



# Moving Beyond Set-It-And-Forget-It Privacy Settings on Social Media

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# Need to revisit old privacy settings

## 2009



Privacy setting: “**all friends**”

# Need to revisit old privacy settings

2009



Undergraduate friends

Privacy setting: “**all friends**”

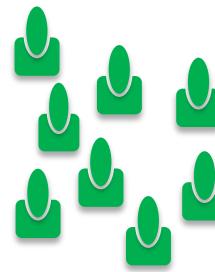
# Need to revisit old privacy settings 2019



Privacy setting: “**all friends**” !!

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## 2019

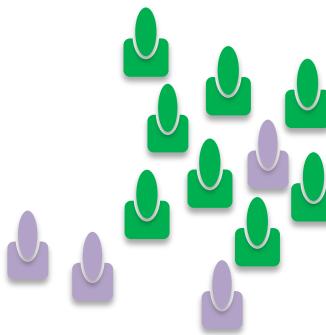


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## 2019



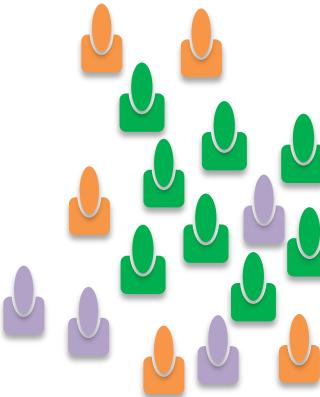
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Graduate school friends

Privacy setting: “**all friends**” !!

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2019



Undergraduate friends

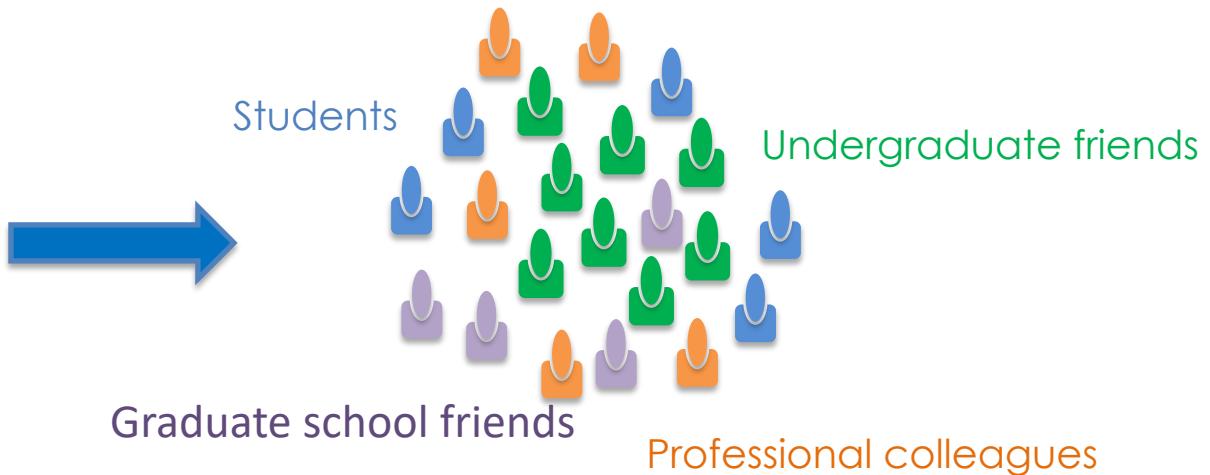
Graduate school friends

Professional colleagues

Privacy setting: “**all friends**” !!

# Need to revisit old privacy settings

2019



Privacy setting: “**all friends**” !!

Issue: Users take a “**set-it-and-forget-it**” approach to privacy settings for social media posts

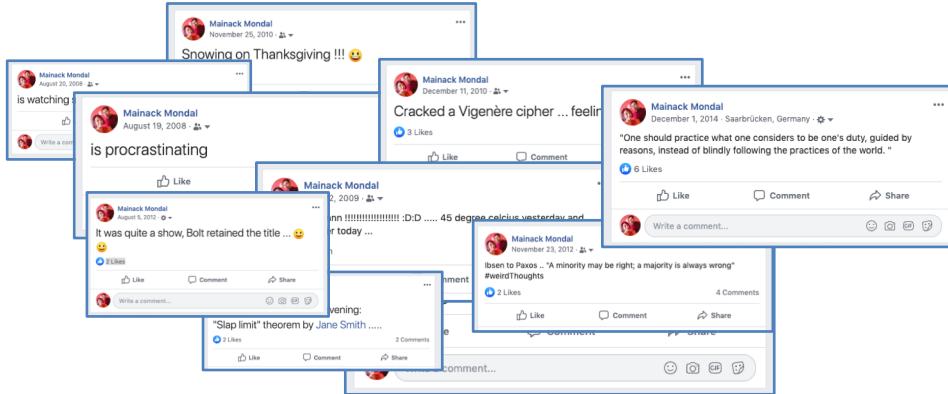
Need: Retrospectively manage privacy

# Retrospective privacy management is difficult

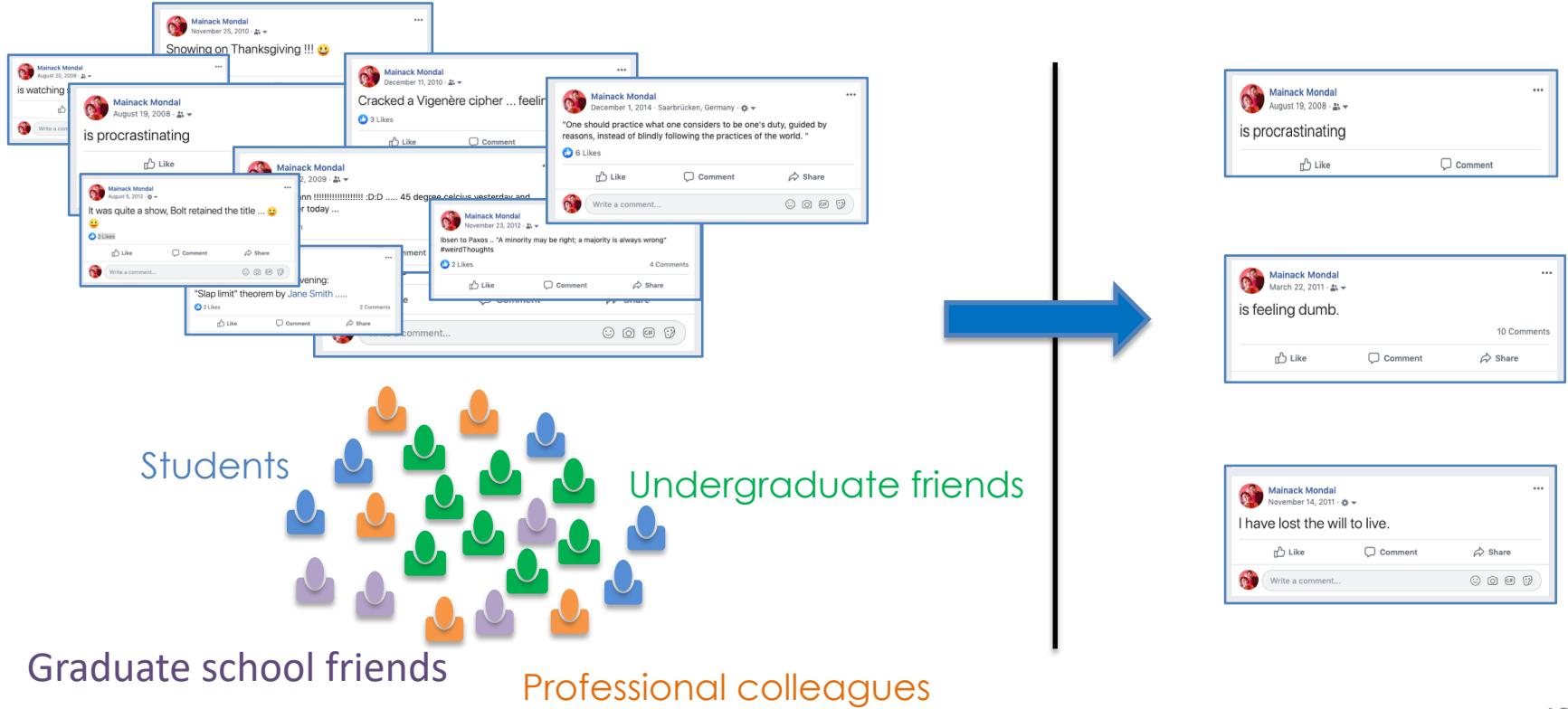


Undergraduate friends

# Retrospective privacy management is difficult



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# State of the art

No proposal for a predictive model or mechanism

[Bauer et al. 2013]  
[Ayalon et al. 2013]

**Limit The Audience for Old Posts on Your Timeline**

If you choose to limit your past posts, posts on your timeline that you've shared with Friends of friends, and Public posts, will now be shared only with Friends. Anyone tagged in these posts, and their friends, may also still see these posts.

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[No Thanks](#) [Let's Do It!](#)

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Focus of our study

Measure privacy activity and preferences

Predictive models for retrospective privacy management

# Outline

Our data collection approach

Privacy settings and friend network over time

Preferences for changing privacy settings

Automated classifiers

# Outline

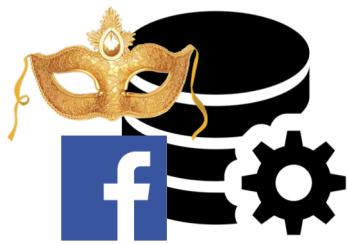
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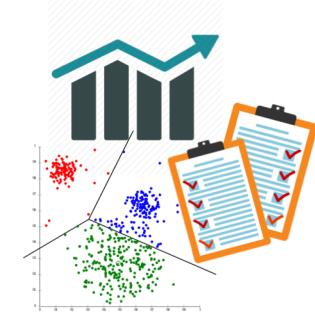
# Study overview



Privacy-preserving  
data-collection  
Infrastructure



78 Facebook users



Two surveys

# Generic survey



Overall Facebook usage over time



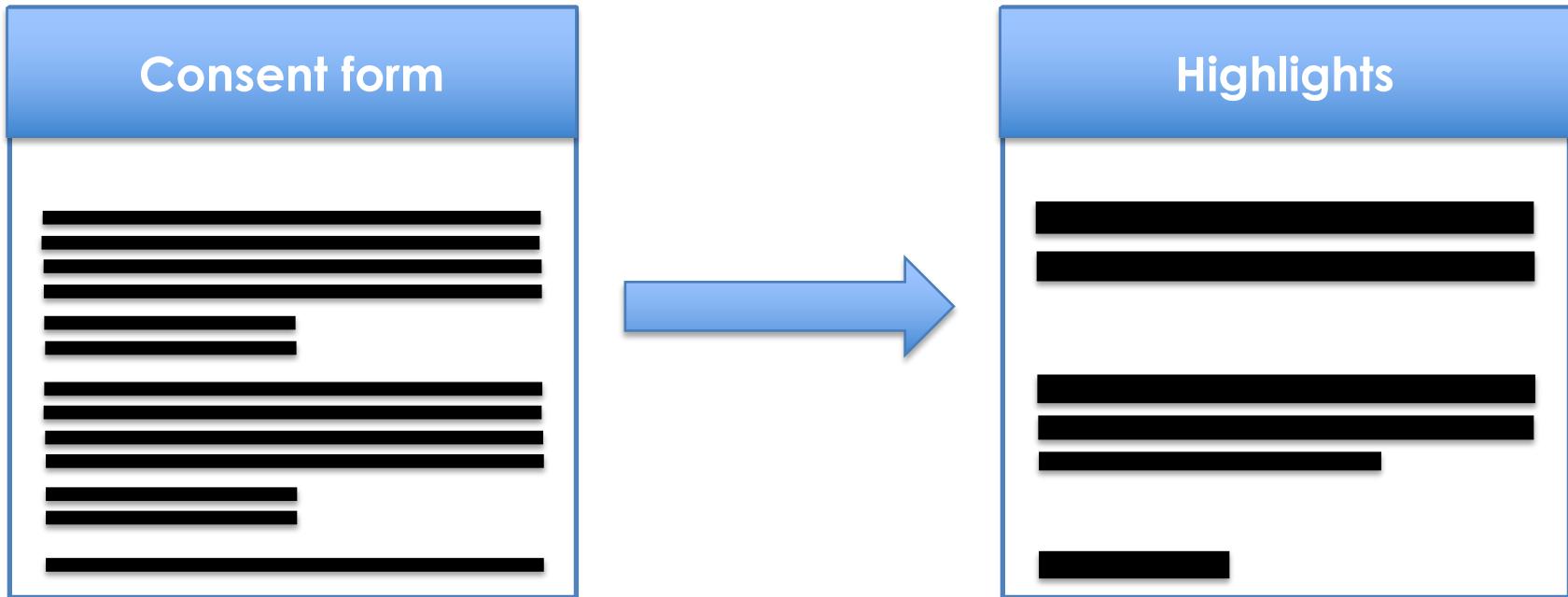
Use of Facebook's privacy features



Participant demographics



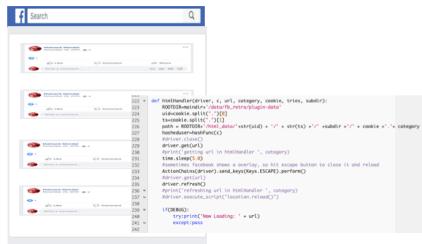
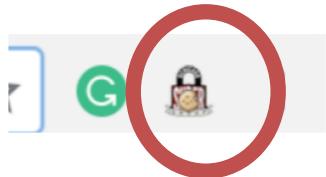
# Consent process



# Data collection process



# Data collection process



Programmatic  
No humans ever view raw HTML

Hash names and IDs;  
No images collected



Never access  
friends' profiles

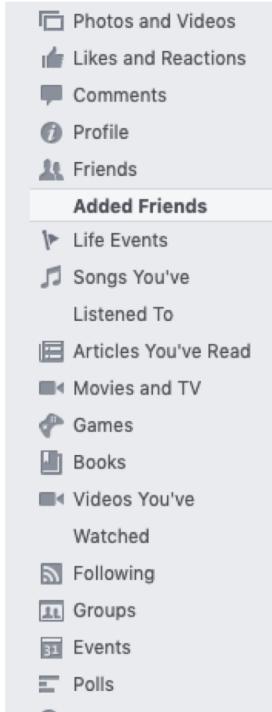
# Facebook Timeline data



```
1 {  
2   "user": "23765ae45...",  
3   "timestamp": "May 26, 2009",  
4   "privacy": "friends",  
5   "numLikes": 5,  
6   "numComments": 18,  
7   "Text": "When we were young",  
8   "post_url": https://facebook.com/...,  
9   "commentObjects": [  
10    {  
11      "user": "877326d4f...",  
12      "text": "You look funny",  
13      "timestamp": "...",  
14      ...  
15    }  
16  ]  
17  .....  
18 }
```

**Chose not to store images!**

# Facebook Activity Log data



```
1 {  
2   "activityType": "addfriends",  
3   "user": "23765ae45...",  
4   "friend": "3264325ef...",  
5   "timestamp": "Oct 31, 2018"  
6 }  
7 {  
8   "activityType": "addfriends",  
9   "user": "23765ae45...",  
10  "friend": "85e47873...",  
11  "timestamp": "Oct 26, 2018"  
12 }  
13 ...
```

**ALL Facebook activities by user  
(friendship, likes, comments,...)**

# Post-specific survey

1. Desired privacy settings for 5 random posts per user

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Click [here to see Post 1.](#) Current privacy setting: Public



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Keep same setting

Change setting to:

<input type="radio"/>	[REDACTED]
<input type="radio"/>	[REDACTED]
<input type="radio"/>	[REDACTED]



Delete

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Change setting to:

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Why?

# Post-specific survey

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This question concerns [Post 1](#) and one of your Facebook friends: [Blase Ur](#)  
You can visit Blase Ur's profile by clicking his picture:



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Keep sharing post 1  
with Blase Ur



Stop sharing post 1  
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Why?

# Demographics



AMT workers from US

69% identified as female

46% reported age 25-34

18% reported CS background

# Facebook usage

	Total	Median
Account age (Years)	-	10
#Friends	-	224
#Timeline posts	253,122	1,840
#Activity log entries	1,738,303	20,263

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Active users with old accounts and lots of posts

67% reported reduced Facebook usage over time

# Outline

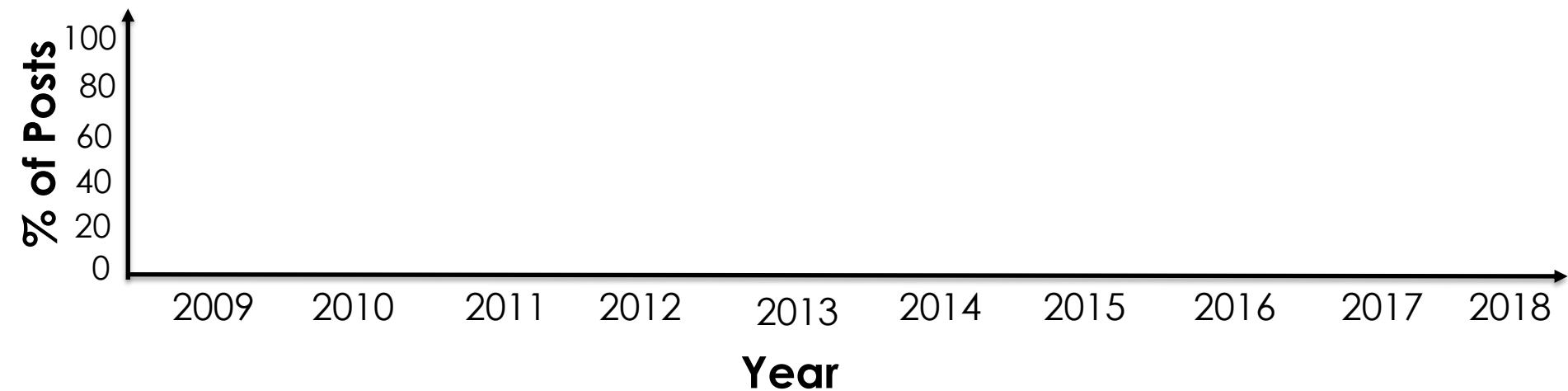
Our data collection approach

**Privacy settings and friend network over time**

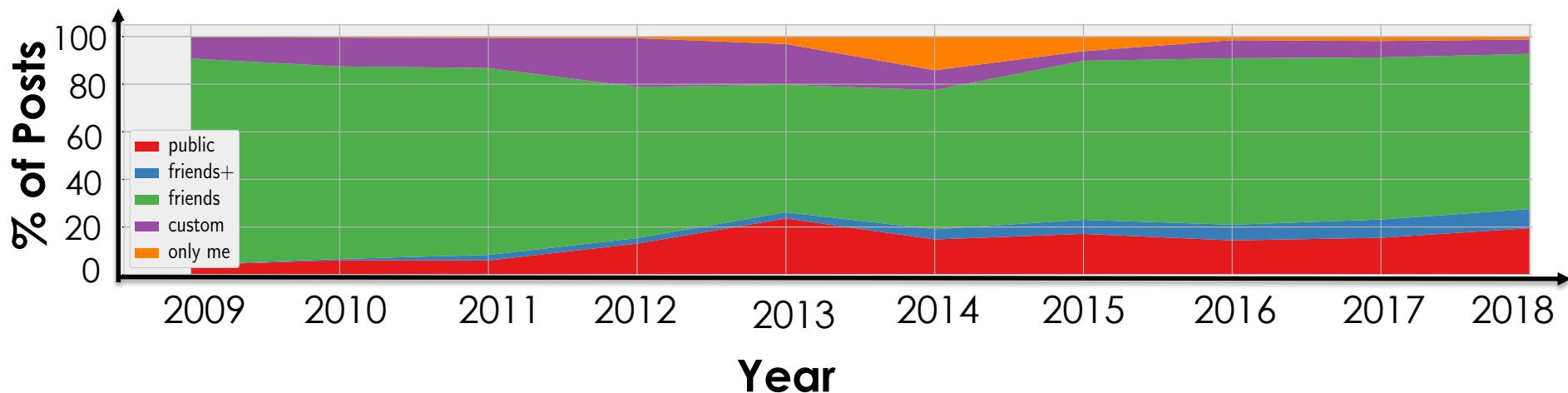
Preferences for changing privacy settings

Automated classifiers

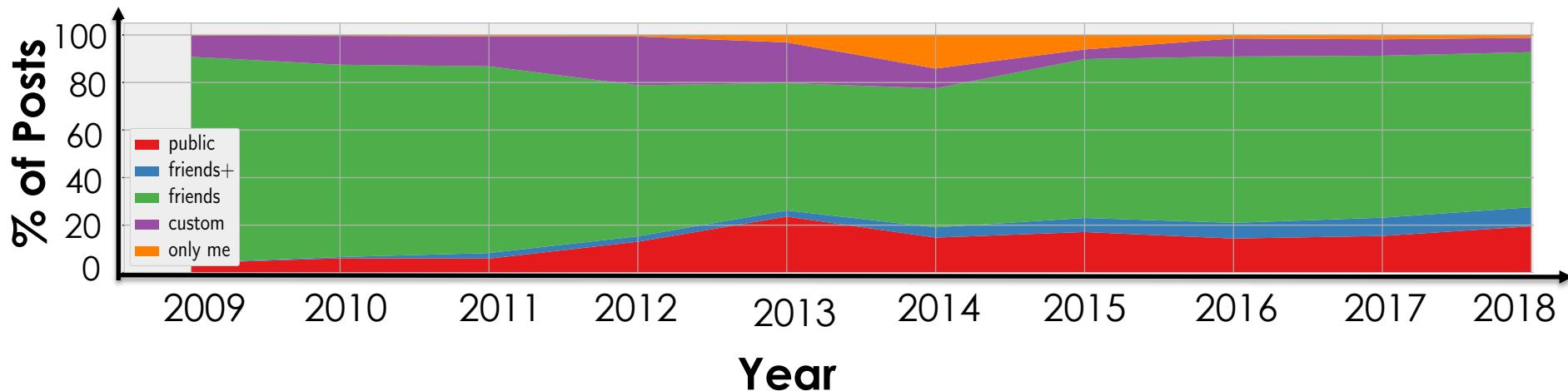
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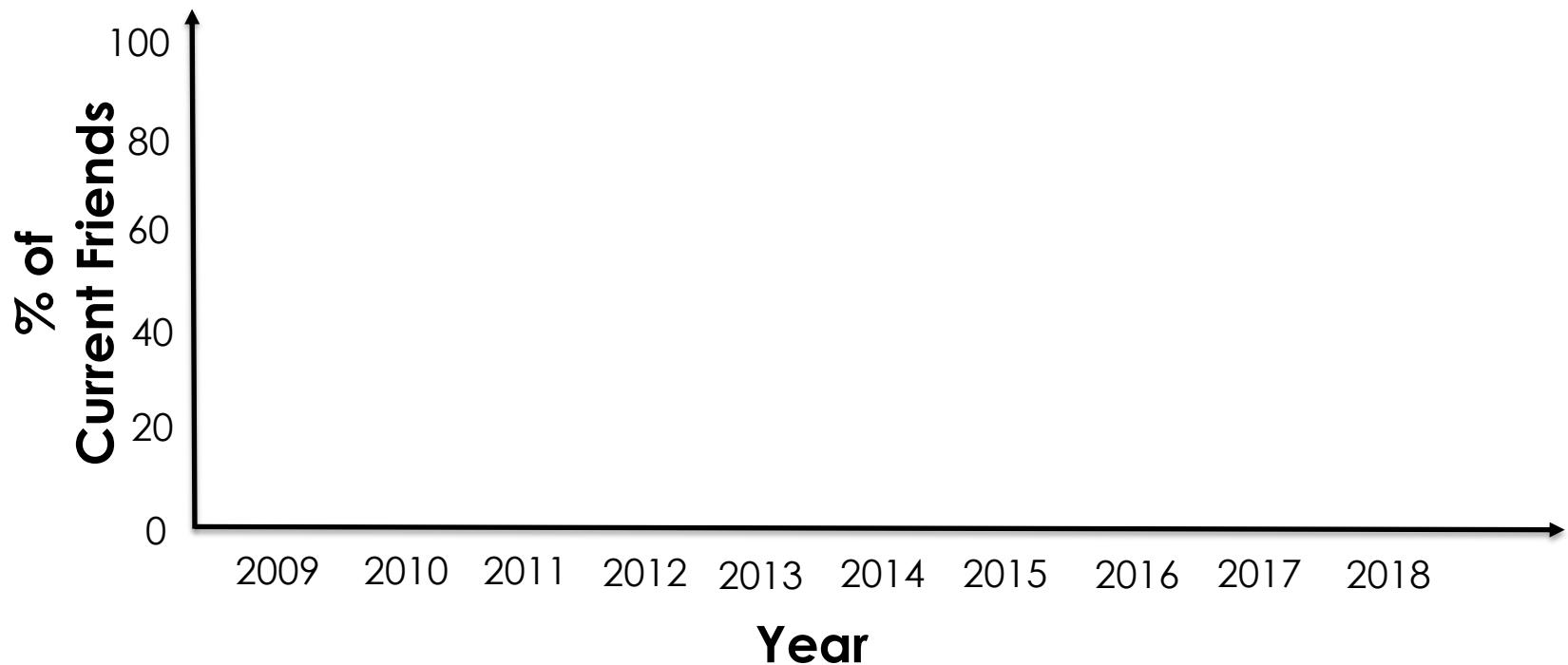


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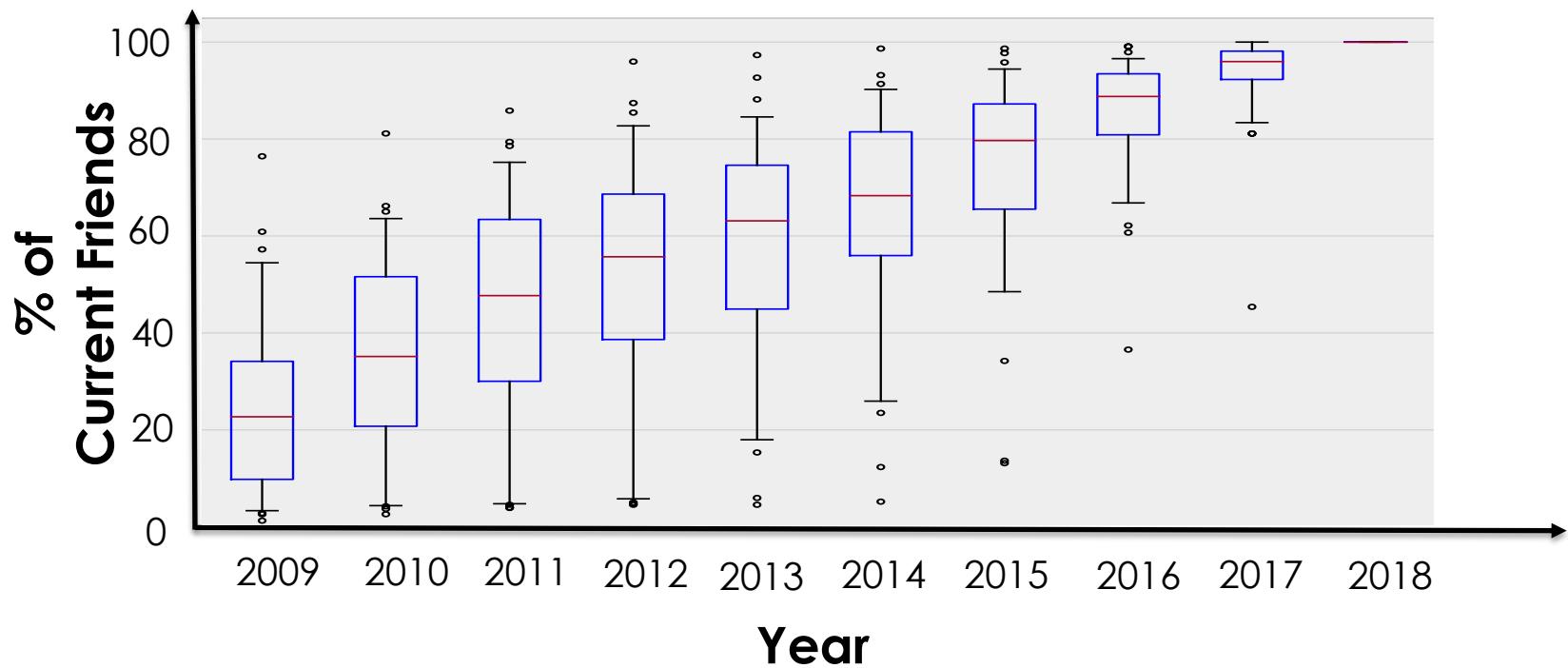


Majority of old posts are shared with all “friends”

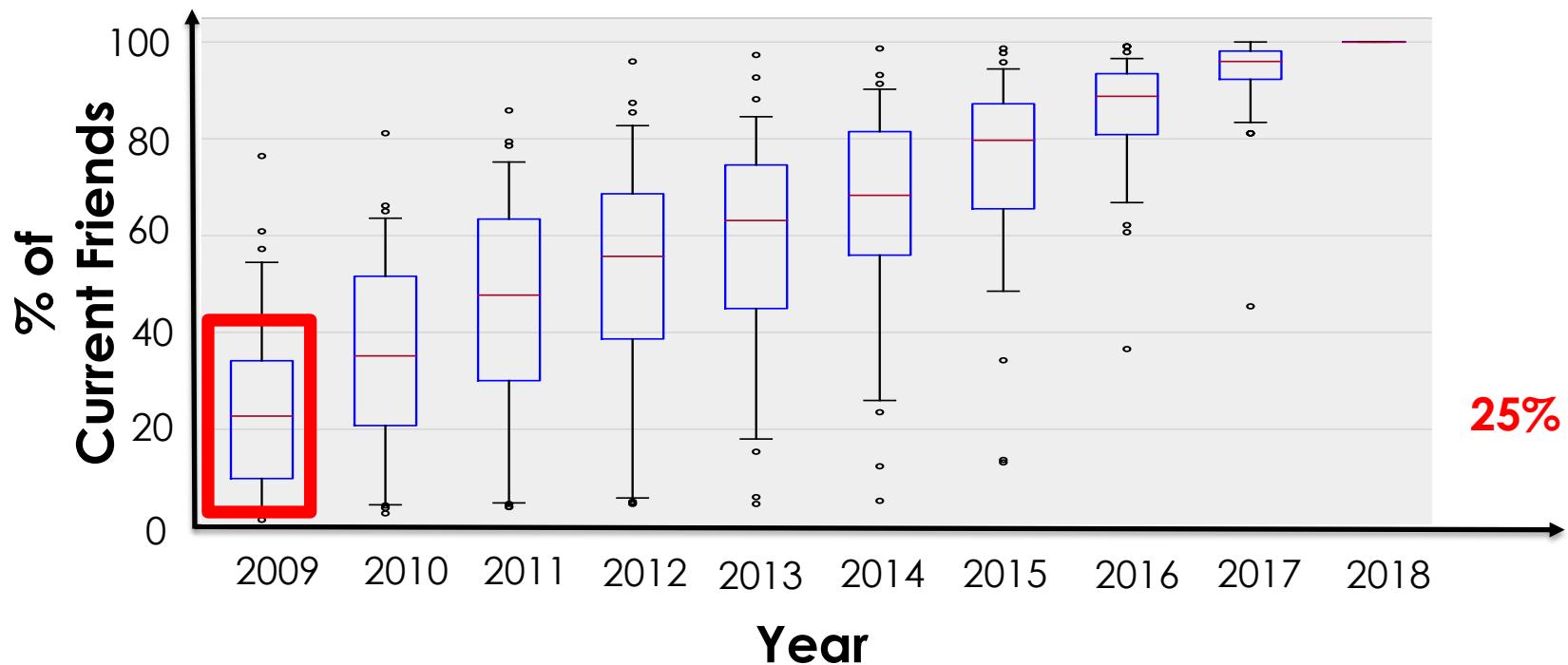
# Change in number of friends



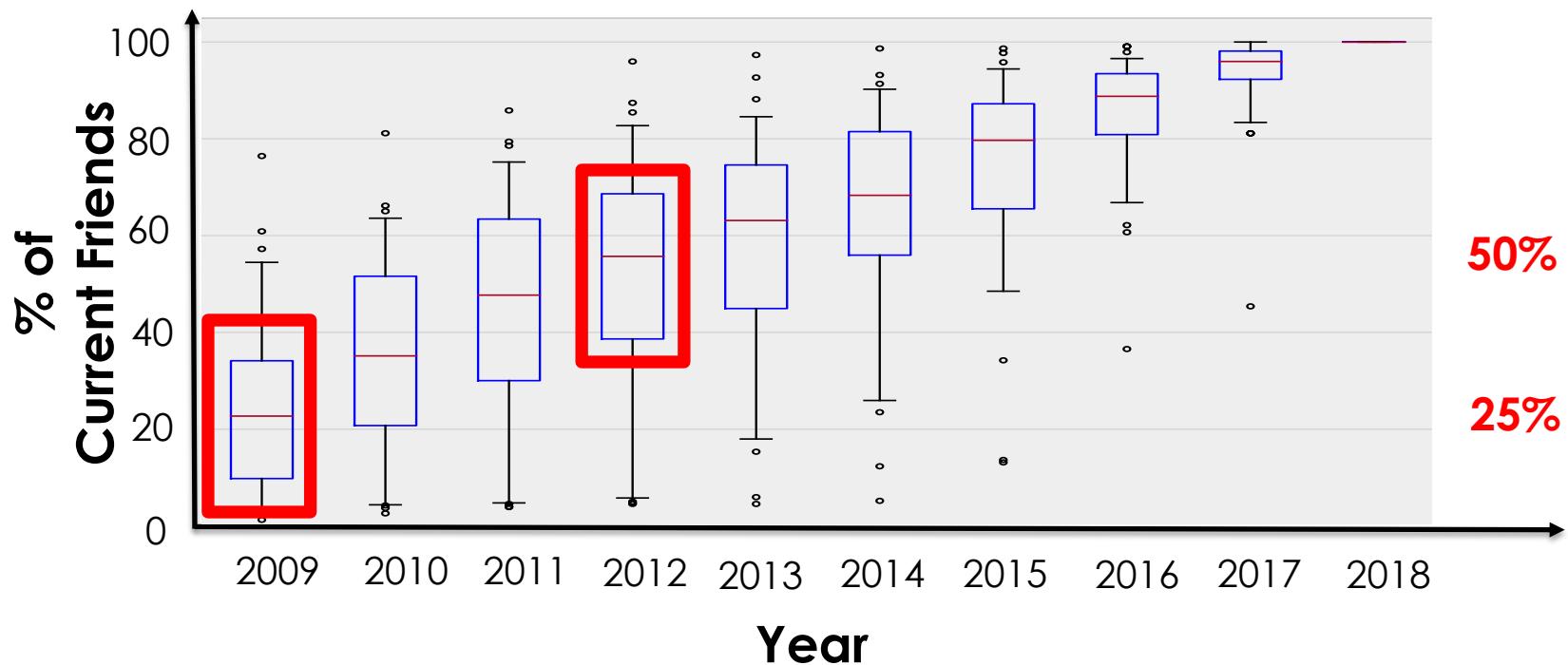
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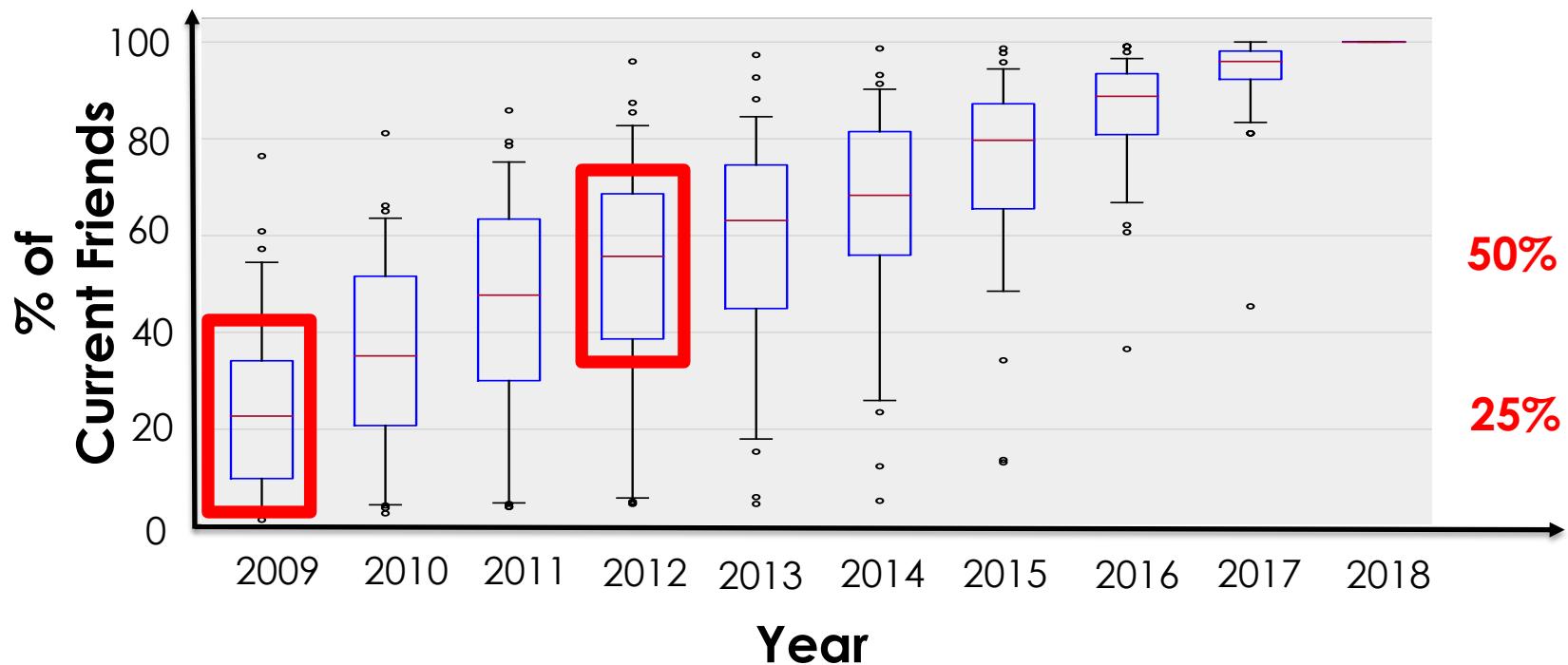
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Substantial change in the meaning of “friends” privacy setting

# Outline

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## **Preferences for changing privacy settings**

Automated classifiers

# Desired privacy setting for old posts

Post-specific survey: **Desired privacy setting for 390 random posts**

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Current setting	Desired setting						
	Public	Friends+	Friends	Custom	Only Me	Custom (Decreased)	Delete
Public	58	-	3	-	-	-	1
Friends+	3	27	3	-	-	-	-
Friends	21	4	177	3	5	-	31
Custom	6	2	9	19	1	2	4
Only Me	-	-	-	-	9	-	1

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Participants **desire to change audience for 25% of old posts!**

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Desire to limit audience: 54 posts

Desire to increase audience: 45 posts

Participants **desire to change audience** for 25% of old posts!

# Effectiveness of Facebook's privacy tools

## Limit The Audience for Old Posts on Your Timeline

If you choose to limit your past posts, posts on your timeline that you've shared with Friends of friends, and Public posts, will now be shared only with Friends. Anyone tagged in these posts, and their friends, may also still see these posts.

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## Privacy Checkup



Hi Charlie!

We have a new tool that helps you quickly review a few of your privacy settings to make sure they're set up the way you want.

It should take a minute or two to use. Do you want to check it out?

[No Thanks](#)

[Let's Do It!](#)

Found no significant correlation between usage of these tools and the desire to change posts' privacy settings

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## **Automated classifiers**

# A human-in-the-loop design

## Inspiration

People You May Know

	<b>John Doe</b> Johnny Doe and 14 other mutual friends
	<b>Jenny Doe</b> Jane Doe and 6 other mutual friends
	<b>Matt Doe</b> Robert Doe and 41 other mutual friends
	<b>Julia Doe</b> Robert Doe and 40 other mutual friends
	<b>Judith Doe</b> Robert Doe and 35 other mutual friends

# A human-in-the-loop design

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## Our vision

Stop sharing



with



?

Stop sharing



with



?

Stop sharing



with



?

# Prediction task

Prediction task

**Predict if a user wants to “stop sharing” a given post with a given friend**

Output

List of friend-post pairs ordered by probability

Ground truth

Privacy decisions for 78 participants x 5 posts X 6 friends = 2,340 pairs

# Features for prediction

<b>User-specific</b>	#friends, age of the account, life change, Facebook privacy tool usage, user age, CS-background
<b>Post metadata</b>	Age of the post, #likes, #comments, previous change in privacy setting, type of post, tagged friend
<b>Post content</b>	Word2vec embeddings, Google content-classification categories, sentiment
<b>Friend-specific</b>	Days since first and last communication, #wall words exchanged, #likes from friend to user

# Prediction algorithms

Supervised learning algorithms with cross validation

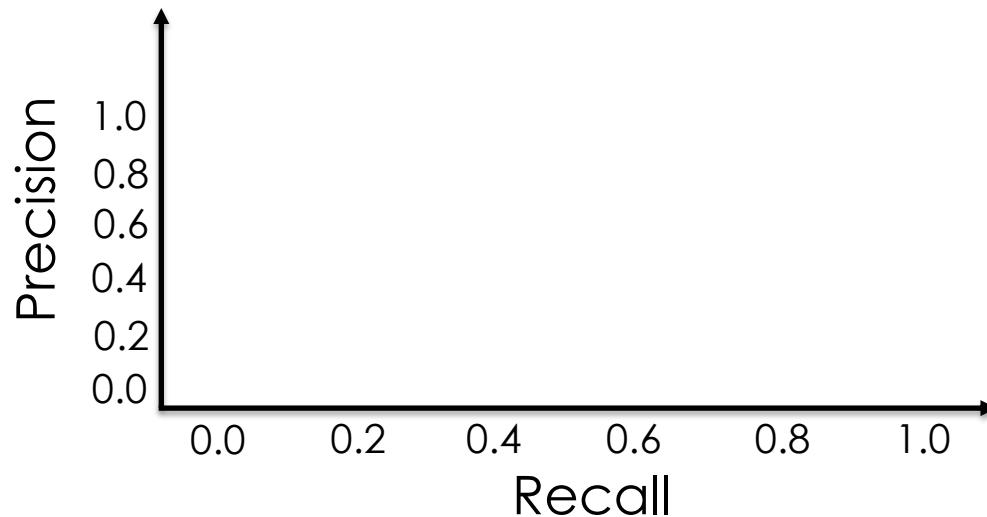
**Random Forests, XGBoost**, Decision Trees, Logistic Regression,  
Support Vector Machines, Deep Neural Networks

## Baselines

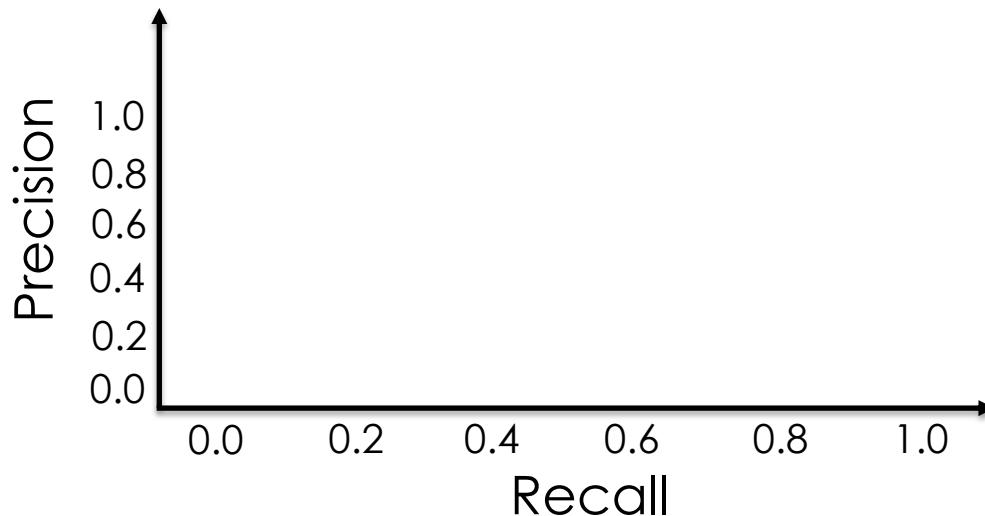
Random: Randomly predicts “stop sharing” for a pair

Interaction: Low interaction level → “stop sharing”

# Are our models better than the baselines?

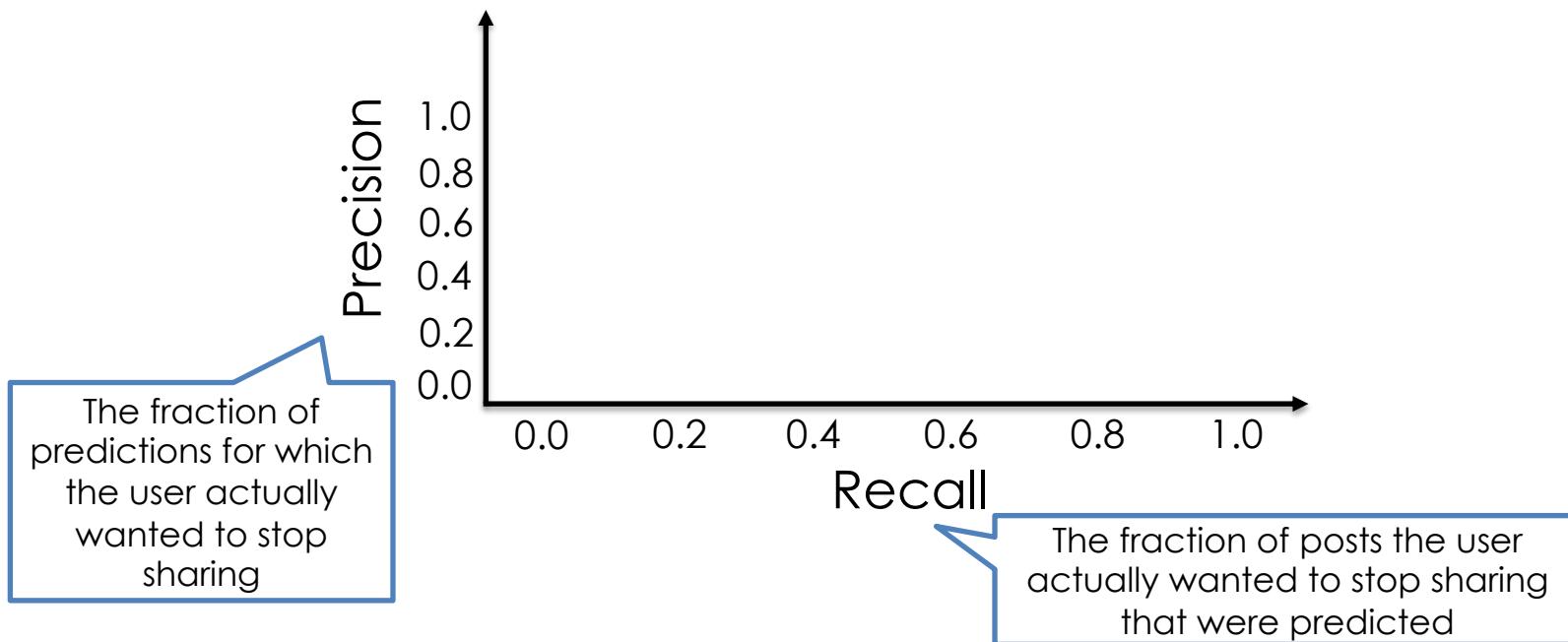


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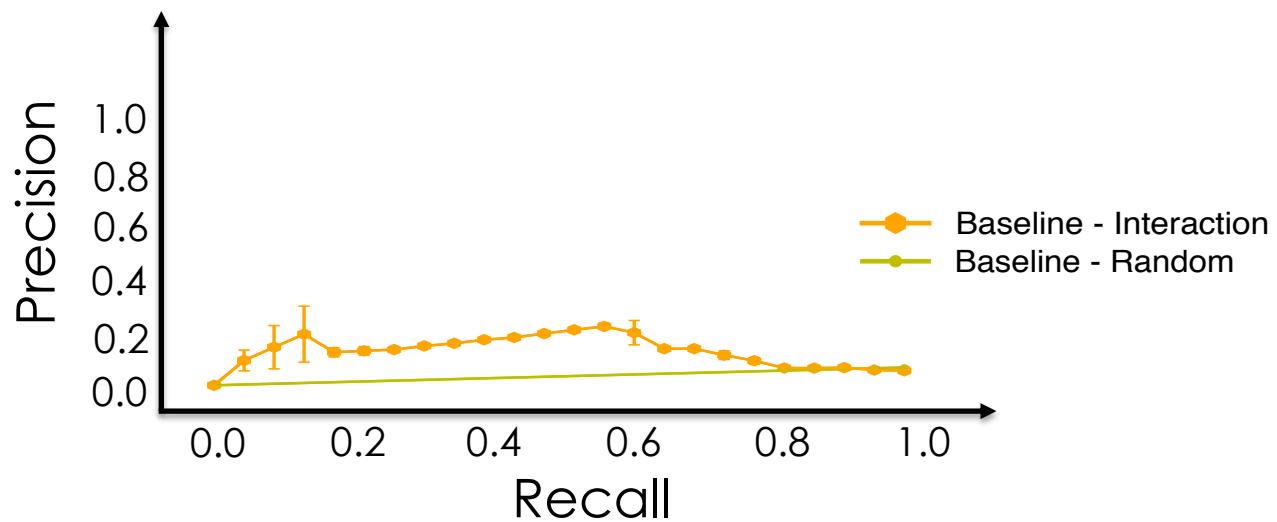


The fraction of posts the user  
actually wanted to stop sharing  
that were predicted

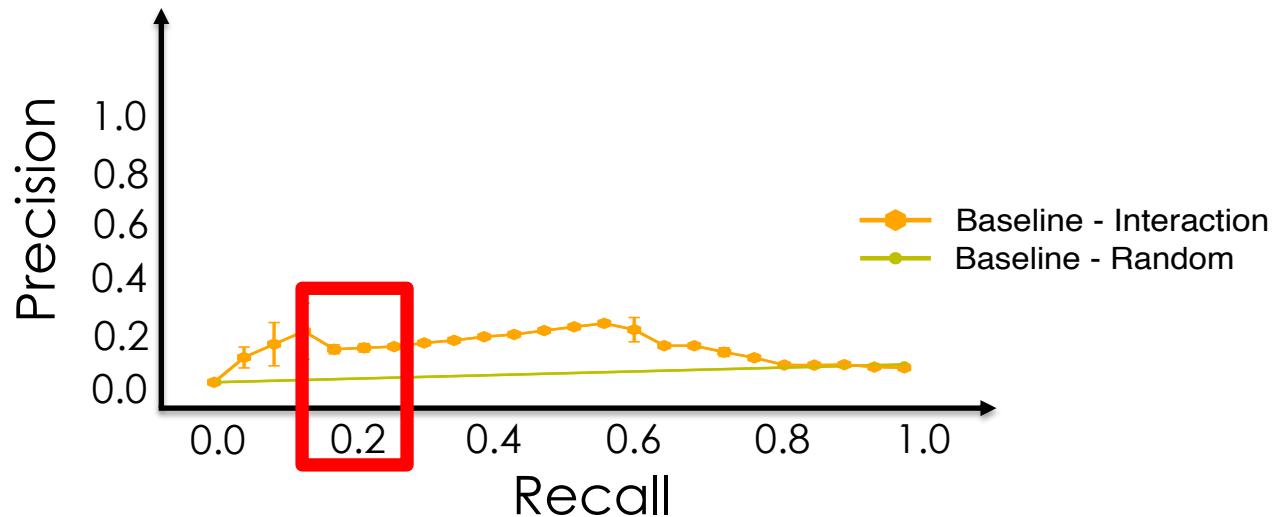
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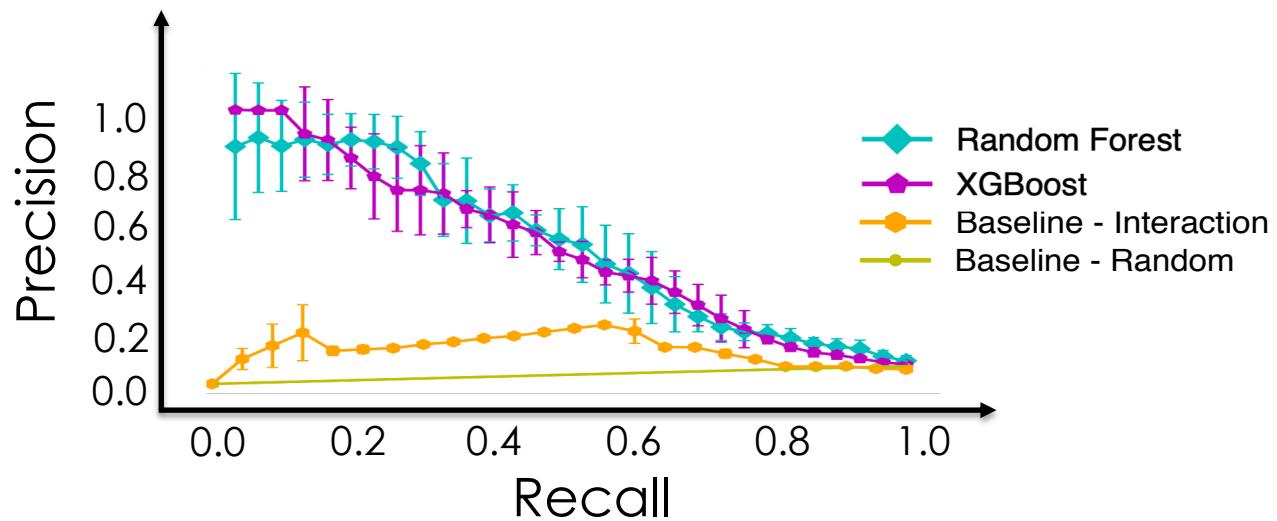
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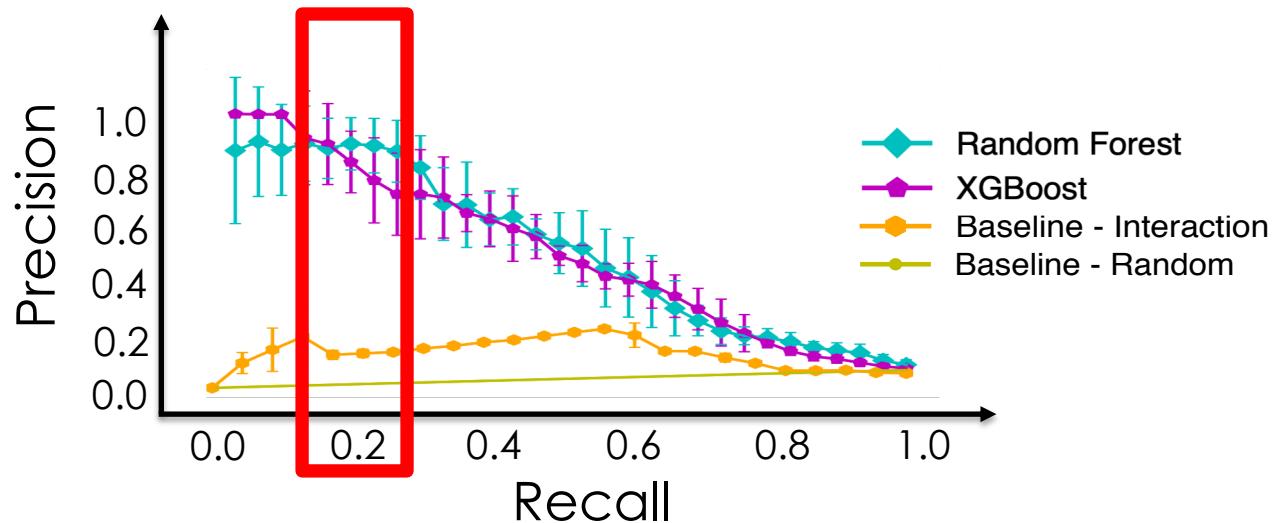
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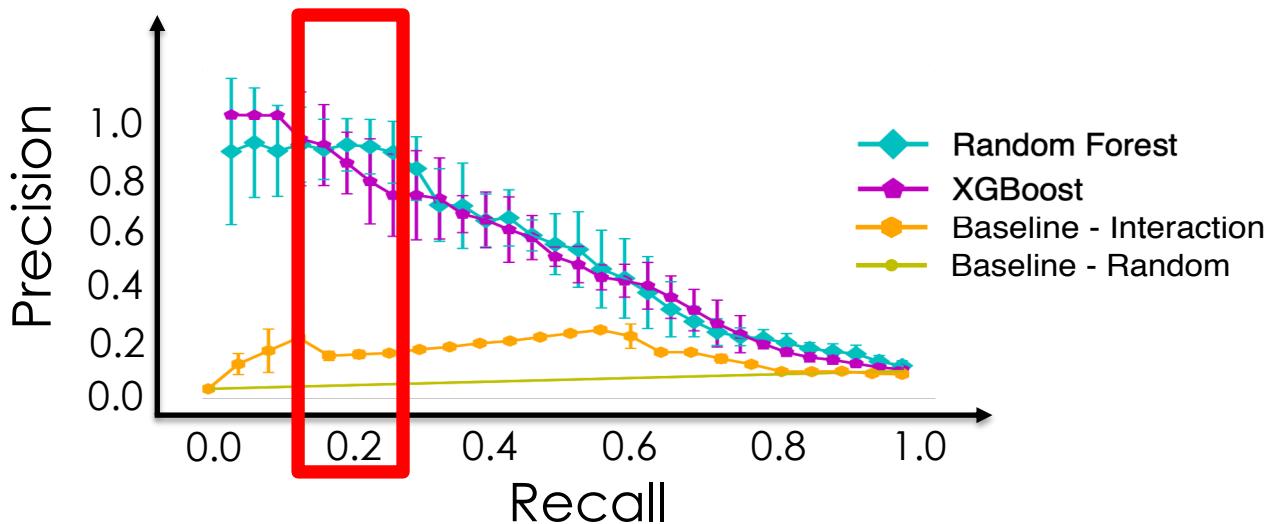
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**Substantial improvement over baselines**

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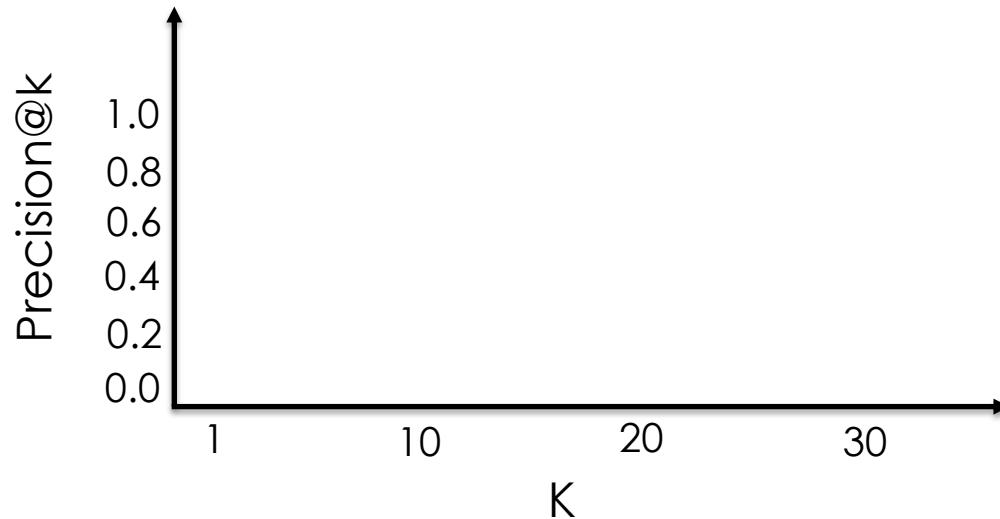
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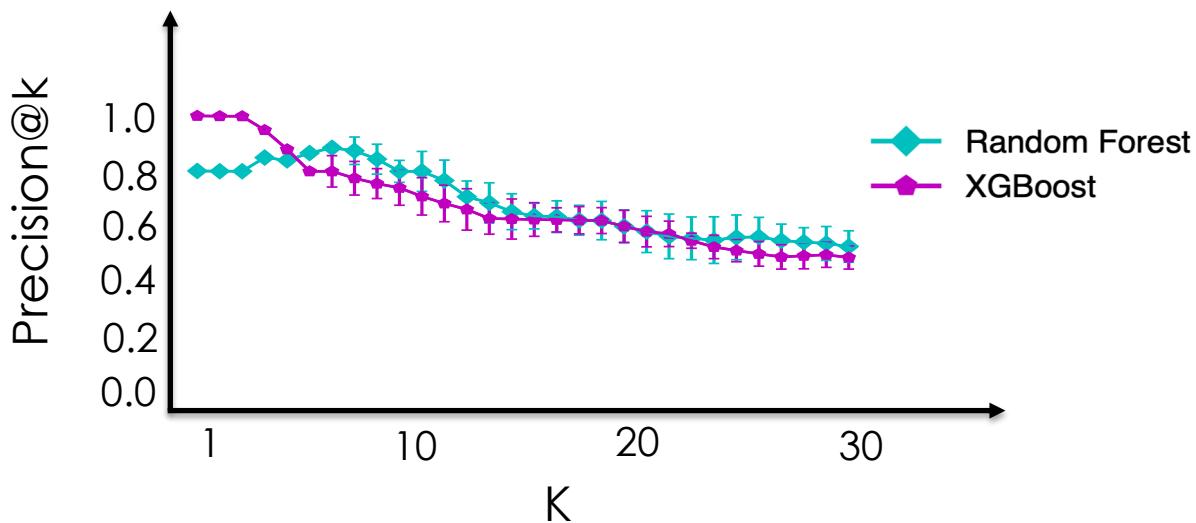
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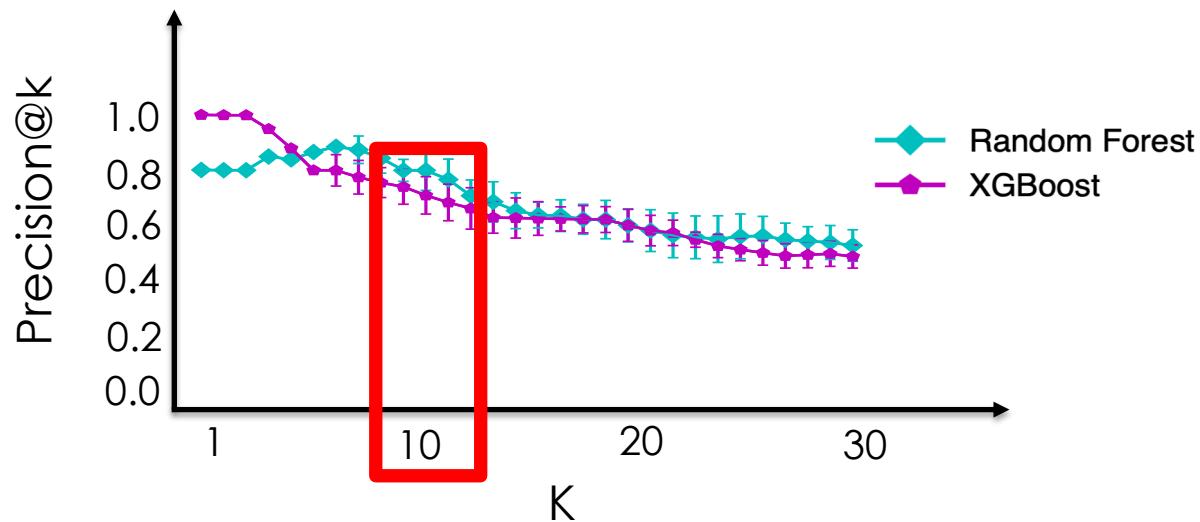
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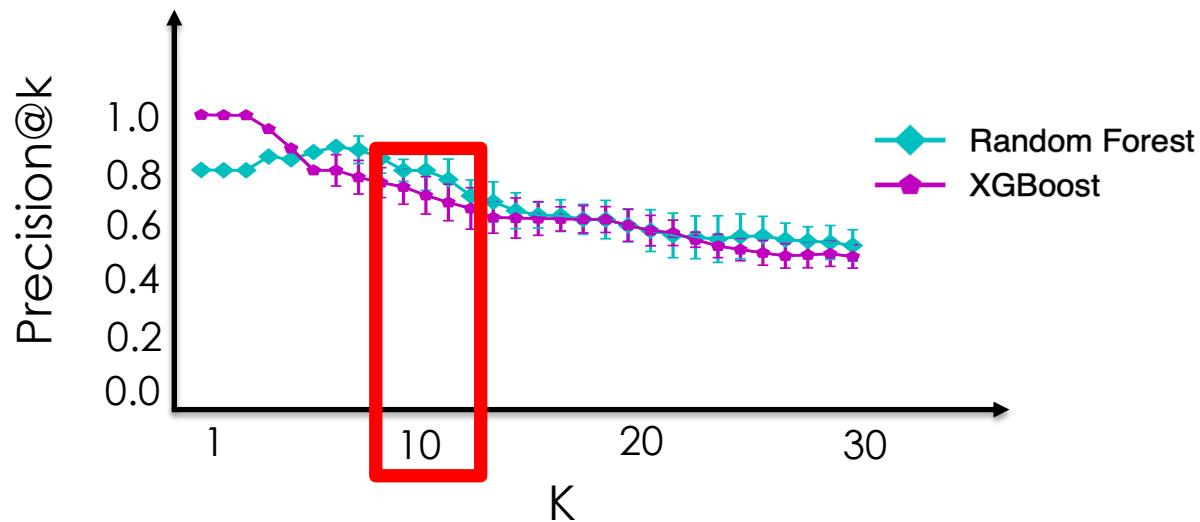
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**30 recommendations with good precision!**

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Qualitative data from survey: “Why” did desired setting change?

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Qualitative data from survey: “Why” did desired setting change?

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*“Because the people I feel  
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*“ it shows a time that I was upset  
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Coded this data to identify additional  
predictive features for future efforts

# Future features to collect

Features of posts

Features from external content (image/video)

Classes of sensitive information (e.g., children)

Similarity of content with user's current interest

# Future features to collect

Features of posts	Features from external content (image/video) Classes of sensitive information (e.g., children) Similarity of content with user's current interest
Features of friends	Interests, likes and dislikes of specific friends If particular friends are close family or related Frequency of offline interaction

# Summary

Median 1,840 #old posts, 400% increase in audience size within 10 years

Users want to change privacy for 25% of old posts

Predictive recommender system achieves > 80% precision identifying some friend-post pairs needing privacy change

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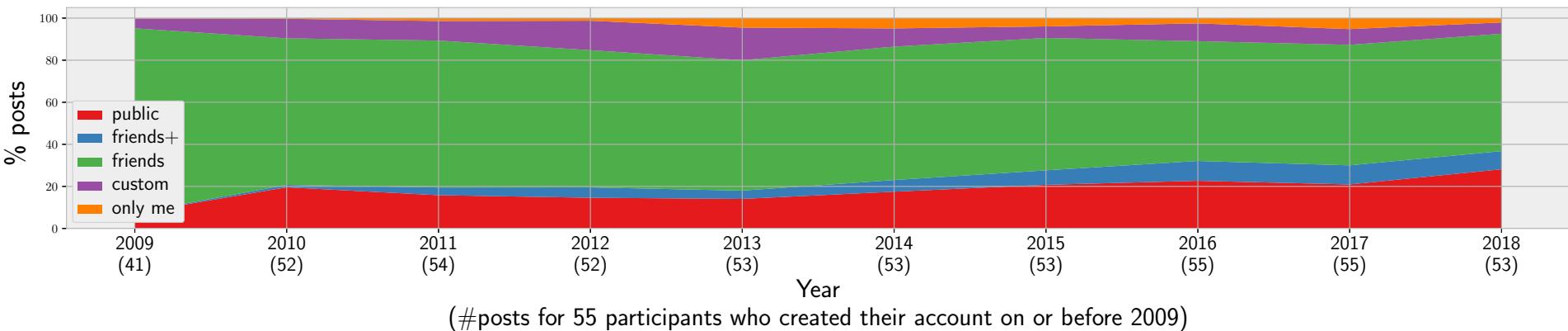
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# Extra slides!

# Privacy setting change over time

Normalized by users



# Worry about others checking old posts

86% expect other people check their old posts

55% reported checking others' old posts

Purposes: checking past relationships, family history



Might partially **motivate changes in privacy settings**

# Correlating interaction / friend-addition time

Post-specific survey: privacy setting change for friend-post pairs

Friends chosen based on interaction frequency and addition time

Hypothesis: Desired privacy changes correlate with interaction frequency

Found only weak correlation

Mostly offline communication with some close relations

Hypothesis: Desired privacy changes correlate with when friend was added

Found no correlation