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SOCIAL CYBERSECURITY

Reshaping Security Through An Empirical Understanding of
Human Social Behavior

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How can we design *systems* that
encourage better cybersecurity
behaviors?



What makes people...

...use a **PIN** on their phone?

...enable **two-factor authentication**?

...keep their software **updated**?

...behave "**securely**"?

*“I started using [a PIN] because **everyone around me had a [PIN]** so I kind of felt a group pressure to also use a [PIN].”*

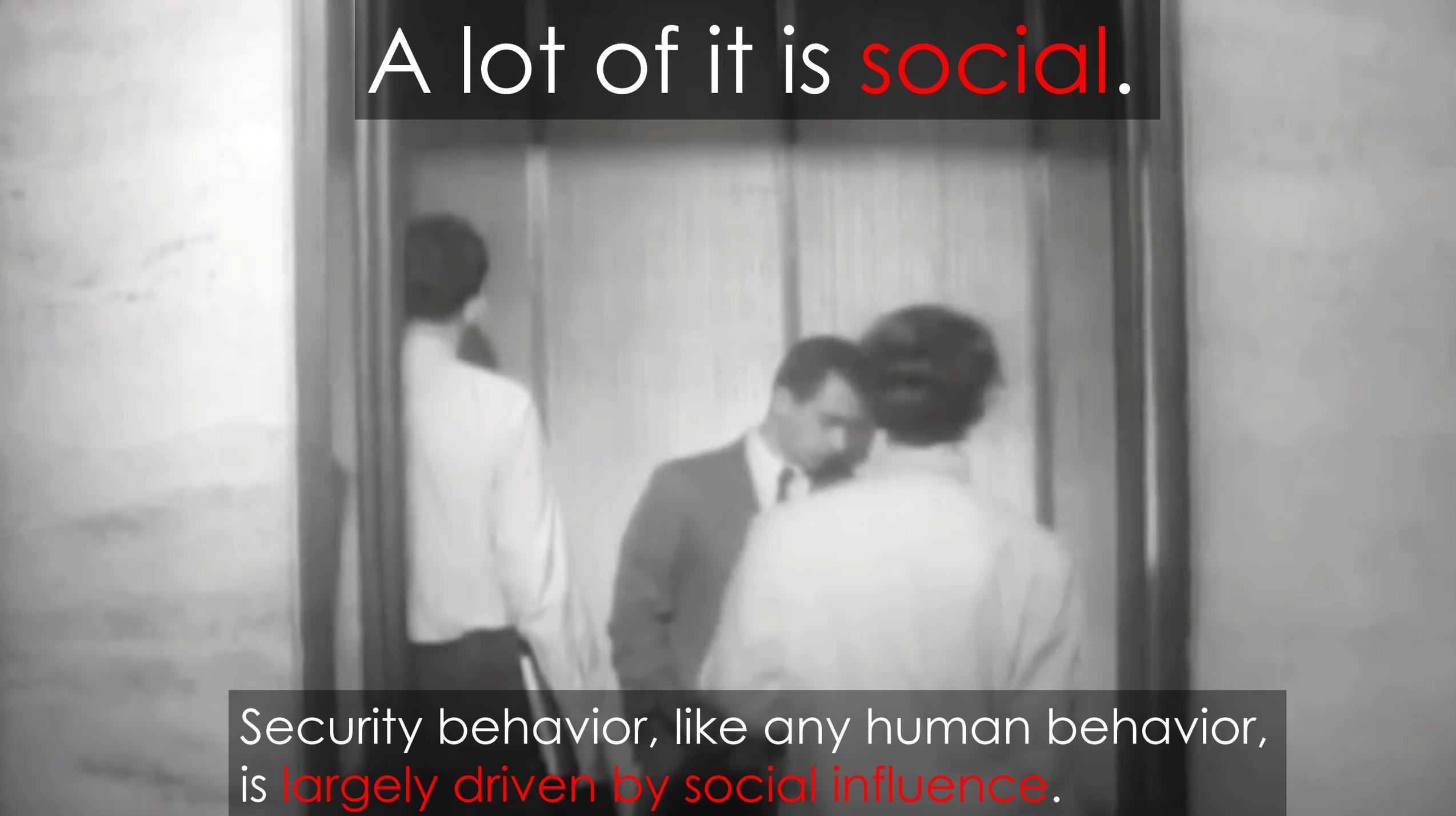




*“One of my boys wanted to use my phone...so I gave **them my passcode.** And not that I have anything that I don't care for them to see or anything, **but after they did that then I changed it”***

A photograph of a busy street in an Asian city, likely Singapore, with a person in the foreground. The person is seen from behind, wearing a light-colored backpack and a striped shirt. The street is filled with people, including a person in a blue uniform and helmet, and a person in a white jacket. There are many motorcycles and a bus in the background. The scene is brightly lit, suggesting daytime.

“my friends...have a lot of different accounts, the same as me. But they didn’t get into any trouble. So I think maybe it will not be dangerous [to reuse passwords].”



A lot of it is **social**.

Security behavior, like any human behavior, is **largely driven by social influence**.

HACKERS, TOM



~50%

of behaviors were
socially driven

HACKERS EVERYWHERE



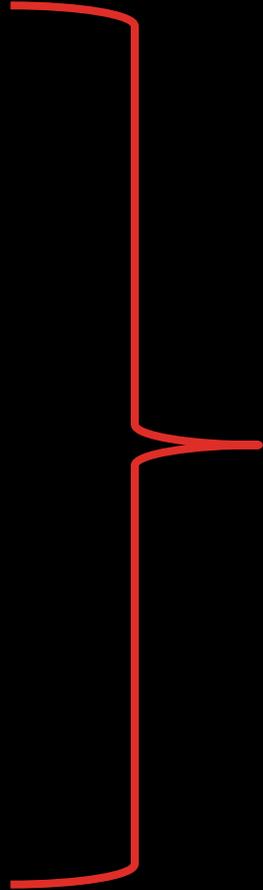
Absent knowledge of
how **security and social
behaviors interact**, we have
little hope of doing better



Social influence **strongly affects** security behaviors, and this effect is contingent upon **the design of a security tool affects its potential for social spread.**



Making cybersecurity systems more social can **encourage better security behaviors.**





Social influences **strongly affect cybersecurity behaviors**, and we can encourage better behaviors by designing **more social** cybersecurity systems.

A network diagram with stylized human figures in various colors (yellow, green, orange) connected by lines. One figure in the center is highlighted with a larger circle.

Measuring Social
Influence In
Security Behaviors

A photograph of people sitting at a table in a town square, with buildings in the background. The image is overlaid with a semi-transparent red filter.

Improving Security
Behaviors with
Social Influence

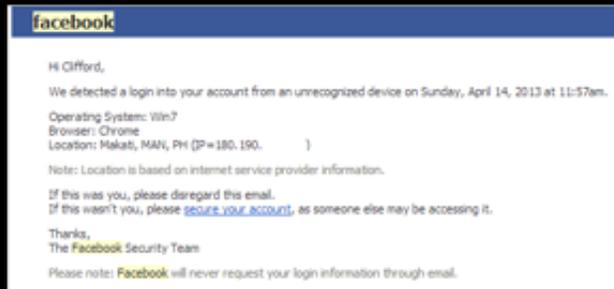
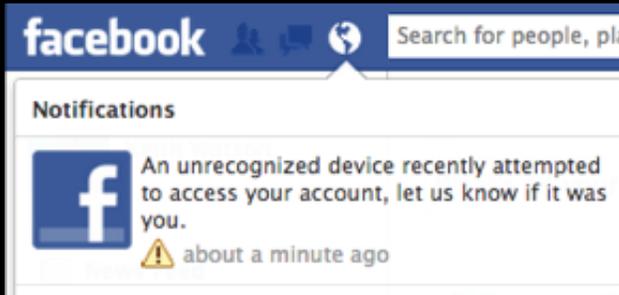


MEASURING SOCIAL INFLUENCE IN SECURITY BEHAVIORS

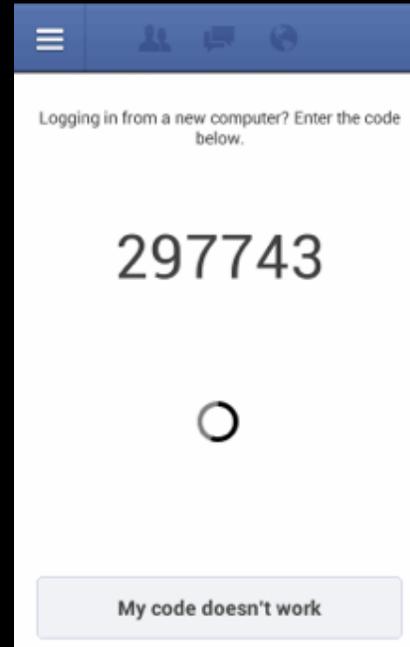
Das, S., Kramer, A., Dabbish, L., and Hong, Jason I. [The Role of Social Influence in Security Feature Adoption](#). Proc. CSCW'15.

Analyzed how the (non)-use of **three optional security tools** was affected by friends' use of those tools for 1.5 million Facebook user's social networks.

Standard



Login Notifications



Login Approvals

Social



Trusted Contacts

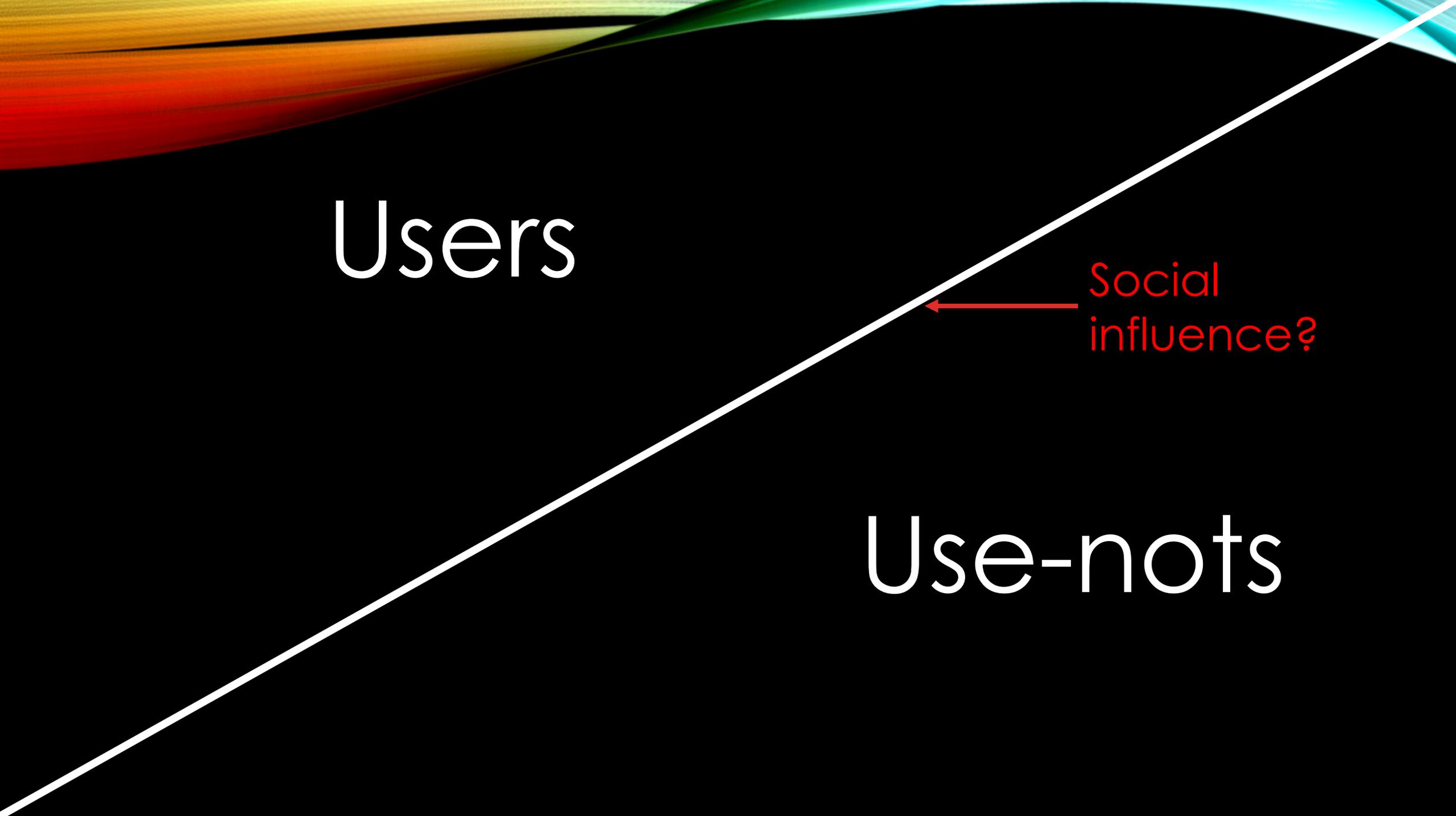
DATA COLLECTED

750k

users who newly adopted one of the aforementioned security tools.

750k

“use-nots” who had not adopted one of the aforementioned security tools.



Users

Social
influence?

Use-nots

MATCHED PROPENSITY SAMPLING

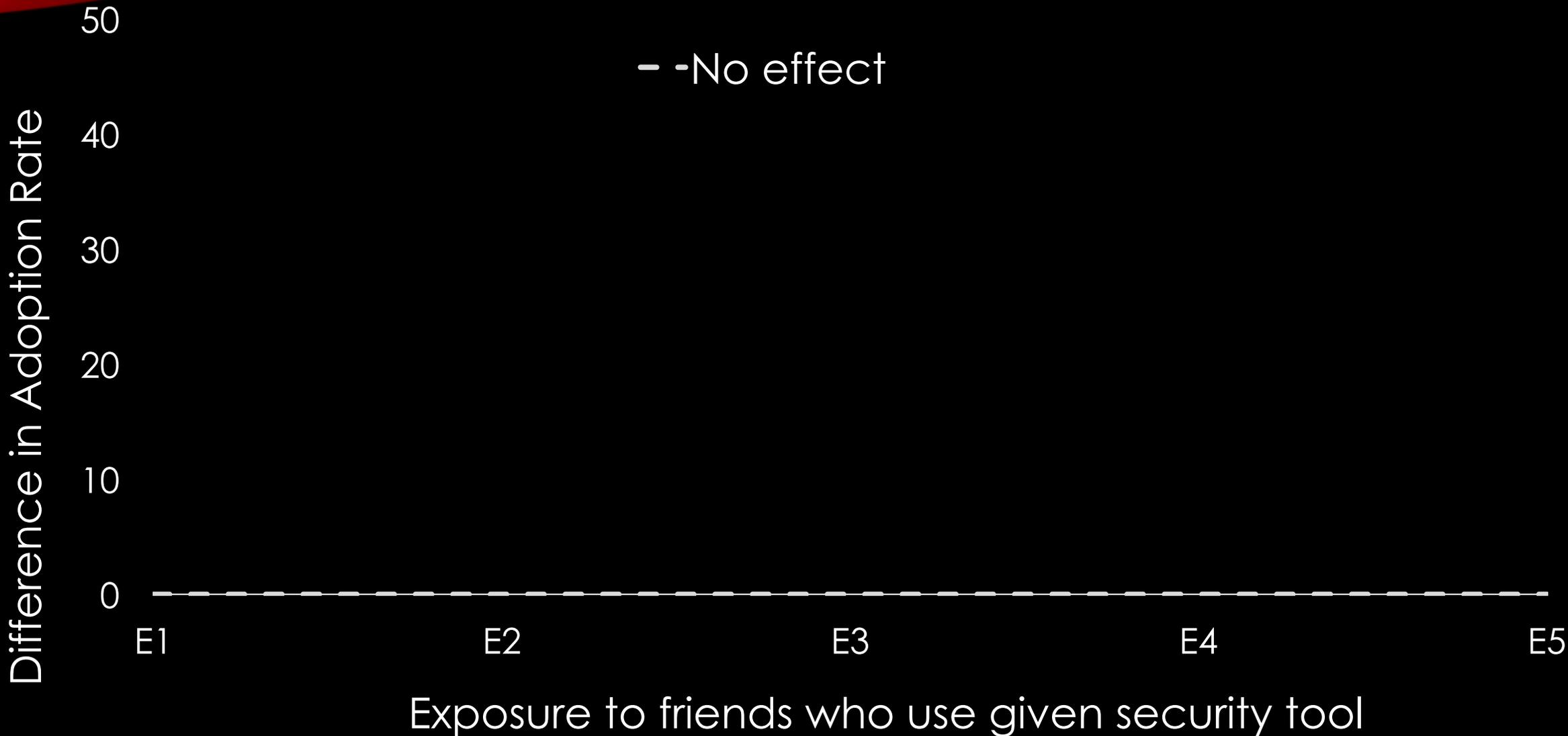
For a given security tool, empirically select **exposure levels** to friends who use that tool.

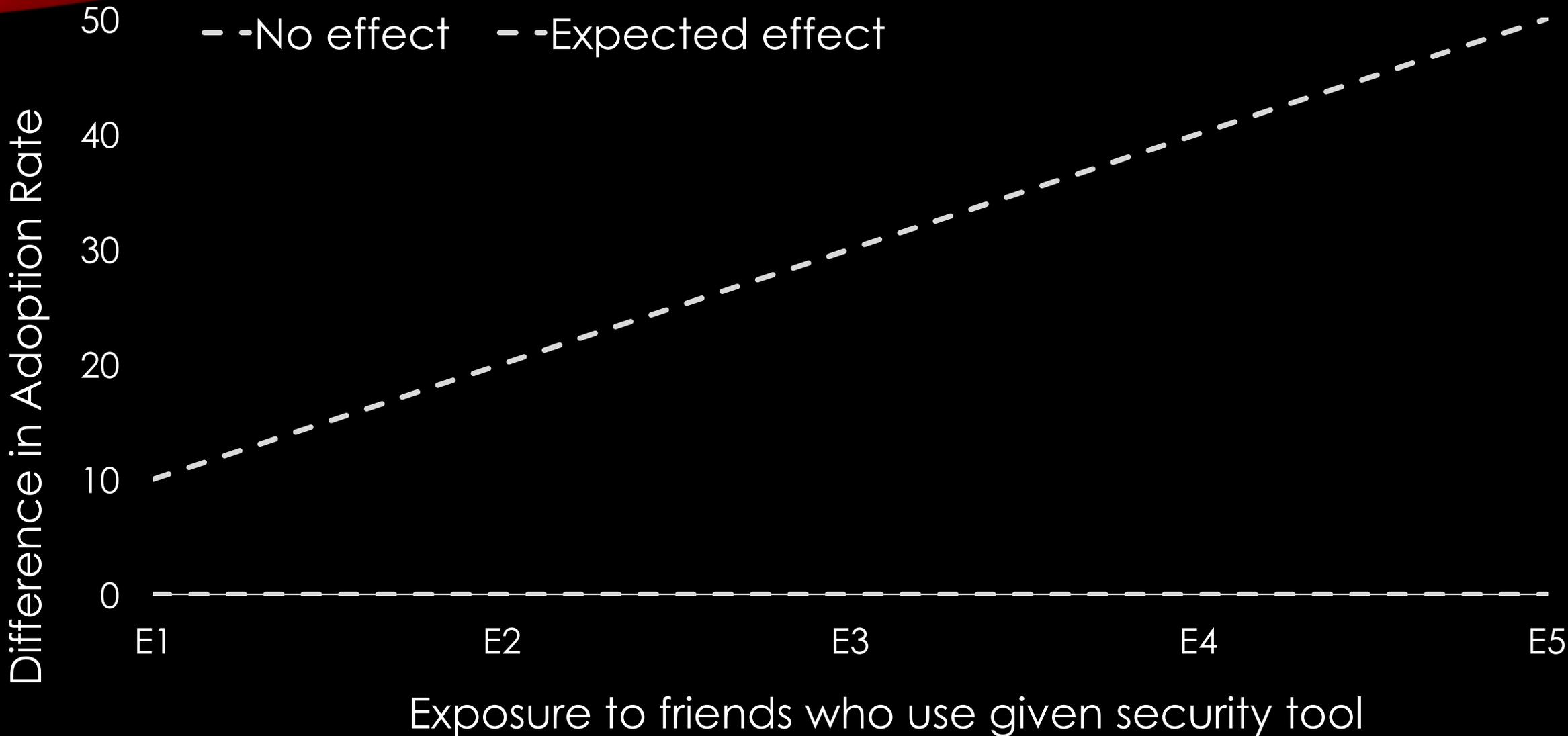
e.g., 1%, 5%, 10%...

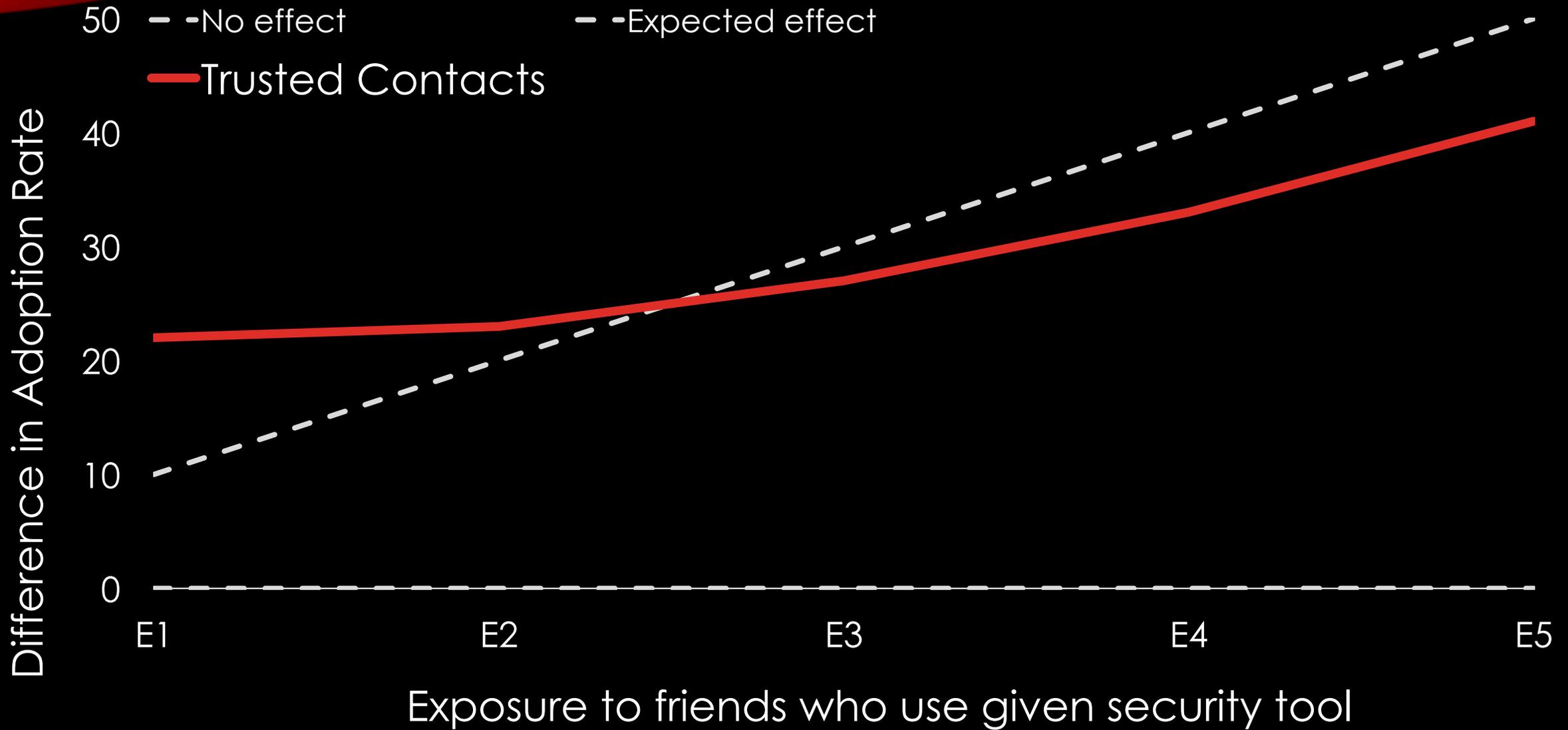
For each **exposure level**, compare adoption rate of those who **are** exposed versus those who **are not**. This is the effect of social influence.

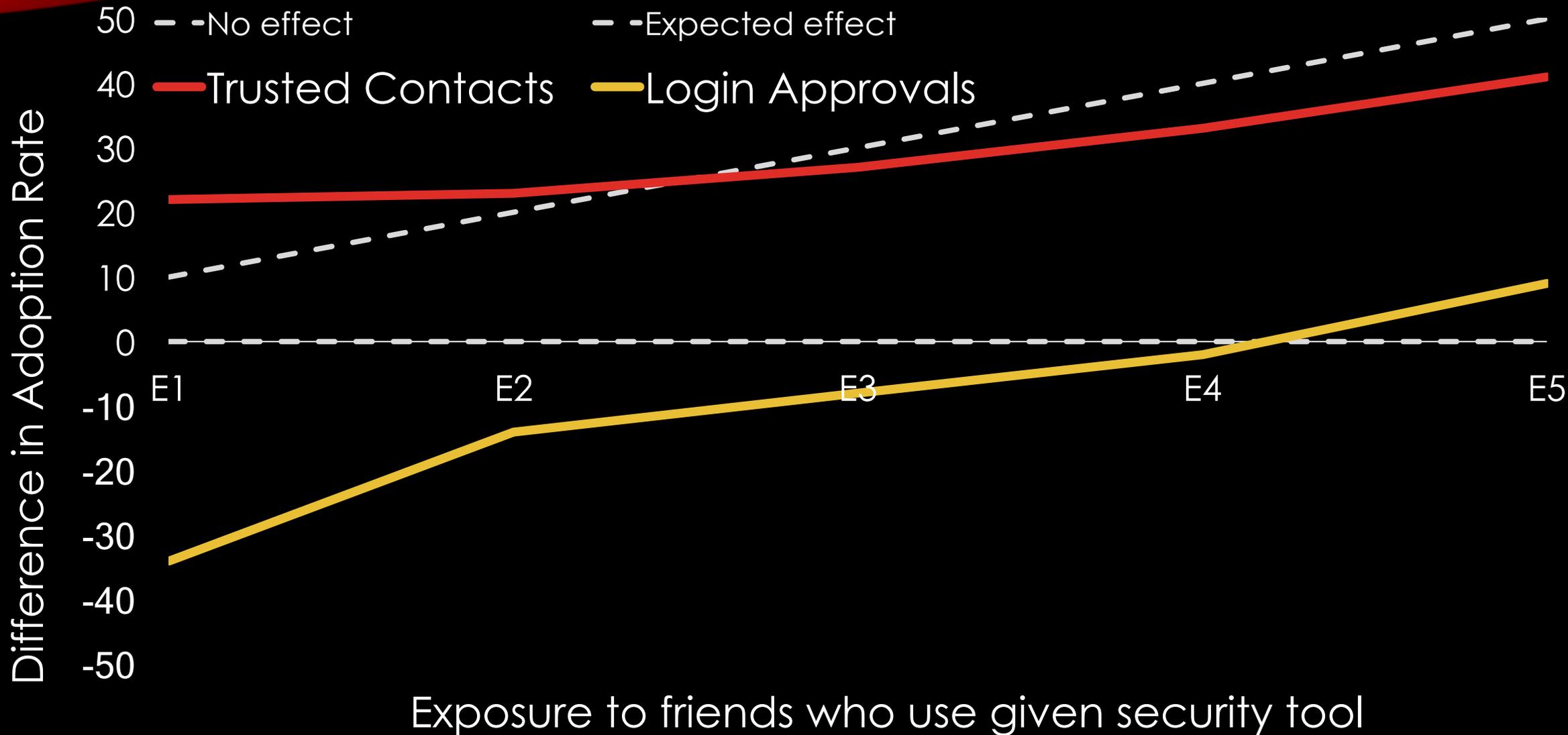
Aral, S, Muchnik, L., and Sundarajan, A. Distinguishing influence-based contagion from homophily-driven diffusion in dynamic networks. PNAS 106 (51). 2009.

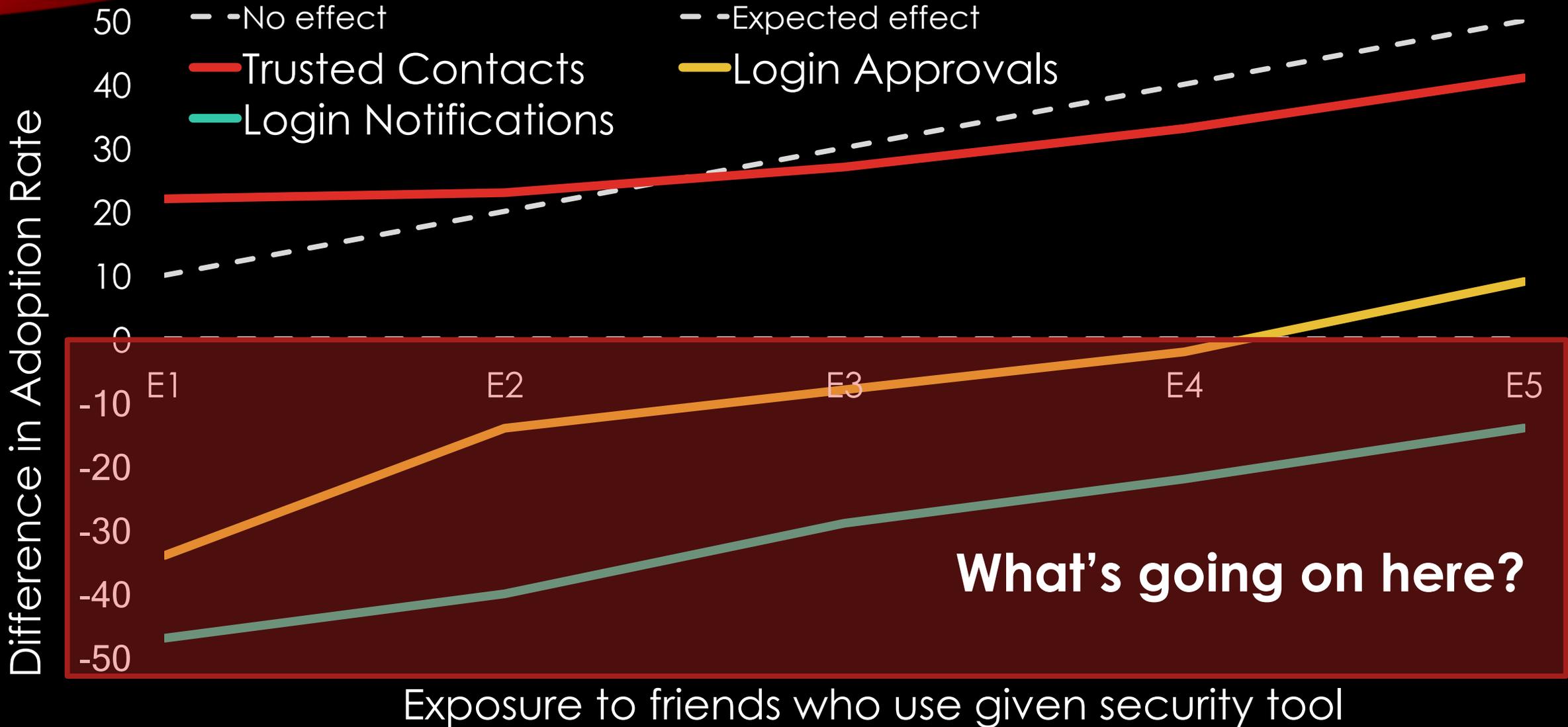












What's going on here?

DISAFFILIATION

e.g., teenagers who dislike facebook because parents now use it

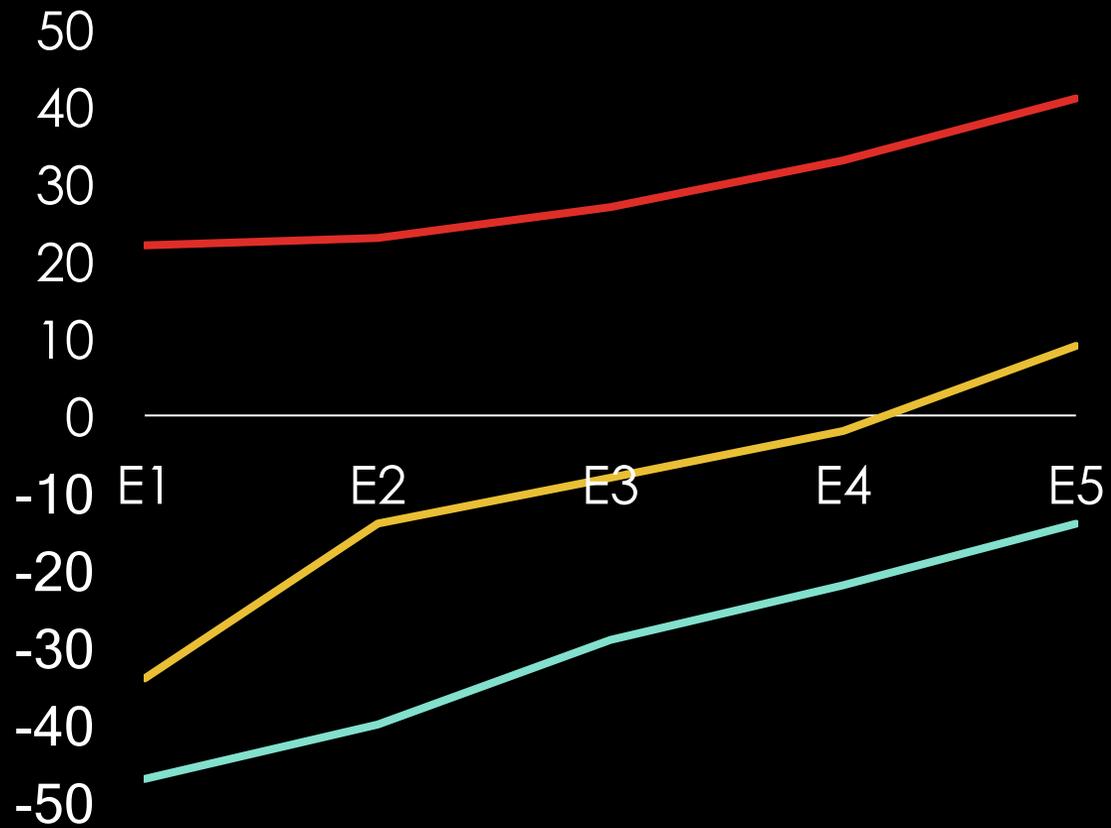


The image is a screenshot of a Facebook interface. At the top, there is a blue navigation bar with the word "facebook" in white lowercase letters on the left, and the words "Home", "Profile", "Friends", and "Inbox" in white uppercase letters to its right. Below the navigation bar, there is a notification area with a green and white icon of two people and the text "You have a friend request." Below this, there is a friend request card. On the left side of the card is a square profile picture of a woman with dark, wavy hair, smiling. To the right of the picture, the text reads "Your Mother — 1 mutual friend". Below this text, there is a checked checkbox followed by the text "Show in News Feed" and a smaller, partially visible text "posts will appear on your home page." Below that is the text "Add to list..." followed by a small downward-pointing triangle. At the bottom of the card, there are three buttons: a blue button with the word "Confirm" in white, a white button with the word "Ignore" in black, and a grey button with the text "Send message" in black.

Early adopters of some security tools can be perceived as “paranoid” or “nutty”, and, in turn, stigmatize the use of those security tools.

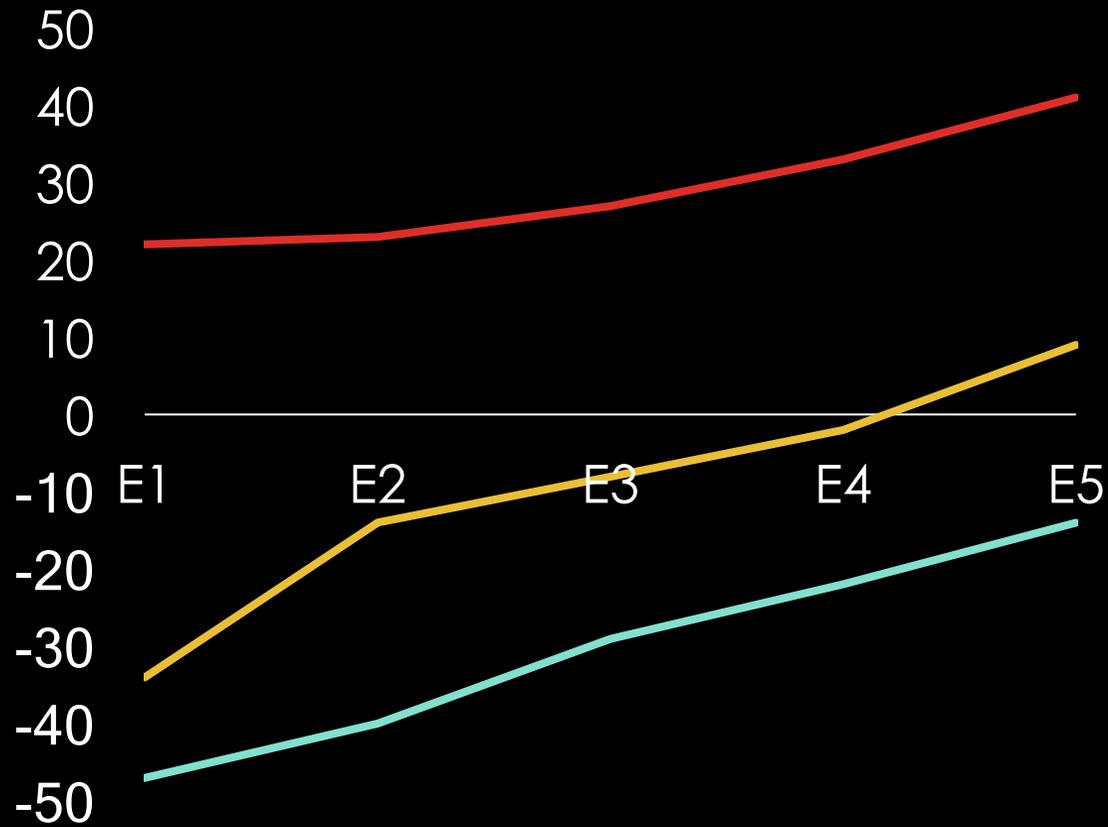


GOOD NEWS



All effects go up
and to the right.
*More exposure is
good!*

GOOD NEWS



The **design** of a security tool affects its **potential** for social spread.



Observability



Cooperation



Stewardship

A network diagram with several human icons connected by lines, representing social influence. The icons are in various colors (yellow, green, orange) and are arranged in a circular pattern. The background is a light pinkish-red color.

Measuring Social Influence In Security Behaviors

Social influence **strongly affects** security behaviors, and this effect is contingent upon **the design of a security tool affects its potential for social spread.**

A photograph of people sitting at a table in a city square, with buildings in the background. The image is overlaid with a semi-transparent red filter.

Improving Security Behaviors with Social Influence

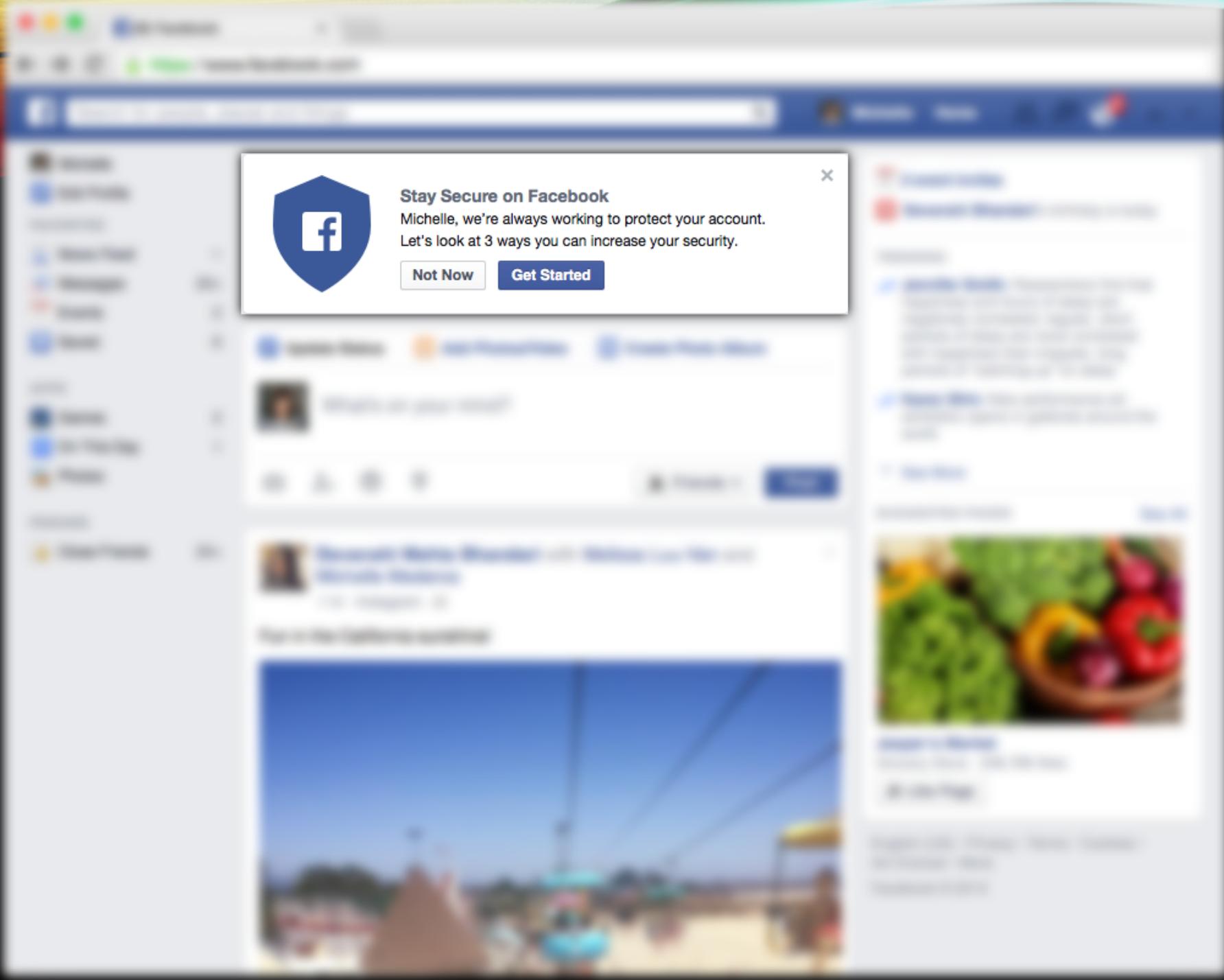
A black and white photograph of three men sitting on a bridge railing, looking out over a city. The city features prominent red buildings with many windows. A large red semi-transparent rectangle is overlaid on the image, containing the title text in white.

IMPROVING SECURITY BEHAVIORS WITH SOCIAL INFLUENCE

Das, S., Kramer, A., Dabbish, L., and Hong, Jason I. Increasing Security Sensitivity With Social Proof: A Large-Scale Experimental Confirmation. Proc. CCS'14.



Randomized experiment with 50,000
Facebook users.



Stay Secure on Facebook

Michelle, we're always working to protect your account. Let's look at 3 ways you can increase your security.

Not Now

Get Started



Keep Your Account Safe

You can use security settings to protect your account and make sure it can be recovered if you ever lose access.

Improve Account Security

Announcement text

Call-to-action button

Raw (#/%)



Keep Your Account Safe

108 of your friends use extra security settings. You can also protect your account and make sure it can be recovered if you ever lose access.

Improve Account Security

Over (#/%)



Keep Your Account Safe

Over 20% of your friends use extra security settings. You can also protect your account and make sure it can be recovered if you ever lose access.

Improve Account Security

Only (#/%)



Keep Your Account Safe

Only 108 of your friends use extra security settings. Be among the first to protect your account and make sure it can be recovered if you ever lose access.

Improve Account Security

Some



Keep Your Account Safe

Some of your friends are using extra security settings. You can also protect your account and make sure it can be recovered if you ever lose access.

Improve Account Security



8 conditions: 7 **social** + 1 non-social control

6250 randomly assigned participants per condition

Experiment ran for **3 days**

MEASURES

CTR

(click through rate)

7d

adoptions

5mo

adoptions

DESCRIPTIVE STATS

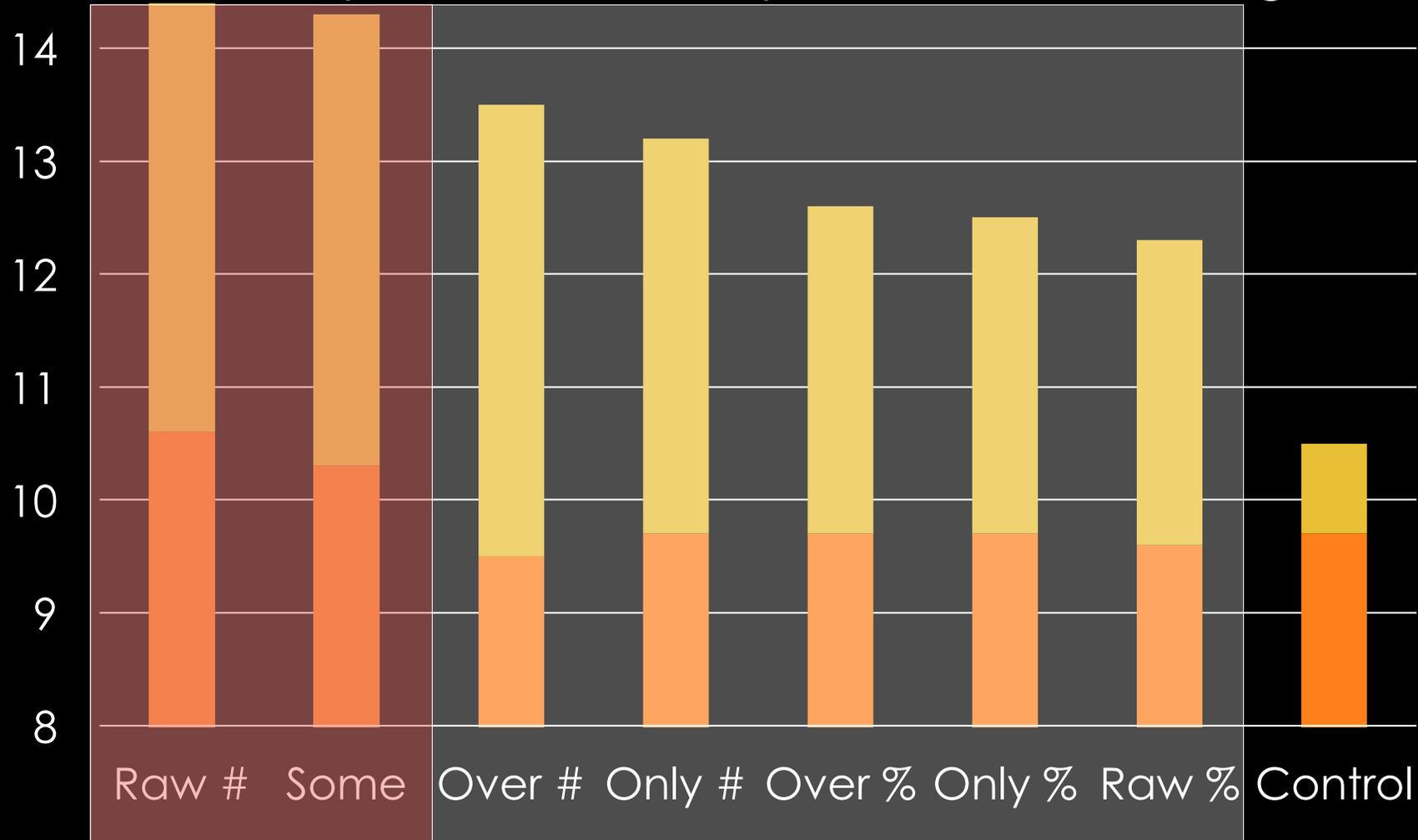
46,235 (93%) logged in and saw announcement

5,971 (13%) clicked on an announcement

1,873 (4%) adopted one of the promoted tools within 7 days

4,555 (10%) adopted one of the promoted tools within 5 months

15
 ■ 7d adoptions ■ 5m adoptions ■ Click-through rate



Raw # vs Control

1.36x
 improvement
 in CTR

1.10x
 improvement
 in adoptions



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Improving Security Behaviors with Social Influence

Making cybersecurity systems more social can **encourage better security behaviors.**



How can we design *systems* that
encourage better cybersecurity
behaviors?

There is a **fruitful but largely untapped** opportunity to improve cybersecurity behaviors by making social systems that are more:



Observable



Cooperative



Stewarded

OBSERVABLE

A hand holding a white smartphone in the foreground, with a blurred background of a person and foliage. The phone screen shows a camera interface with a brick wall in the background. The text 'OBSERVABLE' is overlaid in a dark grey box at the top left. Below it, another dark grey box contains the text 'How can we make it easier for people to observe and emulate good security behaviors?' with 'observe and emulate' in red.

How can we make it easier for people to **observe and emulate** good security behaviors?

COOPERATIVE

How can we design **additive security systems** that make group security a sum instead of a min function?



STEWARDED

How can we design systems that allow people to act on their concern for the security of their loved ones?

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