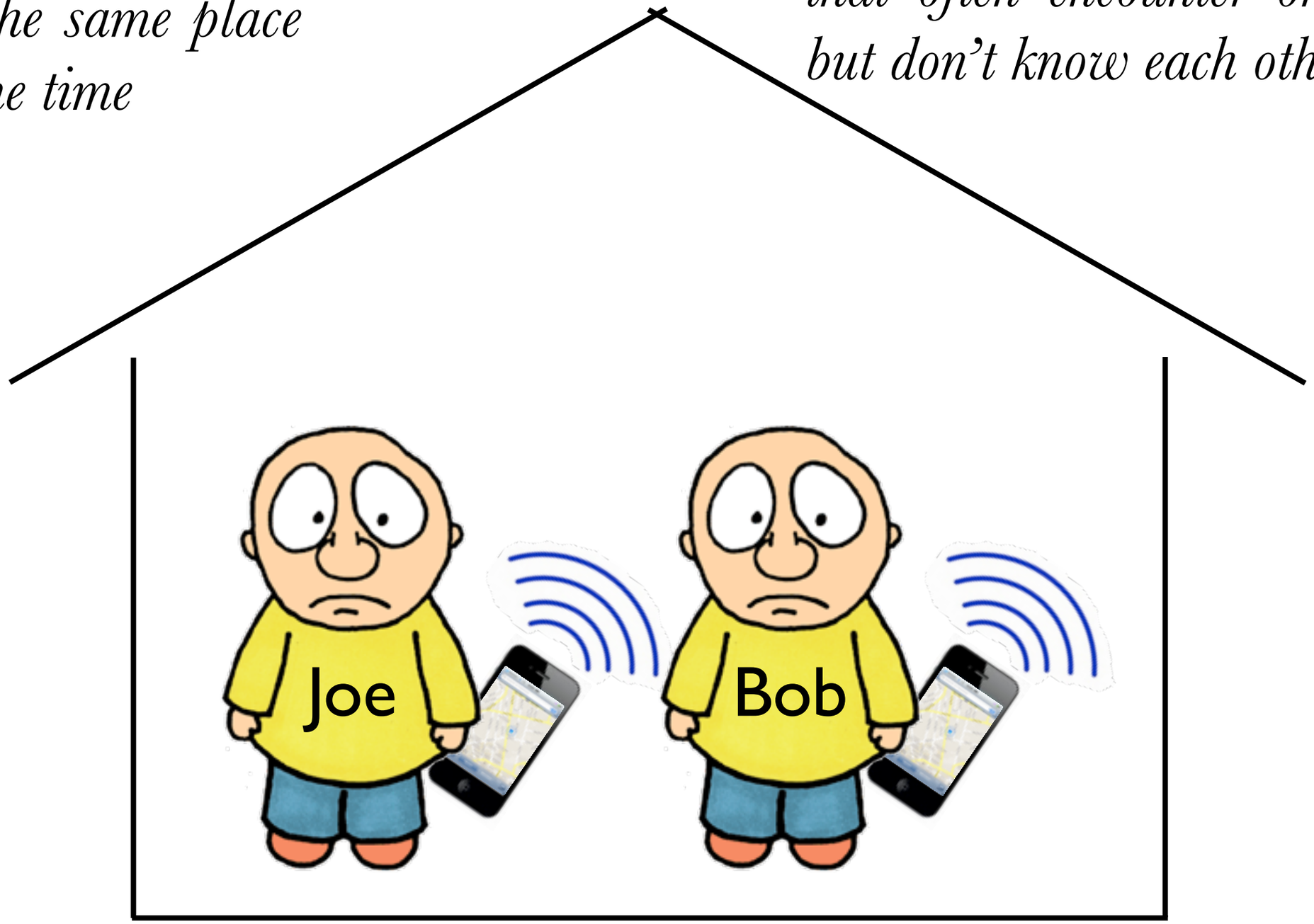


One reason for the difficulty (there are many) is the large number of *familiar strangers* found in a dense urban environment.

Co-Locations

being in the same place
at the same time

Familiar Strangers: *two people that often encounter one another, but don't know each other.*



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Co-Locations

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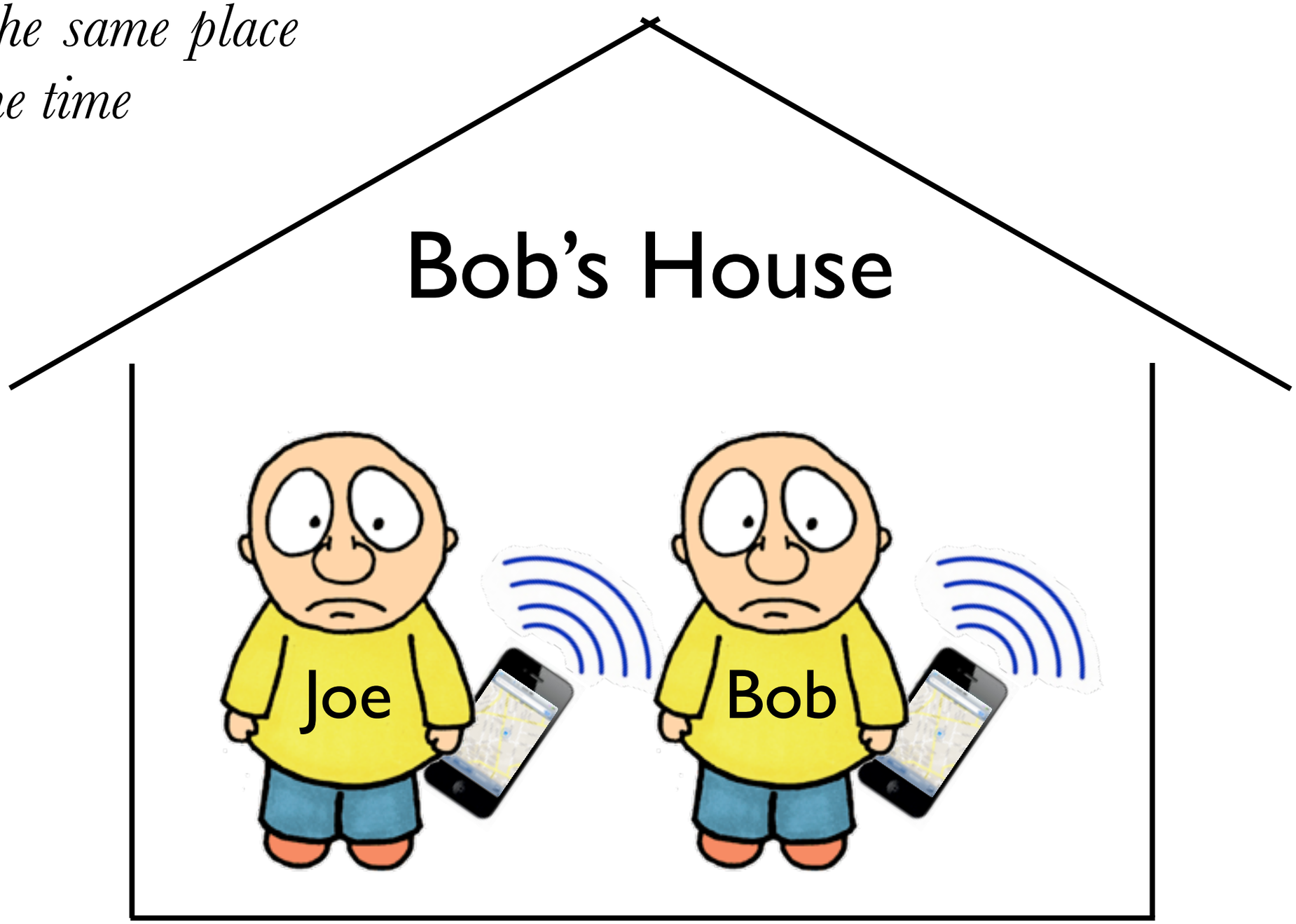
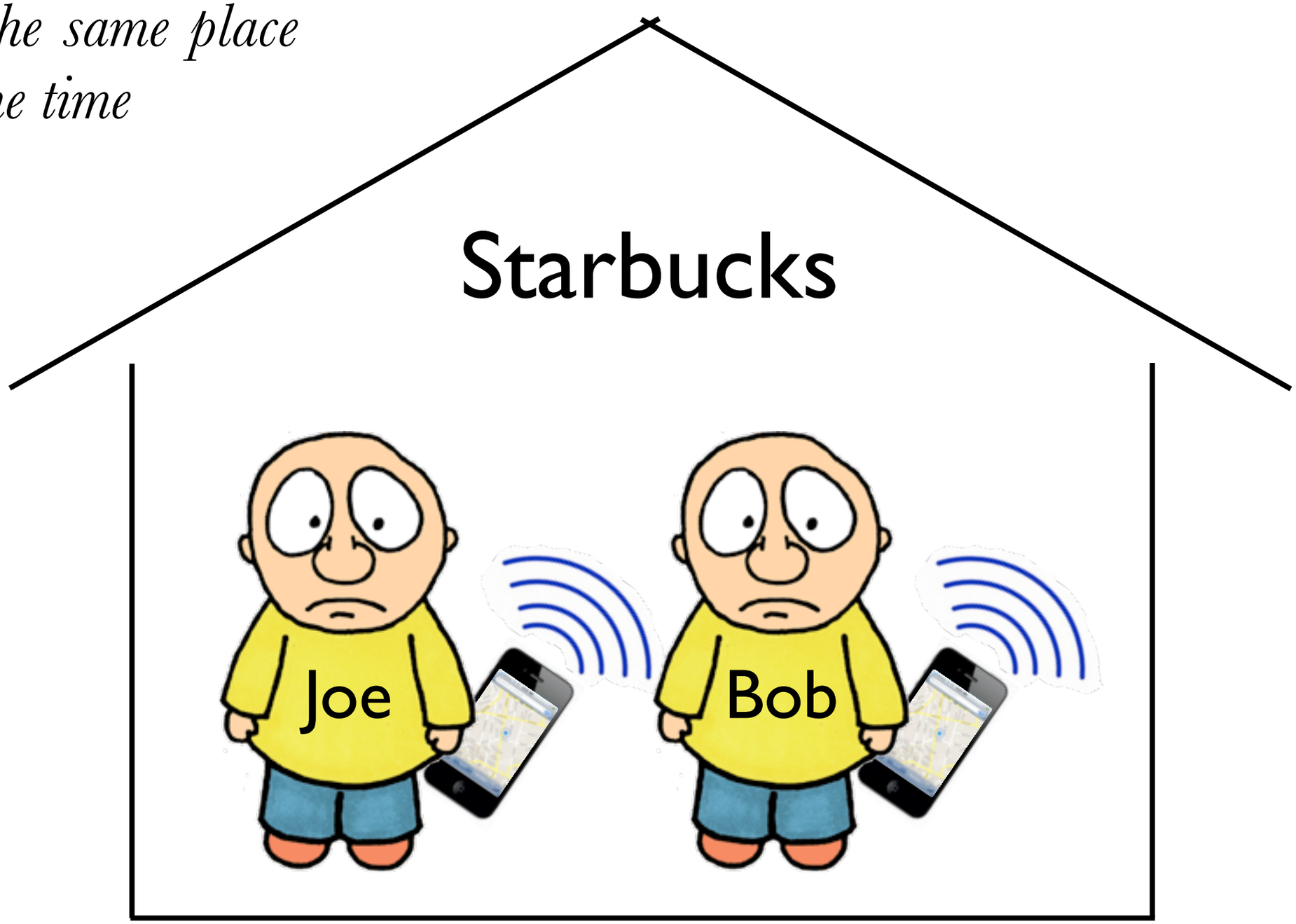


Context matters when looking at co-locations.

Co-Locations

being in the same place
at the same time



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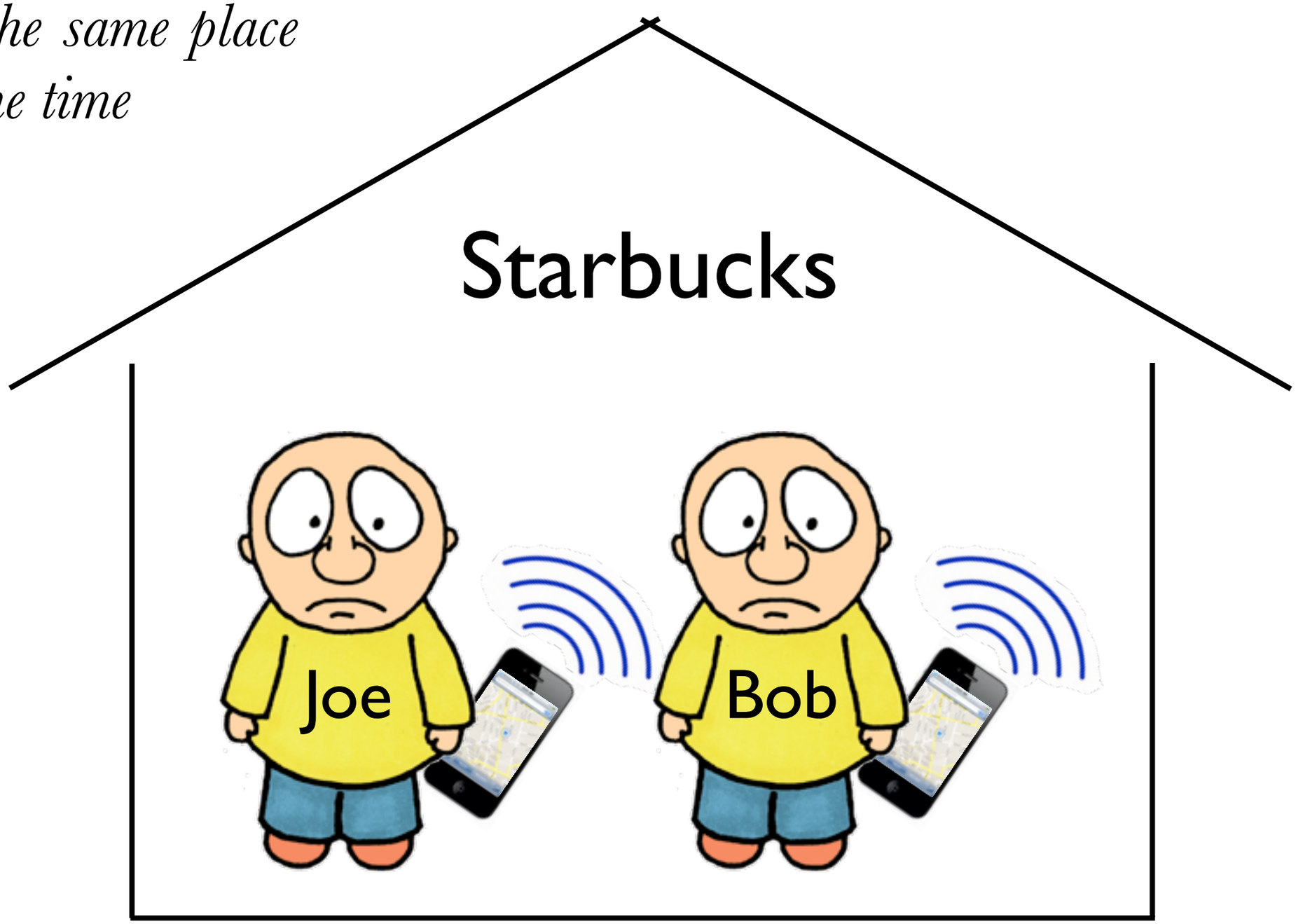
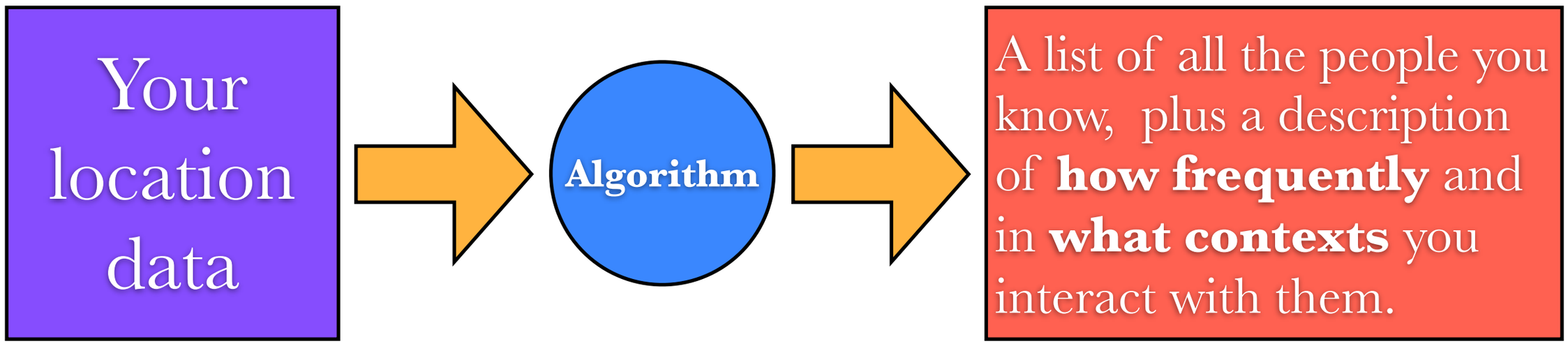
Co-Locations

being in the same place
at the same time



We designed a set of contextual properties of co-locations that predict pretty well whether or not two people are friends.

What are the privacy implications here?



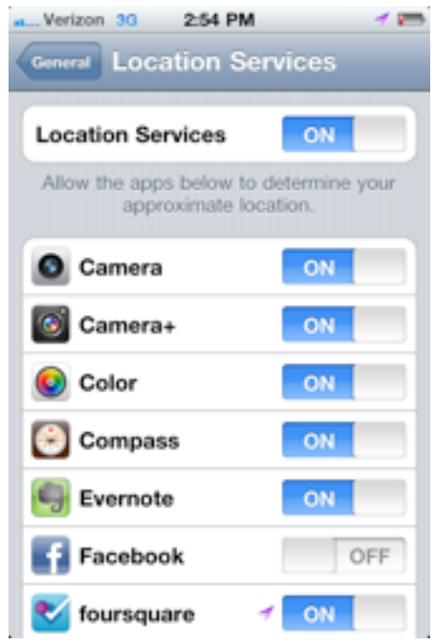
What are the privacy implications here?

[see above picture]

Location & Privacy

The (near) Future

But, what if you want some privacy?



Phones let you turn tracking off per app

But many applications use location in complex ways

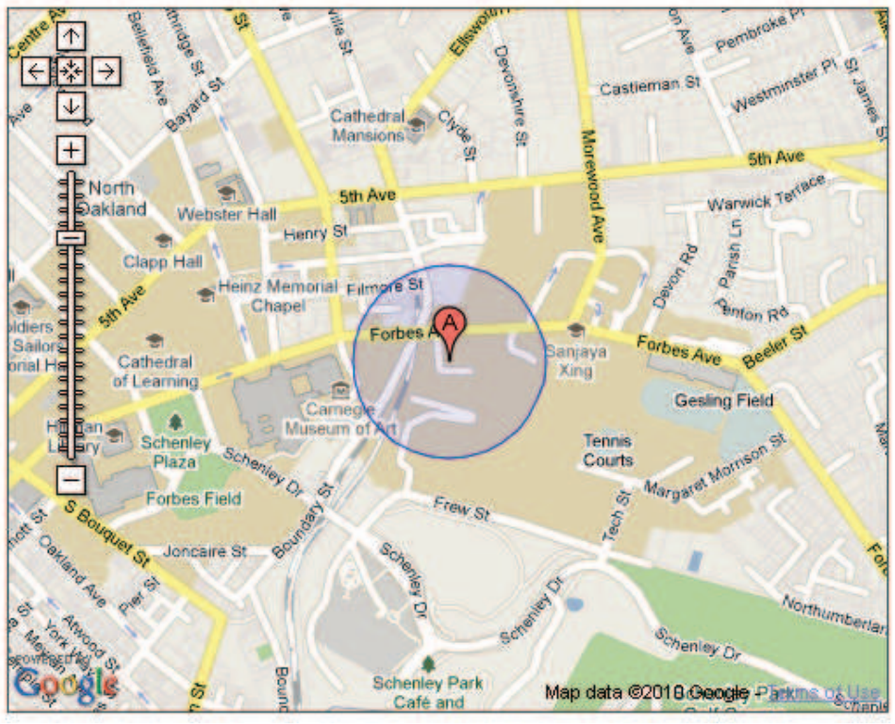
Apps will need richer access control policies

Policy Configuration is Complex

Capturing Location-Privacy Preferences: Quantifying Accuracy and User-Burden Tradeoffs

Personal Ubiquitous Computing, 2011

Mike Benisch
Patrick Kelley
Norman Sadeh
Lorrie Cranor



Page 1 of 14

You were observed to be at Location A **between Sunday September 21, 8:48pm and Monday September 22, 9:02am.**

Please indicate whether or not you would have been comfortable sharing your location during this time with each of the groups below.

Click here if you believe that this observation is completely inaccurate.

Your Close Friends and Family?

(e.g., Jim, Mary, Pam, etc.)

- Yes, during this entire time
- No, not during any of this time
- Yes, during part of this time...
- Yes, for some of these people

I would have been comfortable sharing my location from:

9/21 8: 48 pm

to:

9/22 9: 02 am

Add an additional time span.

Would you have been comfortable sharing your location **between Sunday September 21, 8:48pm and Monday September 22, 9:02am** with:

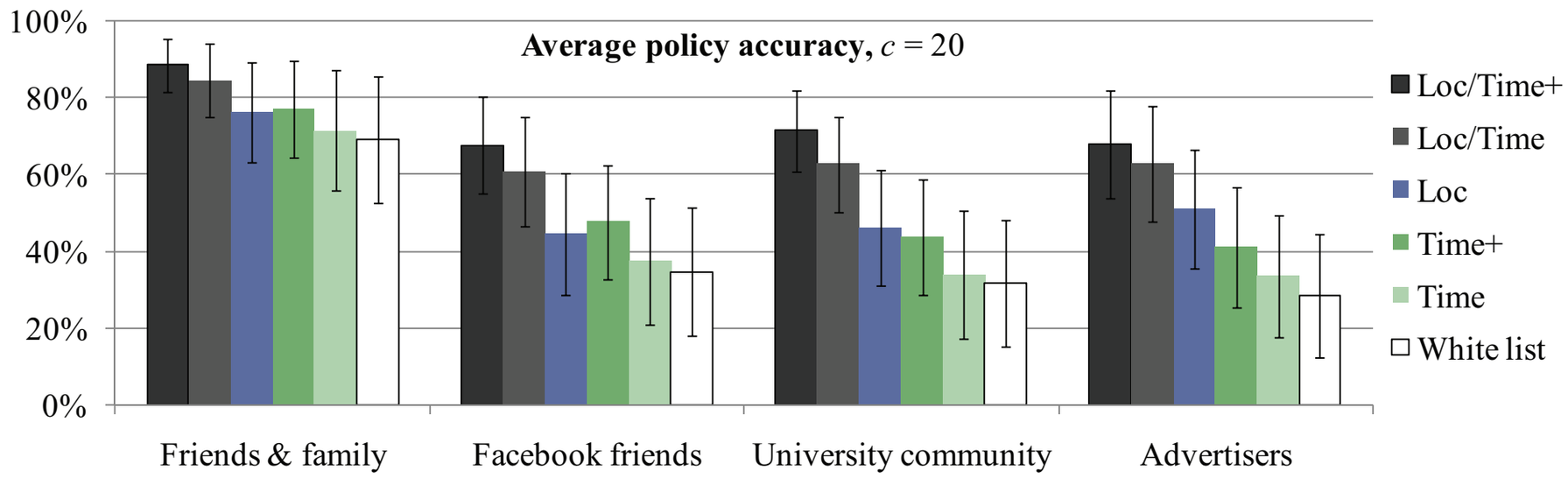
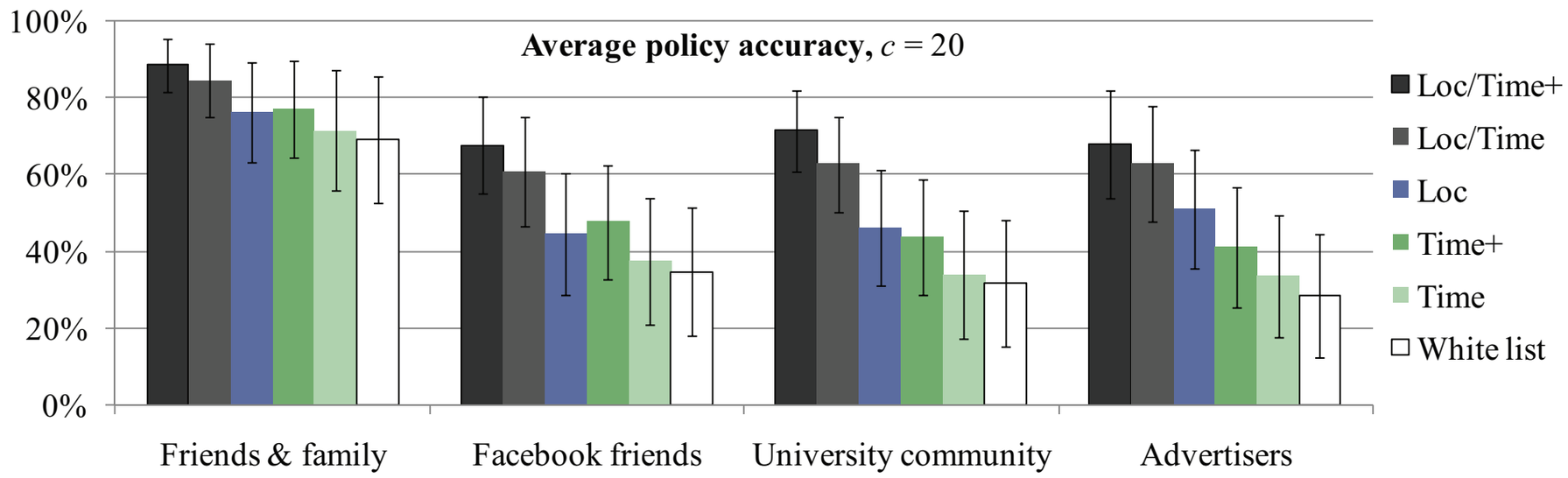


Figure 4: The average accuracy (bars indicate 95% confidence intervals) for each group, under each of the different privacy-setting types. For these results, we hold constant the cost for inappropriately revealing a location at $c = 20$.

- White-lists (on and off switches) do pretty well at capturing sharing preferences with close friends and family.
- For sharing with more diverse social groups, more expressive policies are required to capture user preferences.
- Even the most complex policies are only 60-70% efficient for social groups beyond Friends and Family.



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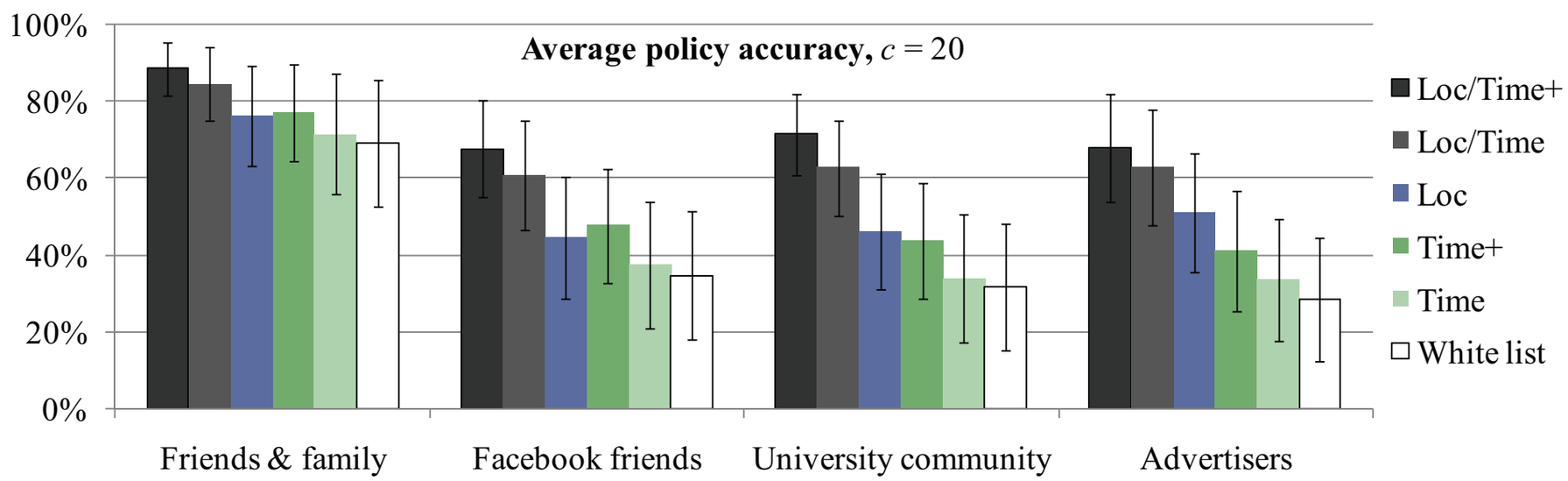
People have complex preferences



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LOCACCINO

Continuous Friend-To-Friend Location Sharing With Rich Privacy Settings

Available on the App Store

Android

OVI NOKIA

Who?

Where?

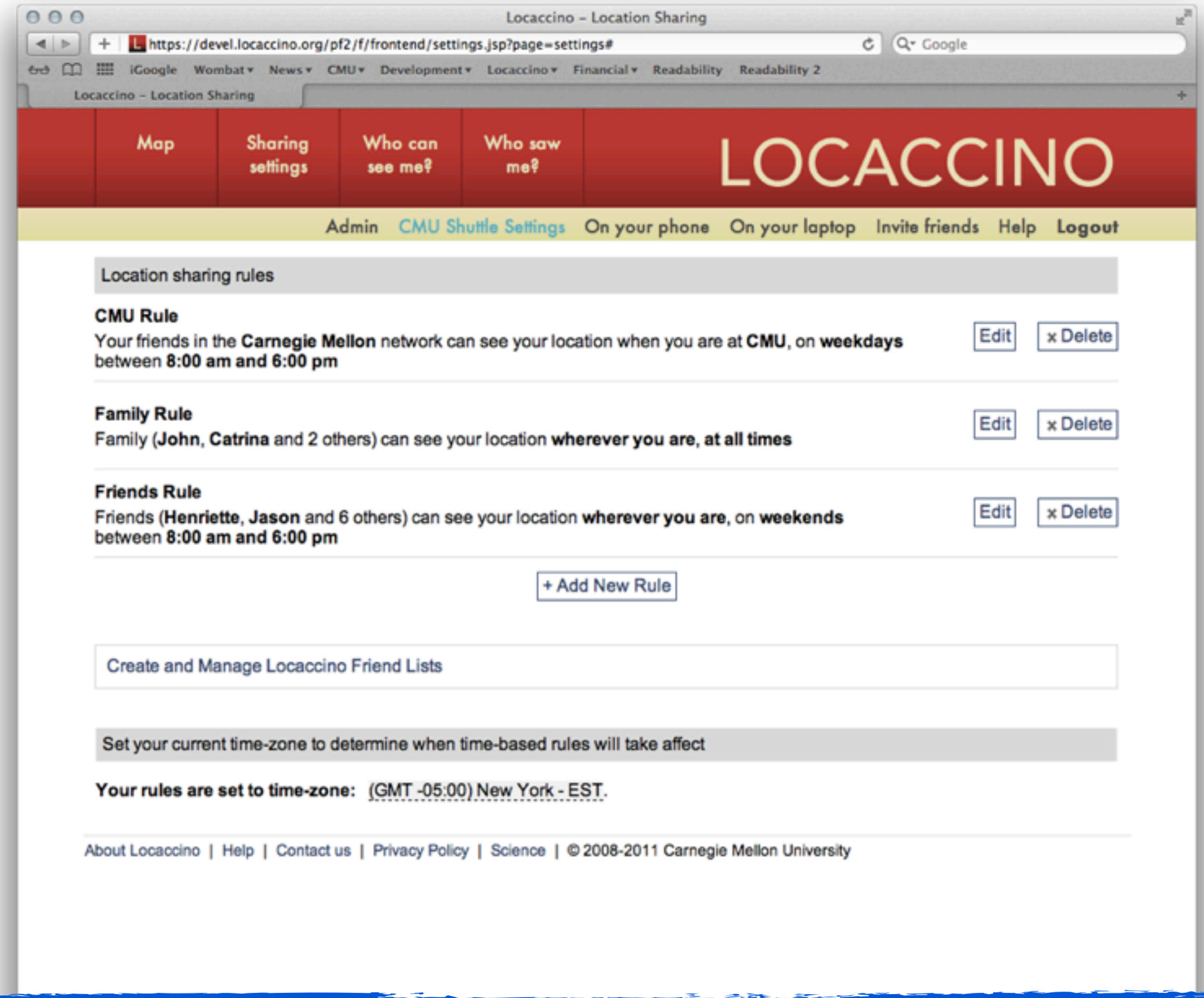
When?

***Policy* is a disjunction of *Rules*.**

***Rule* is a conjunction of *Who*, *Where* and *When* clauses.**

Location Sharing Policies

Example Rules



Location Sharing Policies

Comments, Limitations, Criticisms???

Comments, Limitations, Criticisms???

[raise hands now]

- Efficiency is a **best case** analysis. It assumes the user is actually capable of knowing (and specifying in advance) the optimum policy. Real world policies will be less accurate.

Comments, Limitations, Criticisms???

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Comments, Limitations, Criticisms???

- The analysis (for the most part) ignores **user motivations** and **utilities** of sharing. There are many complex reasons why people would want to share their location. It's difficult for the participant to anticipate in advance what these reasons might be.

Why do people share their location?

Why do people share their location?

[sorry, raise hands again]

Location Sharing is more than checking up on friends.

Foursquare

Gmail – Inbox (4) – jbcransh | Europe Tries to Stave Off a R | foursquare

Foursquare Labs, Inc. [US] https://foursquare.com

iGoogle | beLocL | News | CMU | Locaccino | Wombat | Development | New folder | Other Bookmarks

foursquare

Justin in Pittsburgh, PA | Notifications | Apps | Help | Settings | Log Out

Me | History | Badges | Stats | Friends

Search places, people and tips

It's more fun with friends! FIND FRIENDS

tin Cranshaw, Ramnath Balasubramanyan and 24 friends are using Foursquare.

Hi Justin Cranshaw

Pittsburgh, PA

Last seen 1 week ago at: Legume

Friends' Recent Check-ins

Jorge Ortiz @ Giaimo & Giaimo

"Re-signing my East Village apartment lease for another year."

New York - 45 minutes ago — 3

Yanneh @ WINLAB

North Brunswick, NJ - 1 hour ago

Eran T @ קריית טבעון

20 hours ago

Katie Klencheski @ Manhattan Inn

Brooklyn, NY - 1 day ago

Bryan Pendleton @ East End Food Co-Op

People you may know — See All

Michael Dinitz — 2 friends in common — ADD

Ziv Baum — 2 friends in common — ADD

David Randall — 2 friends in common — ADD

Lists from your friends — See All

Create and share your own list: Get started

Legit Mexican Food in New York
Created by Jorge O.

Food worth leaving Manhattan for
Created by Jorge O.

Geek Coffee
Created by Jorge O.

Newly Crowned Mayors — What's this?

Near Pittsburgh, PA

Dylan B. @ Assumption Hall

Glenn H. @ East Mckeesport Police

Checkins

- When users are at a place they want to share with their friends, they “check-in.”
- Check-ins are viewable only by your social connections, and other people who are checked-in to the same place as you.
- If people are checked in near by to you, you’ll receive a push notification on your phone.
- Users get points and rewards for checkins.

- Your friends' check-ins provide ambient cues into what they're up to.

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- By seeing where your friends go, you can discover new places to visit.

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Foursquare Apps:
An Ecosystem of Location Sharing

Europe Tries to Stave Off a R | foursquare | foursquare :: Application Ga

Foursquare Labs, Inc. [US] https://foursquare.com/apps/

iGoogle | beLocL | News | CMU | Locaccino | Wombat | Development | New folder | Other Bookmarks

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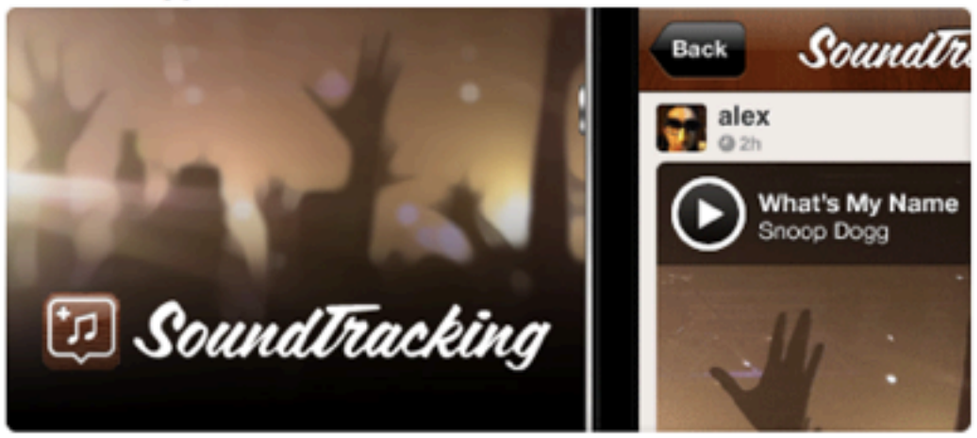
Me | History | Badges | Stats | Friends

Search places, people and tips

4SQ App Gallery

Featured Apps



Mobile | Websites | Plugins | Visualizations | Games | Other

Take a look at what others have already built using our API.

GoodHop

We believe in the power of feedback

4SQFF

Wondering who that guy is who seems to be the mayor of every

https://foursquare.com/app/goodhop#

Get foursquare on your mobile

iPhone | android | BlackBerry | OVI by NOKIA | palm | Windows phone

Interested in building something?

The foursquare API enables developers to build applications that interact with the foursquare platform.

You can use the API to create new ways to check-in to foursquare or visualize the data generated by the foursquare community.

foursquare Developer Site

Need help? Join the Discussion Group.

Submit your foursquare App

Recently Added Apps

1. GoodHop

Gmail – Inbox (4) – jbcra | Europe Tries to Stave Off | foursquare | foursquare :: Apps :: Oust

Foursquare Labs, Inc. [US] https://foursquare.com/app/oustme

iGoogle | beLocL | News | CMU | Locaccino | Wombat | Development | New folder | Other Bookmarks

foursquare

Justin in Pittsburgh, PA | Notifications | Apps | Help | Settings | Log Out

Me | History | Badges | Stats | Friends

Search places, people and tips

Back to the App Gallery →

Oust.me

Description

Oust.me is strategic geo location game, which uses geo locations as main game feature to build territories, influencers and top spots. Oust.me collects all your recent history of check-ins from before mentioned services and let you play strategic interactive game at one spot.

Screenshots

Oust.me

Category: Games
Created by: Oust
Date added: April 14, 2011
More info: Learn more
Like it: Like 1

Try this Application

About | Apps | Blog | Developers | Help | Jobs | Privacy | Terms (New) | Store

© 2011 foursquare · English

DON'T EAT AT ____

Get a text message when you check into a NYC restaurant that is at risk of being closed for health code violations.

SIGN IN WITH FOURSQUARE

About @maxstoller

Takeaway:

- People share their locations for lots of different reasons.
- Understanding user motivations is important to understanding how do design privacy mechanisms for location sharing.

- UbiComp envisions a world with thousands of invisible computing devices embedded wherever we go.
- This suggests we can expect lots of third party devices tracking our location (not just cell phones).
- This may mean even **less** control over our location data (at least the smart phone is **ours**).

The (distant) Future

Questions?

Justin Cranshaw
jcransh@cs.cmu.edu
@jcransh (twitter)