

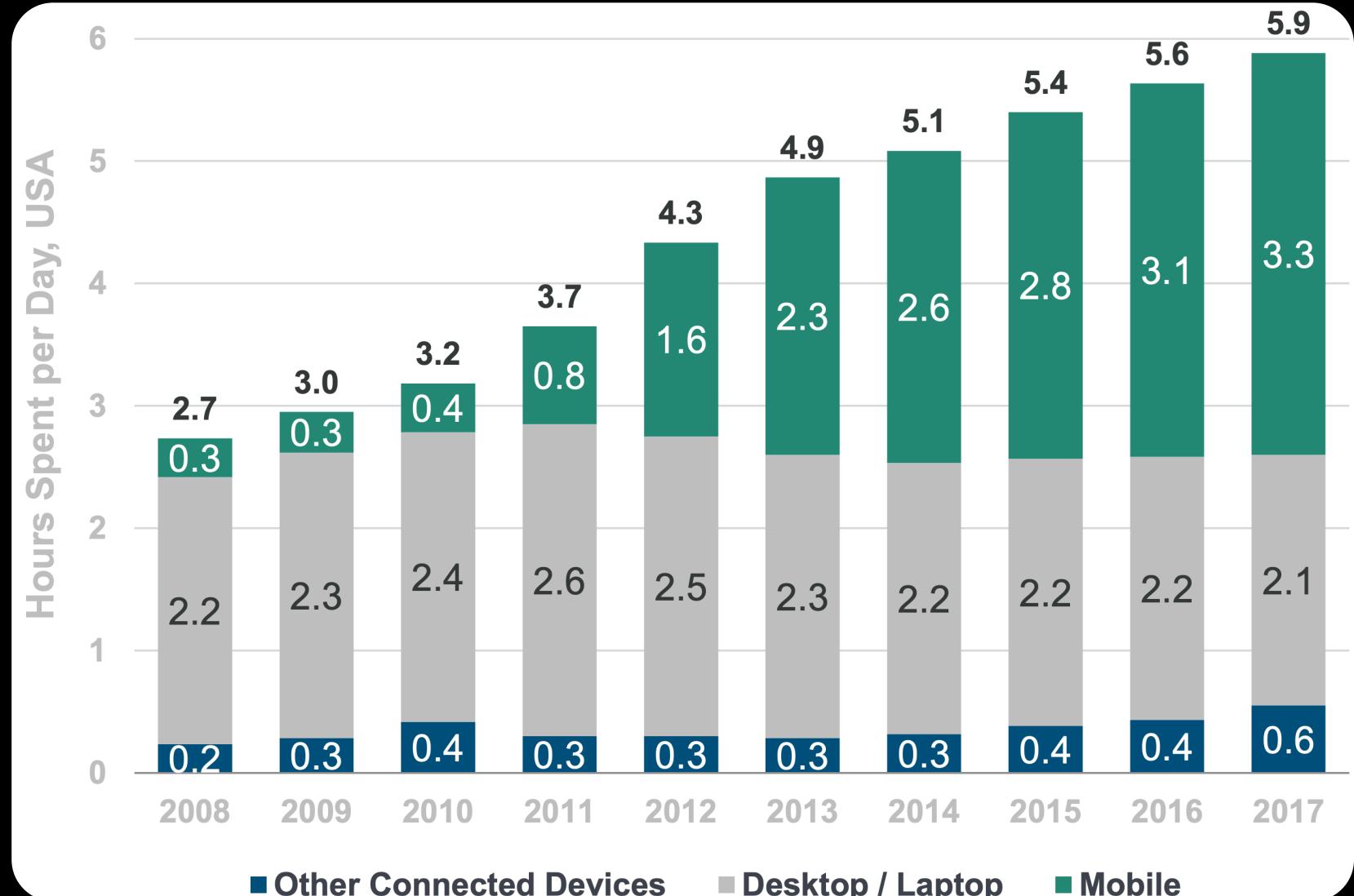
# HabitLab: In-the-wild Behavior Change Experiments at Scale

Geza Kovacs

Stanford HCI Group

# People spend increasing amounts of time online

Average US adult spends 5.9 hours per day with digital media



Source: Kleiner Perkins 2018 Internet Trends



# People struggle to reduce their time online

Kim, Young-Ho, et al. "TimeAware: Leveraging framing effects to enhance personal productivity." Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems. ACM, 2016.

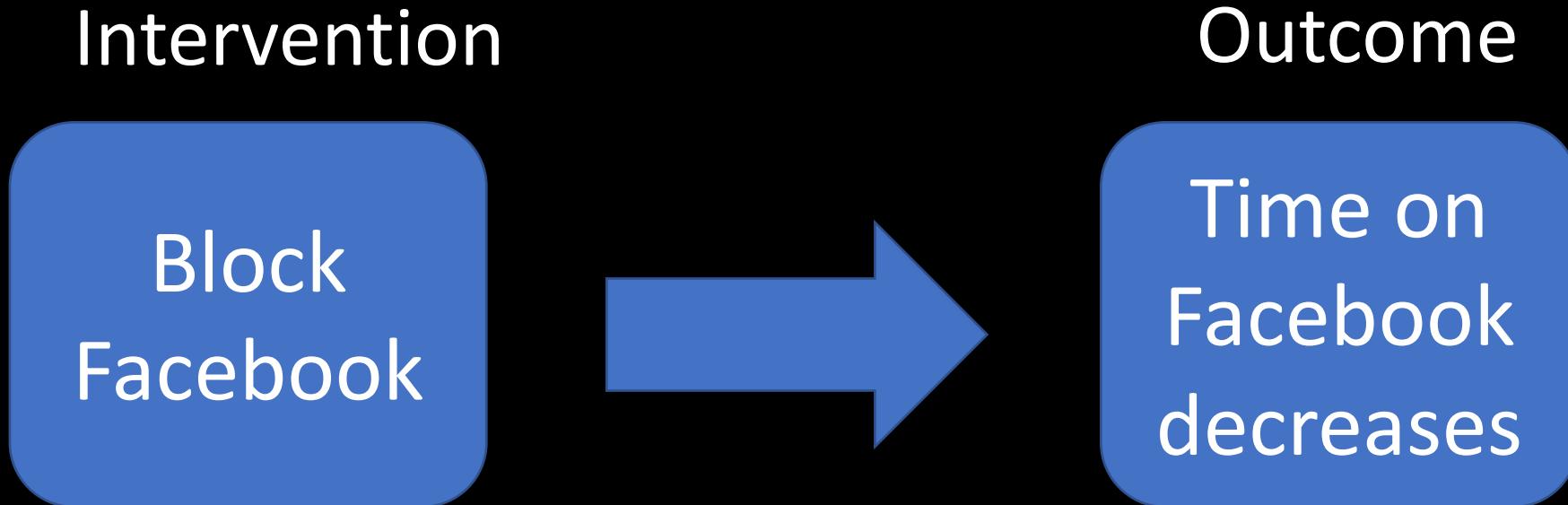
Andreassen, Cecilie Schou, et al. "Development of a Facebook addiction scale." Psychological reports 110.2 (2012): 501-517.

Users use productivity tools to help them reduce time online



# Interventions and resulting outcomes

If your goal is to spend less time on Facebook



# Online behavior change is a domain well-suited for studying interventions and outcomes

## Outcomes

- Can measure outcomes precisely (time spent on each site each visit)

## Interventions

- Many interventions possible
- Can adapt interventions quickly (new one each visit)

# Current productivity tools make assumptions about interventions and outcomes

## Assumptions about **outcomes**

- Effectiveness persists over time
- There are no negative externalities

## Assumptions about **interventions**

- A single intervention can meet most needs
- Users are good at predicting what interventions will work for them

We developed HabitLab to study whether these assumptions are actually true

### Questions about **outcomes**

- Does effectiveness remain constant over time?
- Do externalities exist?

### Questions about **interventions**

- Does a single intervention meet most needs?
- Are users good at predicting what interventions will work well for them?

## HabitLab: Our in-the-wild behavior change platform

### Outcomes

Does effectiveness remain constant over time?

What externalities exist?

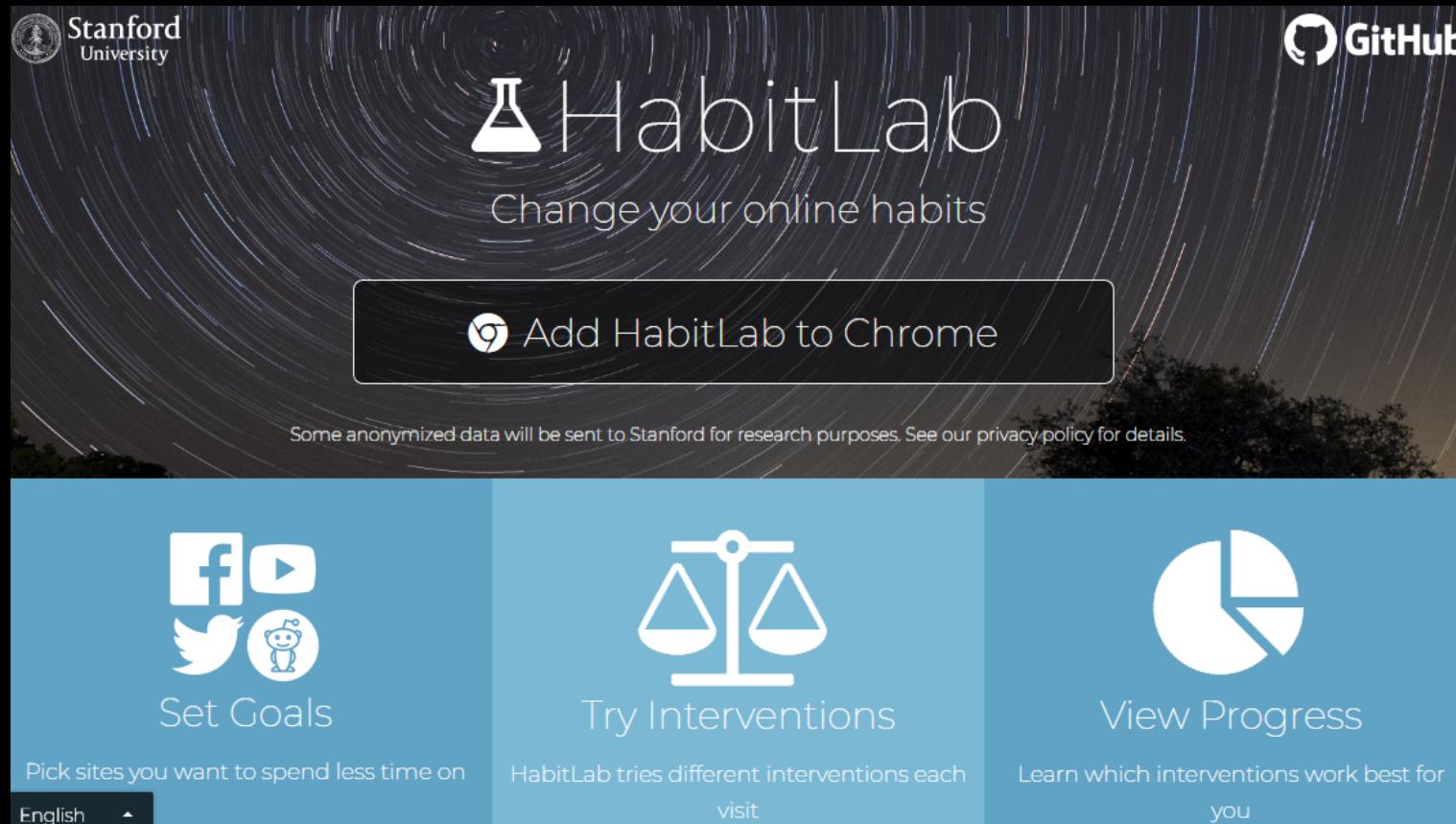
### Interventions

How do users' preferences change over time?

# HabitLab

Our behavior  
change platform

12,000+ in-the-  
wild active users  
(Browser+Android)



The image displays the HabitLab platform. At the top left is the Stanford University logo. On the right is the GitHub logo. The main heading "HabitLab" is in large white letters, with "Change your online habits" in smaller text below it. A button labeled "Add HabitLab to Chrome" is shown. Below this is a note about anonymized data being sent to Stanford for research purposes. The bottom section features three cards: "Set Goals" with social media icons (Facebook, YouTube, Twitter, Reddit), "Try Interventions" with a scale icon, and "View Progress" with a pie chart icon.

Stanford University

**HabitLab**

Change your online habits

Add HabitLab to Chrome

Some anonymized data will be sent to Stanford for research purposes. See our privacy policy for details.

**Set Goals**

Pick sites you want to spend less time on

English ▾

**Try Interventions**

HabitLab tries different interventions each visit

**View Progress**

Learn which interventions work best for you



# HabitLab

Our behavior change platform

12,000+ in-the-wild active users  
(Browser+Android)

The image shows the HabitLab app page on a mobile store. The top section displays the app's logo (a flask icon), developer information ("HabitLab (Stanford HCI Group) 商务办公"), a 5-star rating (22 reviews), and a "已安装" (Installed) button. Below this are four screenshots illustrating the app's features: "Customize" (selecting apps to track), "Track" (daily stats with a donut chart showing 102 minutes total for Snapchat, YouTube, Facebook, and Instagram), "Improve" (progress bar chart for the week), and "Intro" (introductory screen).

HabitLab

HabitLab (Stanford HCI Group) 商务办公

适合所有人

此应用与您的所有设备都兼容。

已安装

Customize

Choose the apps you want to track

Manage Watchlist

Select apps to spend less time on

Facebook Instagram Messenger

Snapchat YouTube Adroid

Amazon Shopping BoK Browser

Calculator Calendar Camera

Done

Track

See daily stats for your selected apps

Progress

Mins on Watchlist Today

Total: 102 mins

40 mins 69 mins 2.2 hrs in phone

Snapchat YouTube Facebook Instagram

Improve

Monitor your progress over time

Progress

Mins on Watchlist This Week

321 mins 24 hrs in phone 37 hrs in browser

Snapchat YouTube Facebook Instagram

Intro

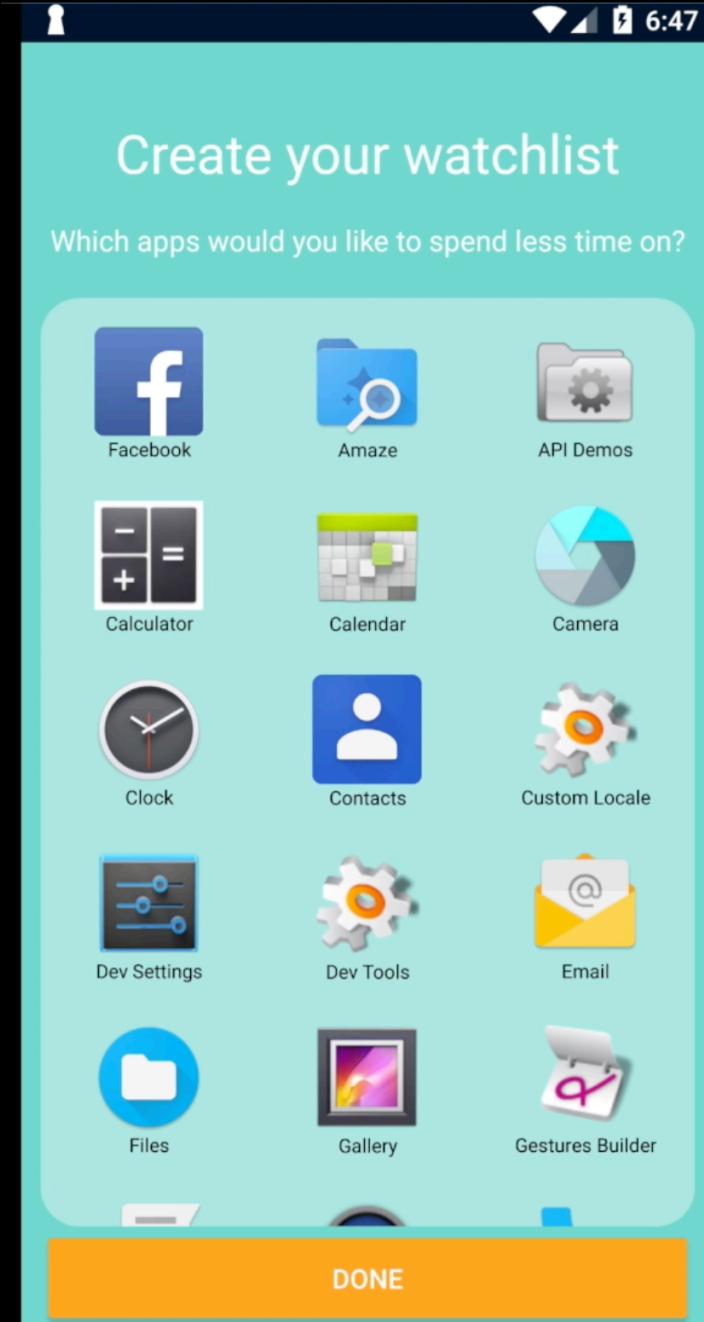
Users select  
sites or apps  
to reduce  
time on  
(goals)

Which sites would you like to spend less time on?  
Below are some popular options, along with how much time you spend on them per day (on average).

Site/App	Average Time Spent (mins)
Add Site	?
Amazon	2.3 mins
Buzzfeed	0 mins
Facebook	9.1 mins
Gmail	19 mins
iQIYI	0.24 mins
Netflix	0 mins
Reddit	3.6 mins
Twitter	0.37 mins
Youku	0 mins
YouTube	5.8 mins

↓ NEXT

Users select  
sites or apps  
to reduce  
time on  
(goals)



# Interventions help reduce time on goal sites and apps

Nudges will help you achieve your goals

One nudge will be selected and shown each time you visit a site.

You can try out and turn off nudges below.

The nudges listed are:

- All Sites (star icon)
- Bouncer (bounce ball icon)
- 1Min Assassin (target with number 1 icon)
- GateKeeper (gate icon)
- Scroll Freezer (laptop with snowflake icon)
- Supervisor (eye icon)
- Stat Whiz (bell with star icon)
- Minute Watch (watch icon)
- Facebook (Facebook logo icon)
- Time Injector (syringe icon)
- Feed Eater (pacman icon)
- TimeKeeper (hourglass icon)
- No Comment (stack of documents icon)
- Clickbait Mosaic (explosion icon)

Navigation buttons at the bottom:

- UP PREVIOUS
- START USING HABITLAB

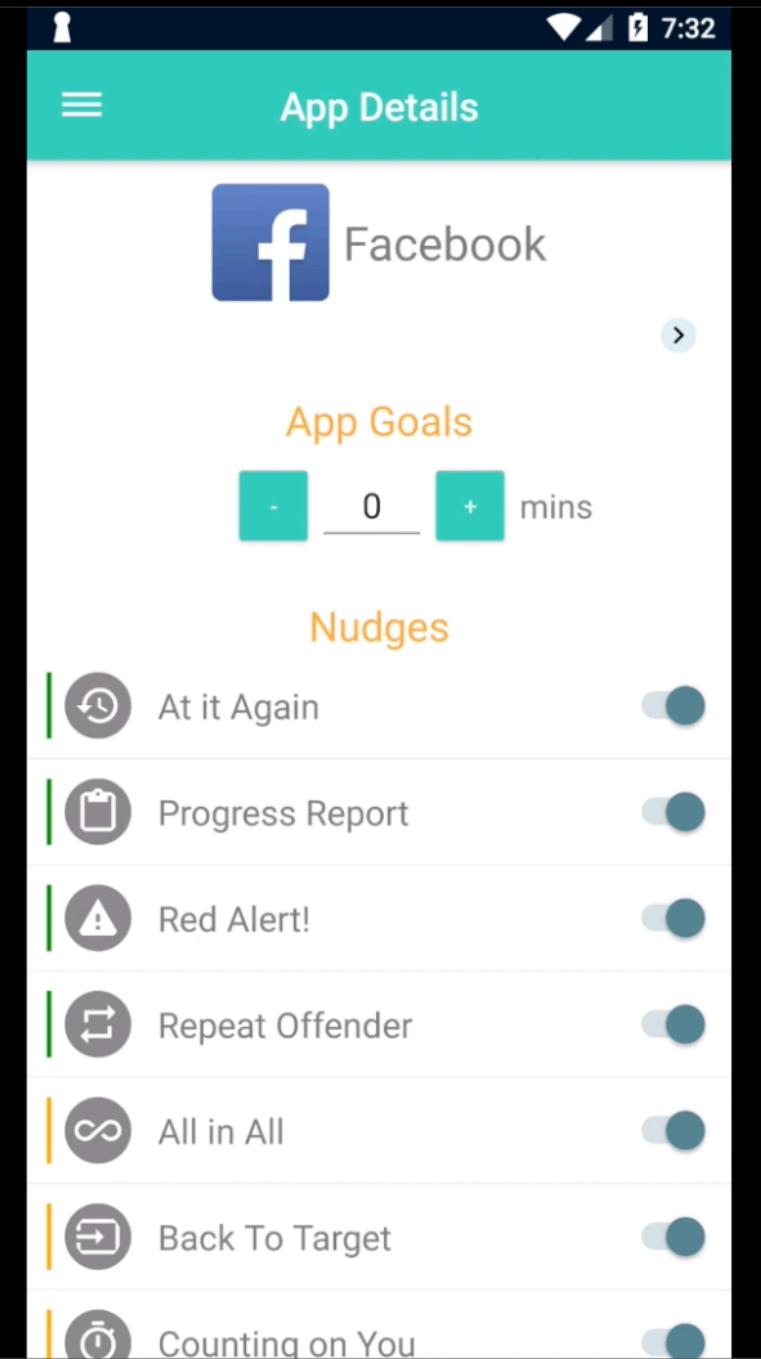
30+  
interventions  
available

## Nudges

Nudges turned on will only be shown some of the time [?](#)

	Time Injector	Injects timer into the Facebook feed	<input type="button" value="Off"/> <input checked="" type="button" value="On"/> <a href="#">Try now</a>
	Feed Eater	Removes the Facebook news feed	<input type="button" value="Off"/> <input checked="" type="button" value="On"/> <a href="#">Try now</a>
	TimeKeeper	Notifies you of time spent in the corner of your desktop	<input type="button" value="Off"/> <input checked="" type="button" value="On"/> <a href="#">Try now</a>
	No Comment	Removes Facebook comments	<input type="button" value="Off"/> <input checked="" type="button" value="On"/> <a href="#">Try now</a>
	Clickbait Mosaic	Removes clickbait	<input type="button" value="Off"/> <input checked="" type="button" value="On"/> <a href="#">Try now</a>
	Minute Watch	Notifies you of time spent every minute	<input type="button" value="Off"/> <input checked="" type="button" value="On"/> <a href="#">Try now</a>
	Supervisor	Shows time spent on site at the top of screen	<input type="button" value="Off"/> <input checked="" type="button" value="On"/> <a href="#">Try now</a>
	Scroll Freezer	Freezes scrolling after a certain amount of scrolls	<input type="button" value="Off"/> <input checked="" type="button" value="On"/> <a href="#">Try now</a>

30+  
interventions  
available



CLOSE FACEBOOK

SHOW MY NEWS FEED



TURN OFF

Today you have been here for:

2 38  
min sec

CLOSE FACEBOOK



TURN OFF

•  **clownheights** From the community 2 hours ago  
A wet floor sign tells your brain to turn on traction control  
  
• 108 comments • Give Award • More • Save • ...

•  **youngbliss** From the community 2 hours ago  
Maine becomes the first state to ban Styrofoam  
  
• 40 comments • Give Award • More • Save • ...

•  **clownheights** From the community 2 hours ago  
Henry VIII and his choices in marriage   
Obviously there has been a lot of discussion on the marriages of Henry VIII.  
I have a question about them:  
"Why were only 2 of his six wives foreign princesses?"  
Catherine of Aragon was a traditional choice of wife.  
Anne of Cleves sort of was, even though she was just the daughter of a duke.  
The other wives were all English (quite modest to be fair).  
So why didn't he use his money for alliance purposes? As seen the note  
• 108 comments • Give Award • More • Save • ...

•  **clownheights** From the community 2 hours ago  
In Classic Children's Books, a Window to Childhood in Past Centuries: Rare children's books, made available online through the Library of Congress, show both the constants and the evolution in children's literature  


About  
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The Reddit User  
Reddit Content  
Reddit Premium  
Reddit API  
  
Cookie Policy | Privacy Policy  
User Agreement | Mod Policy  
© 2013 reddit, Inc. All rights reserved.

CLOSE TAB

Time remaining:

0 min 42 sec

Time added:

ADD TIME

0 min



TURN OFF

BACK TO TOP

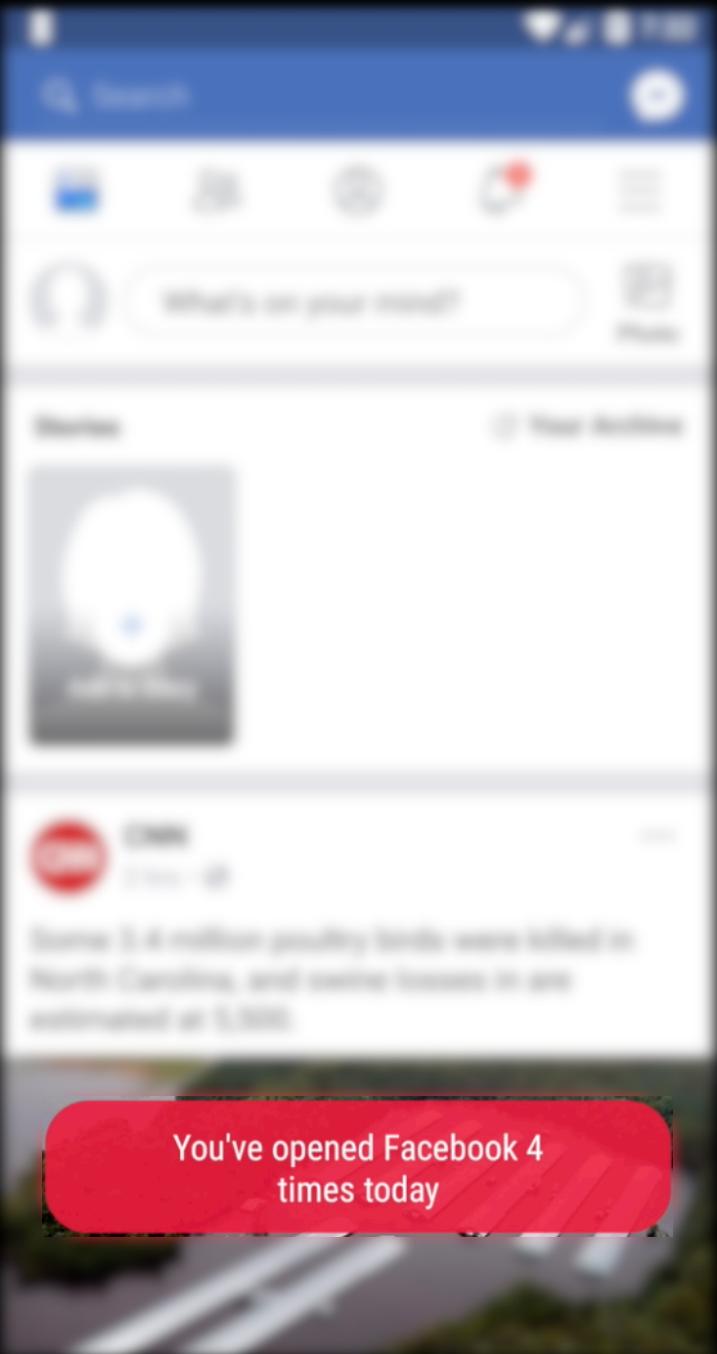


TURN OFF

This video is 3 minutes and 30 seconds long.  
Are you sure you want to play it?

CLOSE YOUTUBE

WATCH VIDEO





## Continue to Facebook?

You've been here 39 times  
today. Want to take a break?

[GET ME OUT OF HERE!](#)

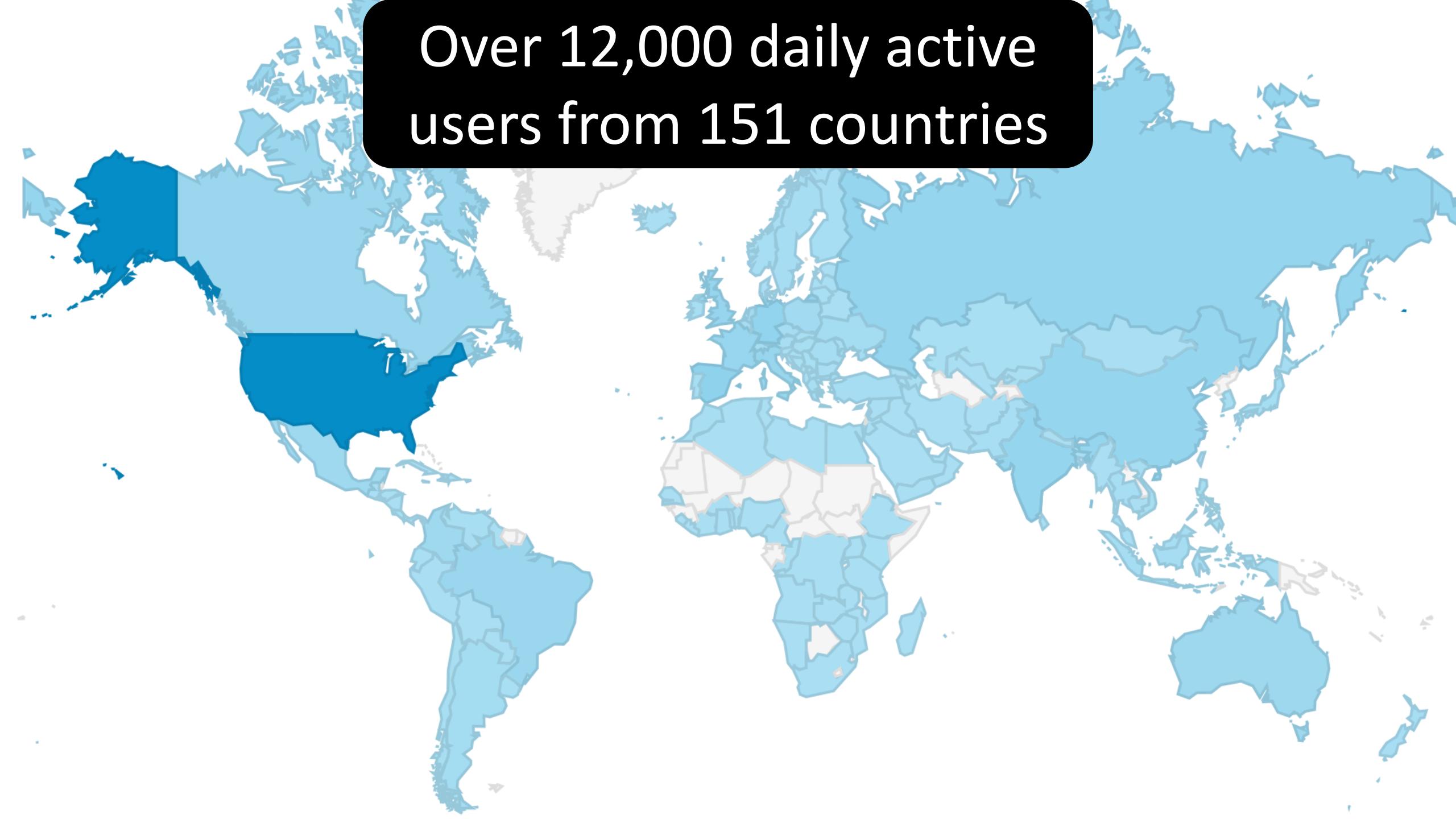
[Continue to Facebook](#)

# Design process for interventions

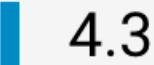
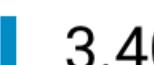
Existing interventions on the Chrome Store

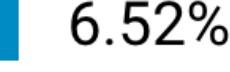
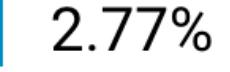
Ideas proposed by experts and users

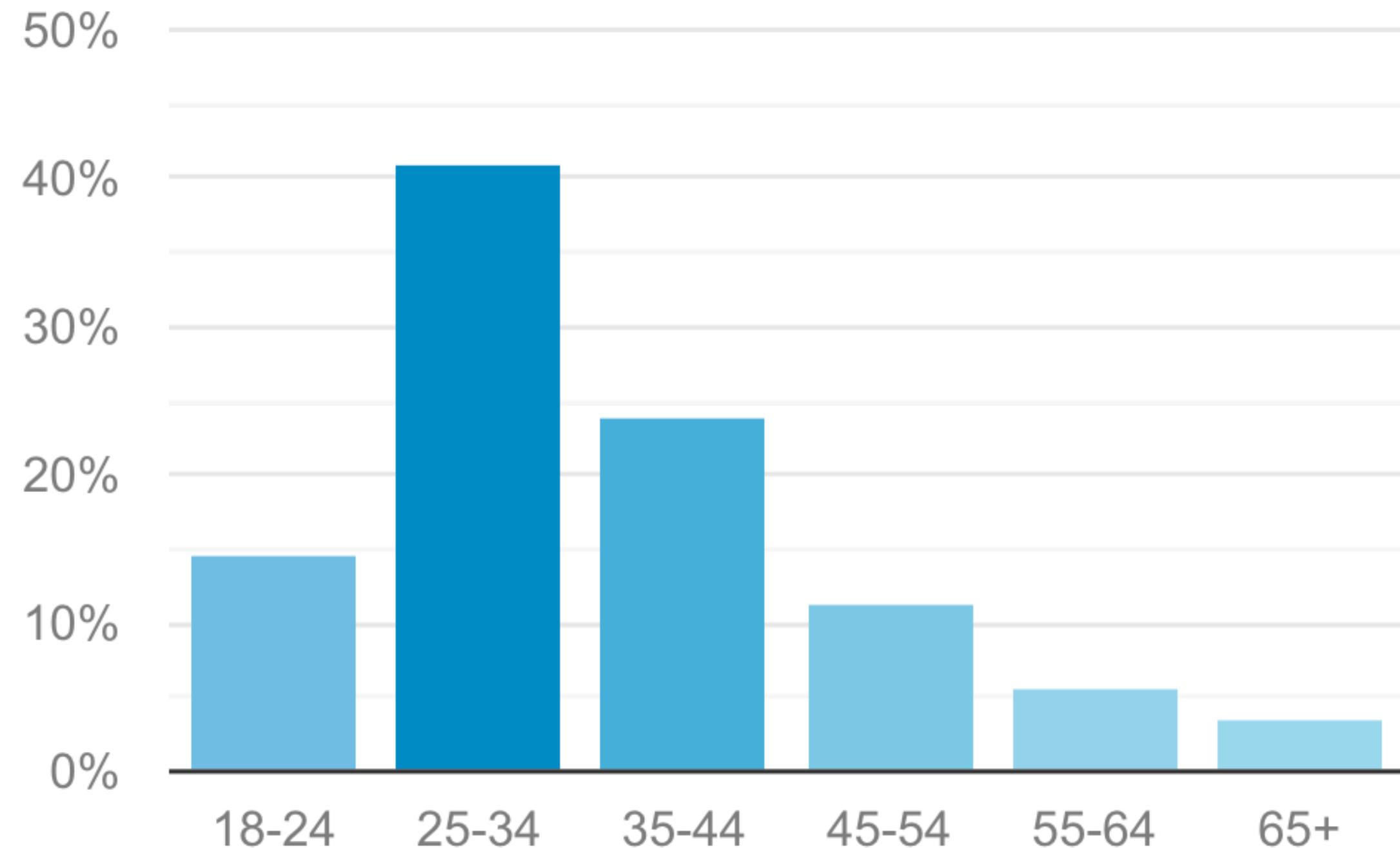
Adaptations of techniques from the literature



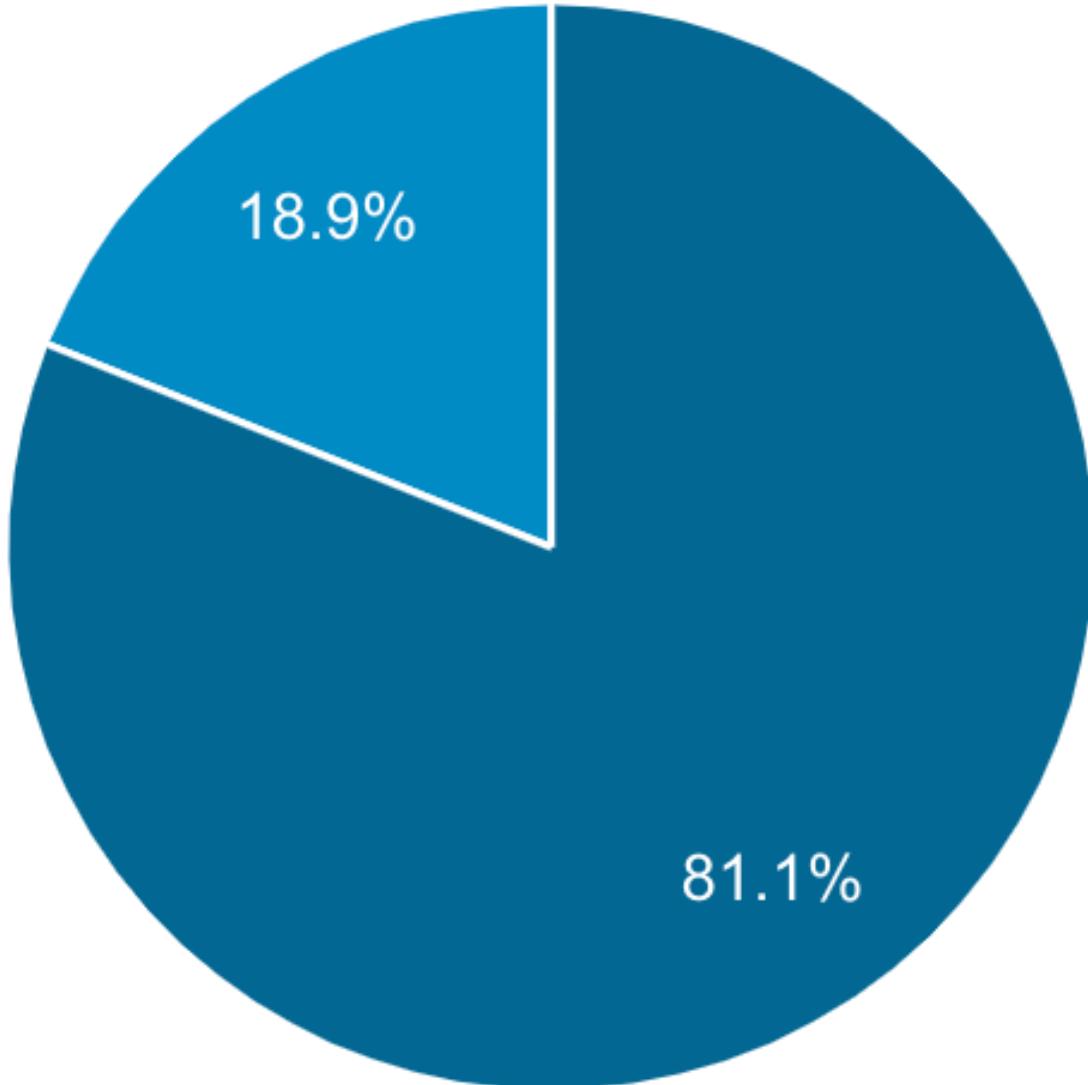
Over 12,000 daily active  
users from 151 countries

1.		United States	3,710		30.16%
2.		Spain	605		4.92%
3.		Germany	540		4.39%
4.		Russia	461		3.75%
5.		China	450		3.66%
6.		India	448		3.64%
7.		United Kingdom	439		3.57%
8.		France	418		3.40%
9.		Italy	402		3.27%
10.		Canada	368		2.99%

1. English (US)	6,143		50.00%
2. Spanish	801		6.52%
3. English (UK)	725		5.90%
4. Chinese (Simplified)	462		3.76%
5. Russian	443		3.61%
6. Italian	340		2.77%
7. Portuguese (Brazil)	293		2.38%
8. French	289		2.35%
9. German (Germany)	260		2.12%
10. German	212		1.73%



■ male ■ female



# Designing for Growth In-the-wild

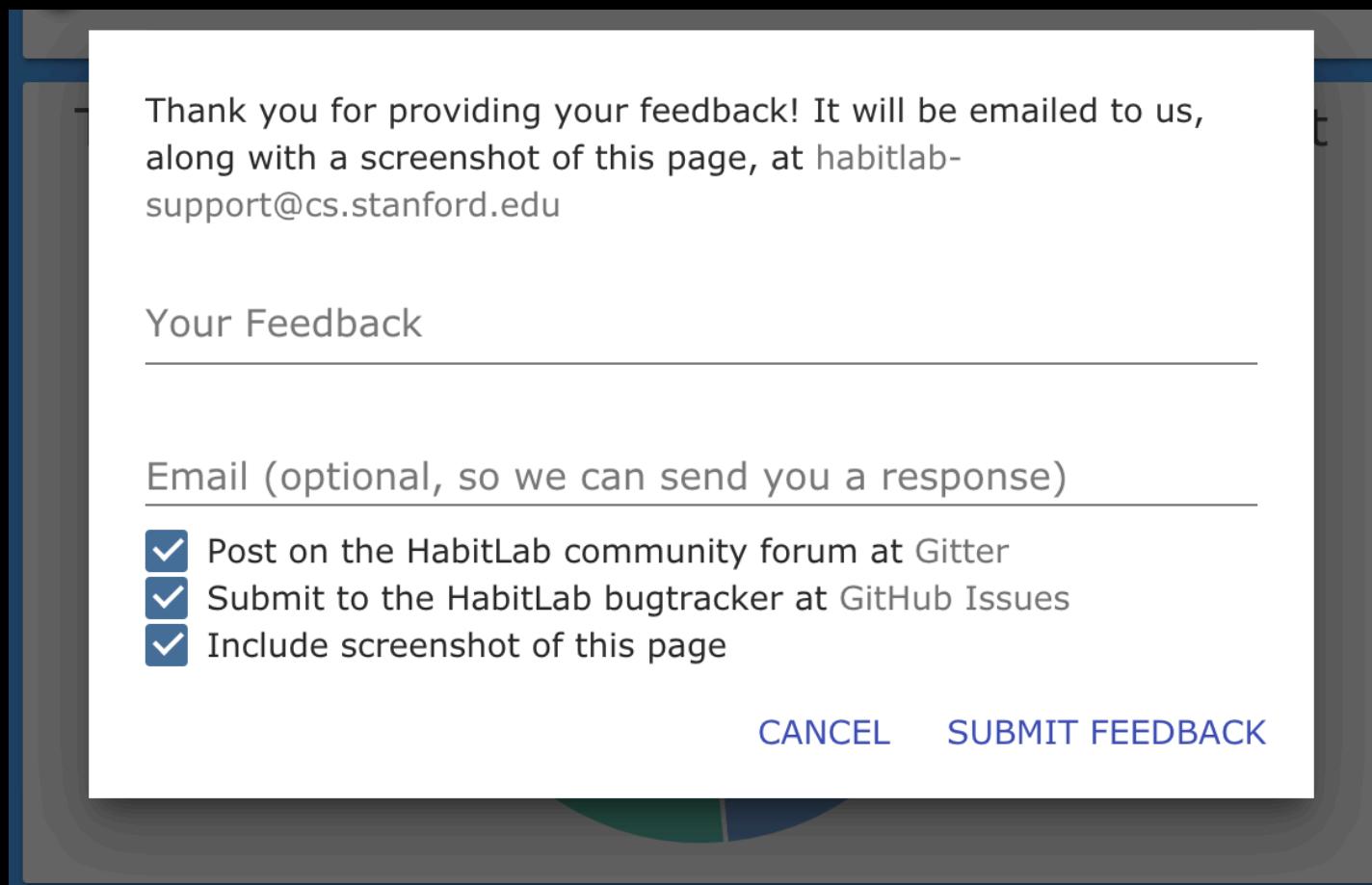
Design for good user experience: polish product, remove bugs, avoid long onboarding surveys and excessive experience sampling

# Designing for Growth In-the-wild

A/B test to find good defaults that maximize retention

# Designing for Growth In-the-wild

Give people plenty of opportunities to leave feedback



# Designing for Growth In-the-wild

Give people plenty of opportunities to leave feedback

Sorry to see you go! HabitLab has been uninstalled

Thanks for trying HabitLab! We'd appreciate your feedback so we can make it better! Why are you uninstalling?

- Interventions were annoying**
- Was causing lag**
- Did not feel effective**
- Privacy concerns**
- Other reason**

We would appreciate your feedback here

**Submit**

# Designing for Growth In-the-wild

Give people plenty of opportunities to leave feedback

HabitLab "how aggressive" panel 收件箱 ×

上午1:00 (9小时前) ☆ ⌂ ⌂ ⌂

发送至

Hi Professors Kovacs, Wu, and Bernstein,

I've been enjoying HabitLab, and think it's a really nice system. I have one pet peeve though which might lead to my unfortunate disabling of it. Wanted to bring this to your attention and see if a fix could possibly be made.

Whenever I go to a "nudged site", this "how aggressive" overlay comes up. I would not like it to. I click on "Light touch" every time, and it's so annoying that I'd sooner remove the Chrome extension than keep doing it every time. I get the thought, that maybe the annoyingness will make me visit those sites less. But if I wanted to not visit them at all, I'd just block them outright using another extension. I want to visit them, but be aware of how much time I'm spending. And I don't want additional tasks to accomplish every time.

Would the "how aggressive" panel triggering-or-not be a setting you could add? I'd really like to keep using this system!

Thank you,

# Designing for Growth In-the-wild

Give people plenty of opportunities to leave feedback

The screenshot shows a Reddit post from the r/habitlab subreddit. The post has 3 upvotes and was made 9 days ago by u/Getset. The title is "Change site background to a nauseating color over time". The post content discusses how certain colors evoke negative feelings and suggests fading the background to a disgusting shade of green or brown over time. It also mentions A/B testing colors and shades for effectiveness. Below the post are standard Reddit controls: Comment (0), Give Award, Share, Approve, Remove, and more options. The post is followed by another one from u/[deleted] 3 months ago with 1 upvote, titled "Show confirmation text when you submit a new idea in the web app settings".

Posted by u/Getset 9 days ago

**Change site background to a nauseating color over time**

Certain colors evoke negative feelings. A disgusting shade of green or brown will make the site less appealing to look at. I suggest slowly fading the background to one of these colors over time as the user remains on the site (A/B test colors and shades for effectiveness). If you can reduce visual appeal of a site, then you can reduce how addictive the site is.

Comment 0 Give Award Share Approve Remove ...

Posted by u/[deleted] 3 months ago

**Show confirmation text when you submit a new idea in the web app settings**

When I submit an idea for a pudge, there is zero indicator that it sent successfully. Please implement something

# Designing for Growth In-the-wild

Give people plenty of opportunities to leave feedback

- ⓘ [User Feedback] Youtube nudges not working as expected. Sidebar and comments turned on and ...  
#620 opened 3 days ago by habitlab-feedback
- ⓘ [User Feedback] I want to see my history and detailed results for longer durations, such as ...  
#618 opened 5 days ago by habitlab-feedback
- ⓘ [User Feedback] I came to Facebook to check notifications for events, but the scroll freezer ...  
#617 opened 6 days ago by habitlab-feedback
- ⓘ [User Feedback] Love HabitLab so far! However, I am unable to log in on the extension. I press ...  
#616 opened 6 days ago by habitlab-feedback
- ⓘ [User Feedback] Thank you so much. I downloaded this to track my work time ( work on social ...  
#615 opened 7 days ago by habitlab-feedback
- ⓘ [User Feedback] Nudges should NOT cover the page, they should possibly push the whole page ...  
#613 opened 12 days ago by habitlab-feedback

# Designing for Growth In-the-wild

Give people opportunities to contribute: ideas

Which do you think would be a better nudge for Facebook?

Shows time spent on site at the top of screen

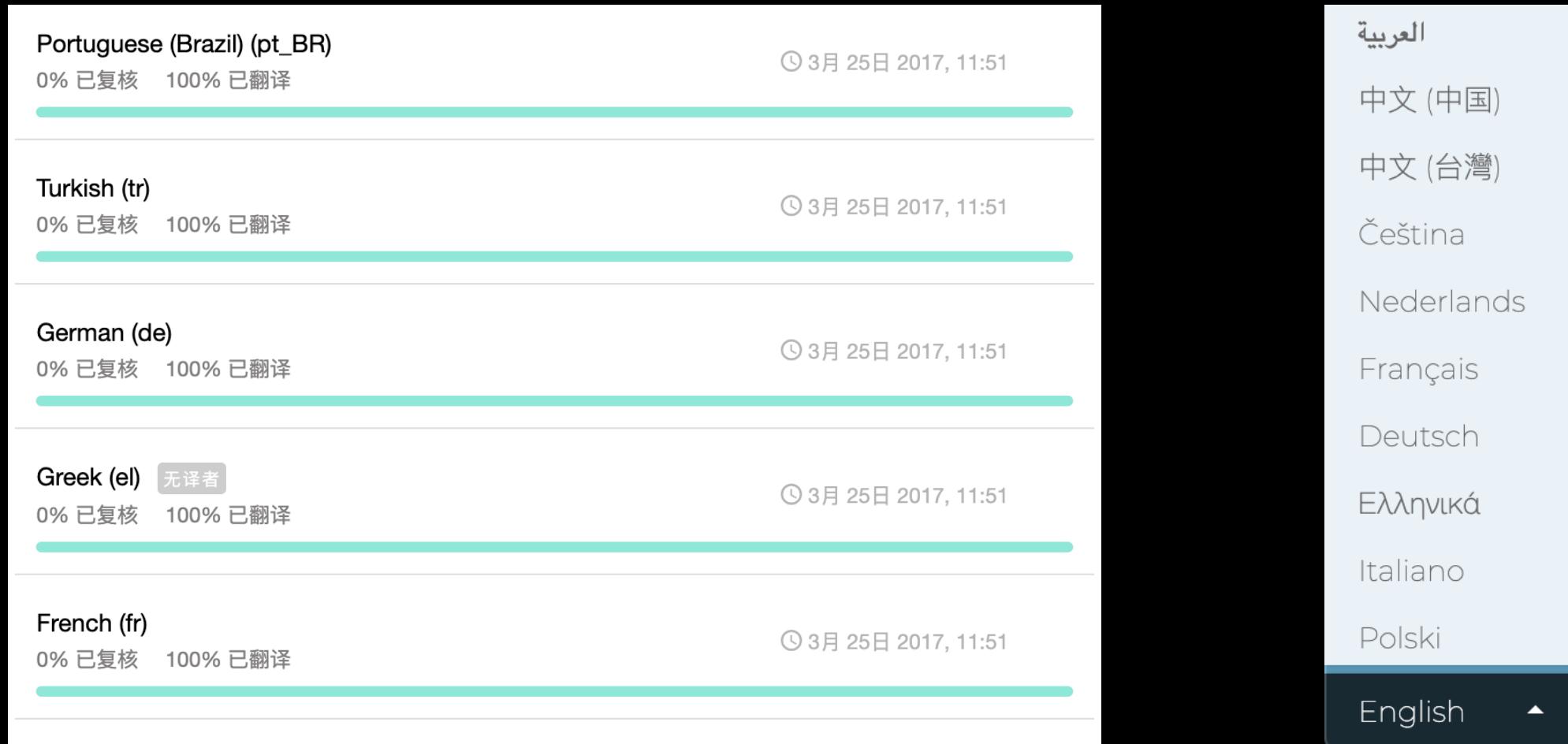
Freezes scrolling after a certain amount of scrolls

I cannot decide

Or add your own idea

# Designing for Growth In-the-wild

Give people opportunities to contribute: internationalization



# Designing for Growth In-the-wild

Give people opportunities to contribute: code

The screenshot shows a user interface for creating web-based interventions. At the top, there's a dark header bar with the word "Tutorial" and a close button "X". To the right of the header is a blue button labeled "CREATE A NEW NUDGE". The main content area has a white background. It contains two paragraphs of text: "You can find the code for built-in interventions at [src/interventions](#) and see interventions others have shared [here](#)" and "Interventions are written in JavaScript. You can find tutorials which teach you JavaScript and web development [here](#)". Below this text is a section titled "Show an alert" in bold black font. Underneath the title, it says "This intervention will show an alert saying 'Hello World' when you visit the website." A code editor window shows a single line of JavaScript: "1 alert('Hello World');". To the right of the main content area is a vertical sidebar with a blue background. It features three icons: a white square with a plus sign labeled "CREATE", a white folder icon labeled "OPEN", and another white folder icon labeled "OPEN" (likely a duplicate or error). The overall theme is dark with blue highlights.

# Designing for Growth In-the-wild

Give people opportunities to contribute: code

## Adding front feed remover nudge #439

Merged gkovacs merged 4 commits into habitlab:master from pamelafelix:remove-front-feed on 4 Jul 2018

Conversation 4 Commits 4 Checks 0 Files changed 4

pamelafelix commented on 12 Jun 2018

Contributor + 😊 ...

I've made a nudge that removes the front page feed, inspired by my simple Chrome extension (<https://github.com/pamelafelix/youtube-feed-hider>) and based on the current Sidebar hider from HabitLab.

# Designing for Growth In-the-wild

Ultimately, a lot depends on press and factors outside your control

The screenshot shows a web page from lifehacker.com. At the top left is the 'lifehacker' logo. To its right is a three-line menu icon. Below the logo is a horizontal navigation bar with links: VIDEO, SKILLET, TWO CENTS, VITALS, OFFSPRING, THE UPGRADE, APP DIRECTORY, and HOW I WORK. The main title of the article is 'Be More Mindful of the Time You Waste Online With HabitLab', displayed in large, bold, black font. Below the title is the author's name, 'Emily Price', next to a small circular profile picture. To the right of the author info are two icons: a speech bubble with the number '2' and a bookmark with the number '4'. At the bottom of the screenshot, the full URL of the article is visible: <https://lifehacker.com/be-more-mindful-of-the-time-you-waste-online-with-habitlab>.

## Be More Mindful of the Time You Waste Online With HabitLab

Emily Price  
8/05/18 3:18pm • Filed to: TIME MANAGEMENT

2 4

<https://lifehacker.com/be-more-mindful-of-the-time-you-waste-online-with-habitlab>

# Designing for Growth In-the-wild

Ultimately, a lot depends on press and factors outside your control



STYLE | Finding It Hard to Focus? Maybe It's Not Your Fault

[HabitLab](#), developed at Stanford, stages aggressive interventions whenever you enter one of your self-declared danger zones of internet consumption. Having a problem with Reddit sucking away your afternoons? Choose between the “one-minute assassin,” which puts you on a strict 60-second egg timer, and the “scroll freezer,” which creates a bottom in your bottomless scroll — and logs you out once you’ve hit it.

Like [Moment](#), an app that monitors screen time and sends you or loved ones embarrassing notifications detailing exactly how much

# Designing for Growth In-the-wild

Ultimately, a lot depends on press and factors outside your control



The HabitLab Browser Extension Curbs Your Time Wasted on the Web

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SHAR  
E



SHARE



TWEET

**FOR GEZA KOVACS**, our collective time-wasting on the web makes for precious data. A PhD candidate in Stanford's human-computer interaction group, Kovacs studies bad browsing habits and researches what can be done to repair them. Like, when you flick open a new tab and reflexively navigate to Facebook, does it help to be reminded that you have other stuff to do today? Would you consider closing the tab if you saw a stopwatch, tick-tocking to remind you of how much time you've lost? And when you close a tab on your computer, have you actually regained your focus, or

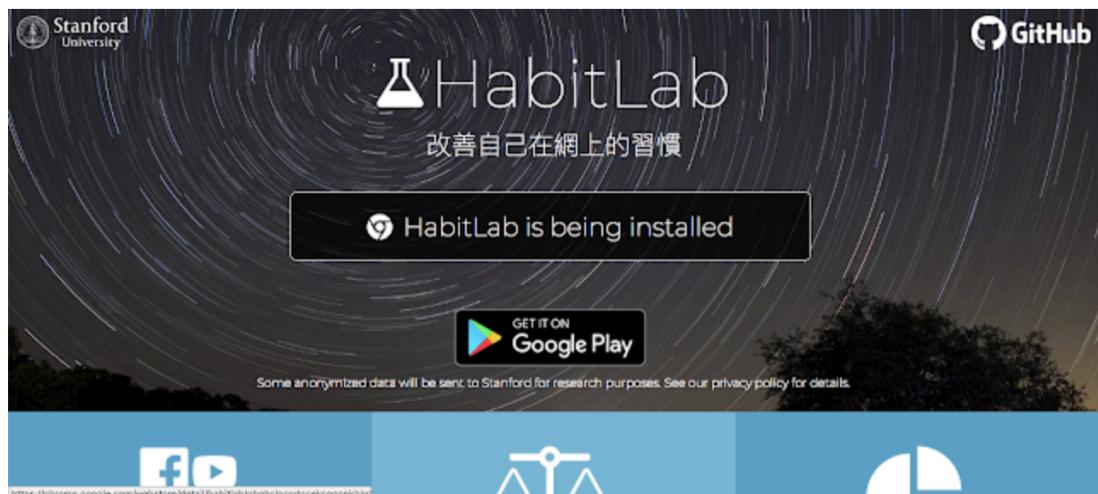
# Designing for Growth In-the-wild

Ultimately, a lot depends on press and factors outside your control

HabitLab 來自史丹佛大學的時間管理工具，實驗改善上網習慣

作者： Esor Huang 8月 06, 2018

✓ 赞 分享 你和其他 147 位用户赞了



腾讯网 要闻 娱乐 财经

一键登录

这款斯坦福大学的工具，让你远离加班，提升200%效率！

从古至今，人们一直无法摆脱拖延症的困扰。

胡适在他的《胡适留学日记》上，刚说要计划“读完《亨利八世》”，第二天就开始疯狂打起了牌，连着打了好几周。

## HabitLab: Our in-the-wild behavior change platform

### Outcomes

Does effectiveness remain constant over time?

What externalities exist?

### Interventions

How do users' preferences change over time?

*Rotating Online Behavior Change Interventions Increases Effectiveness But Also Increases Attrition (CSCW 2018)*

Behavior change  
interventions suffer  
from declined  
engagement over time



Paul Krebs, James O Prochaska, and Joseph S Rossi. 2010. A meta-analysis of computer-tailored interventions for health behavior change. Preventive medicine 51, 3-4 (2010), 214–221

A close-up photograph of a large pile of M&M's candies. The candies are of various colors, including red, blue, green, yellow, orange, and brown. They are scattered across the frame, creating a vibrant and textured background.

Novelty effects  
can provide  
temporary boosts  
in engagement

Reza Kormi nouri, Lars Goran Nilson, and Nobuo Ohta. [n. d.].  
The novelty effect: Support for the Novelty Encoding  
Hypothesis. Scandinavian Journal of Psychology

Existing behavior change systems  
tend to use static interventions





[RQ] Can a strategy of  
rotating interventions  
improve effectiveness?



[H1] Static interventions  
suffer from decreased  
effectiveness over time

A photograph of a well-maintained garden with a variety of colorful flowers, including red, yellow, purple, and white, growing in raised beds and along stone pathways. The garden is set against a backdrop of green trees and foliage.

[H2] Rotation will  
increase intervention  
effectiveness

## HabitLab: Our in-the-wild behavior change platform

Do interventions remain effective as time passes?

What are the side effects of interventions?

How do users' preferences change over time?

*Rotating Online Behavior Change Interventions Increases Effectiveness But Also Increases Attrition (CSCW 2018)*

Rotating vs static intervention strategies  
Study 1: Within subjects  
Study 2: Between subjects

Qualitative feedback

Study 3: Improving users' mental models about rotating interventions

Compare rotating and static intervention strategies, in terms of:

Effectiveness of interventions over time (daily time on sites)

Attrition rates (time until uninstall)

Within-subjects design, 217 participants

Within-subjects design, 217 participants

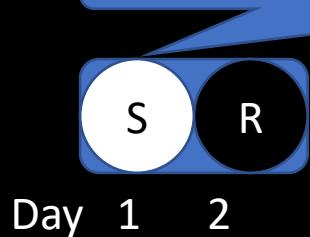
Conditions: on some days, users saw the same intervention (static), on others, interventions changed each visit (rotation)

Within-subjects design, 217 participants

Conditions: on some days, users saw the same intervention (static), on others, interventions changed each visit (rotation)

Conditions were organized into blocks of 1, 3, 5, 7 days

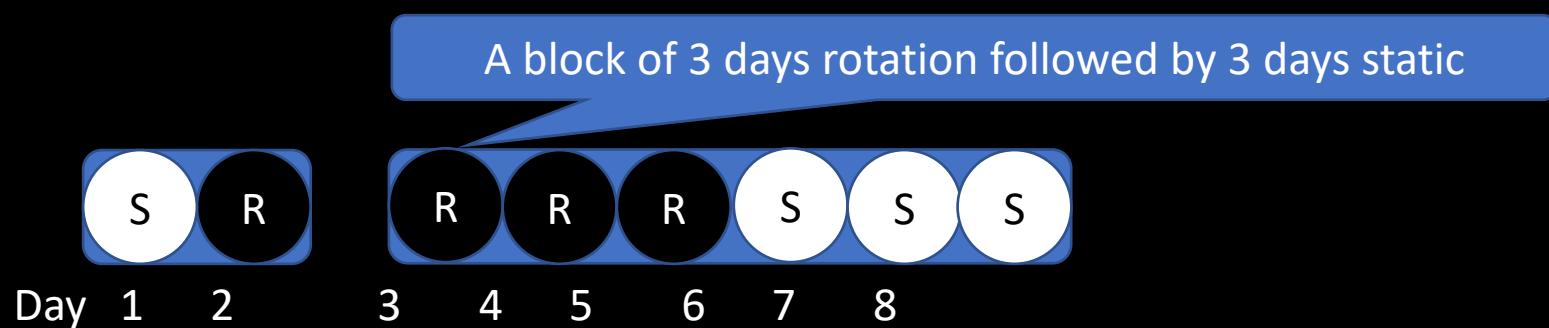
A block of 1 day static followed by 1 day rotation



## Within-subjects design, 217 participants

Conditions: on some days, users saw the same intervention (static), on others, interventions changed each visit (rotation)

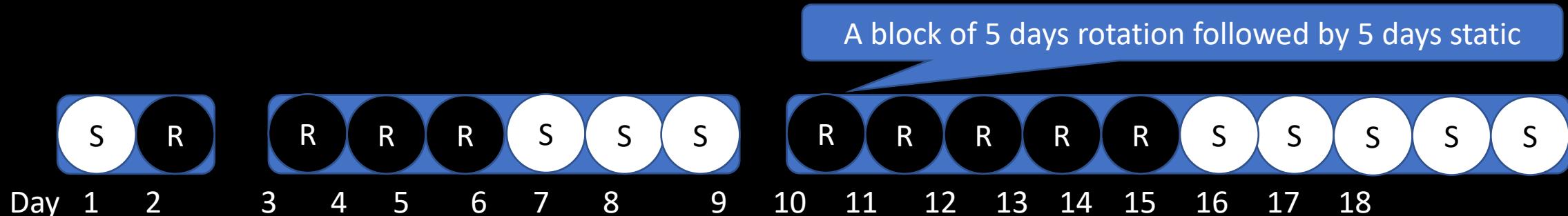
Conditions were organized into blocks of 1, 3, 5, 7 days



Within-subjects design, 217 participants

Conditions: on some days, users saw the same intervention (static), on others, interventions changed each visit (rotation)

Conditions were organized into blocks of 1, 3, 5, 7 days



Do static  
interventions  
decline in  
effectiveness  
over time?

Linear Mixed Model

Fixed effects:

#days intervention seen

Random effects:

User ID, Domain

Dependent variable:

Time spent on domain that day (log)

Time spent on sites increases over time with static interventions (decline in effectiveness)

	Log time spent per day (dependent variable)
# days static intervention seen	0.225 ( $p < 0.05$ )
Intercept	4.759
Observations	124

Interpretation (via exponentiation):

Day 1: 116 seconds per site

Day 2: 146 seconds per site

Day 3: 183 seconds per site

Does rotation  
reduce time  
spent?

## Linear Mixed Model

Fixed effects:

Condition (static or rotation), Block length

Random effects:

User ID, Domain

Dependent variable:

Time spent on domain that day (log)

Daily time  
on sites  
reduced in  
the rotation  
condition

	Log time spent per day (Dependent variable)
Rotation (baseline: static)	-0.417 ( $p < 0.05$ )
Intercept	4.981
Observations	370

Interpretation (via exponentiation):

Static: 146 seconds per site daily

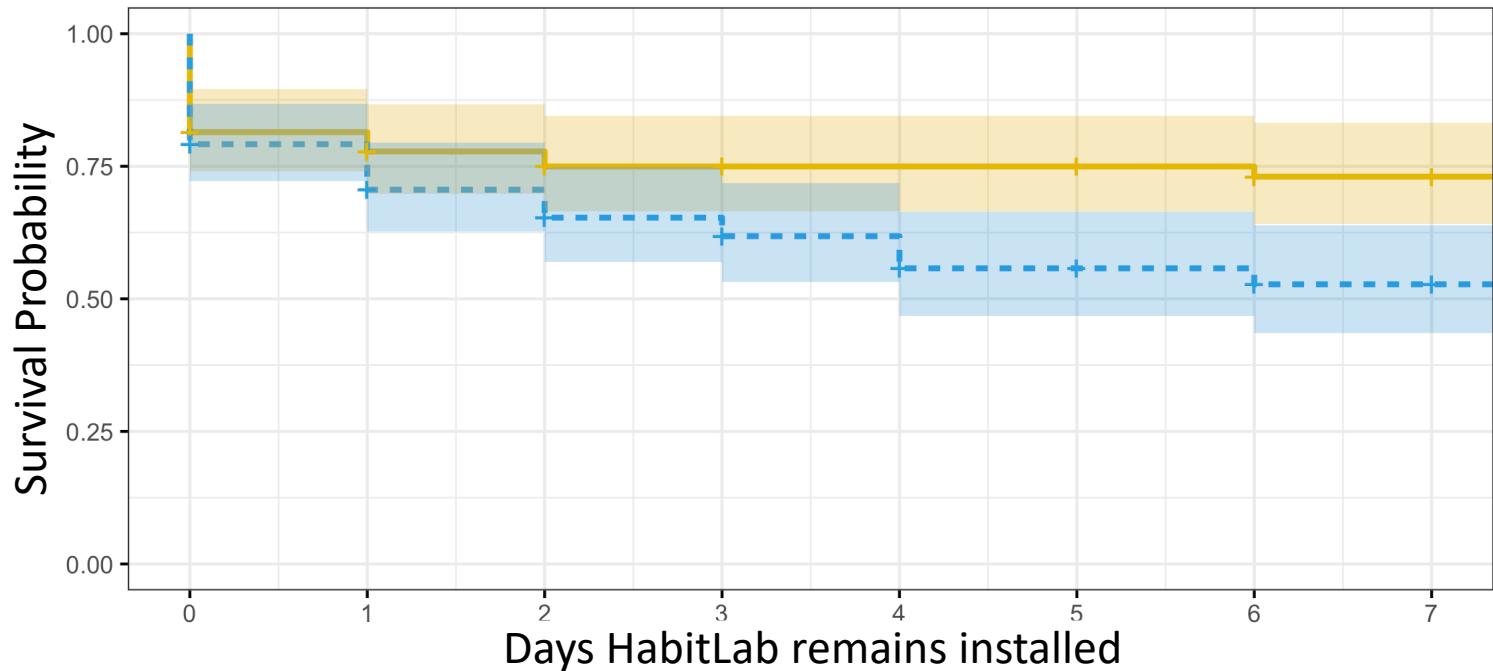
Rotation: 96 seconds per site daily

# Does rotation increase attrition?

Cox hazard regression

Predicting survival probability as a function of condition (static or rotation), within the first block

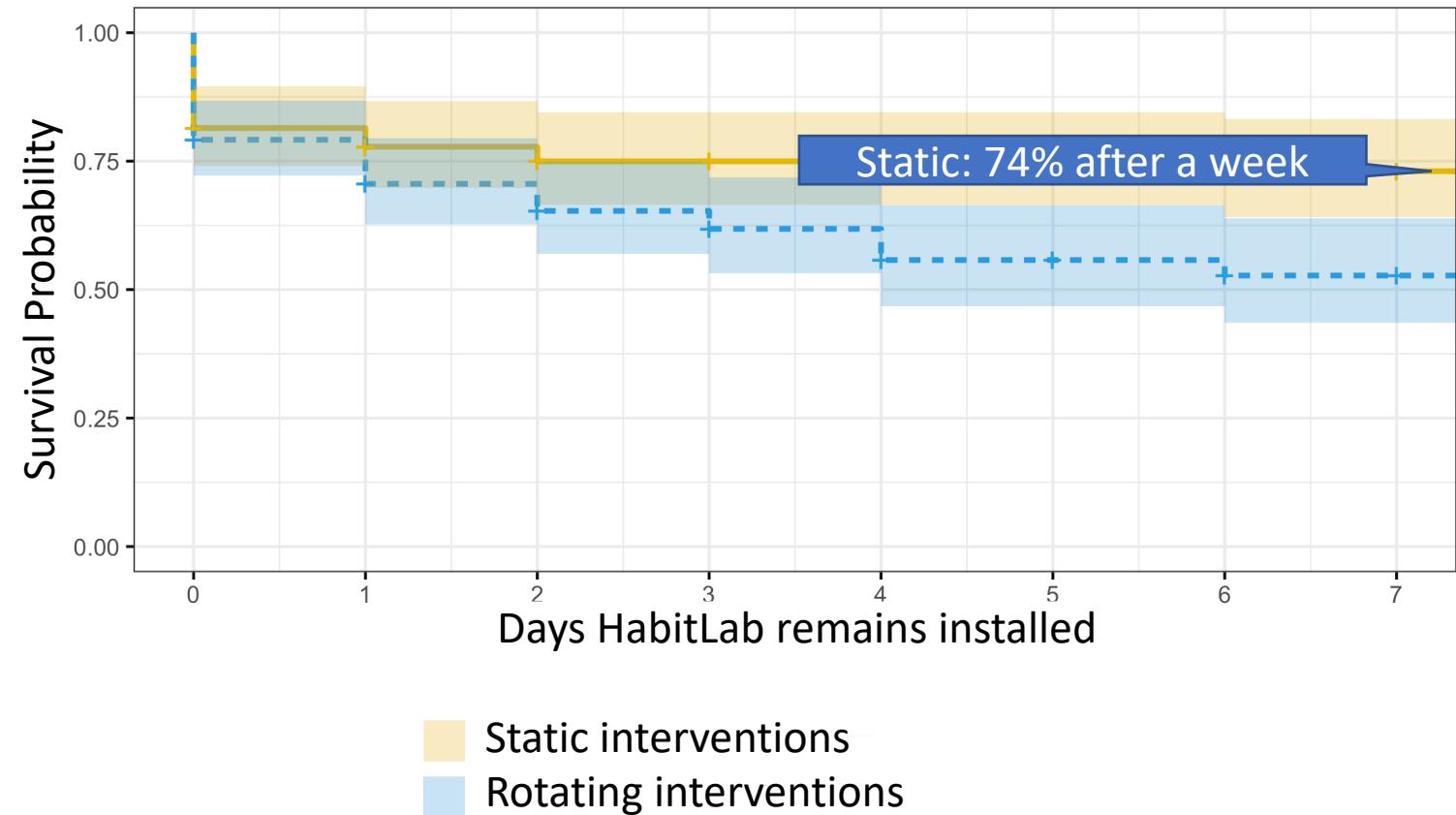
# Rotating interventions increases attrition



■ Static interventions  
■ Rotating interventions

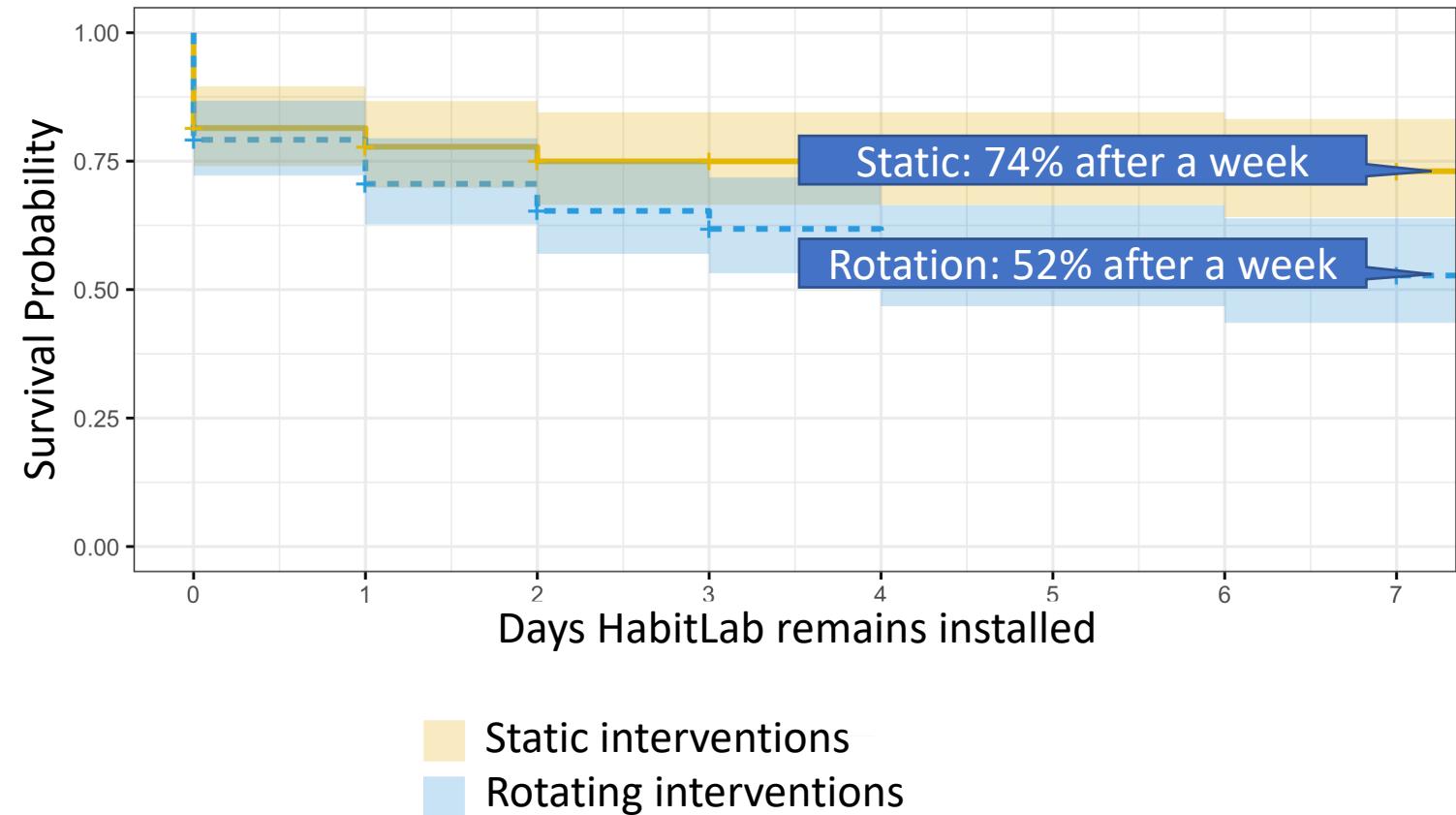
Log hazard ratio for rotation condition:  
0.544 ( $p < 0.05$ )

# Rotating interventions increases attrition



Log hazard ratio for rotation condition:  
0.544 ( $p < 0.05$ )

# Rotating interventions increases attrition



Log hazard ratio for rotation condition:  
0.544 ( $p < 0.05$ )

## HabitLab: Our in-the-wild behavior change platform

Do interventions remain effective as time passes?

What are the side effects of interventions?

How do users' preferences change over time?

Rotating vs static intervention strategies

Study 1: Within subjects

- Rotating interventions improves effectiveness but increases attrition

Study 2: Between subjects

Qualitative feedback

Study 3: Improving users' mental models about rotating interventions

## HabitLab: Our in-the-wild behavior change platform

### Outcomes

Does effectiveness remain constant over time?

What externalities exist?

### Interventions

How do users' preferences change over time?

Rotating vs static intervention strategies  
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Does rotating between more interventions increase attrition?

Does rotating between more interventions increase attrition?

Between-subjects design, 409 participants, 5 weeks

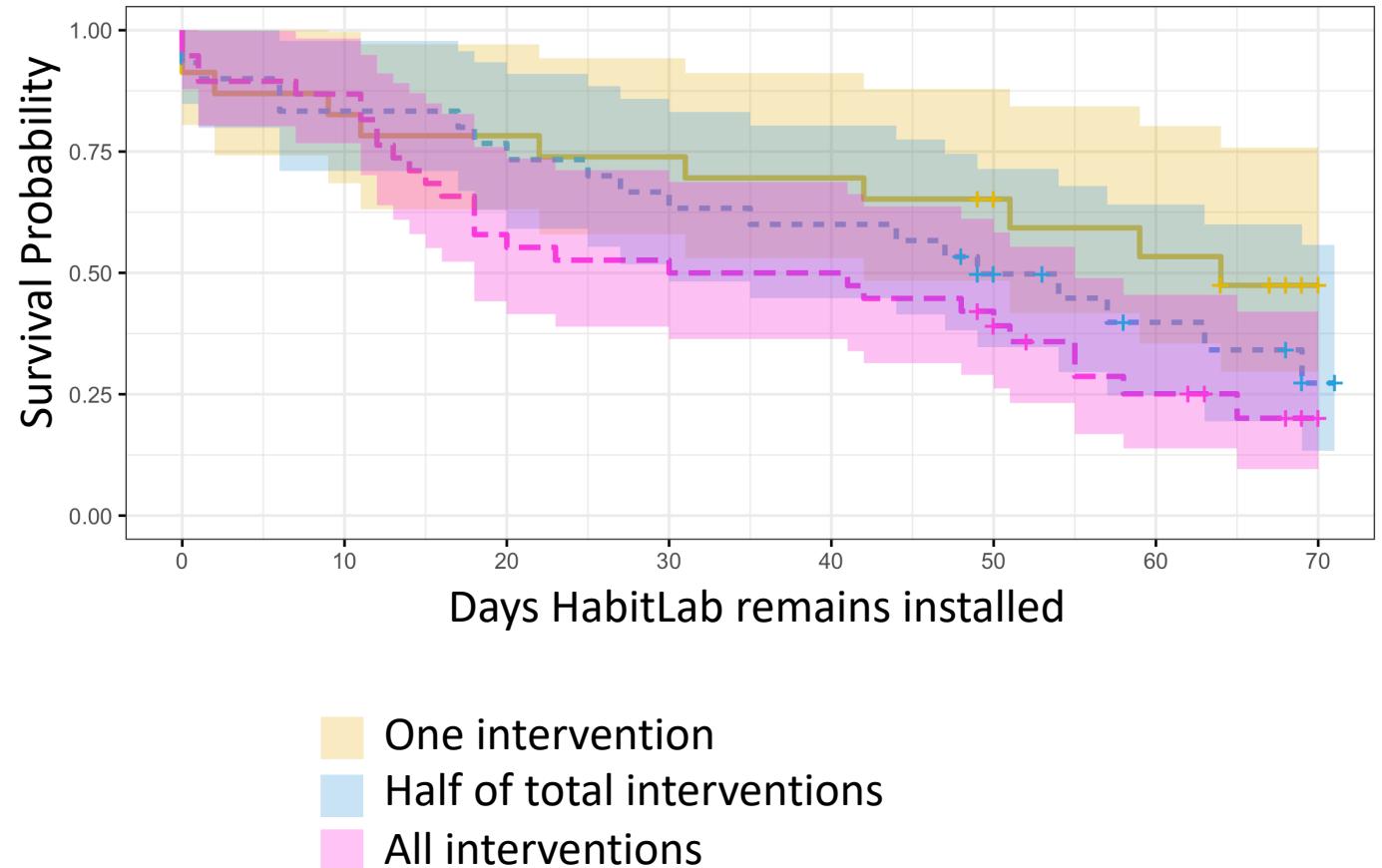
Does rotating between more interventions increase attrition?

Between-subjects design, 409 participants, 5 weeks

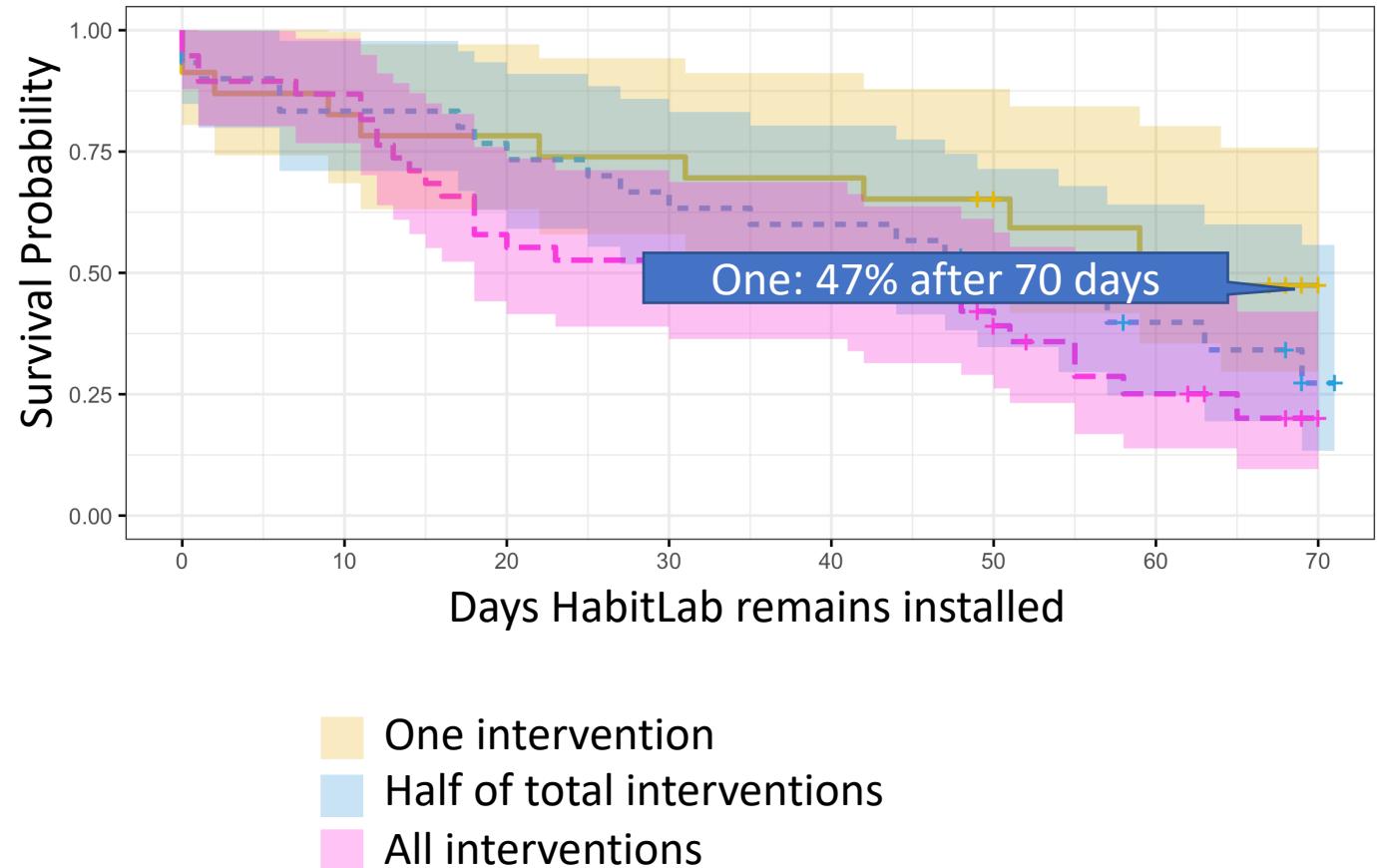
Conditions differ in number of interventions being rotated:

- One intervention per site
- Half of all available interventions per site (ie, 4 on Facebook)
- All available interventions per site (ie, 8 on Facebook)

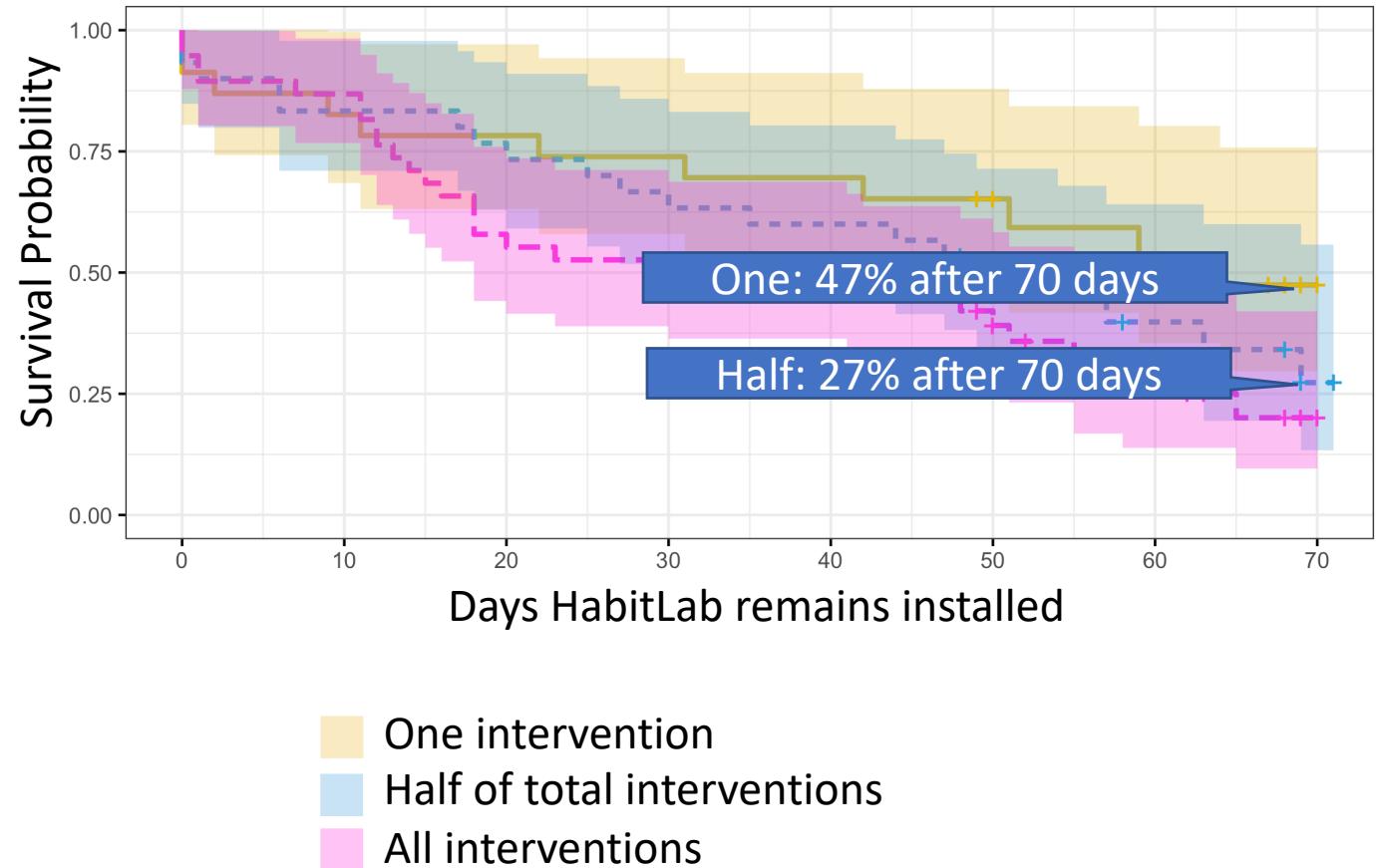
Rotating between  
interventions  
increases attrition



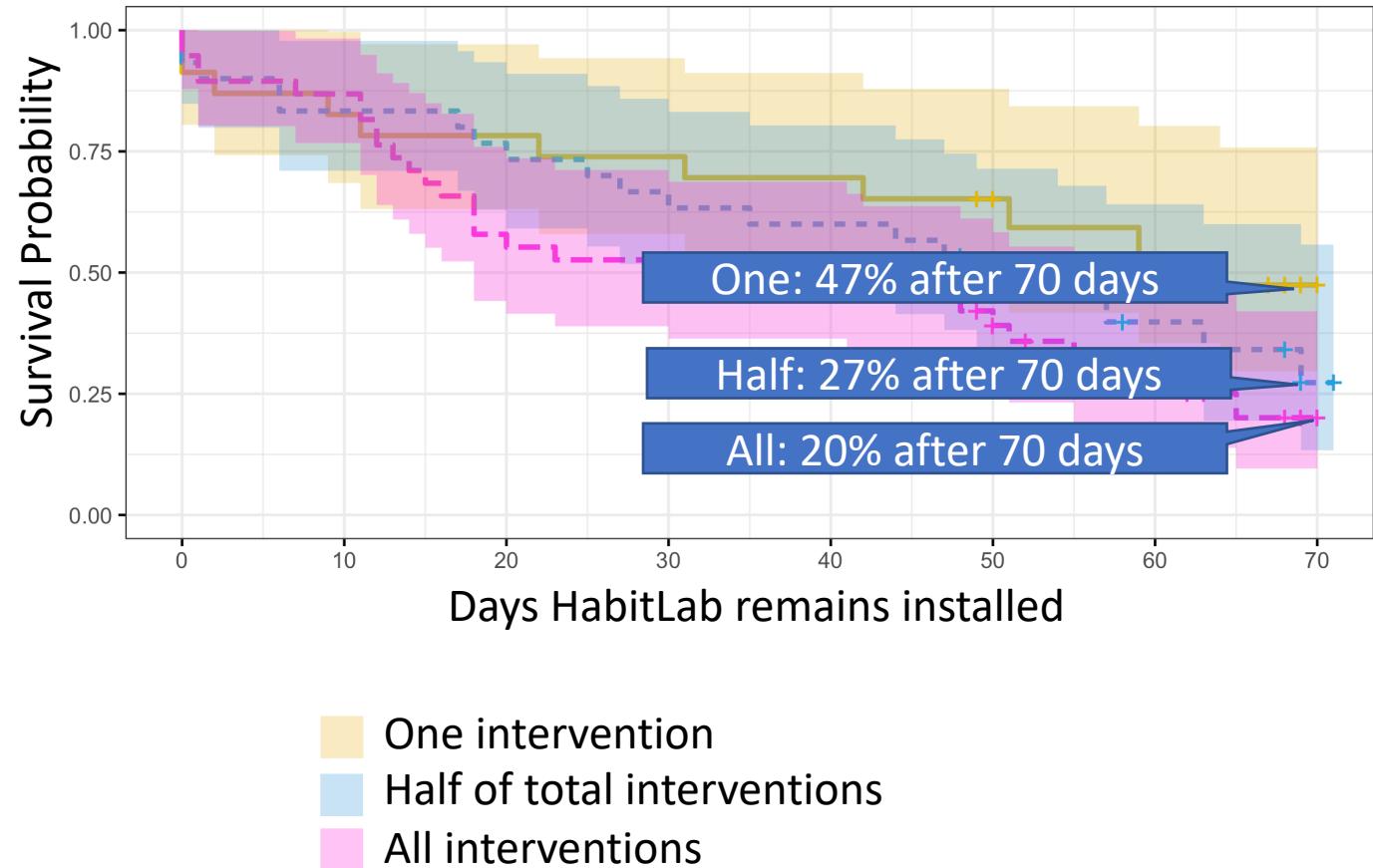
# Rotating between interventions increases attrition



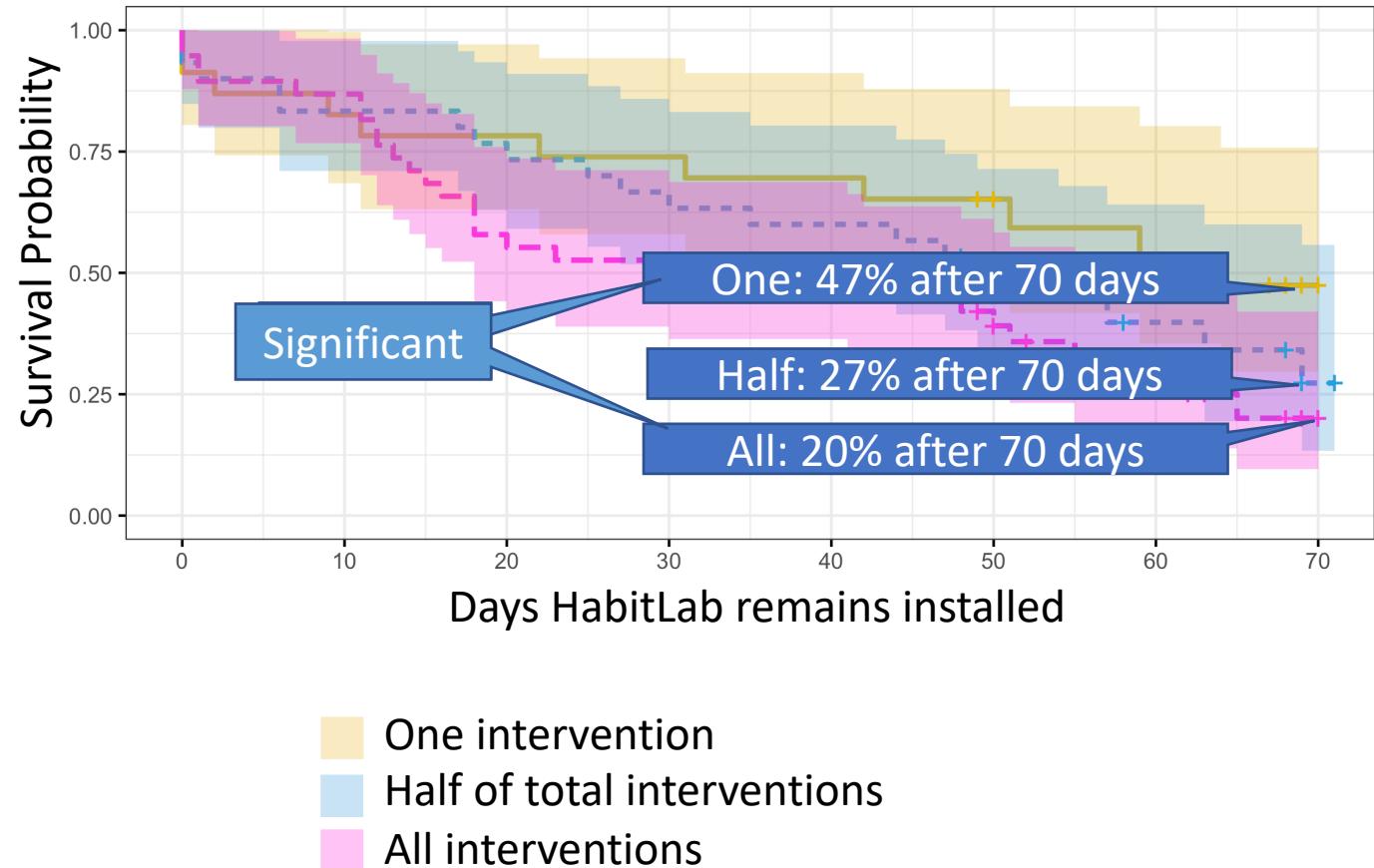
# Rotating between interventions increases attrition



# Rotating between interventions increases attrition



# Rotating between interventions increases attrition



## HabitLab: Our in-the-wild behavior change platform

### Outcomes

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Collected  
uninstall  
feedback to  
understand  
reasons for  
attrition

Sorry to see you go! HabitLab has been uninstalled

Thanks for trying HabitLab! We'd appreciate your feedback so we can make it better! Why are you uninstalling?

Interventions were annoying  
 Was causing lag  
 Did not feel effective  
 Privacy concerns  
 Other reason

We would appreciate your feedback here

# Collected uninstall feedback to understand reasons for attrition

Incorrect mental models

Didn't seem what I was expected. Installed two minutes ago and removed it

Dissatisfaction with particular interventions

Mostly it was the bar covering up facebook message indicators

# Why did rotating interventions increase attrition?

Violation of mental models  
Users lack sense of control

## HabitLab: Our in-the-wild behavior change platform

Do interventions remain effective as time passes?

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## HabitLab: Our in-the-wild behavior change platform

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- Rotation itself causes attrition

Qualitative feedback

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# Can we reduce attrition when intervention rotation happens?

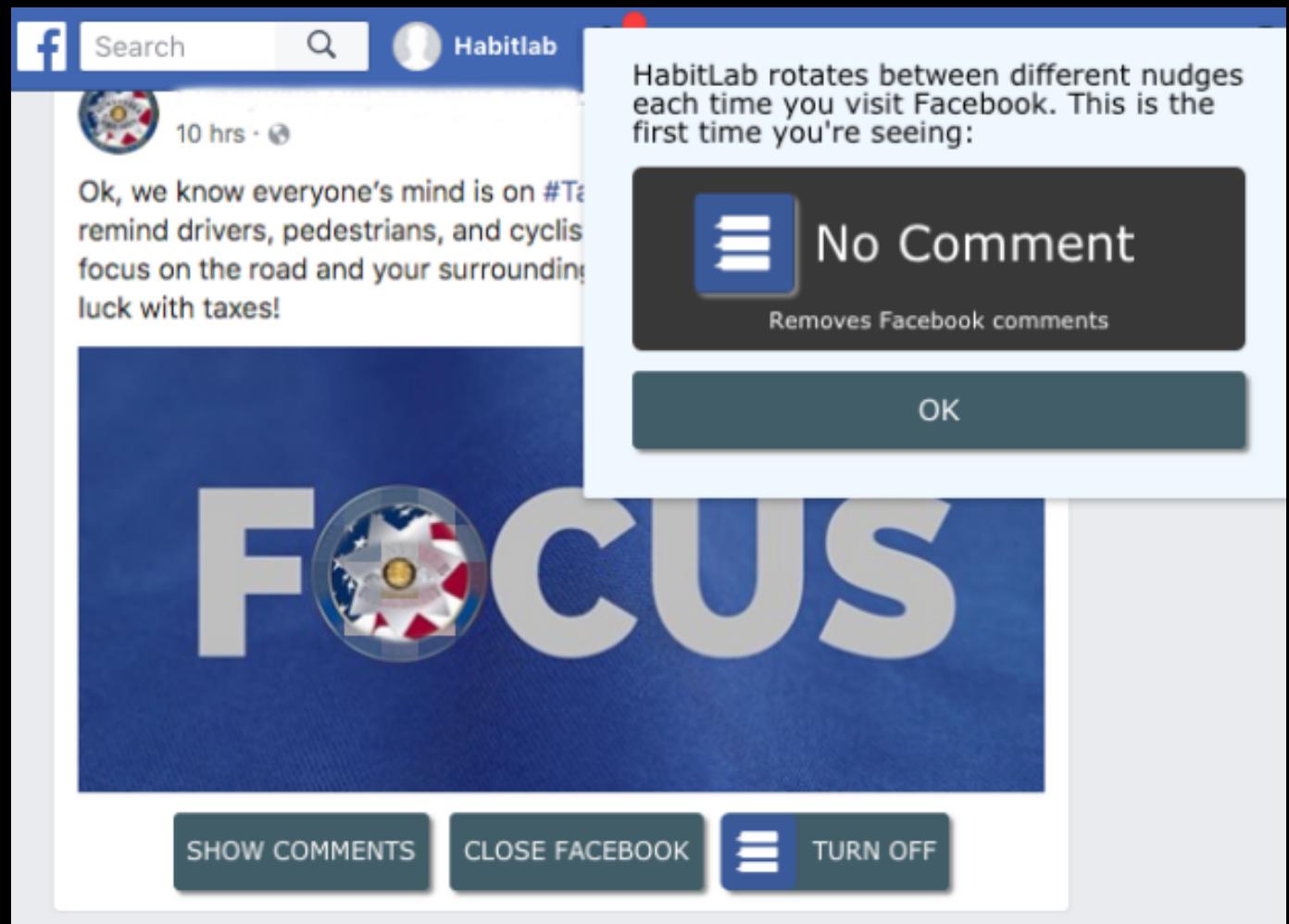
Developed 2 dialogs shown when an intervention is first seen

Mental model design

User control design

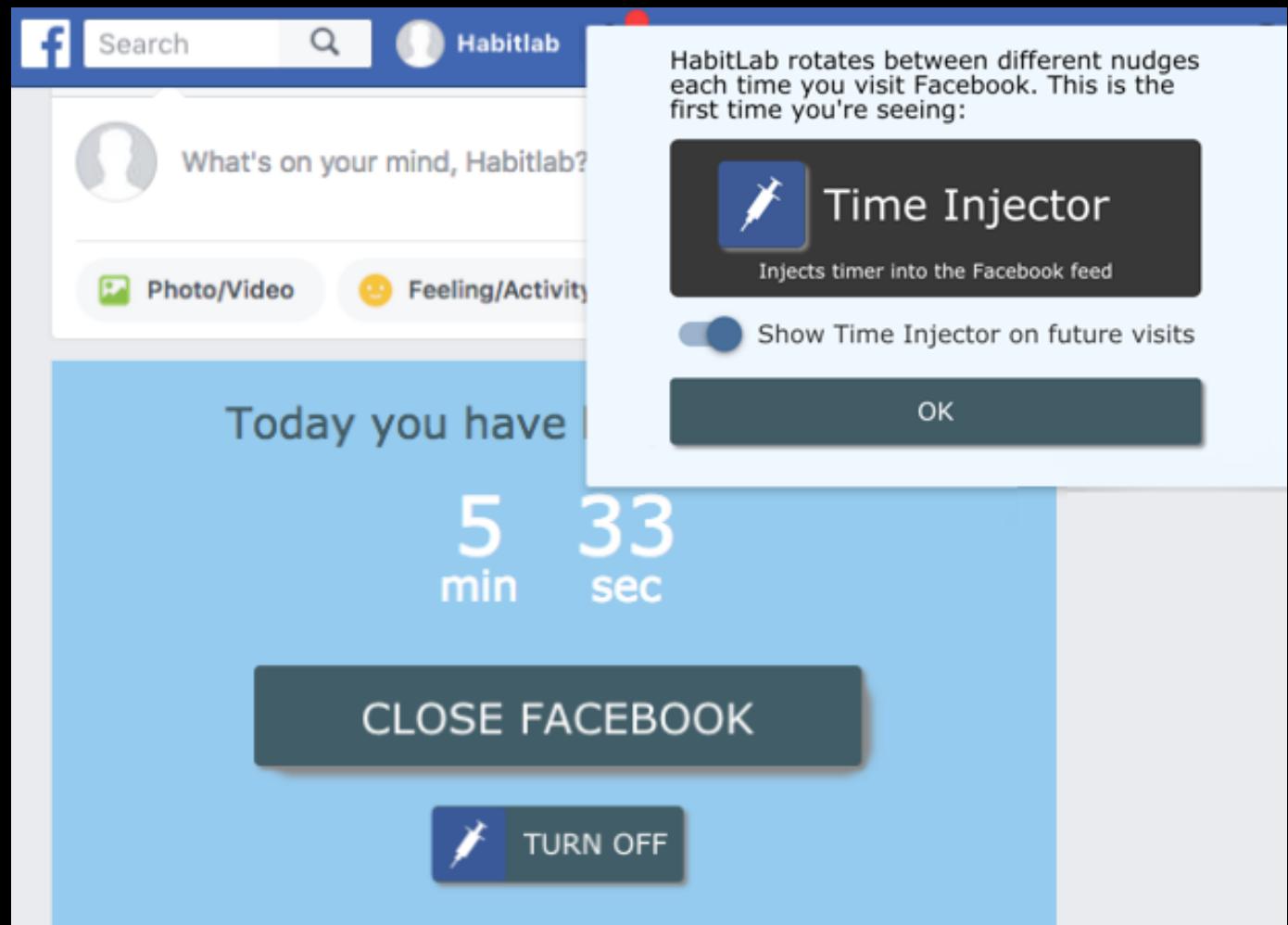
# Mental model design

---



# User control design

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Between subjects design, 282 participants, 10 days

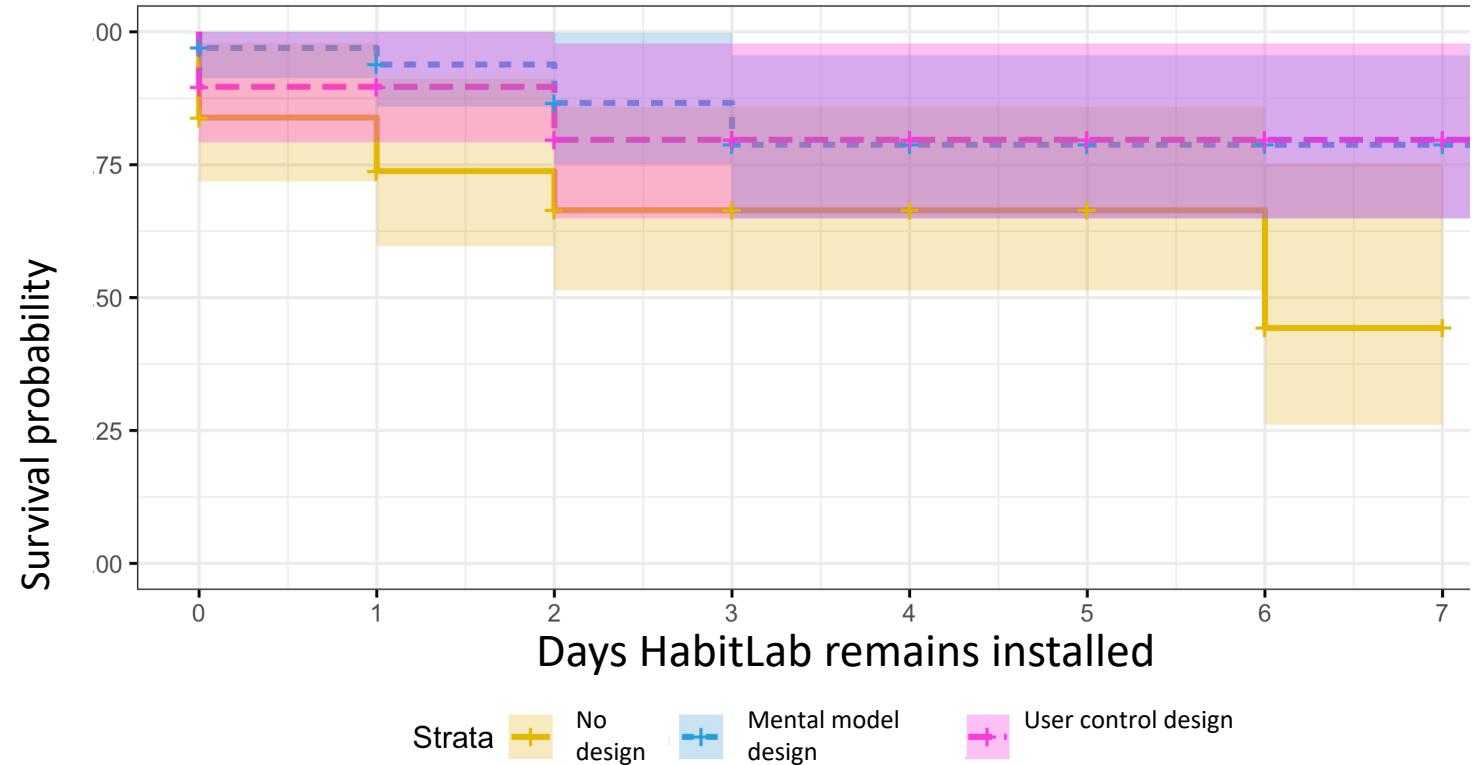
Conditions differ according to which design is shown when an intervention is seen for the first time:

None: No design shown

Mental model design

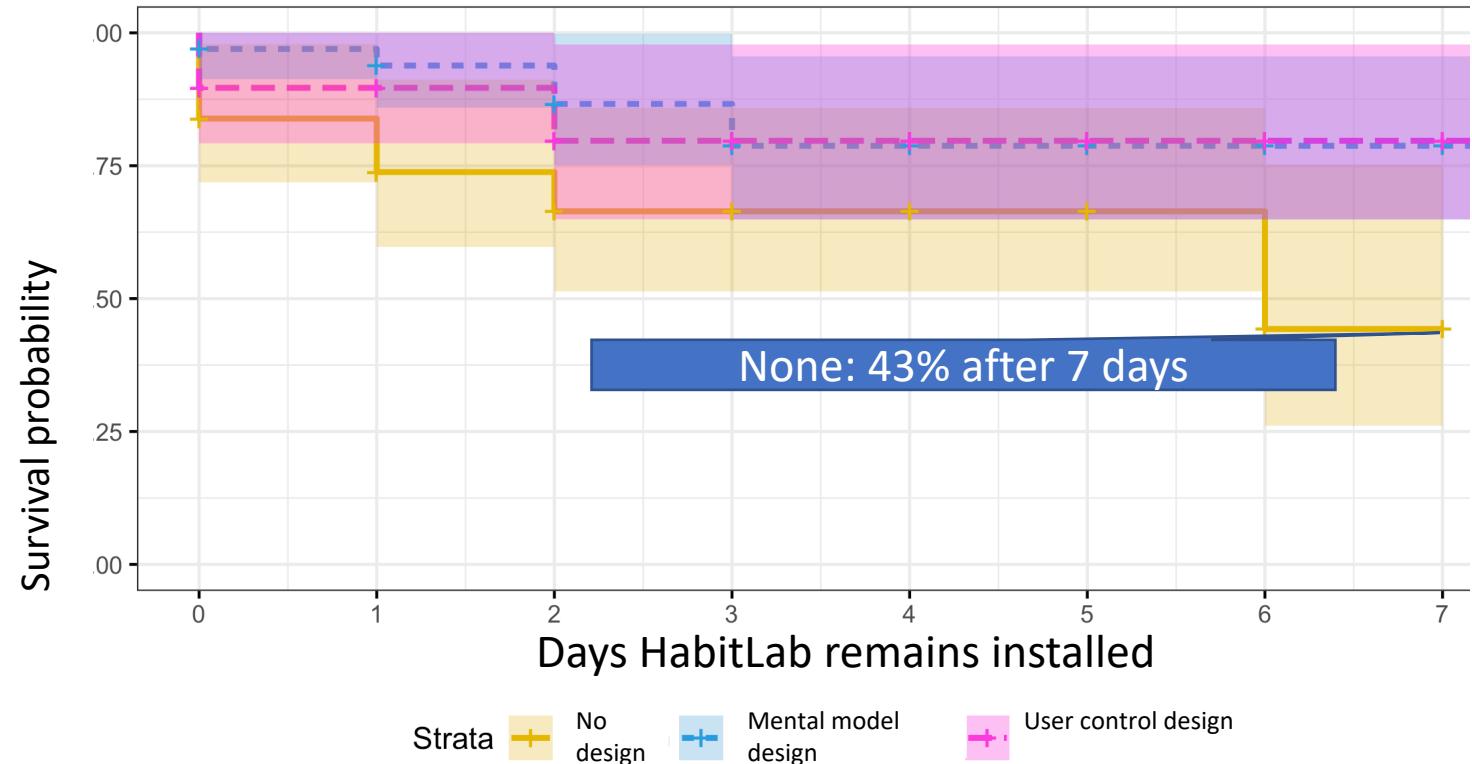
User control design

# Mental model design reduces attrition by half



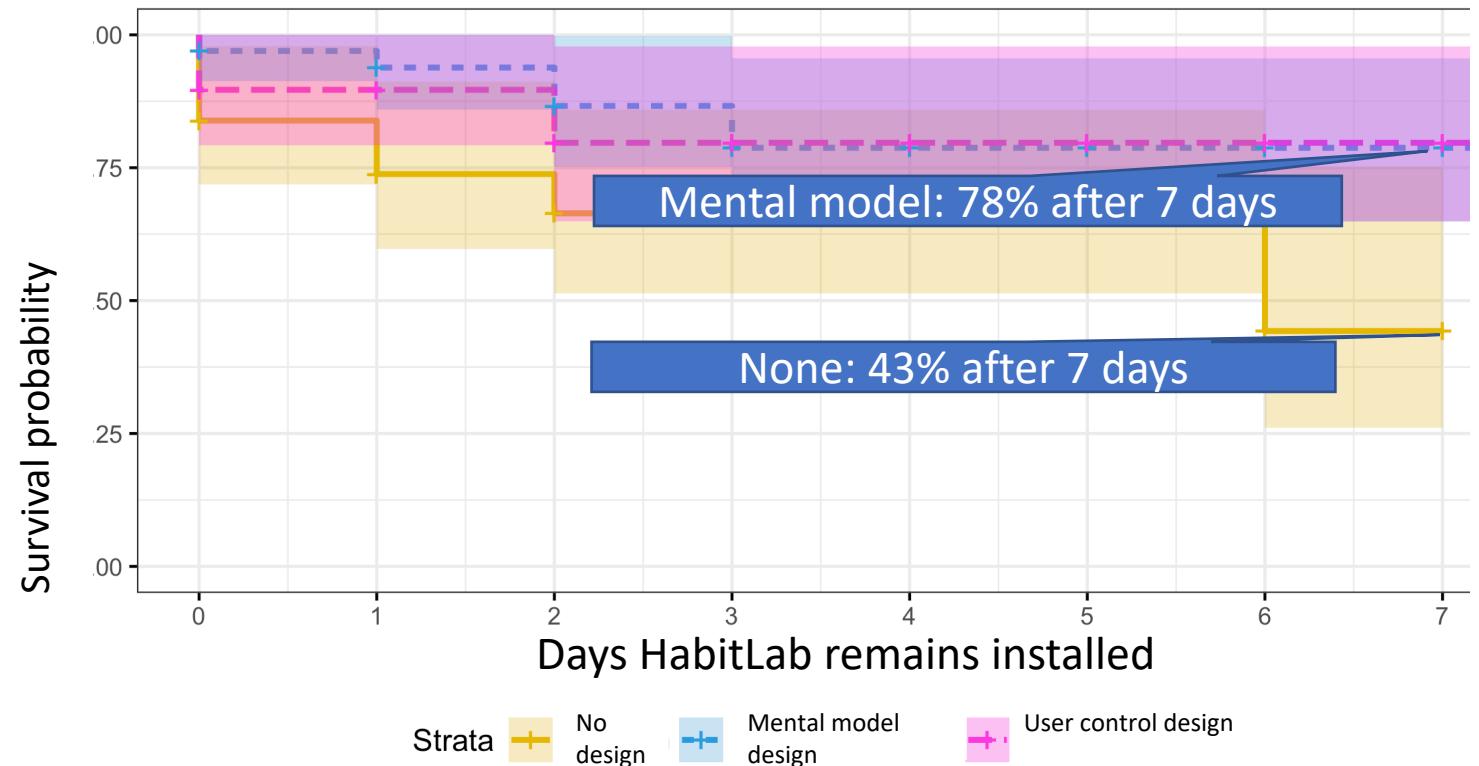
Design	Log hazard ratio
Mental model	-1.015 (p < 0.05)
User control	-0.869

# Mental model design reduces attrition by half



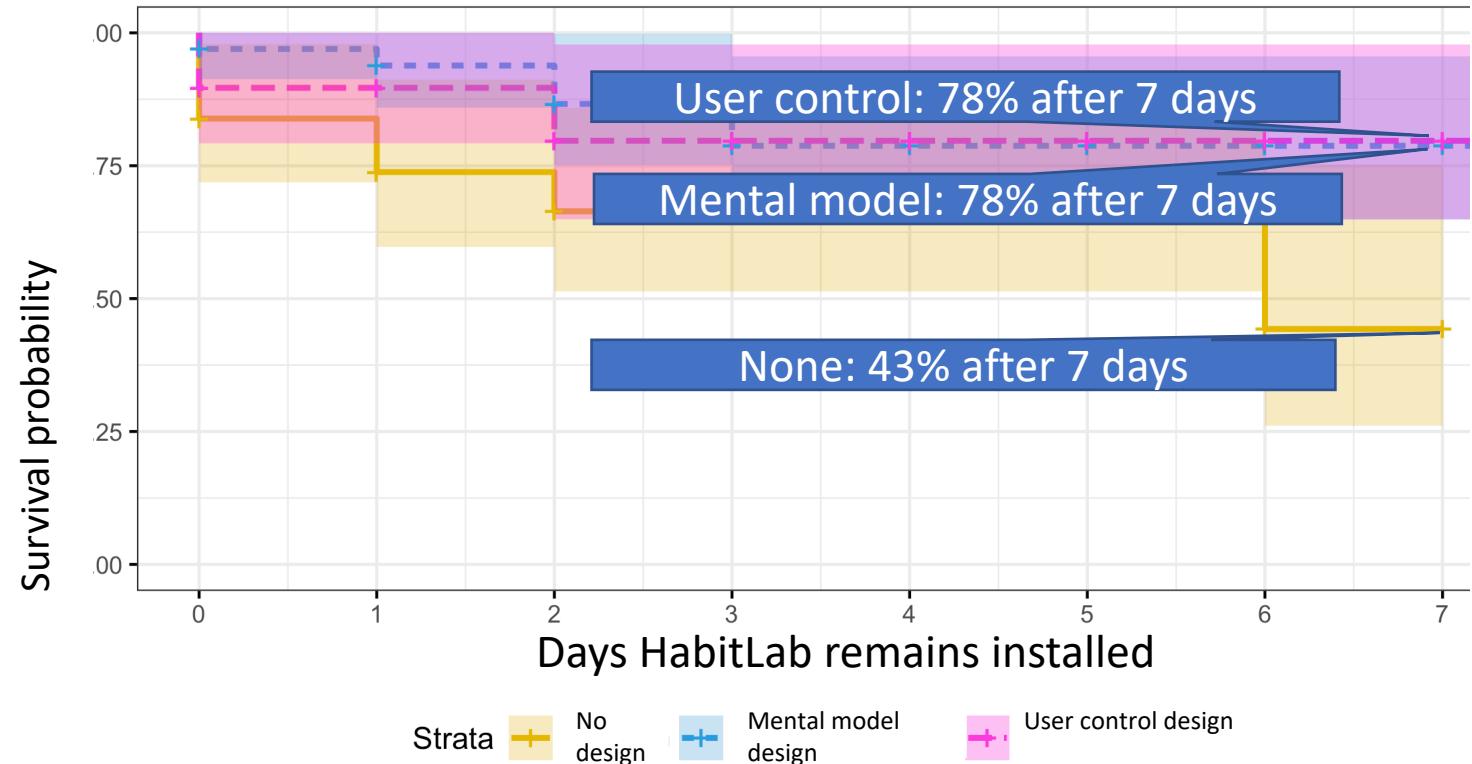
Design	Log hazard ratio
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User control	-0.869

# Mental model design reduces attrition by half



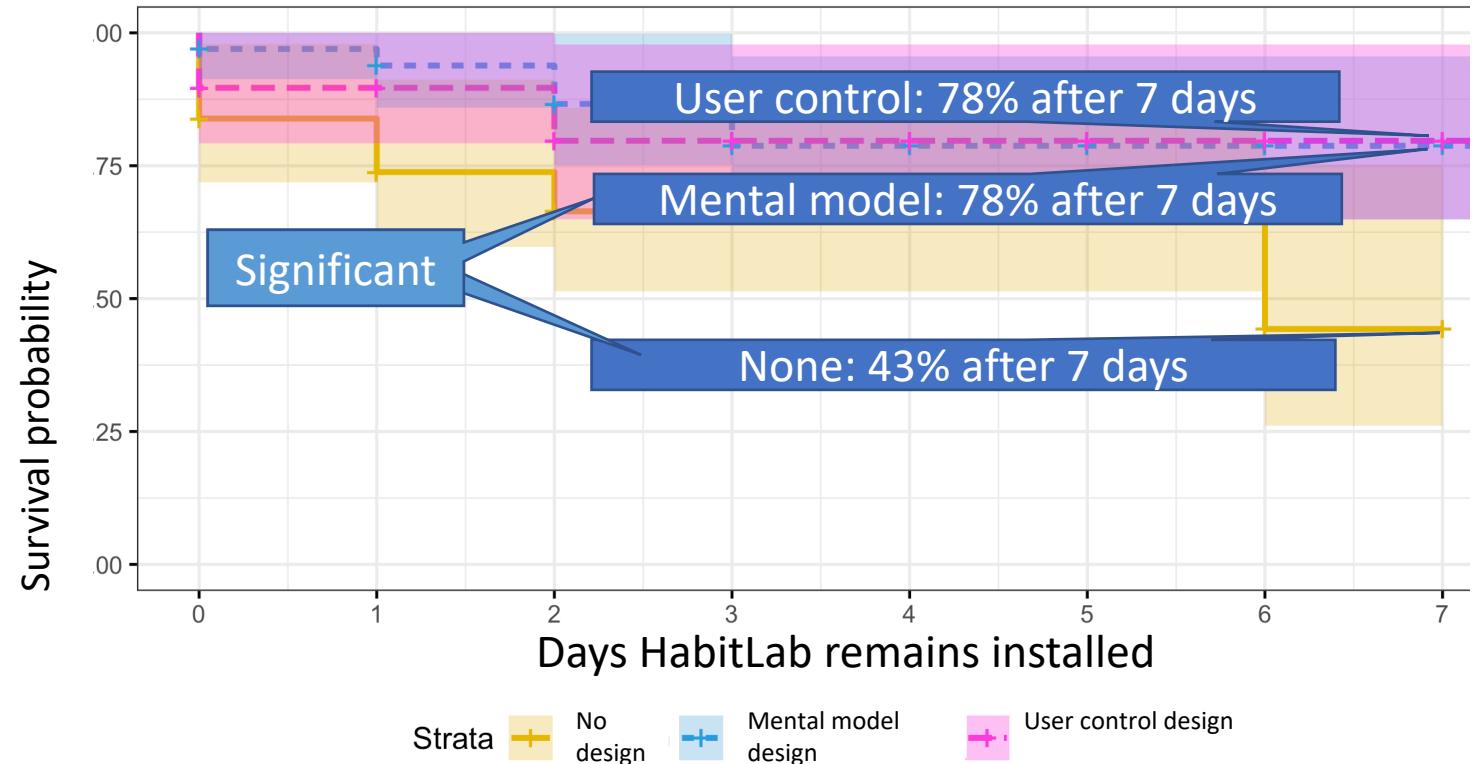
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# Mental model design reduces attrition by half



Design	Log hazard ratio
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# Mental model design reduces attrition by half



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## HabitLab: Our in-the-wild behavior change platform

### Outcomes

Does effectiveness remain constant over time?

What externalities exist?

### Interventions

How do users' preferences change over time?

### Rotating vs static intervention strategies

#### Study 1: Within subjects

- Rotating interventions improves effectiveness but increases attrition

#### Study 2: Between subjects

- Rotation itself causes attrition

### Qualitative feedback

- Rotation violates mental models

#### Study 3: Improving users' mental models about rotating interventions

- Our design halves attrition

## HabitLab: Our in-the-wild behavior change platform

### Outcomes

Does effectiveness remain constant over time?

What externalities exist?

### Interventions

How do users' preferences change over time?

*Rotating Online Behavior Change Interventions Increases Effectiveness But Also Increases Attrition (CSCW 2018)*

- Static interventions decline in effectiveness over time
- Rotating interventions improves effectiveness but increases attrition
- Attrition may be due to incorrect mental models and lack of control
- We can reduce attrition with a simple design that improves users' mental models

## HabitLab: Our in-the-wild behavior change platform

### Outcomes

Does effectiveness remain constant over time?

What externalities exist?

### Interventions

How do users' preferences change over time?

*Conservation of Procrastination: Do Productivity Interventions Save Time or Just Redistribute It? (CHI 2019)*

Users use productivity tools to help them reduce time online



Is that time actually saved, or just redirected  
to other unproductive activities?

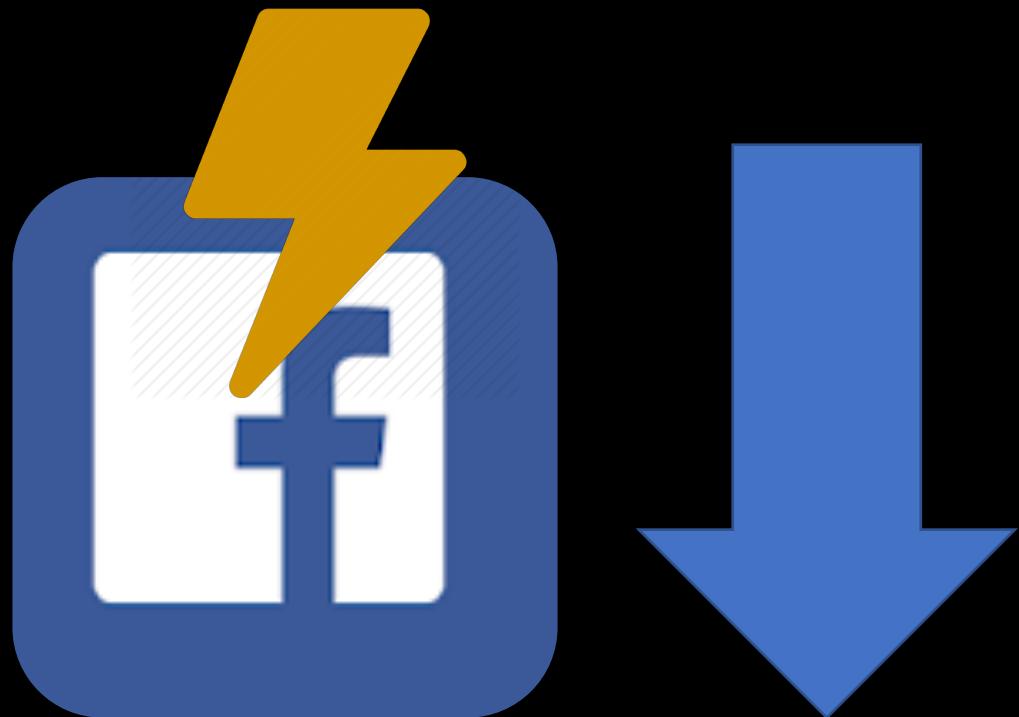
We often assume that intervention effects  
are isolated



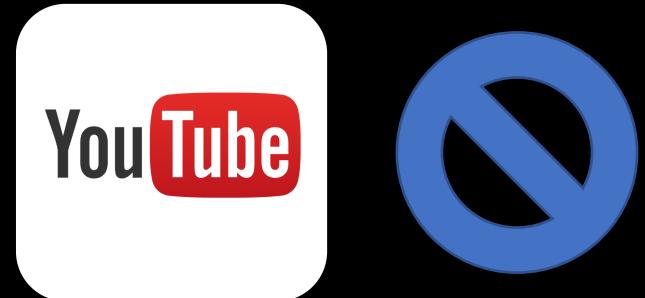
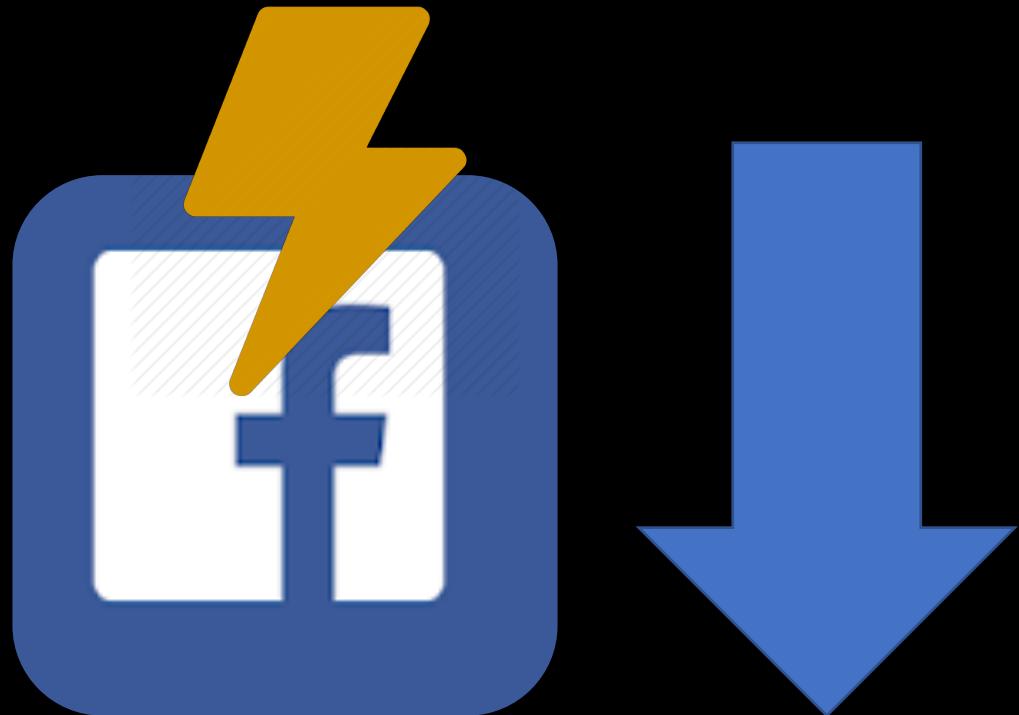
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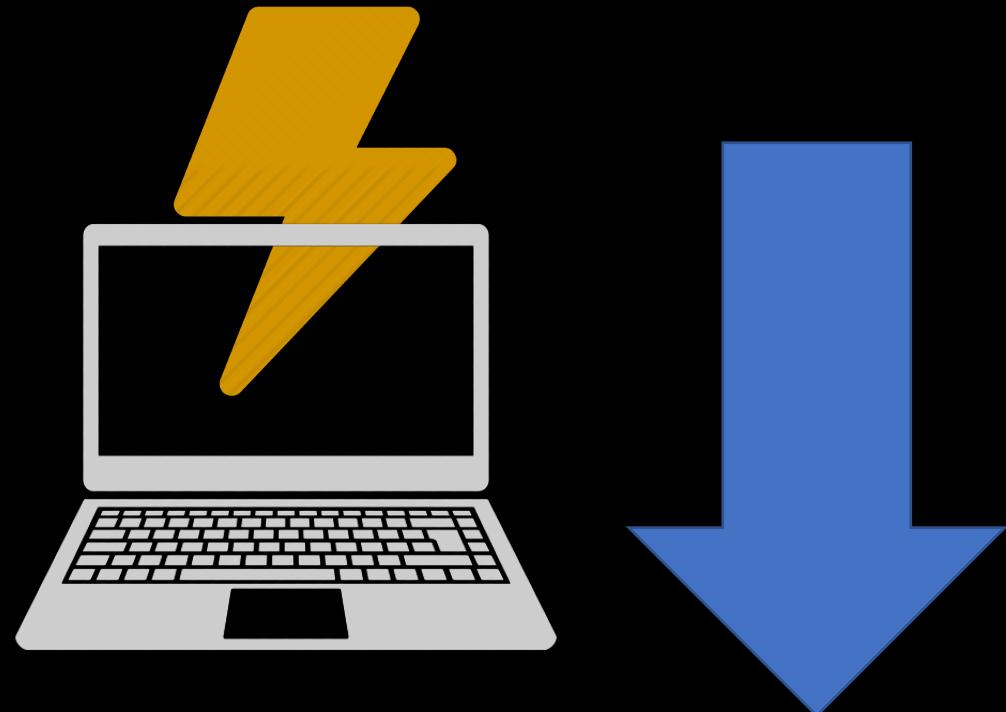
We often assume that intervention effects  
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We often assume that intervention effects  
are isolated



We often assume that intervention effects  
are isolated



What if the time you saved is just shifted elsewhere?

We have a  
limited  
supply of  
willpower

We need breaks  
and downtime

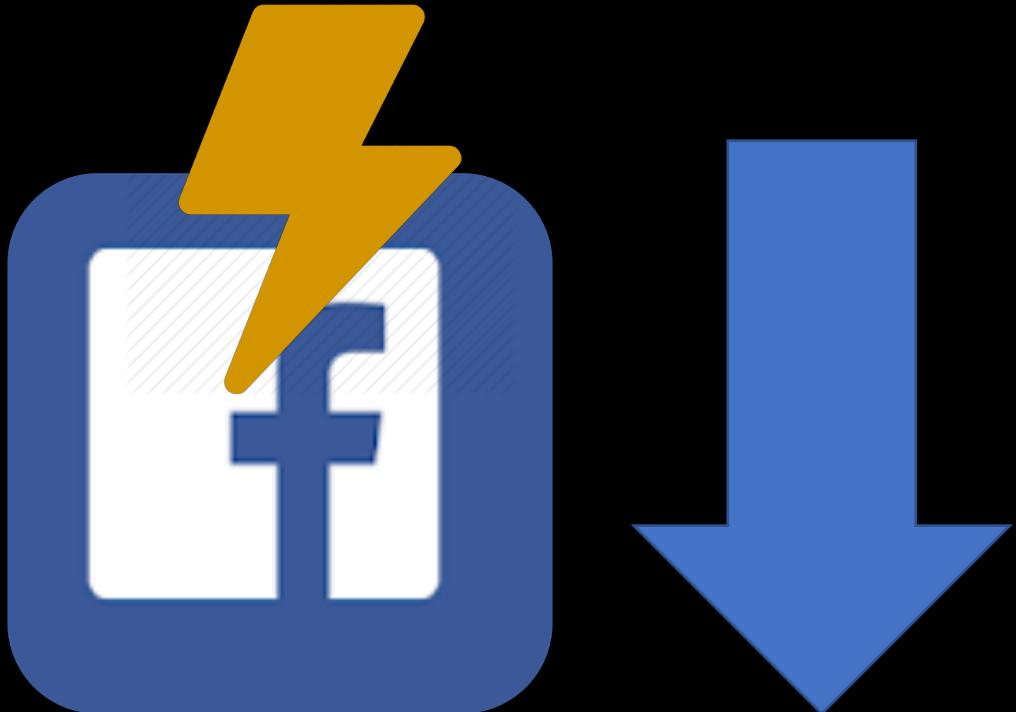


Laura Dabbish, Gloria Mark, and Víctor M González. 2011. Why do I keep interrupting myself?: Environment, Habit and Self-interruption. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. ACM, 3127–3130.

Roy E Baumeister, Ellen Bratslavsky, Mark Muraven, and Dianne M Tice. 1998. Ego Depletion: Is the Active Self a Limited Resource? *Journal of Personality and Social Psychology* 74, 5 (1998), 1252–1265.

# Is there a conservation-of-procrastination effect?

Does reducing time on one site or app increase time on others?



# Is there a conservation-of-procrastination effect?

Does reducing time on one device increase time on others?

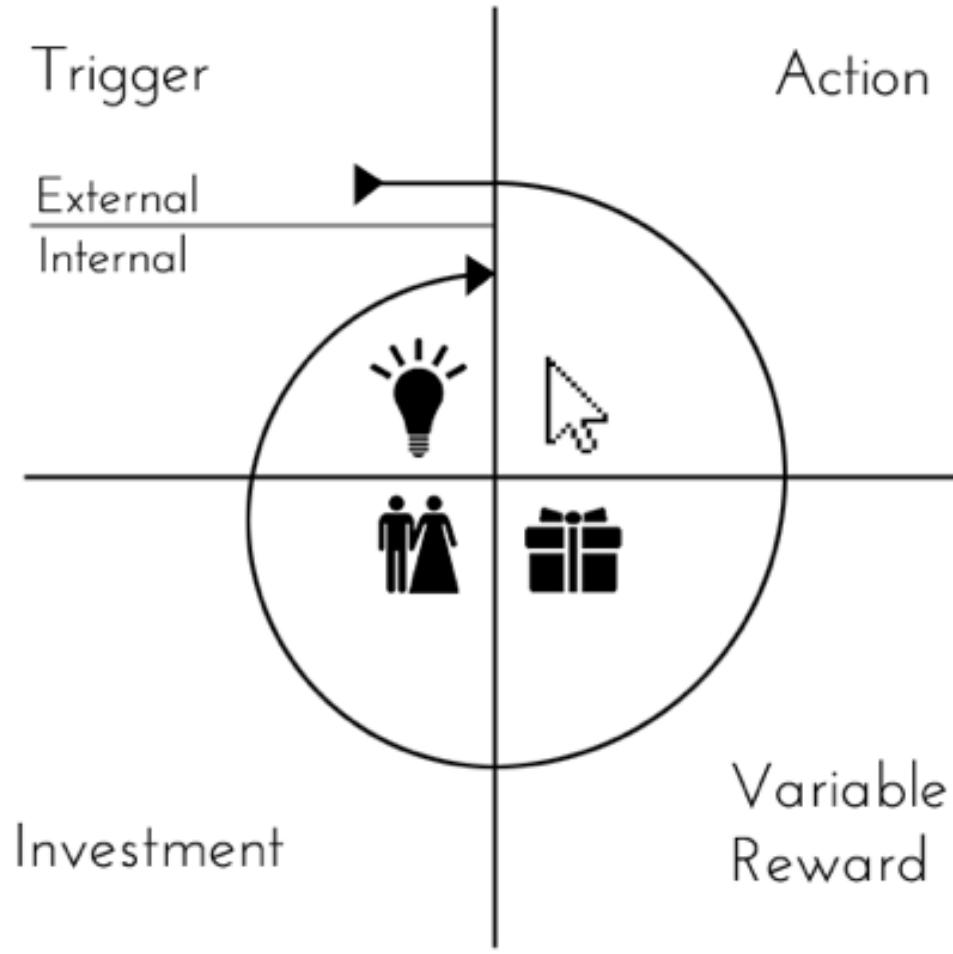


Do interventions have benefits outside the apps they were targeting?

# The Hook

Apps are designed to be habit-building

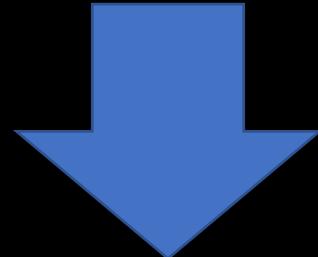
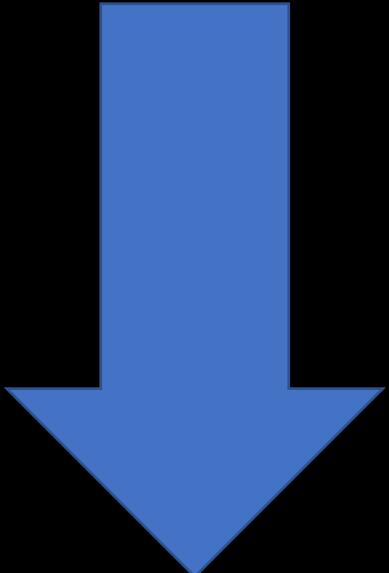
Results in habit loop of constantly visiting sites or checking phones



COPYRIGHT NIR EYAL

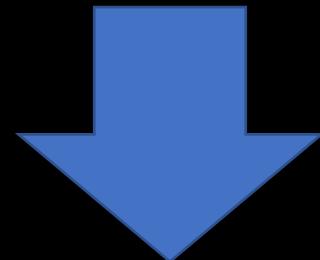
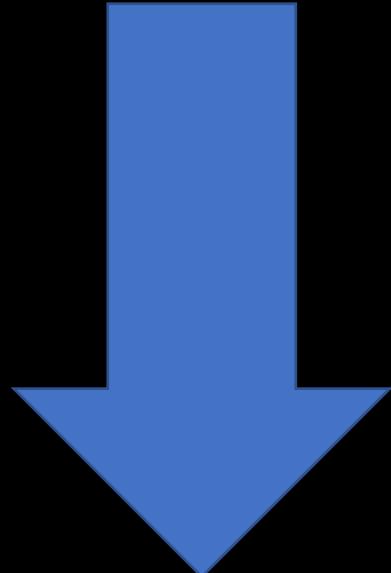
Does breaking habit loops result in further decreases in time spent elsewhere?

Does reducing time on one app or site decrease time on others?



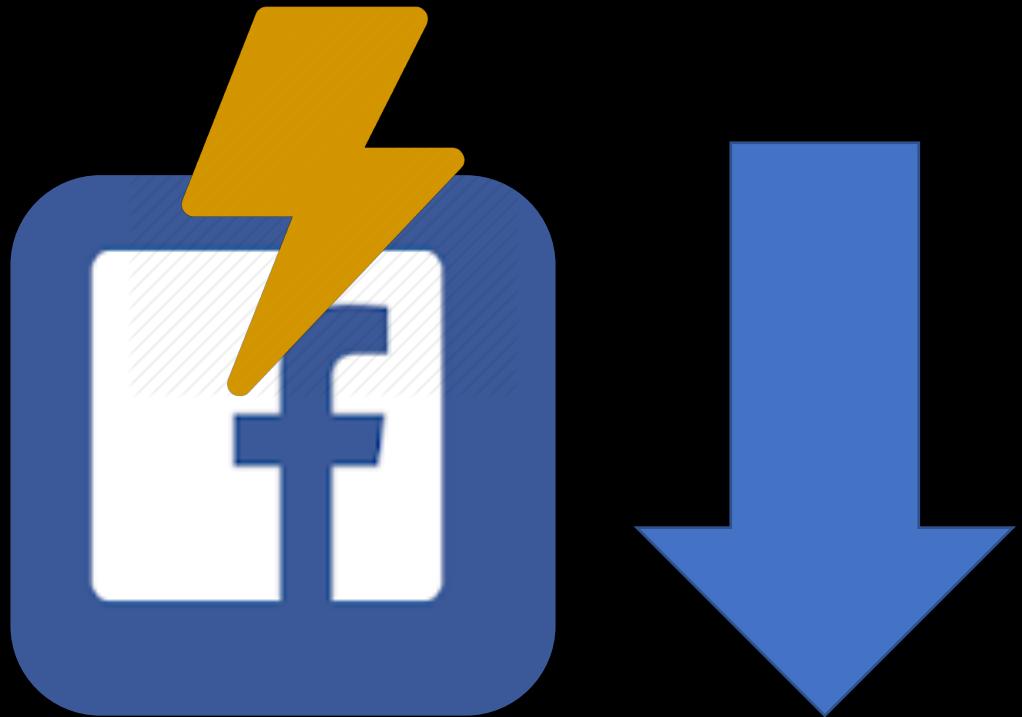
Does breaking habit loops result in further decreases in time spent elsewhere?

Does reducing time on one device decrease time on the other?

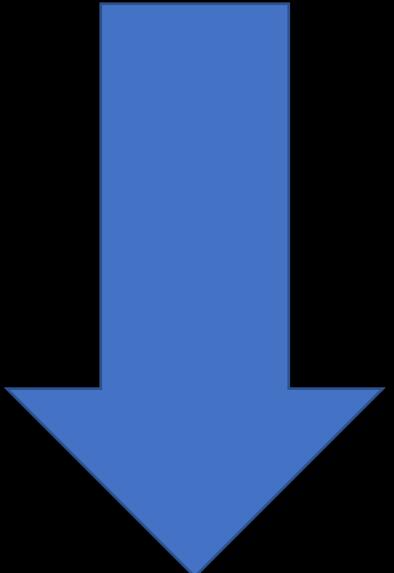


RQ1: Do interventions on one site or app influence time spent on other sites and apps?

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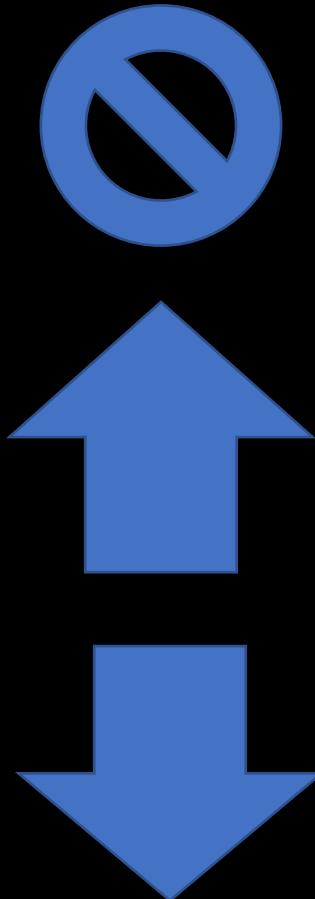
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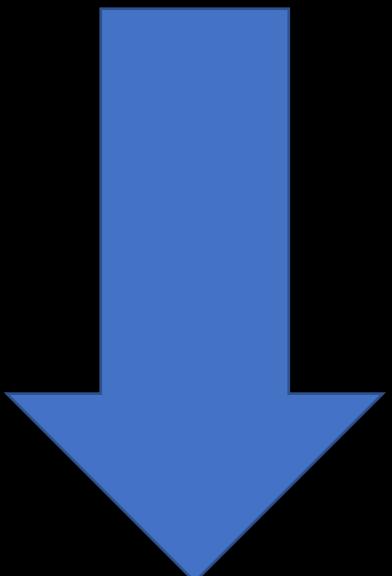
Isolation

Redistribution

Reduction



# RQ2: Do interventions on one device influence time spent on other devices?



Isolation



Redistribution



Reduction



## HabitLab: Our in-the-wild behavior change platform

### Outcomes

Does effectiveness remain constant over time?

What externalities exist?

### Interventions

How do users' preferences change over time?

## *Conservation of Procrastination: Do Productivity Interventions Save Time or Just Redistribute It? (CHI 2019)*

Are interventions effective at reducing time on the focal goal?

RQ1: Is time redistributed to other sites on the same platform?

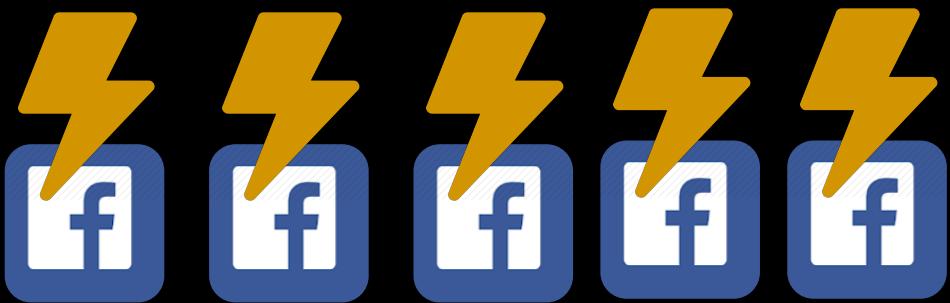
RQ2: Is time redistributed across devices?

# Are interventions effective? (Method)

For each goal, we randomly assign it to one of 2 conditions each week:

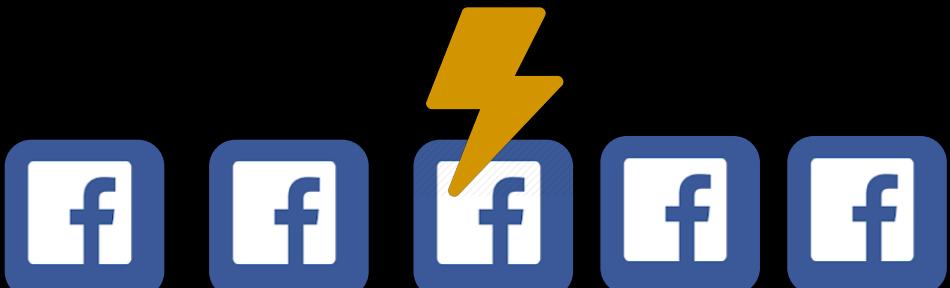
## Frequent

An intervention is shown every visit  
(each site visit for browser, each app visit on android)



## Infrequent

An intervention is shown on 20% of visits



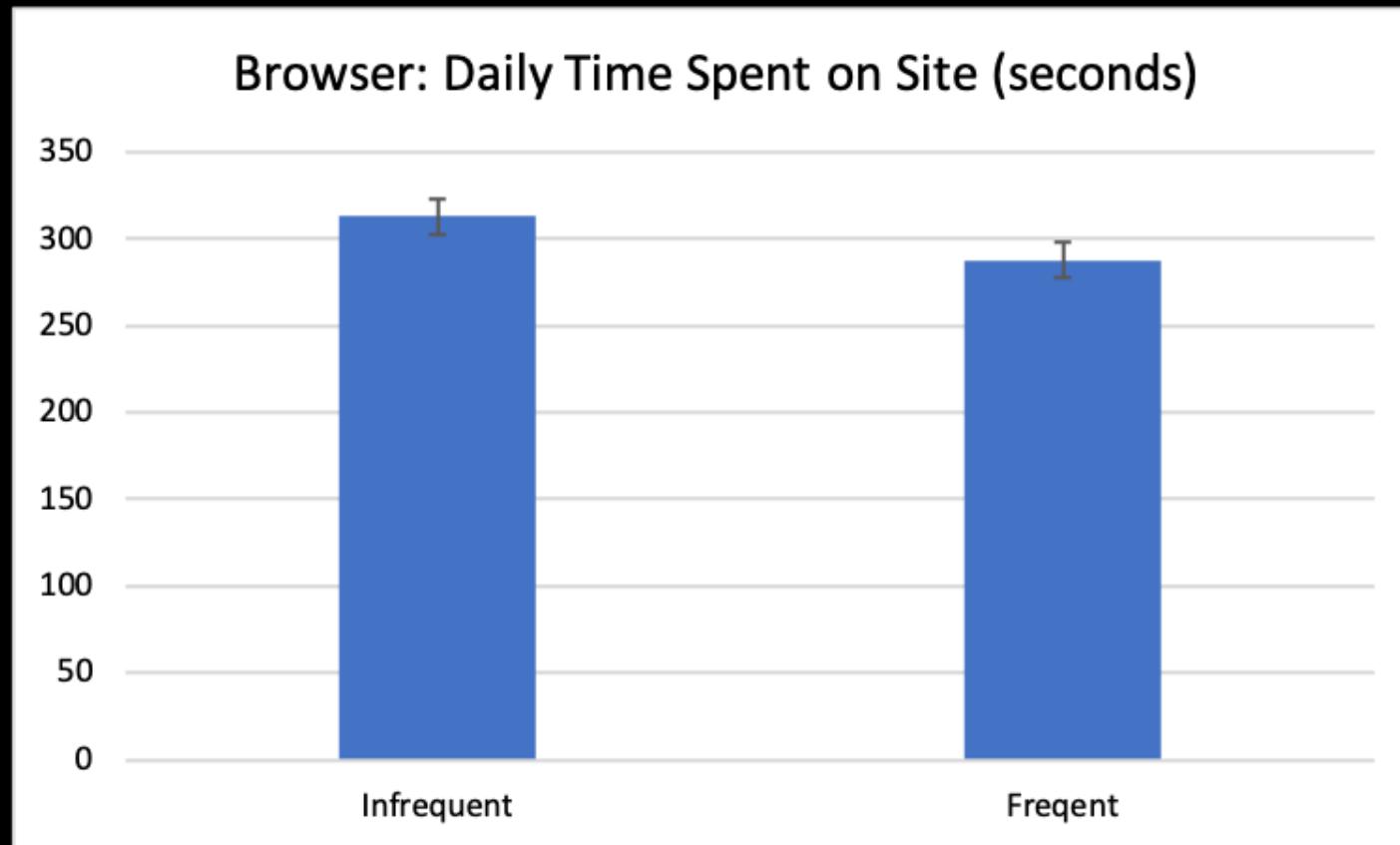
# Are interventions effective? (Method)

- Compare daily time spent on days in the frequent vs infrequent conditions, for each goal

# Are interventions effective? (Method)

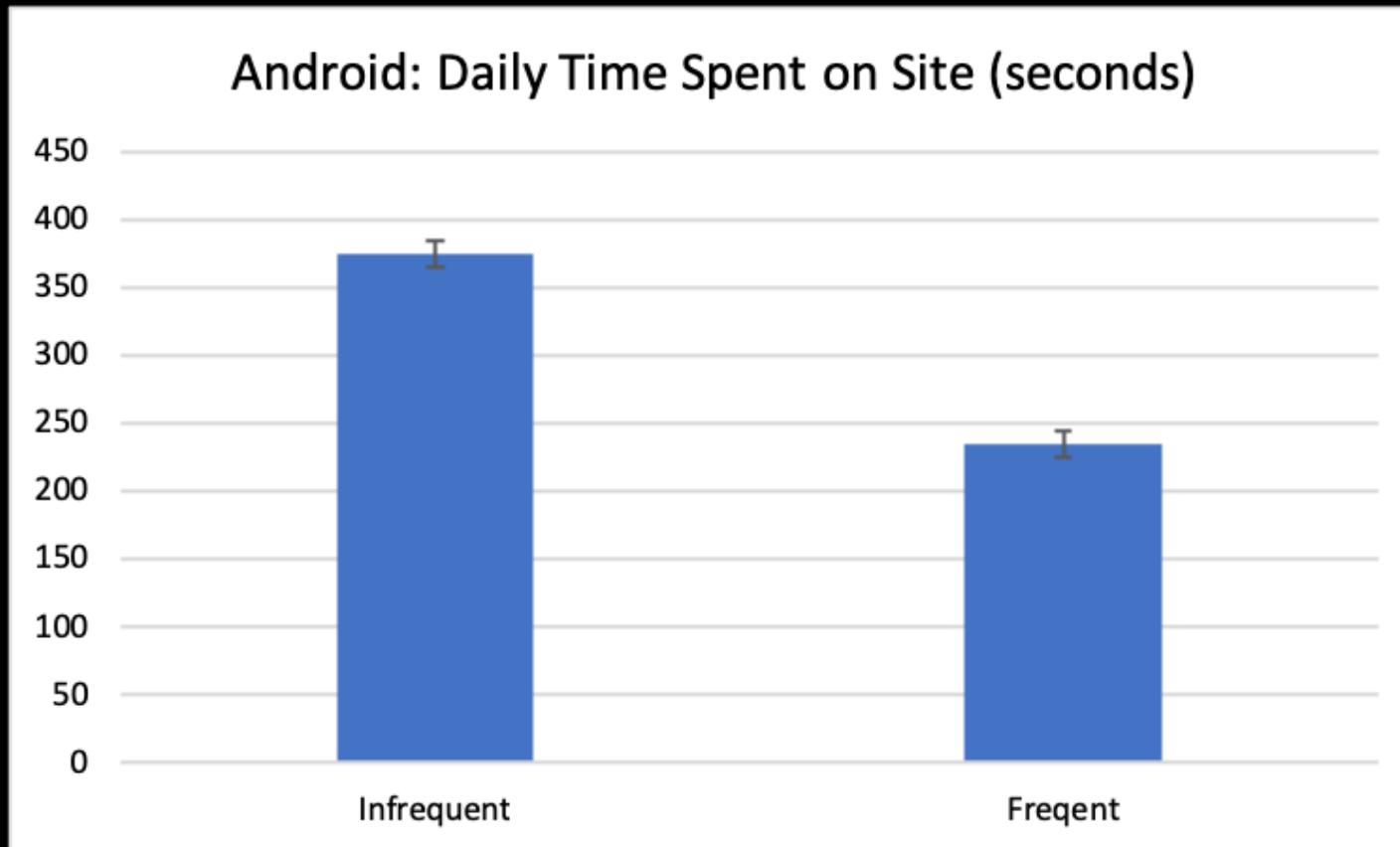
- Compare daily time spent on days in the frequent vs infrequent conditions, for each goal
- 5.8 weeks with 1034 users on browser ( $n=22,462$  days), and 876 users on mobile ( $n=26,273$  days)

# Interventions are effective on both platforms



7.3% reduction in daily time spent on browser version, on frequent weeks. Statistically significant ( $p < 0.001$ )

# Interventions are effective on both platforms



37.2% reduction in daily time spent on android version, on frequent weeks. Statistically significant ( $p < 0.001$ )

## HabitLab: Our in-the-wild behavior change platform

### Outcomes

Does effectiveness remain constant over time?

What externalities exist?

### Interventions

How do users' preferences change over time?

Are interventions effective at reducing time on the focal goal?

- Effective on both browser + mobile

RQ1: Is time redistributed to other sites on the same platform?

RQ2: Is time redistributed across devices?

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RQ1: Is time redistributed to other sites on the same platform?

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# Is time redistributed within platform? (Method)

We developed a metric of how intense interventions are this day (intensity)

- Percentage of sessions on a goal that triggered an intervention

# Is time redistributed within platform? (Method)

We developed a metric of how intense interventions are this day (intensity)

- Percentage of sessions on a goal that triggered an intervention.
- E.g. if visited Facebook 10x, and saw 0 interventions, then intensity=0

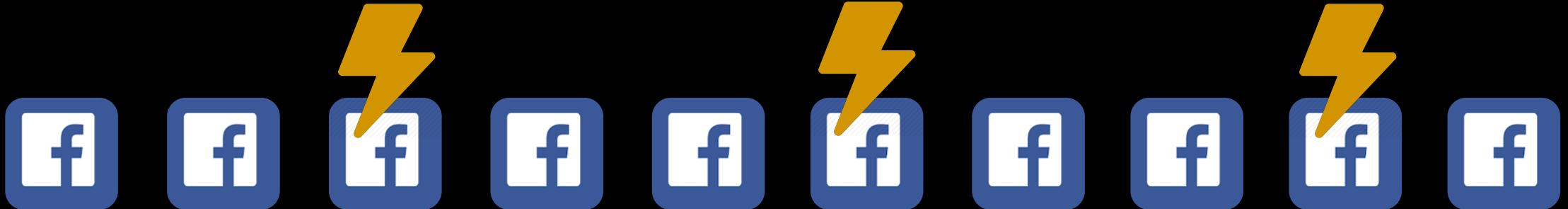


Intensity=0

# Is time redistributed within platform? (Method)

We developed a metric of how intense interventions are this day (intensity)

- Percentage of sessions on a goal that triggered an intervention.
- E.g. if visited Facebook 10x, and saw 3 interventions, then intensity=0.3

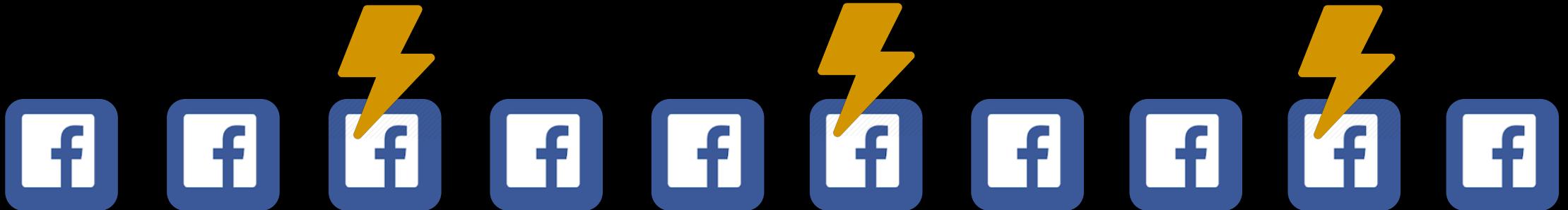


Intensity=0.3

# Is time redistributed within platform? (Method)

We developed a metric of how intense interventions are this day (intensity)

- Percentage of sessions on a goal that triggered an intervention.
- Verified that on days where intensity is higher, overall total time on goal sites is significantly lower on both platforms



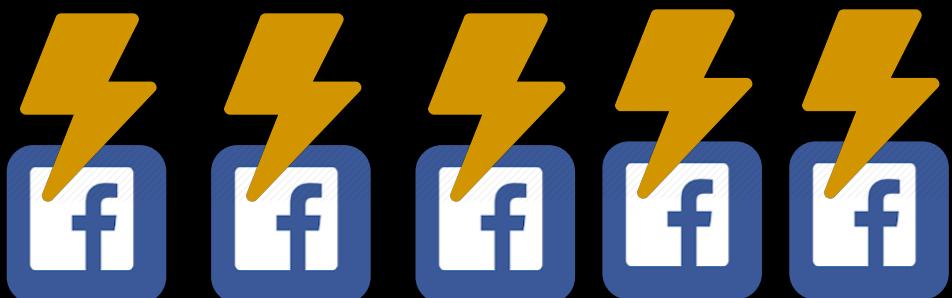
Intensity=0.3

# Is time redistributed within platform? (Method)

To manipulate intensity, we randomly assign each goal to have either frequent or infrequent interventions each week, resulting in a continuous intensity value from 0 to 1

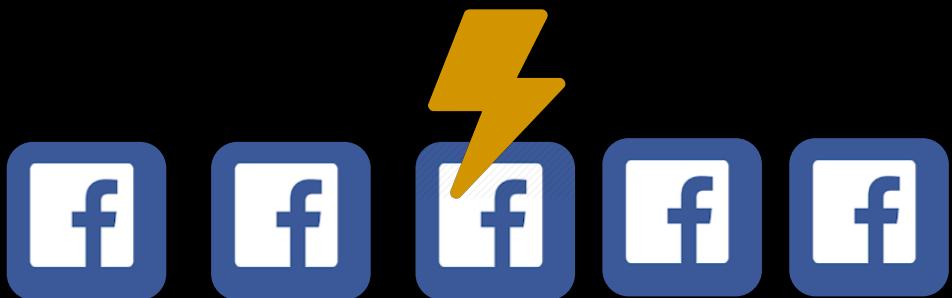
## Frequent

An intervention is shown every visit  
(each site visit for browser, each app visit on android)



## Infrequent

An intervention is shown on 20% of visits

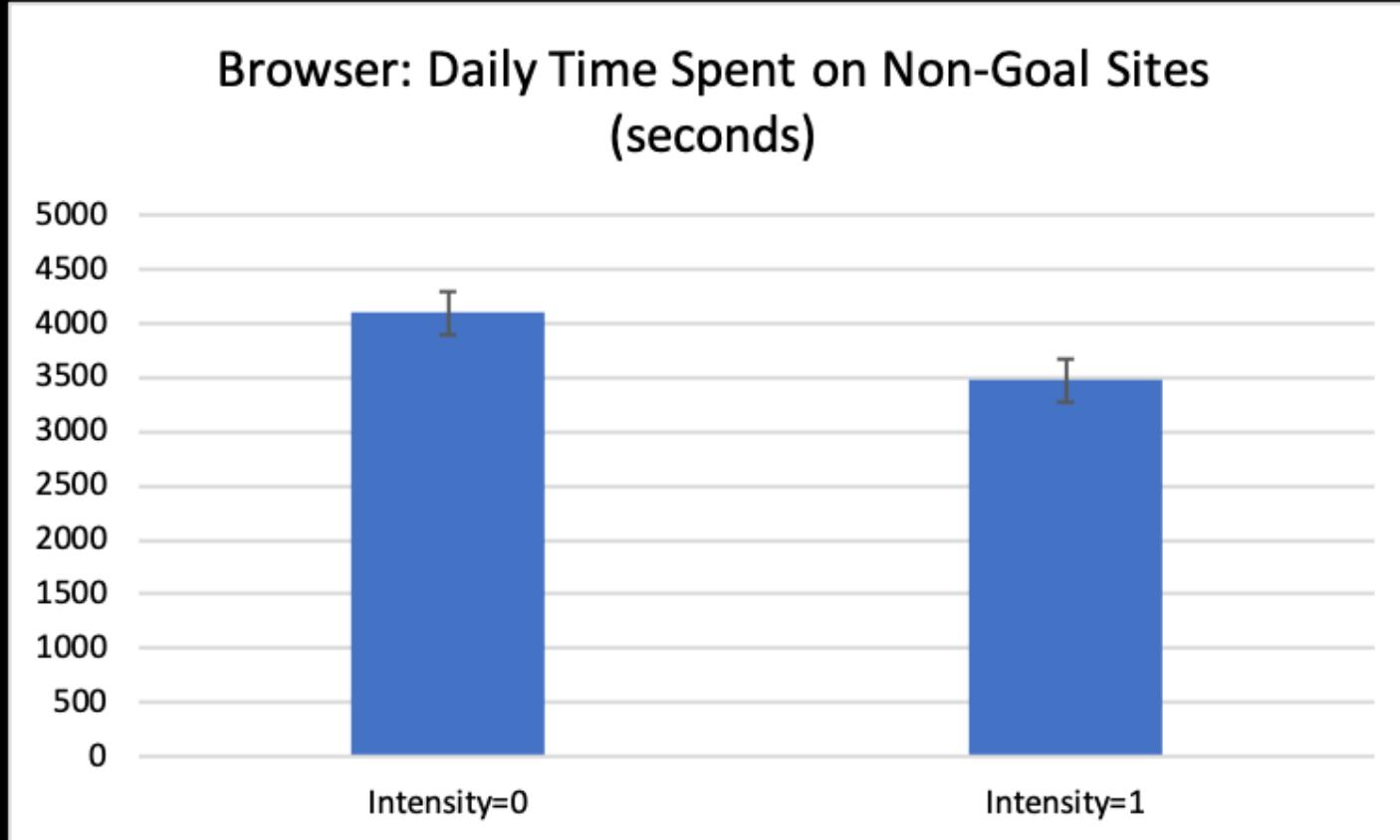


# Is time redistributed within platform? (Method)

On days when intensity is higher, what is the effect on the time spent on non-goal apps and sites?

LMM (Linear Mixed Model) structure	
Dependent variable	Total time on non-goal sites (log)
Fixed effects	Intensity
Random effects	User

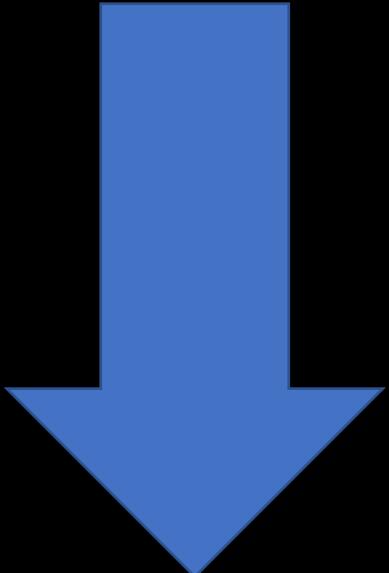
# Browser: reduction of time spent on other sites when intensity is higher



15% reduction in time spent when intensity increases from 0→1 ( $p < 0.0001$ )

Mobile: No significant effect of time on one app on other apps

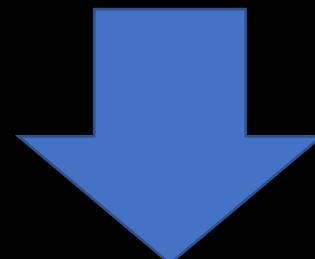
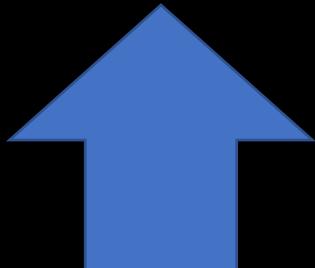
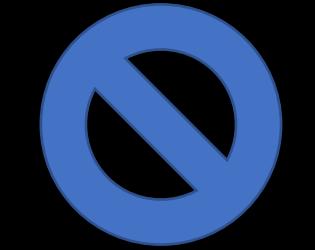
# RQ1: Do interventions on one site/app influence time spent on other sites/apps?



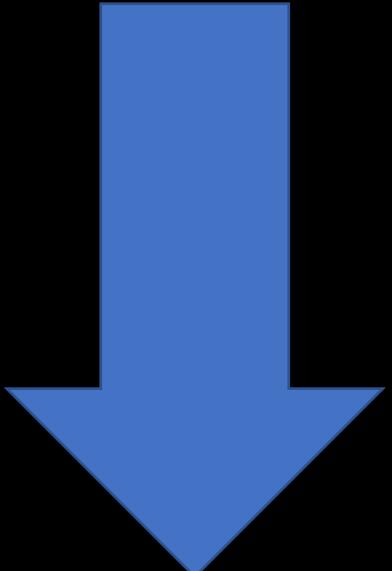
Isolation

Conservatio  
n

Reduction



# RQ1: Do interventions on one site/app influence time spent on other sites/apps?

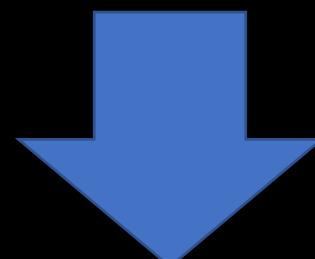
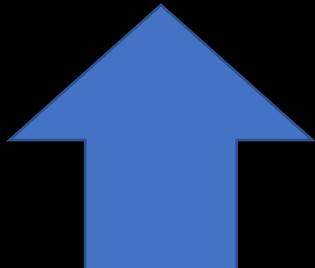
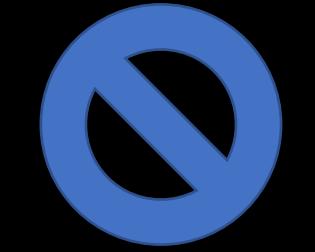


Isolation

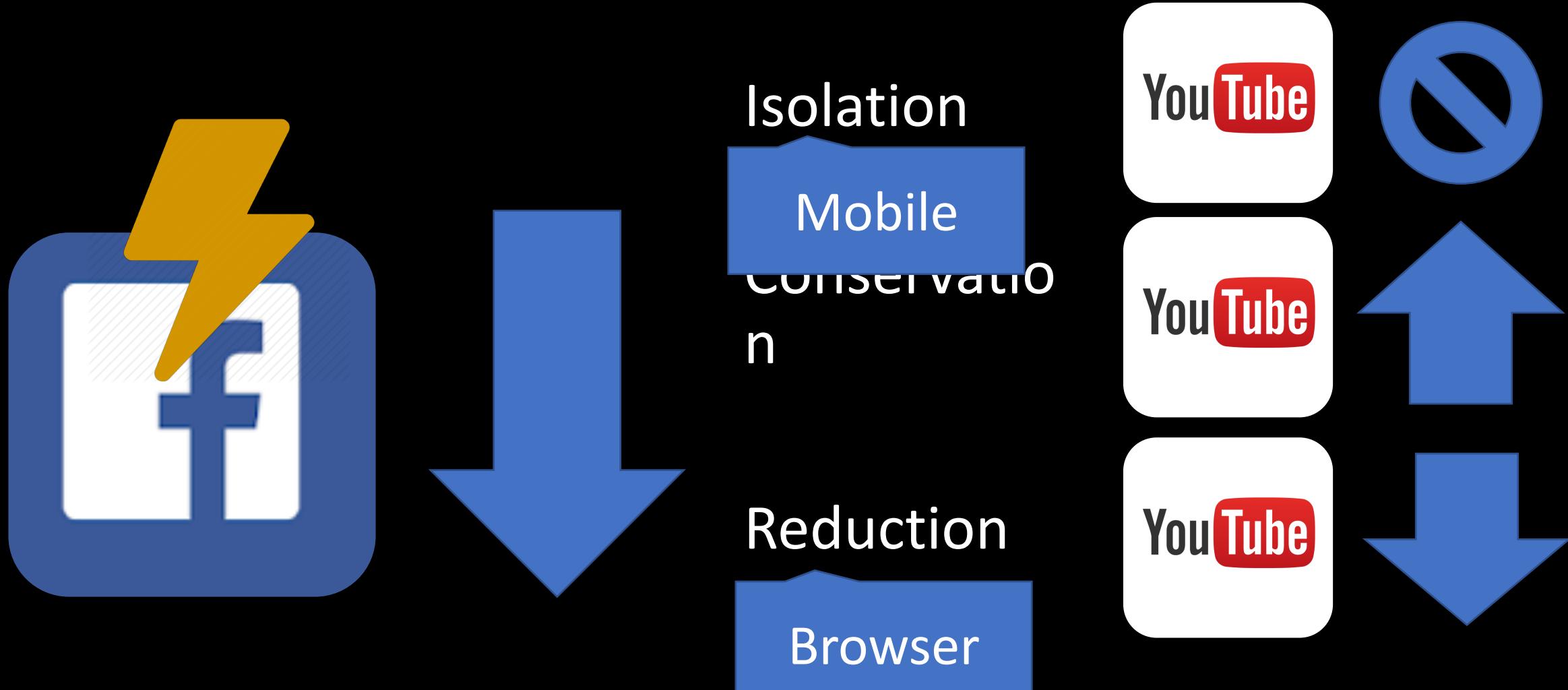
Conservatio  
n

Reduction

Browser



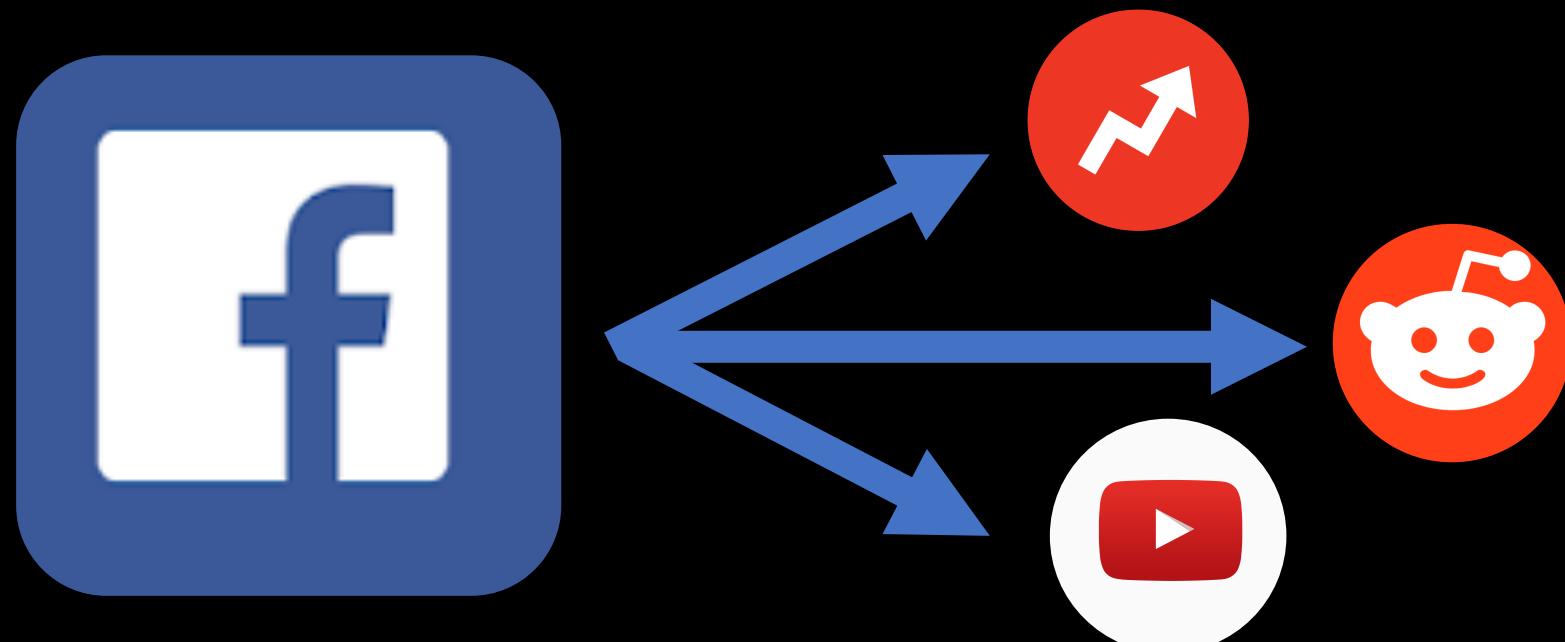
# RQ1: Do interventions on one site/app influence time spent on other sites/apps?



# Why was there a reduction effect on browser?

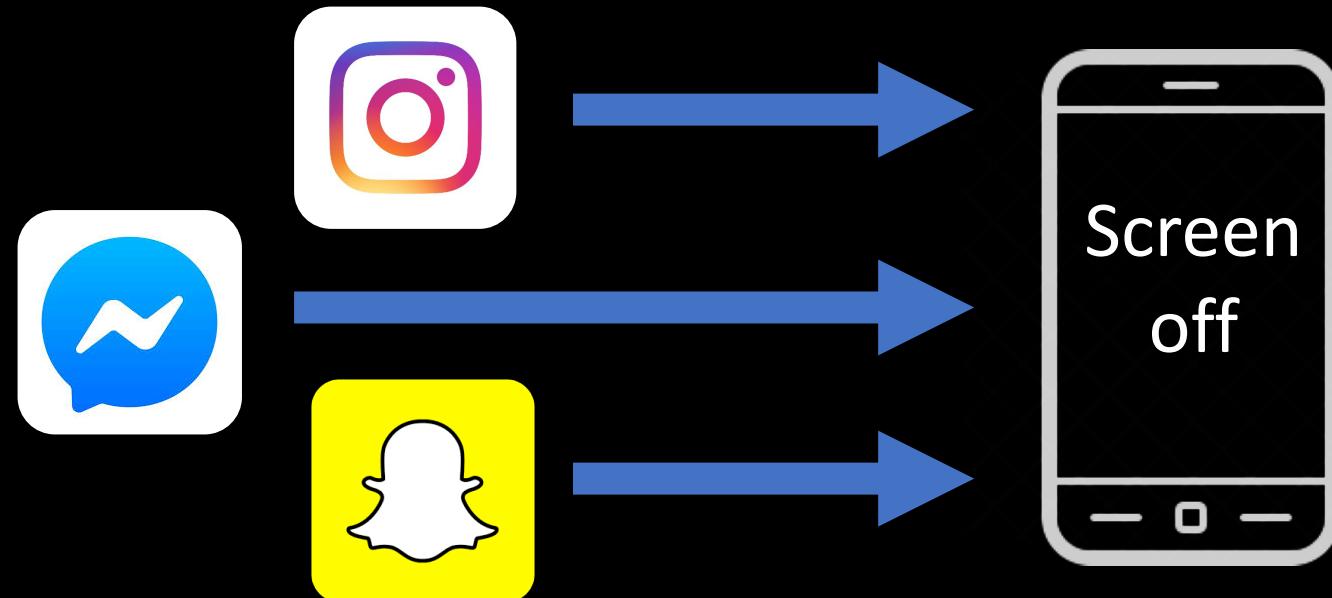
Aggregator sites such as Facebook often link to other domains

By reducing visits and time on Facebook, we reduce time on other domains



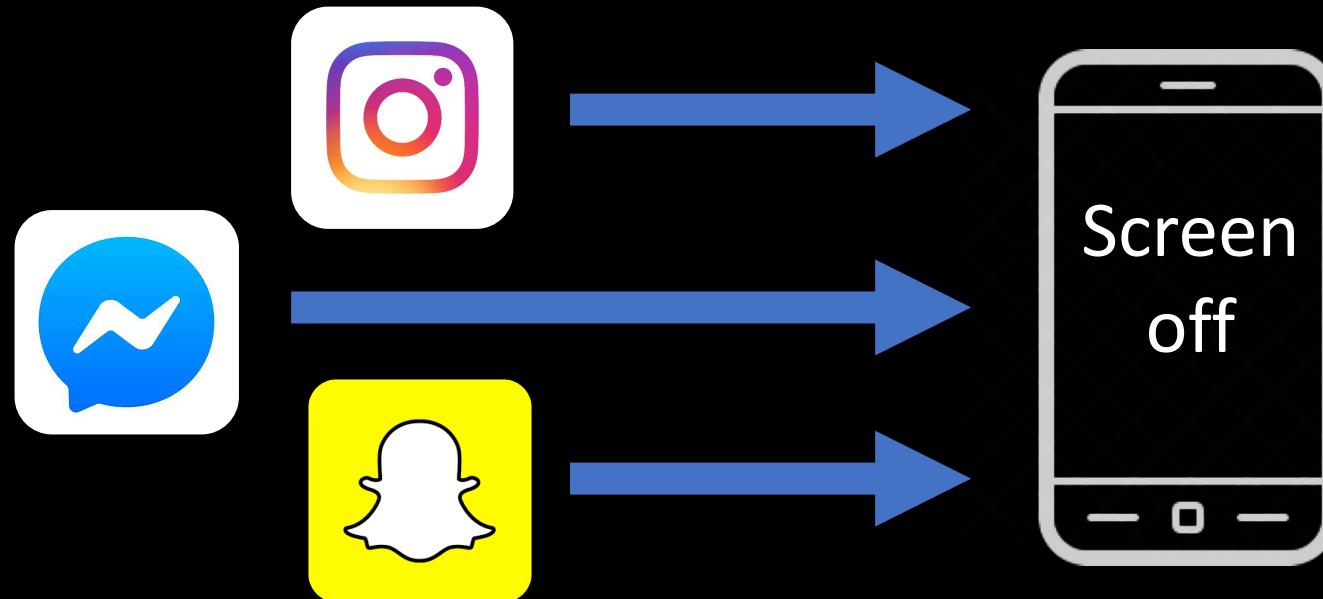
# Why was there no effect on mobile?

Mobile goal apps were mostly messaging-oriented, not aggregators  
Sessions were short and followed by turning off the screen



# Why was there no effect on mobile?

Many mobile apps such as Facebook embed an in-app browser, so visiting external links remains within the same app



## HabitLab: Our in-the-wild behavior change platform

### Outcomes

Does effectiveness remain constant over time?

What externalities exist?

### Interventions

How do users' preferences change over time?

Are interventions effective at reducing time on the focal goal?

- Effective on both browser + mobile

RQ1: Is time redistributed to other sites on the same platform?

- Reducing time on one site reduces time elsewhere on browser (reduction) but not mobile (isolation)

RQ2: Is time redistributed across devices?

## HabitLab: Our in-the-wild behavior change platform

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Are interventions effective at reducing time on the focal goal?

- Effective on both browser + mobile

RQ1: Is time redistributed to other sites on the same platform?

- Reducing time on one site reduces time elsewhere on browser (reduction) but not mobile (isolation)

RQ2: Is time redistributed across devices?

# Is time redistributed across devices? (Method)

- On days when intensity is higher on one device, what is the effect on total time spent on goal sites on the other device?

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- On days when intensity is higher on one device, what is the effect on total time spent on goal sites on the other device?
- Limited to participants using HabitLab on both platforms (60 participants, n=429 days)

# Is time redistributed across devices? (Method)

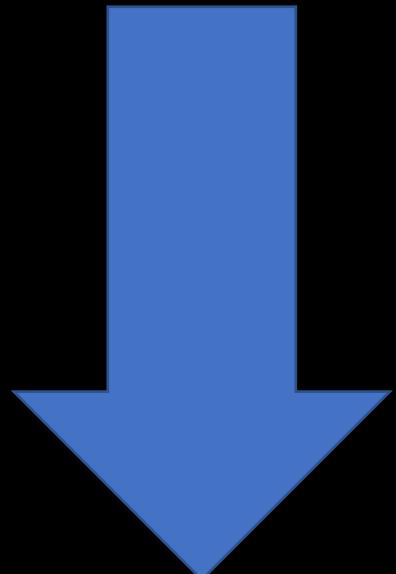
- On days when intensity is higher on one device, what is the effect on total time spent on goal sites on the other device?
- Limited to participants using HabitLab on both platforms (60 participants, n=429 days)

LMM (Linear Mixed Model) structure	
Dependent variable	Total time on other device (log)
Fixed effects	Intensity on this device
Random effects	User

# Time is not redistributed across devices

- Effects of browser intensity on mobile: No significant effect ( $p>.5$ )
- Effects of mobile intensity on browser: No significant effect ( $p>.5$ )

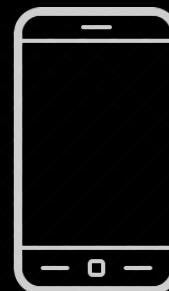
# RQ2: Do interventions on one device influence time spent on other devices?



Isolation



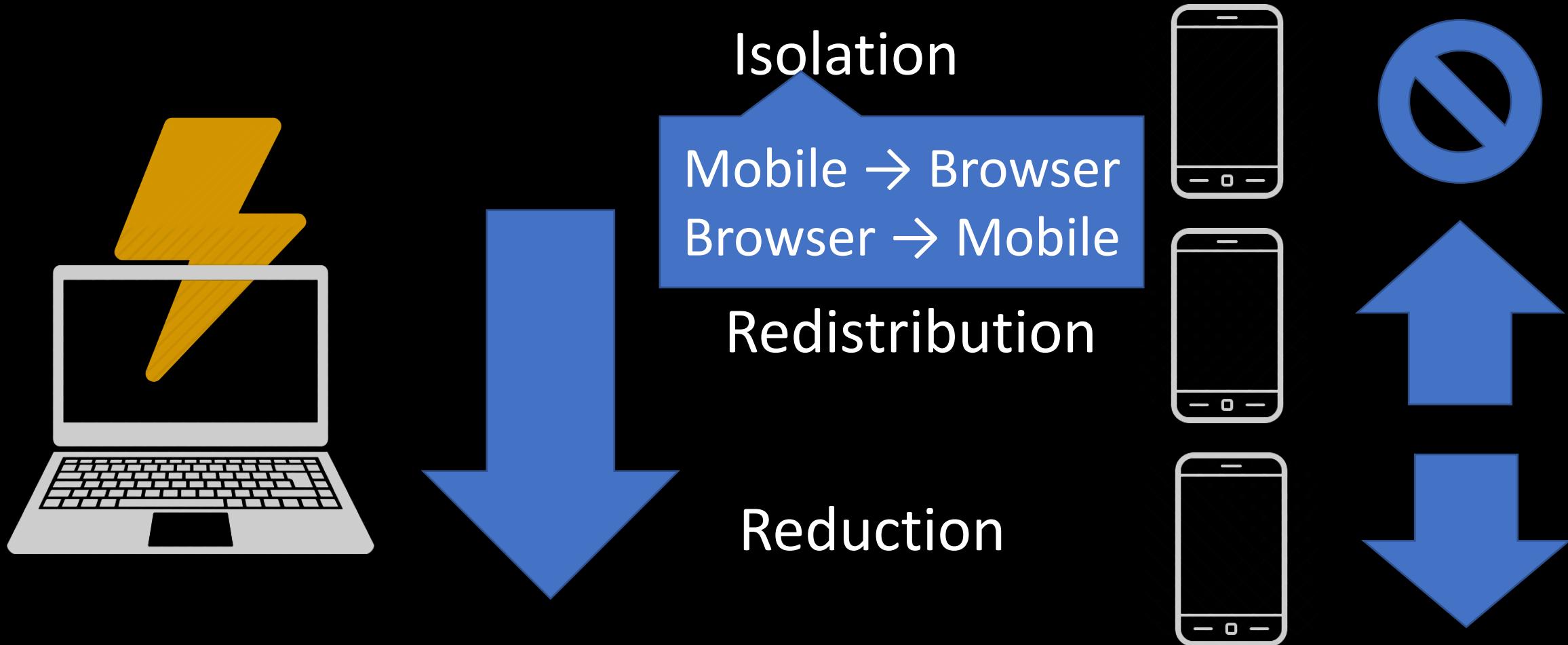
Redistribution



Reduction

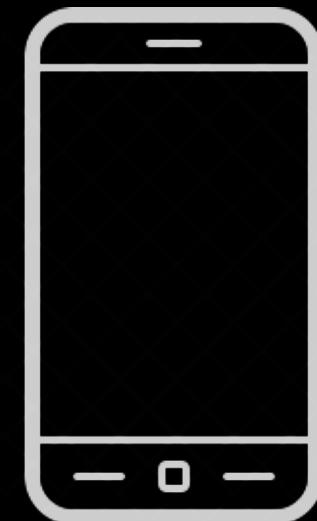
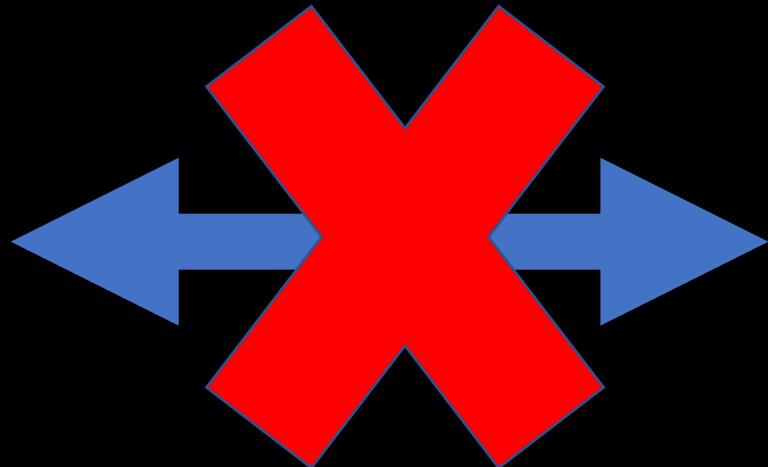
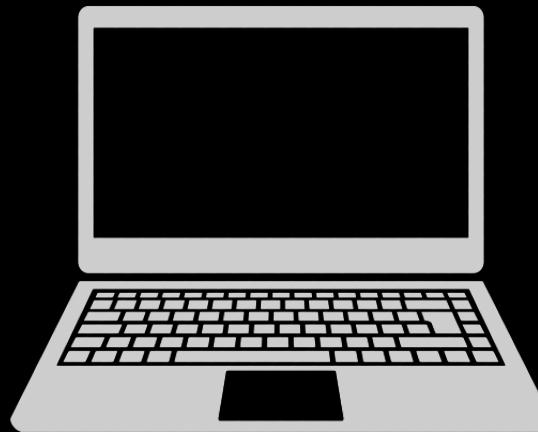


## RQ2: Do interventions on one device influence time spent on other devices?



# Why were there no cross-device effects?

- Laptops and phones are used in different contexts
- Unlike browsers, there are no cross-device “links” – few apps/sites prompt you to start using the other device



## HabitLab: Our in-the-wild behavior change platform

### Outcomes

Does effectiveness remain constant over time?

What externalities exist?

### Interventions

How do users' preferences change over time?

Are interventions effective at reducing time on the focal goal?

- Effective on both browser + mobile

RQ1: Is time redistributed to other sites on the same platform?

- Reducing time on one site reduces time elsewhere on browser (reduction) but not mobile (isolation)

RQ2: Is time redistributed across devices?

- Time is not redistributed across devices (isolation hypothesis)

# Discussion and implications

- We did not observe negative secondary effects of productivity interventions (on other apps, sites, or devices)
- On browsers, there's actually a reduction elsewhere, from reducing time on sites (likely due to aggregator sites)

# Discussion and implications

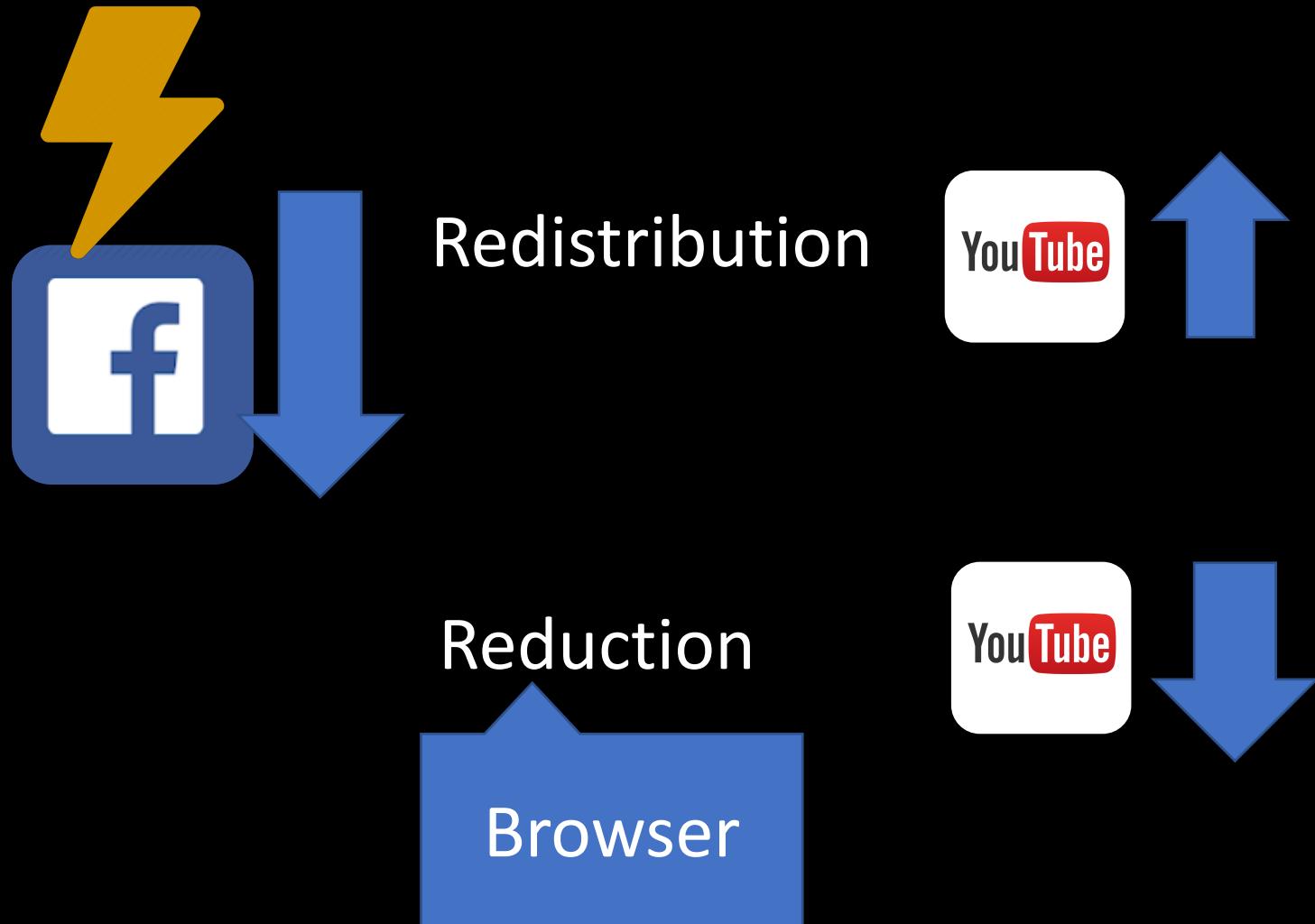
- When designing interventions, we should consider effects not just on the targeted behavior, but the workflow as a whole

# Limitations

- Only monitoring time on phones and browsers
  - Cannot observe if time is being redistributed to non-digital activities
- Only studied productivity domain
  - “Absence of negative secondary effects” may not generalize to other behavior change domains

- Does reducing time via interventions influence time spent elsewhere?

- Does reducing time via interventions influence time spent elsewhere?
- Within-device: reduction on browser



- Does reducing time via interventions influence time spent elsewhere?
- Within-device: reduction on browser, but not mobile



Isolation

Mobile

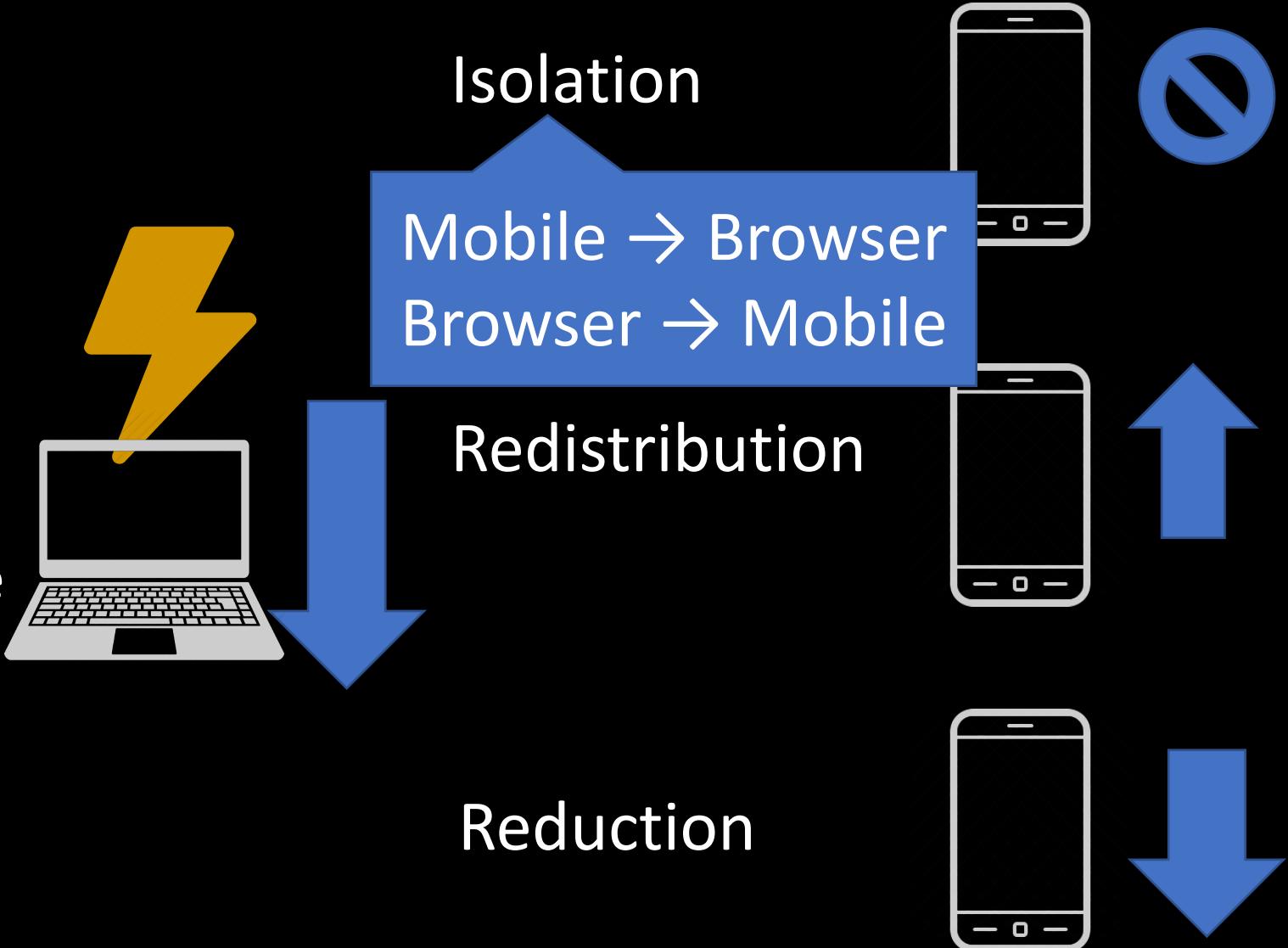
Redistribution

Reduction

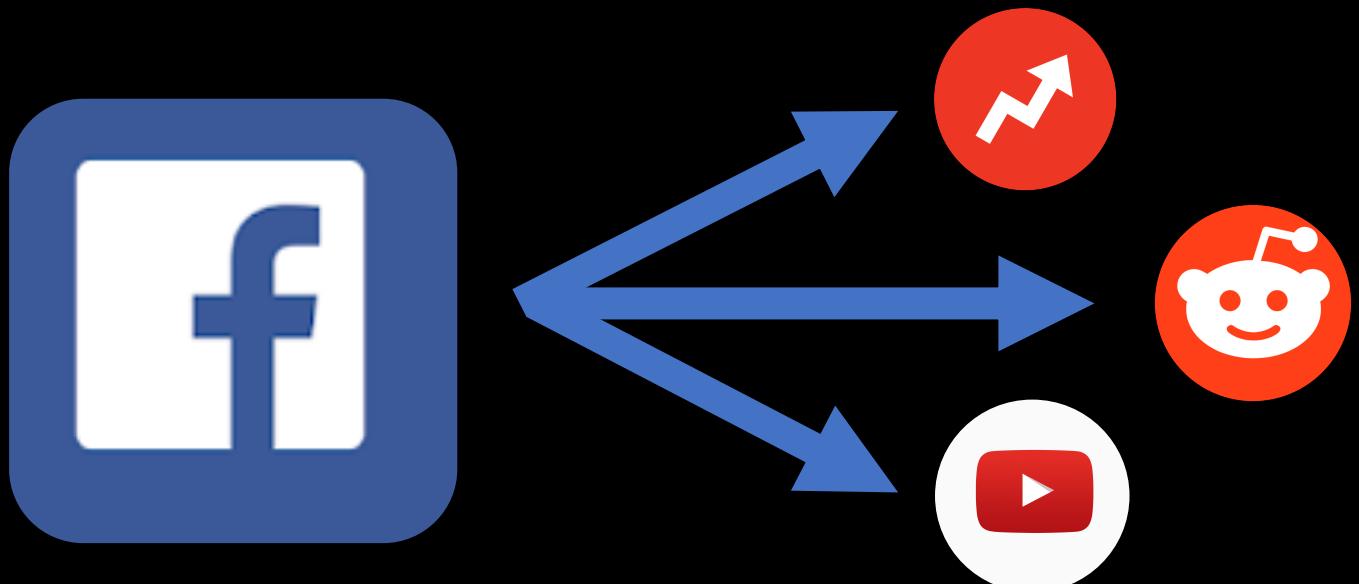
Browser



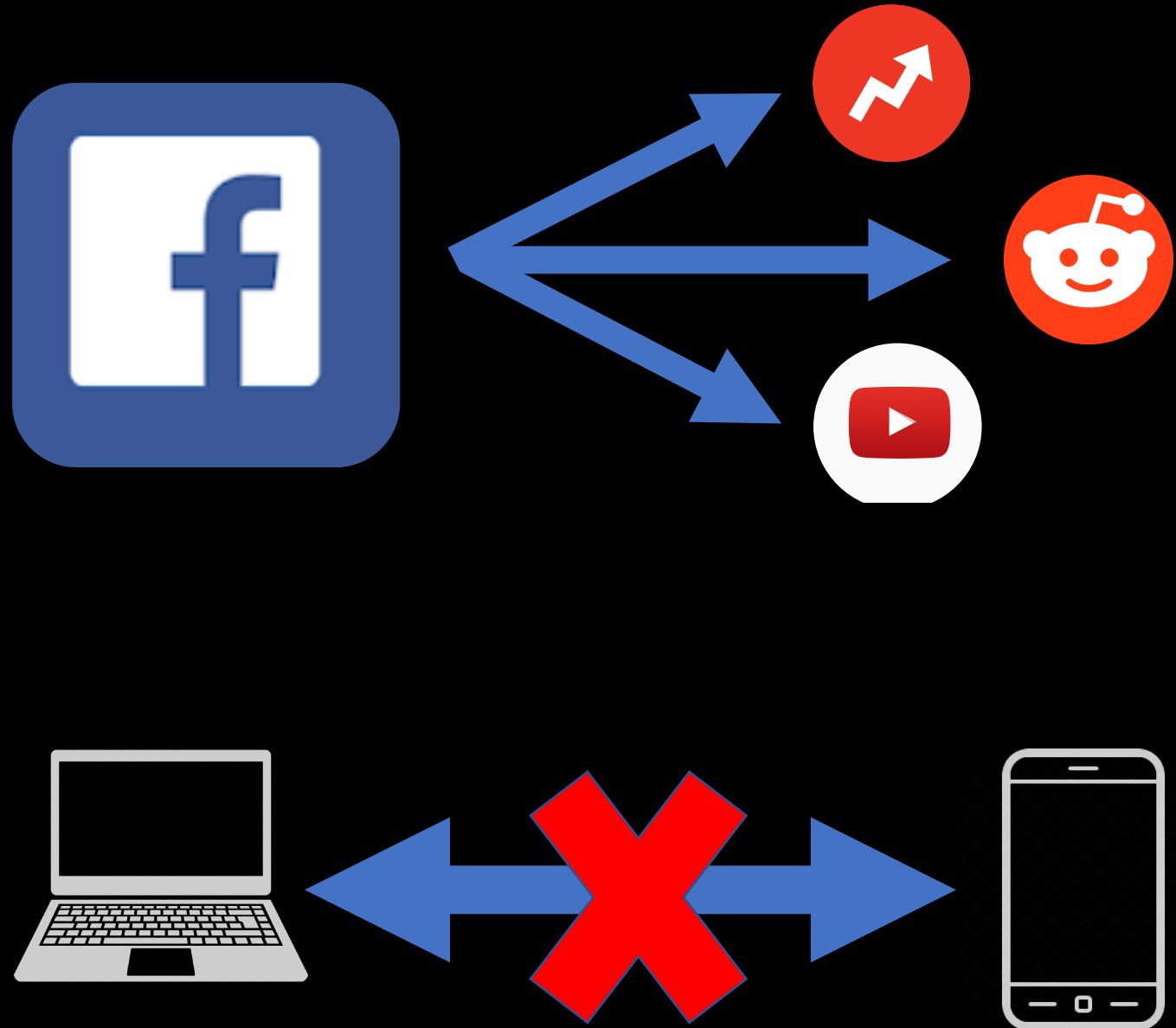
- Does reducing time via interventions influence time spent elsewhere?
- Within-device: reduction on browser, but not mobile
- Cross-device: no effects



- Does reducing time via interventions influence time spent elsewhere?
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  - Due to aggregator sites driving traffic to other sites
- Cross-device: no effects



- Does reducing time via interventions influence time spent elsewhere?
- Within-device: reduction on browser, but not mobile
  - Due to aggregator sites driving traffic to other sites
- Cross-device: no effects
  - Devices used in different contexts



## HabitLab: Our in-the-wild behavior change platform

### Outcomes

Does effectiveness remain constant over time?

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### Interventions

How do users' preferences change over time?

## *Conservation of Procrastination: Do Productivity Interventions Save Time or Just Redistribute It? (CHI 2019)*

- Does reducing time via interventions influence time spent elsewhere?
- Within-device: reduction on browser, but not mobile
  - Due to aggregator sites driving traffic to other sites
- Cross-device: no effects
  - Devices used in different contexts

# HabitLab: Our in-the-wild behavior change platform

## Outcomes

Does effectiveness remain constant over time?

What externalities exist?

## Interventions

How do users' preferences change over time?

# Sorry to see you go! HabitLab has been uninstalled

Thanks for trying HabitLab! We'd appreciate your feedback so we can make it better! Why are you uninstalling?

- Interventions were annoying**
- Was causing lag**
- Did not feel effective**
- Privacy concerns**
- Other reason**

We would appreciate your feedback here

Submit

# Users have different expectations for what they want productivity tools to do

In our uninstall feedback form, we had many users who stated interventions were too hard, but others stated that they thought the interventions were too easy

# Users have different expectations for what they want productivity tools to do

In our uninstall feedback form, we had many users who stated interventions were too hard, but others stated that they thought the interventions were too easy

Naive solution: Classify interventions according to difficulty, and ask them during onboarding what difficulty they would prefer

# Users have different expectations for what they want productivity tools to do

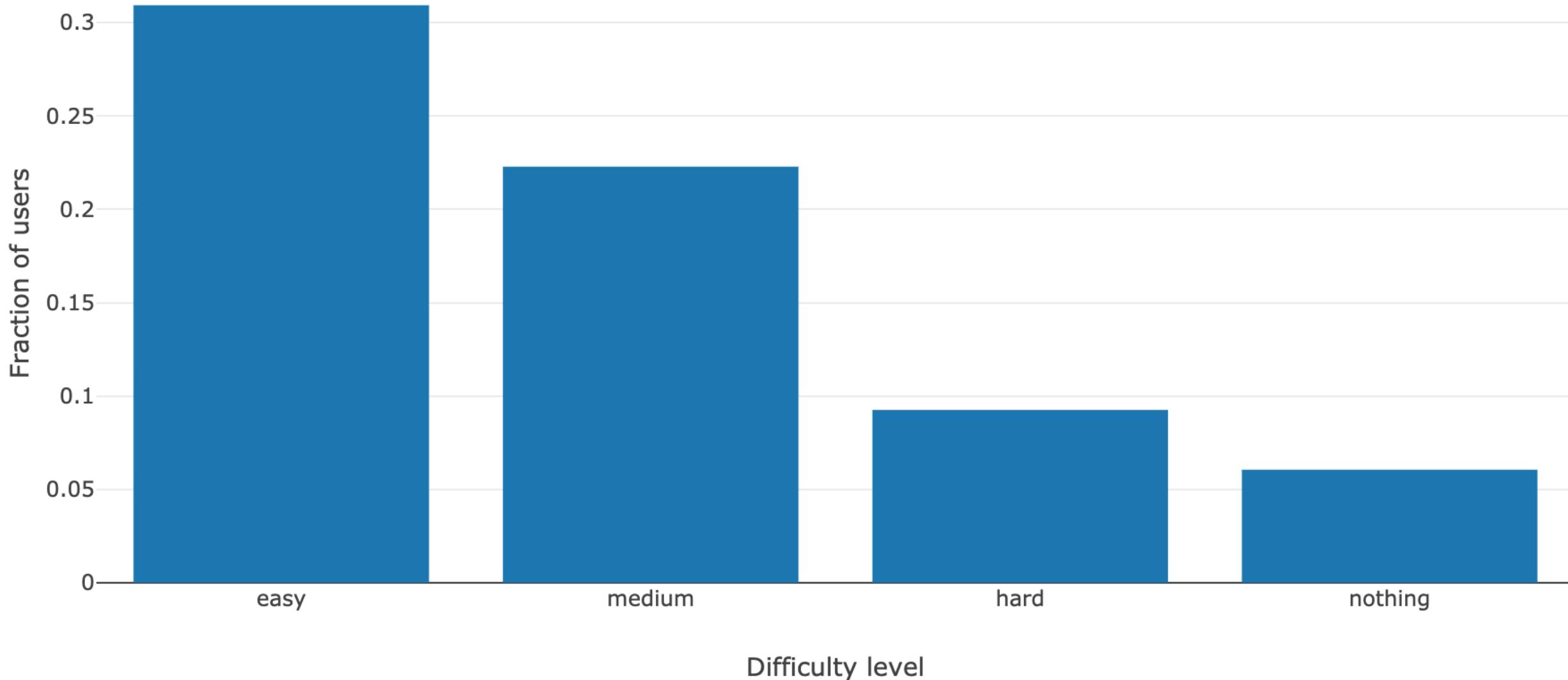
In our uninstall feedback form, we had many users who stated interventions were too hard, but others stated that they thought the interventions were too easy

Naive solution: Classify interventions according to difficulty, and ask them during onboarding what difficulty they would prefer

How aggressive do you want HabitLab to be in helping you reduce your time spent online?

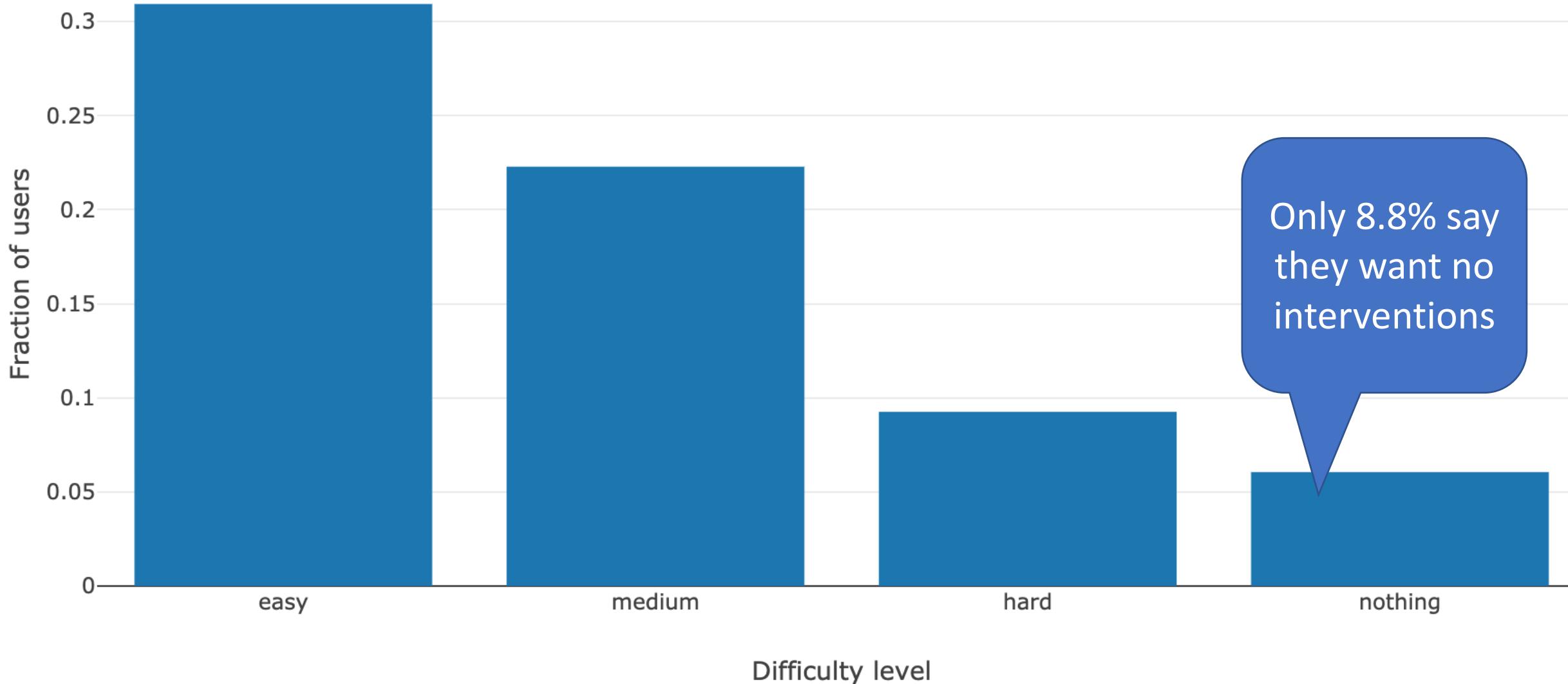
- Don't do anything** - just track time.
- Light touch** - e.g., show a timer when you visit Facebook.
- Medium** - e.g., remove your Facebook feed until you click to show it.
- Heavy handed** - e.g., close the site after 60 seconds.

Initial difficulties chosen during onboarding (n = 5114 users)  
All pairs statistically significantly different ( $p < 10^{-9}$ , chi-squared tests)



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All pairs statistically significantly different ( $p < 10^{-9}$ , chi-squared tests)



## HabitLab: Our in-the-wild behavior change platform

### Outcomes

Does effectiveness remain constant over time?

What externalities exist?

### Interventions

How do users' preferences change over time?

- Users initially are optimistic about how difficult they want their interventions
  - "No intervention" is least frequently chosen during onboarding

Can users predict during onboarding what interventions will work for them?

Do their preferences change over time?

Ask users when they visit site about intervention difficulty preference for this visit

How aggressive would you like HabitLab to be in helping you reduce your time online?

Don't do anything

JUST TRACK TIME

Light touch

E.G., SHOW A TIMER WHEN YOU VISIT FACEBOOK

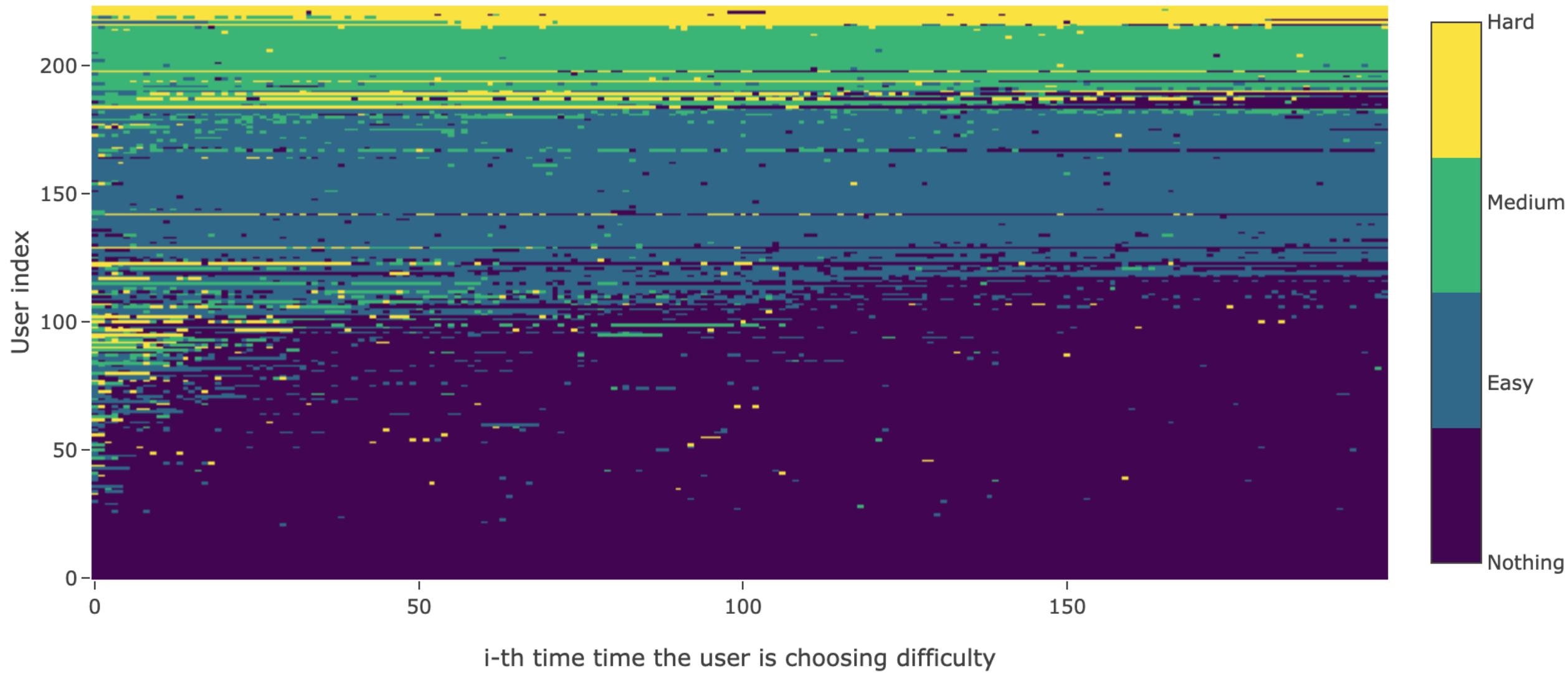
Medium

E.G., REMOVE YOUR FACEBOOK FEED UNTIL YOU CLICK TO SHOW IT

Heavy handed

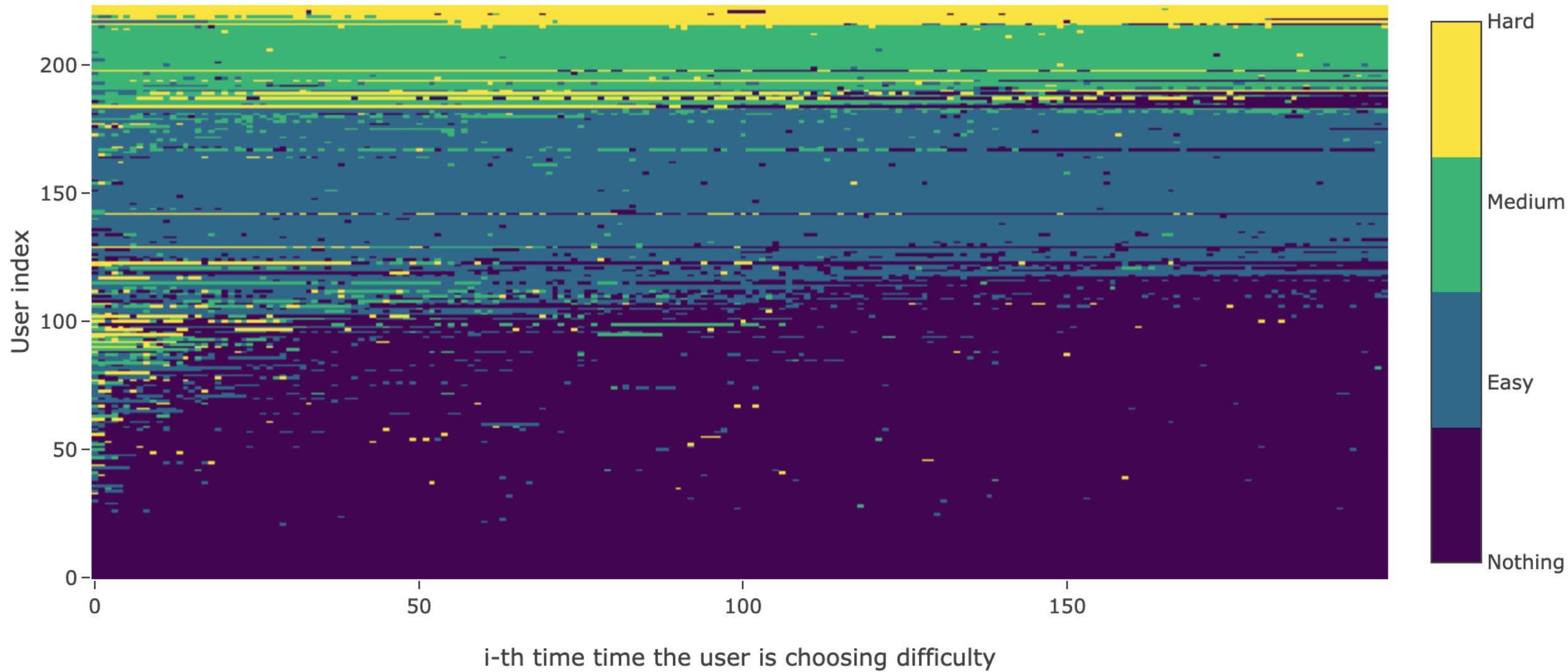
E.G., CLOSE THE SITE AFTER 60 SECONDS

## Changes in user difficulty choices over time



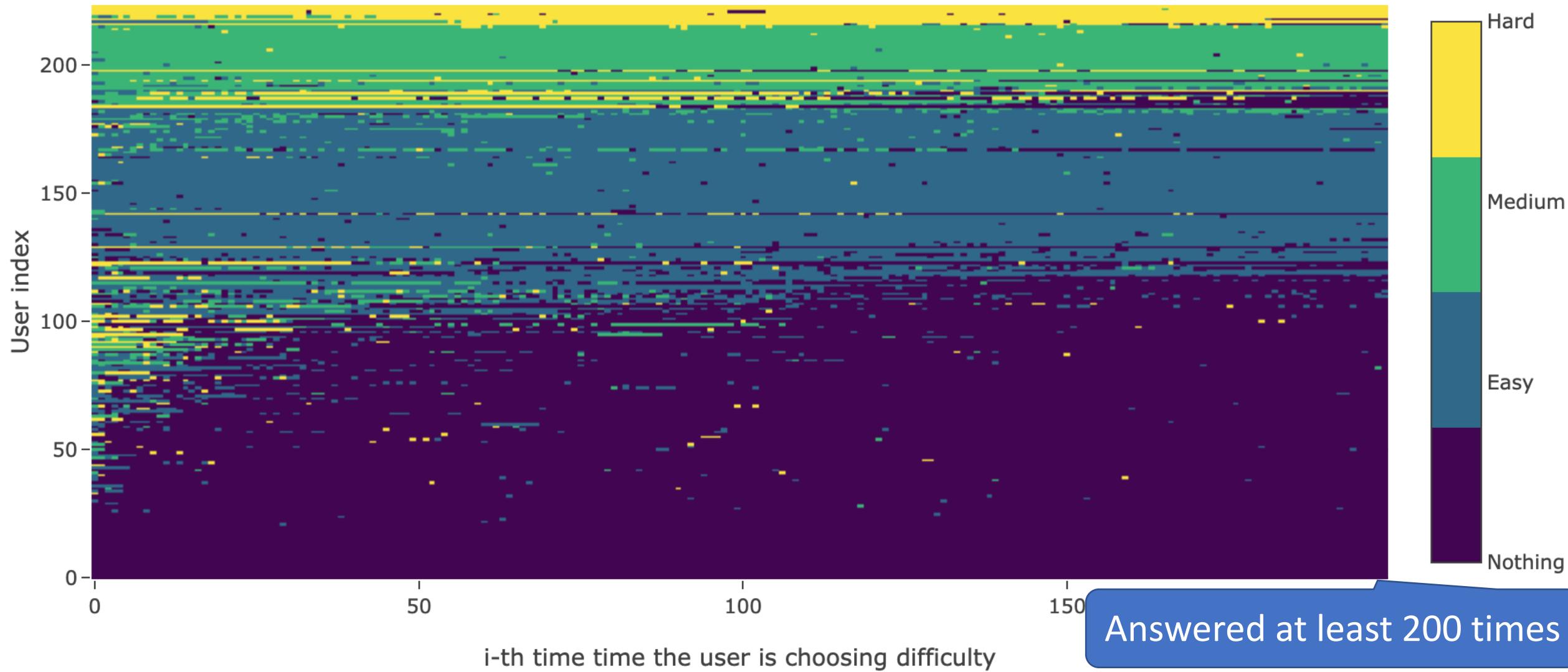
## Changes in user difficulty choices over time

223 users

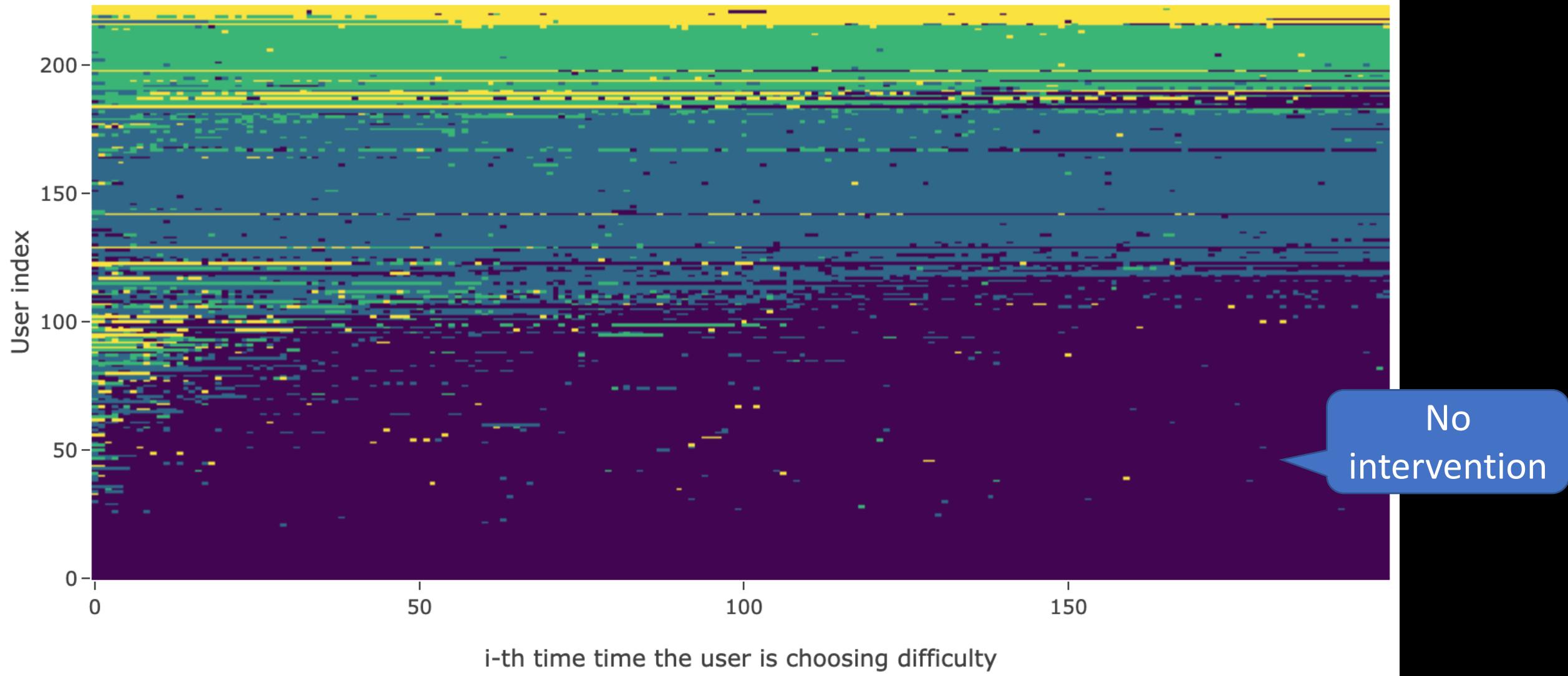


## Changes in user difficulty choices over time

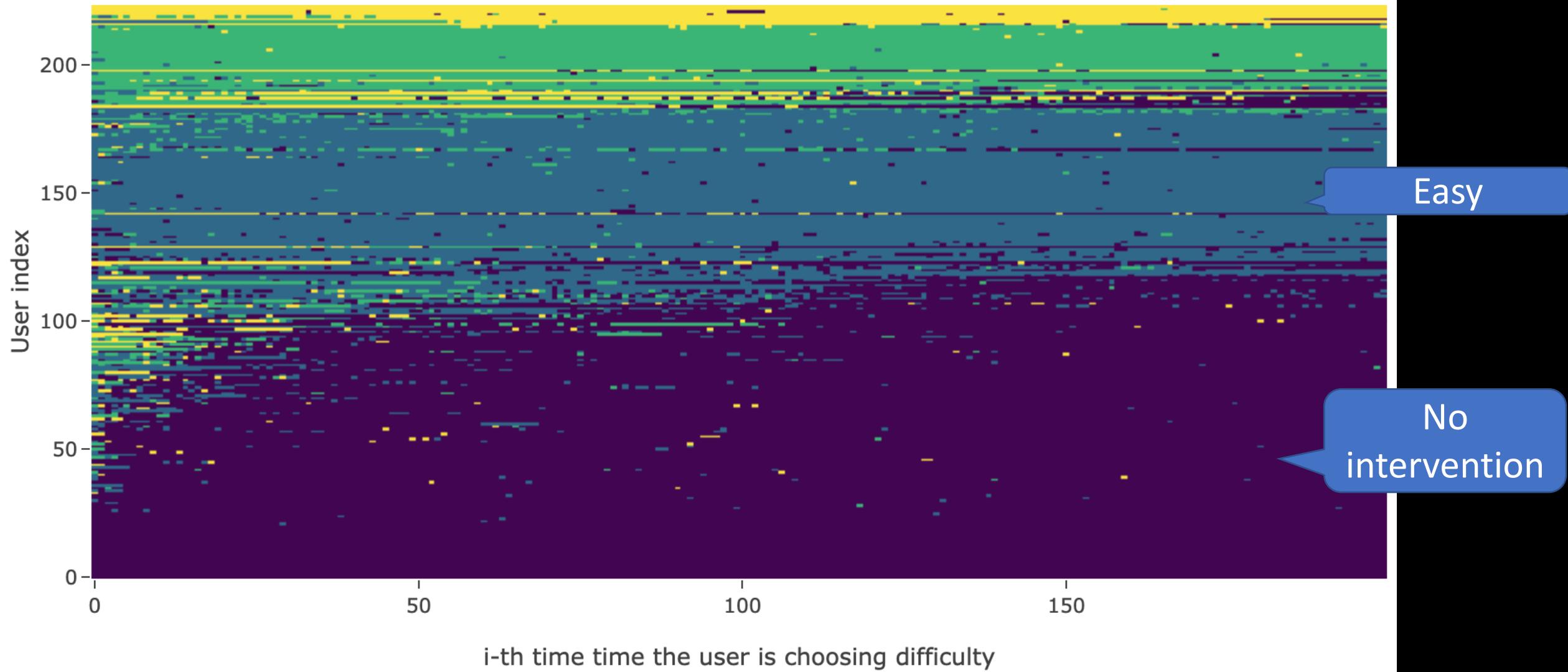
223 users



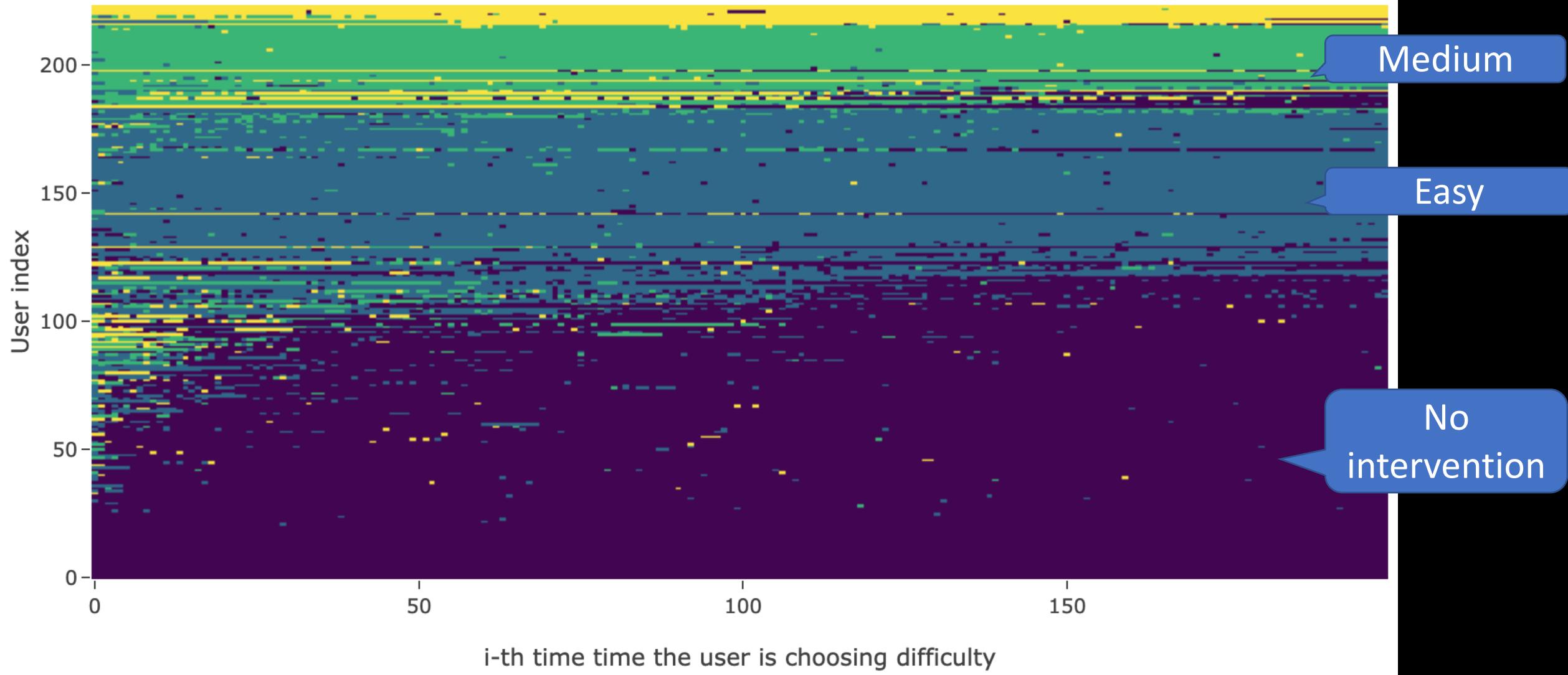
## Changes in user difficulty choices over time



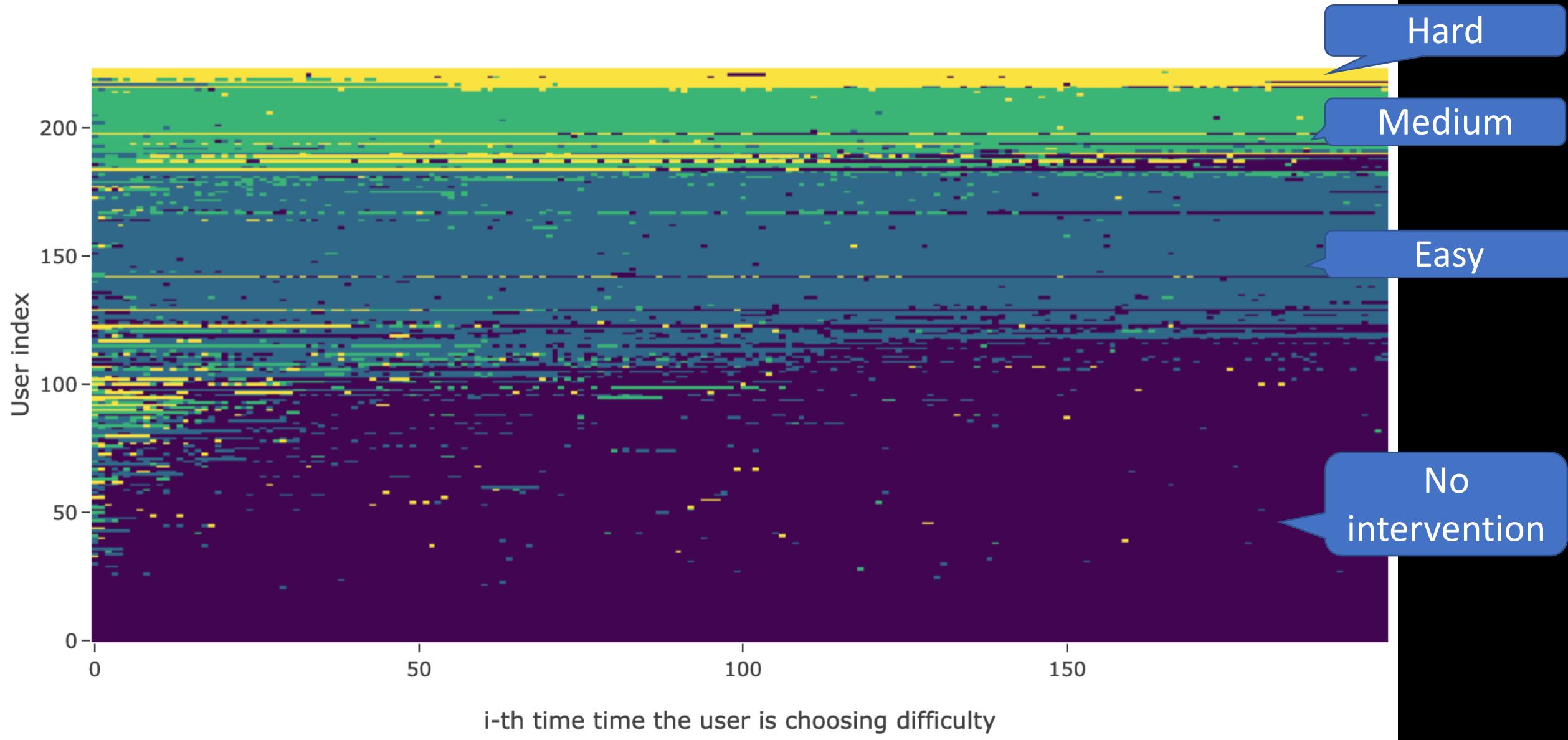
## Changes in user difficulty choices over time



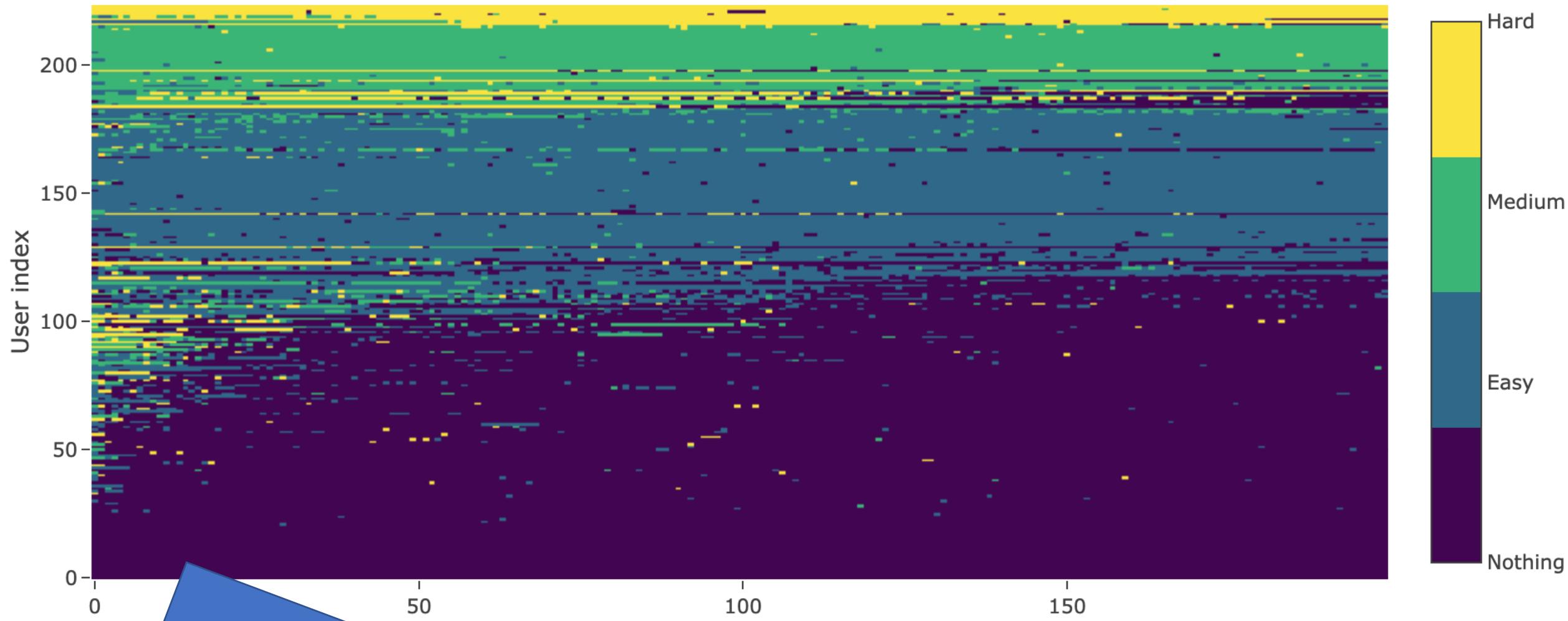
## Changes in user difficulty choices over time



## Changes in user difficulty choices over time

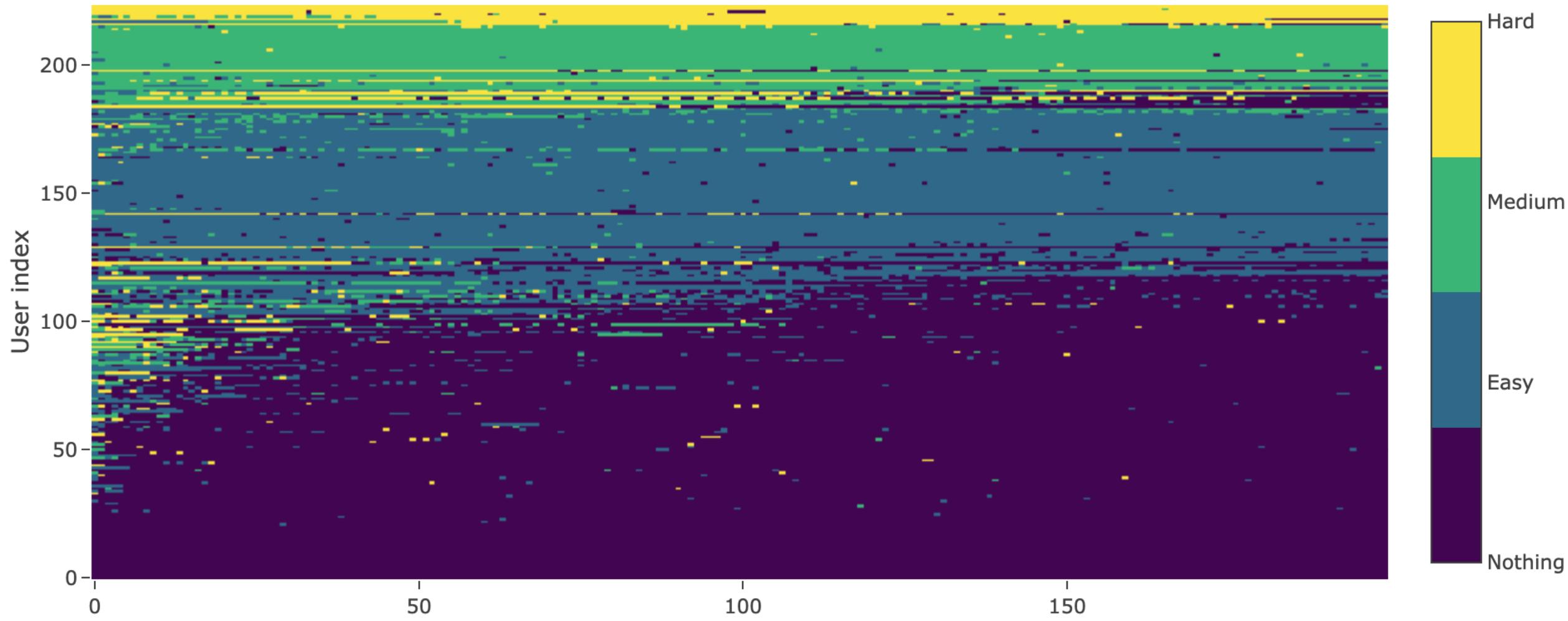


## Changes in user difficulty choices over time



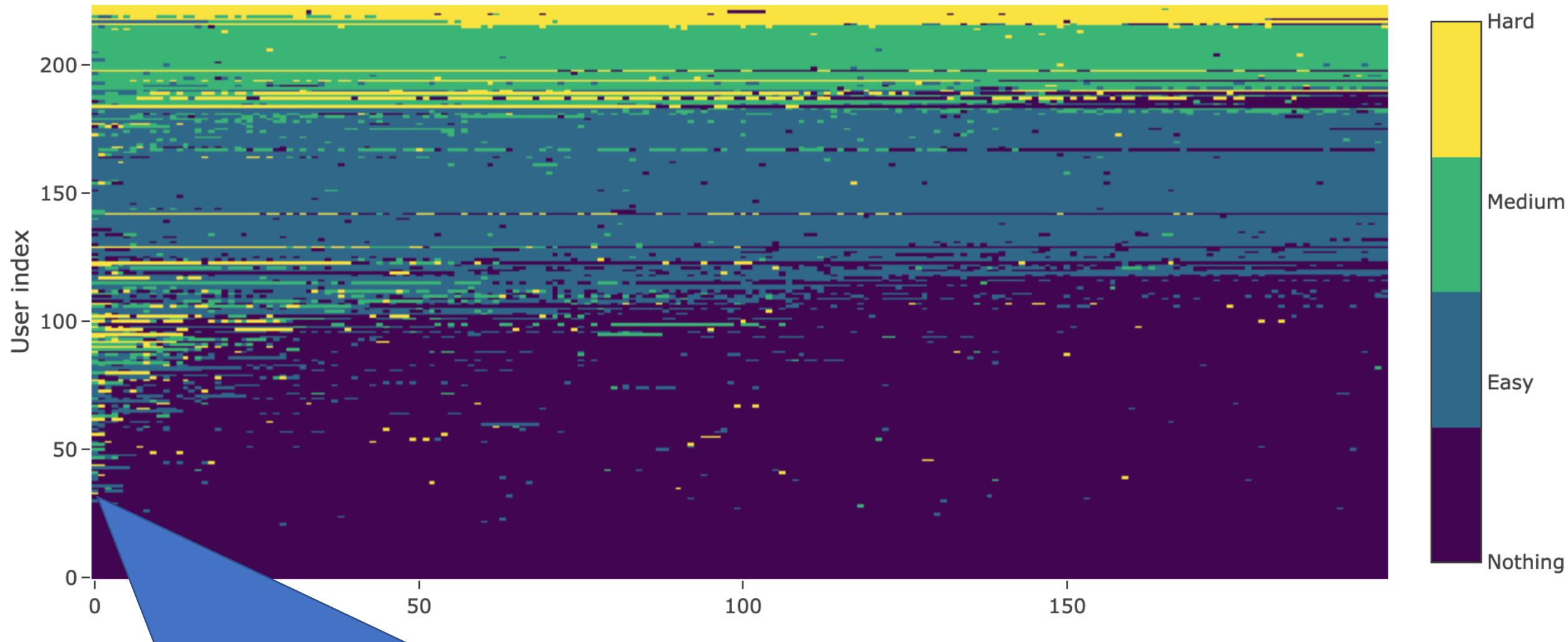
Lots of initial exploration between intervention difficulties

## Changes in user difficulty choices over time

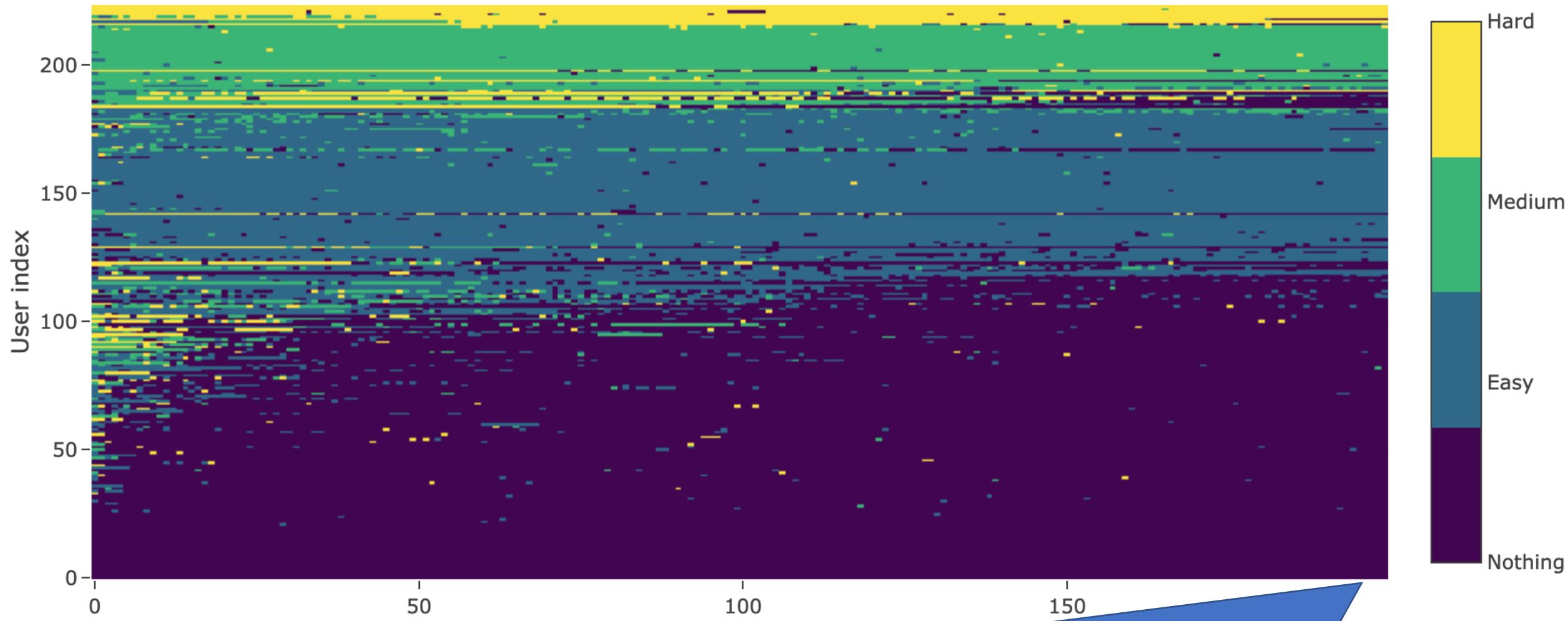


After answering 100 times, preferences become mostly stable

## Changes in user difficulty choices over time



## Changes in user difficulty choices over time



But by the end, 119/223 users (53%) are consistently choosing to have no intervention

## HabitLab: Our in-the-wild behavior change platform

Do interventions remain effective as time passes?

What are the side effects of interventions?

How do users' preferences change over time?

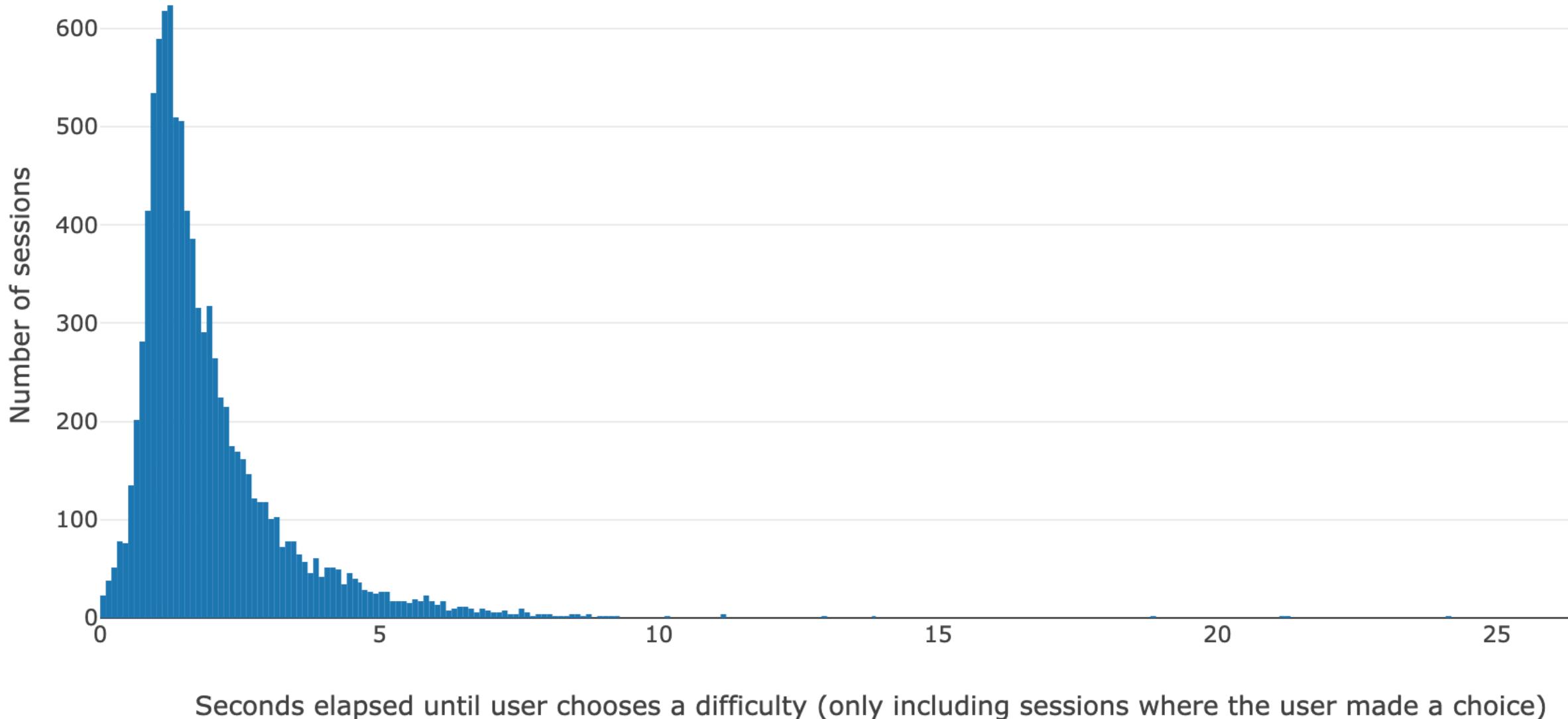
- Users initially are optimistic about how difficult they want their interventions
  - “No intervention” is least frequently chosen during onboarding
- Intervention difficulty choices decline over time
  - **Half of users eventually choose “no intervention” nearly always**

How can we determine when preferred intervention difficulty changes?

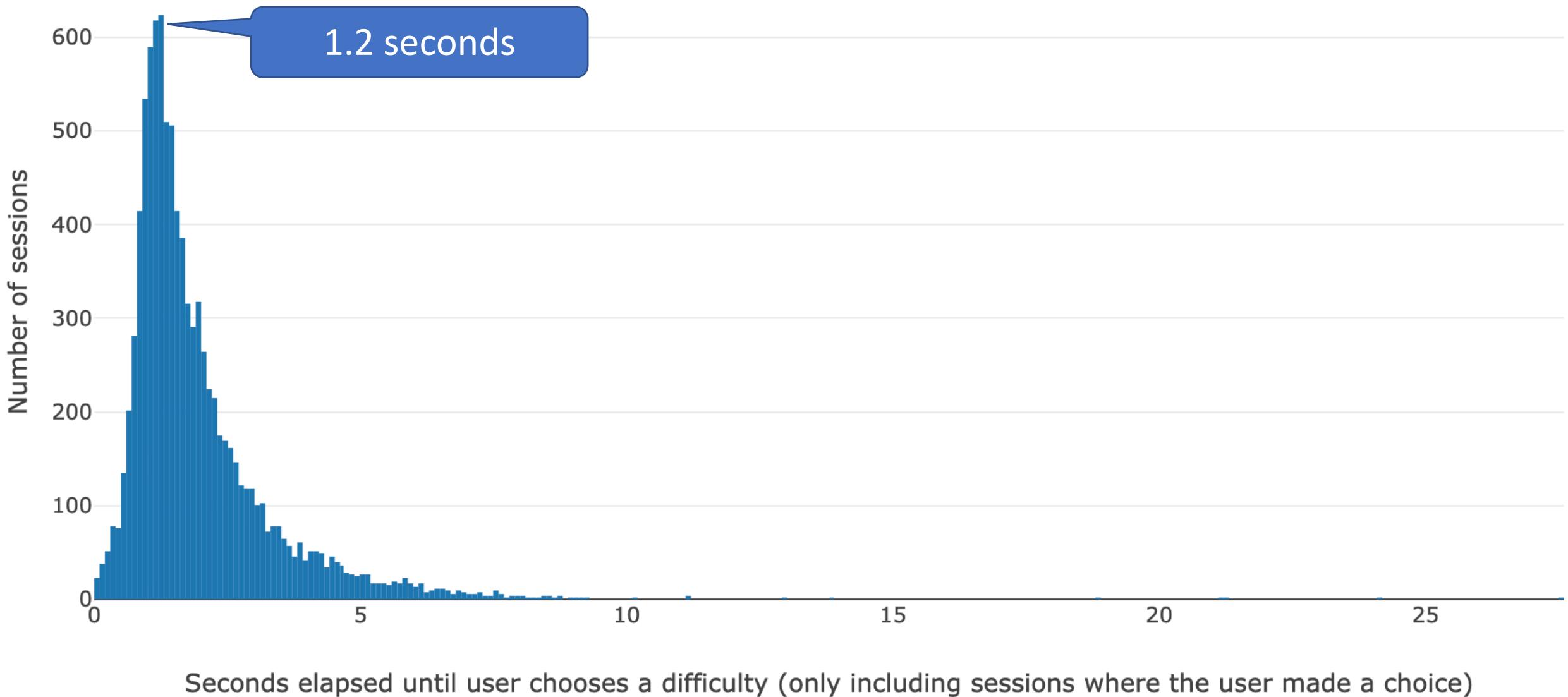
If we periodically ask users their preferred intervention difficulty:

- How frequently do we need to ask to get accurate results?
- What are the costs of asking? (Time? Attrition? Response rate?)

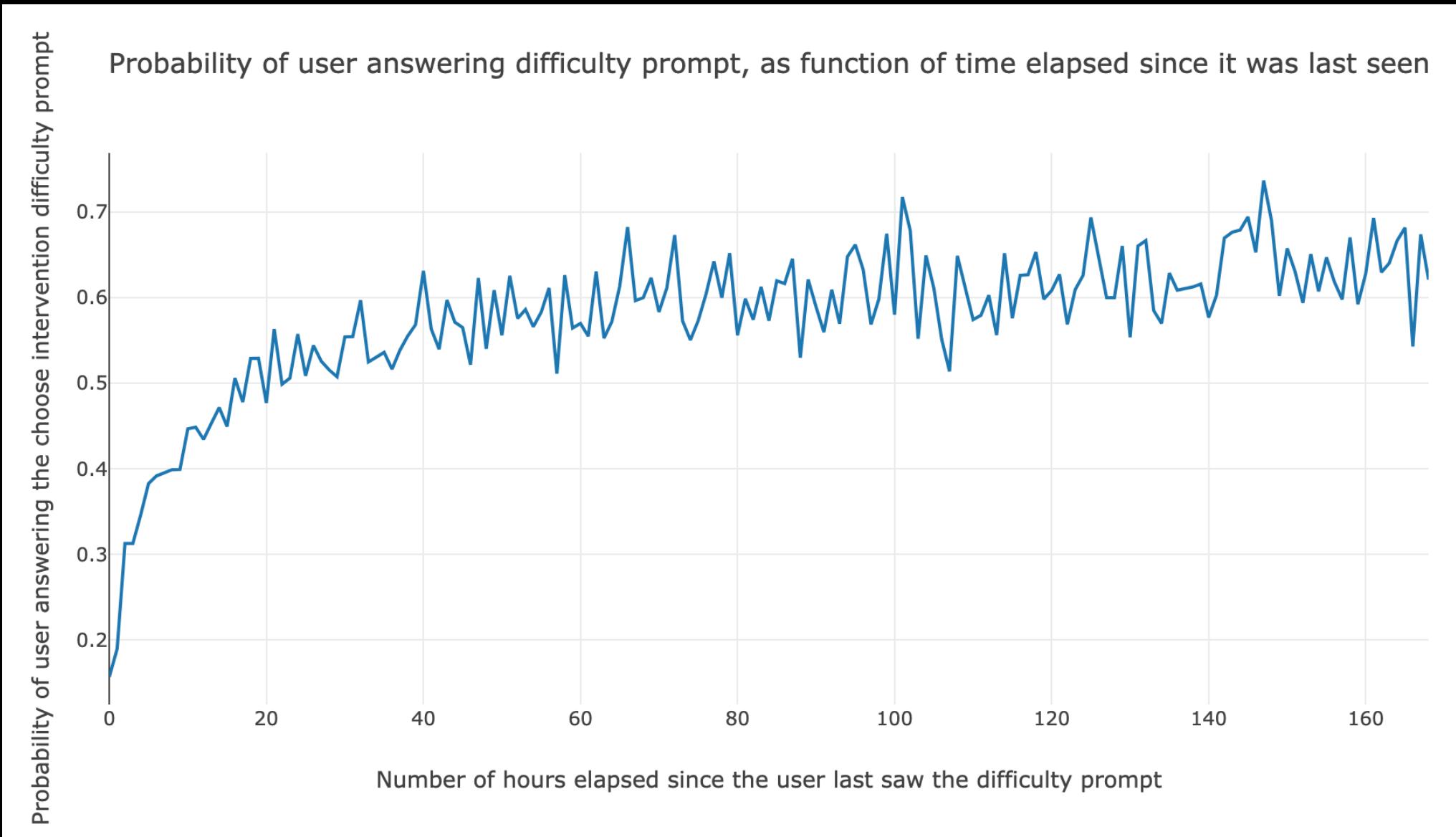
# Time it requires users to choose difficulty



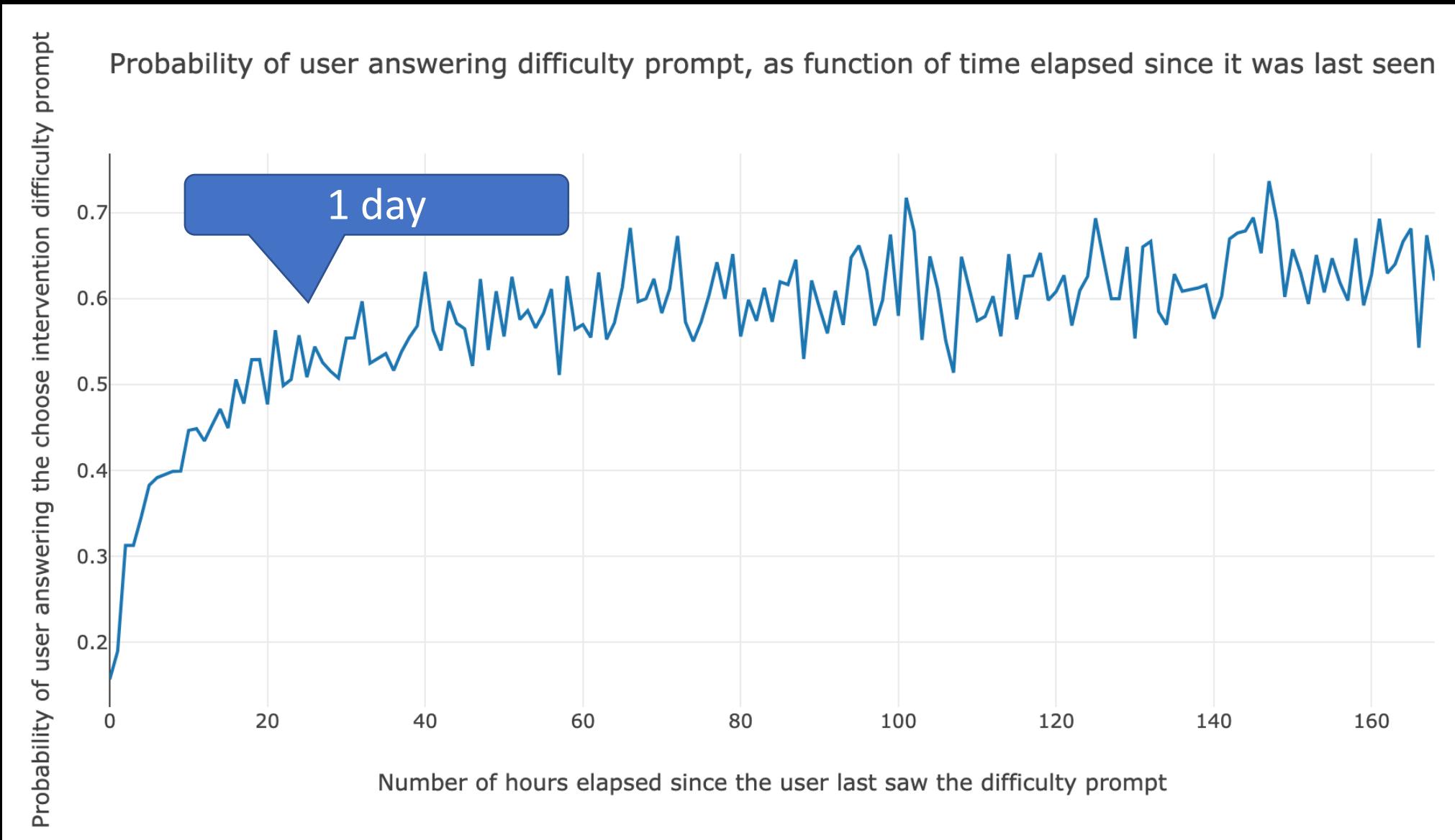
# Time costs are low: 1.2 seconds to choose difficulty



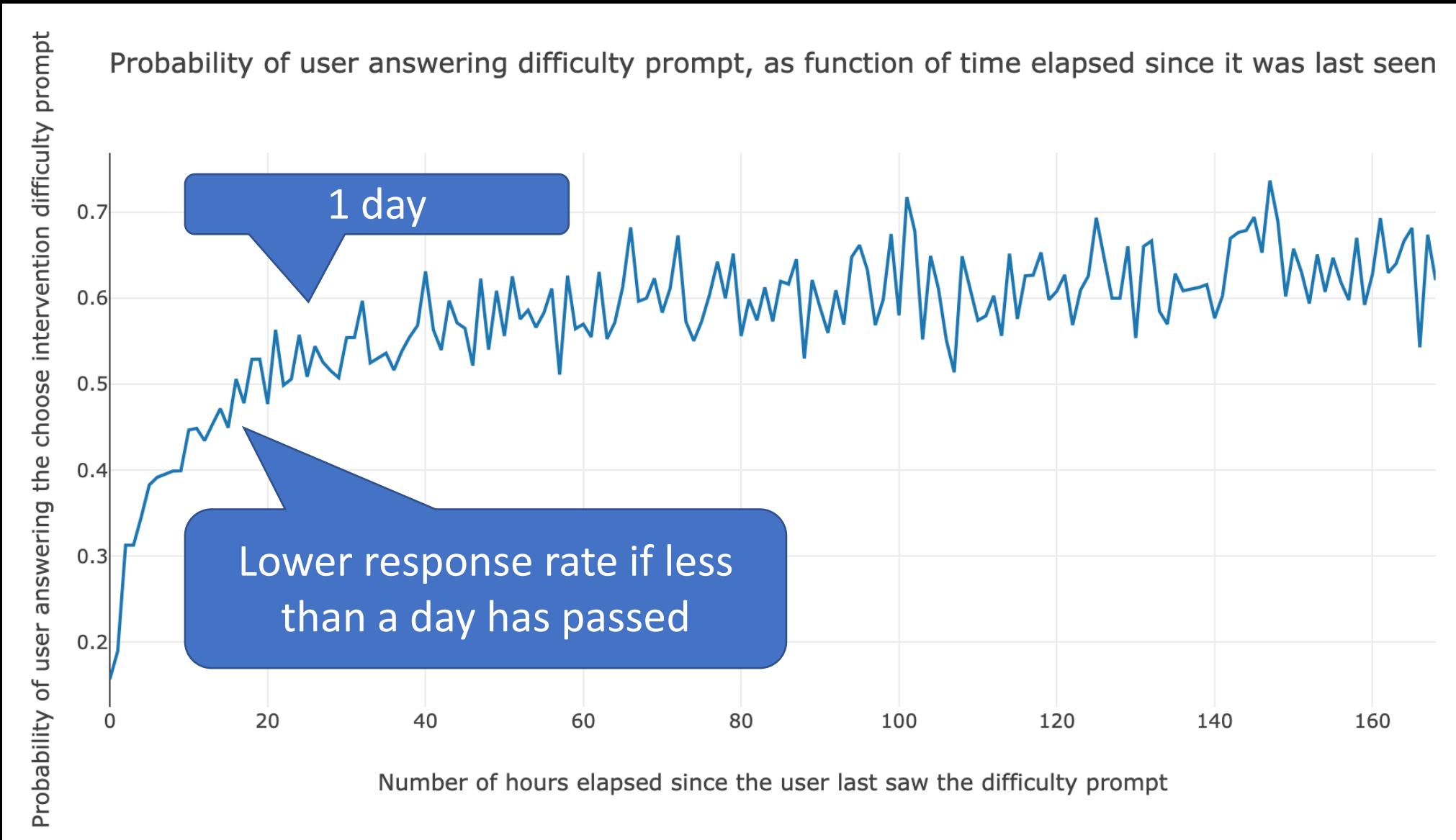
# If less than a day has passed since they were last asked, users are less likely to answer



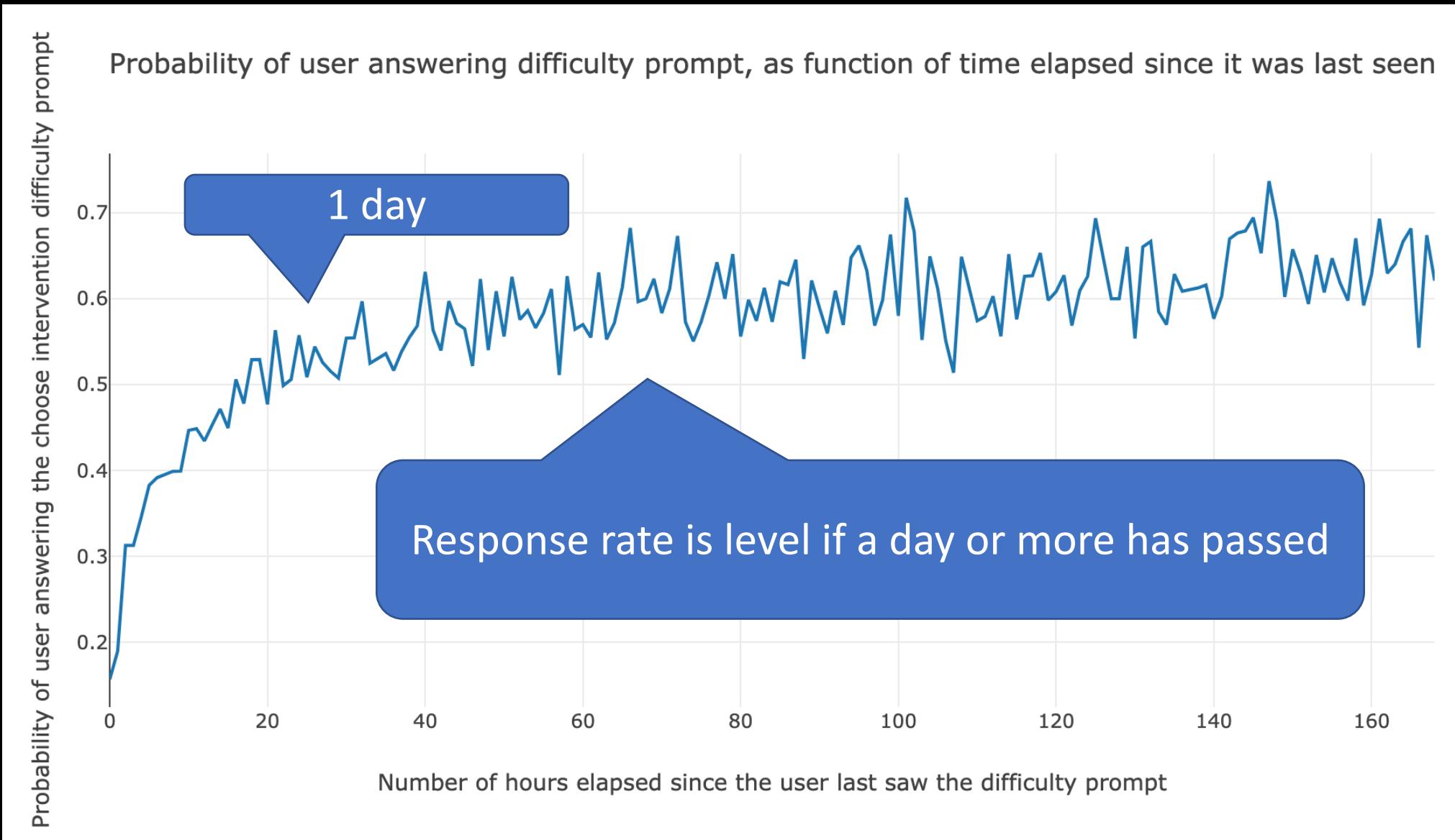
# If less than a day has passed since they were last asked, users are less likely to answer



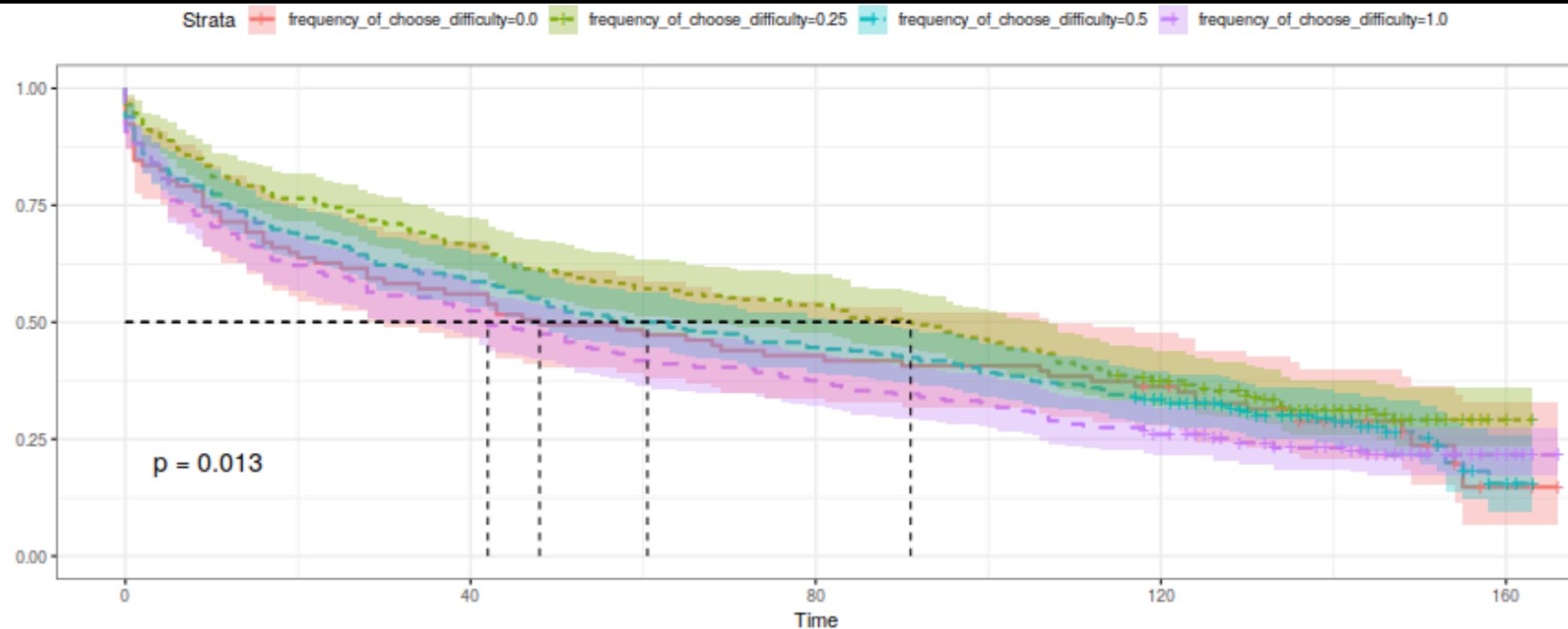
# If less than a day has passed since they were last asked, users are less likely to answer



# If less than a day has passed since they were last asked, users are less likely to answer



# Excessive experience sampling increases attrition



Number at risk

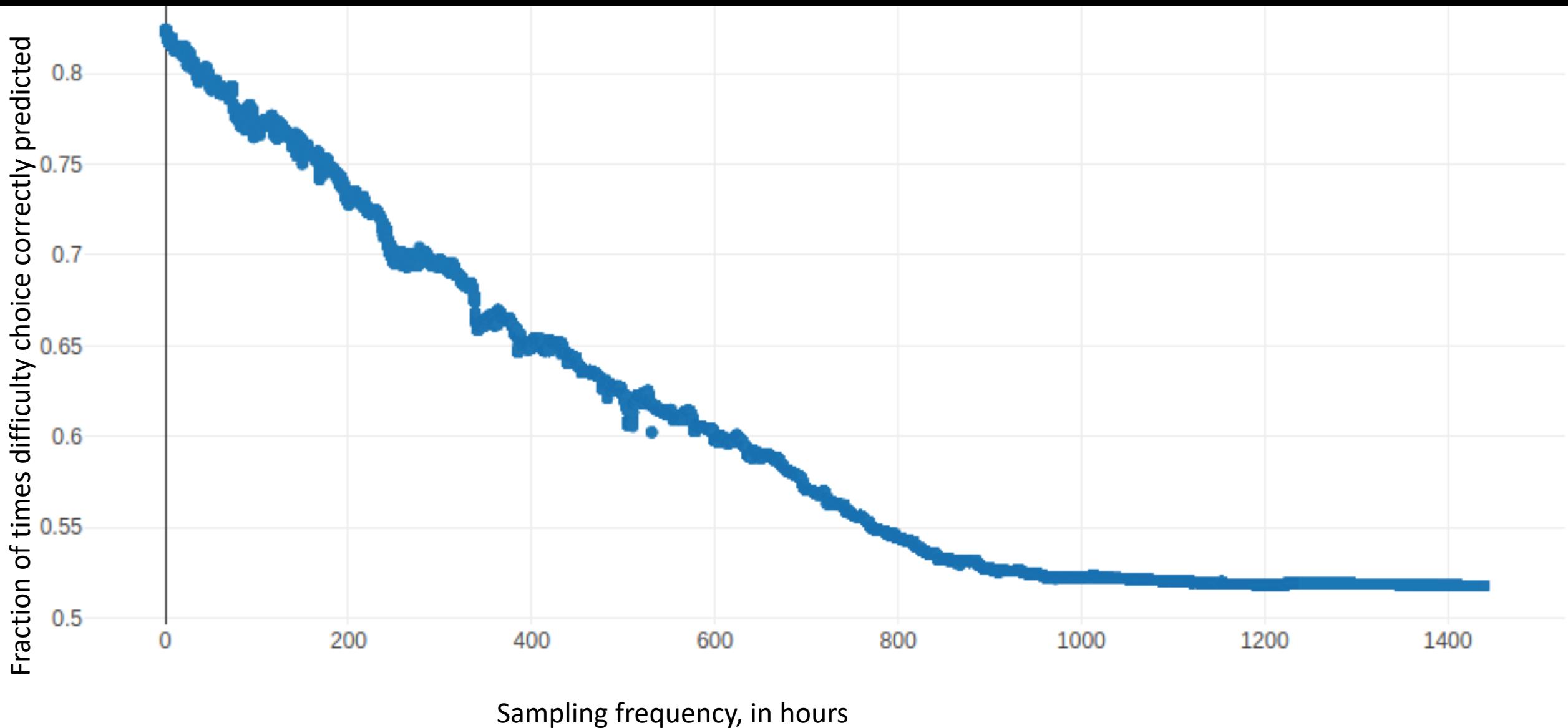
Strata	0	40	80	120	160
frequency_of_choose_difficulty=0.0	91	51	39	32	2
frequency_of_choose_difficulty=0.25	259	172	139	93	5
frequency_of_choose_difficulty=0.5	278	165	124	90	4
frequency_of_choose_difficulty=1.0	280	147	105	67	8

How can we determine when preferred intervention difficulty changes?

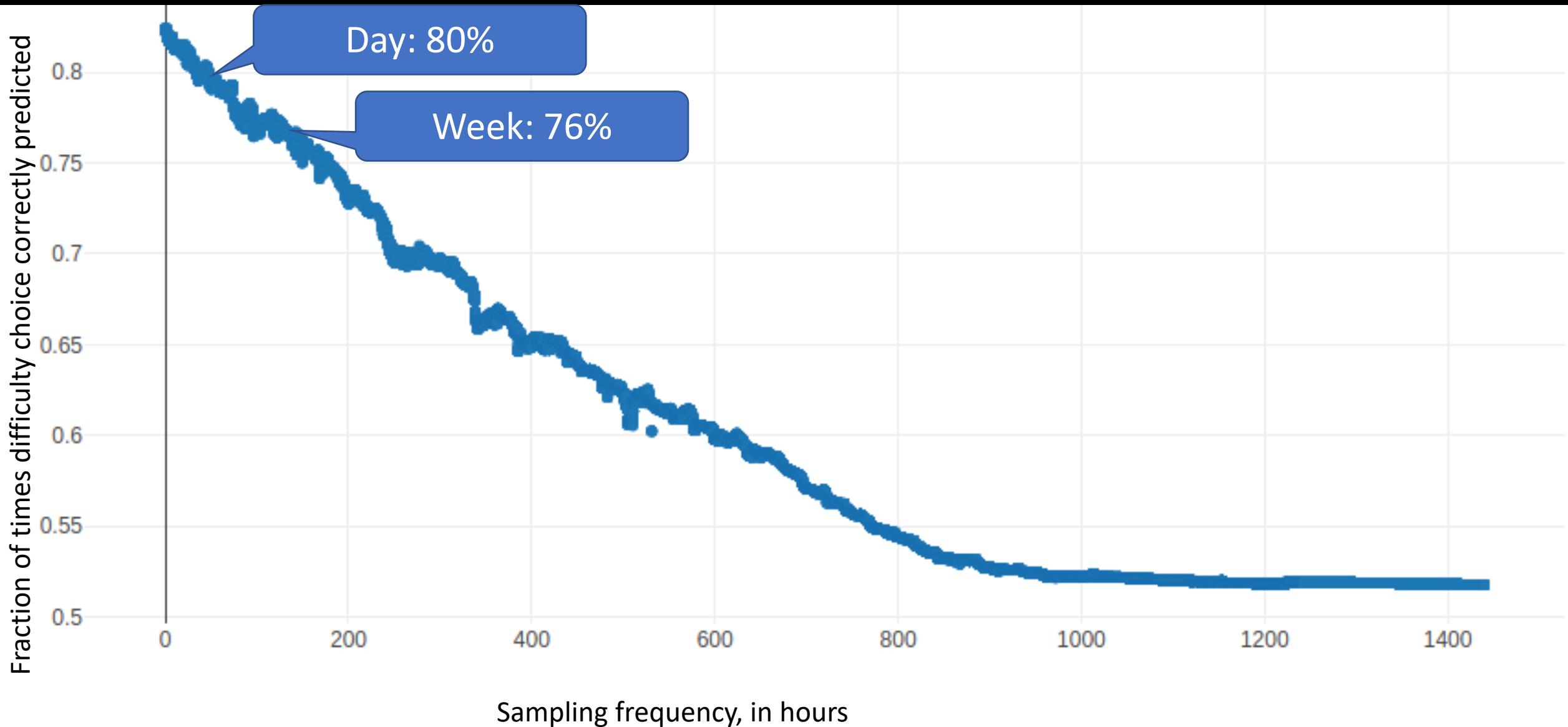
If we periodically ask users their preferred intervention difficulty:

- What are the costs of asking? (Time? Attrition? Response rate?)
  - Low time cost (1.2 seconds)
  - Response rate declines if more frequent than daily
- How frequently do we need to ask to get accurate results?

# Prediction accuracy declines as sampling frequency decreases



# Prediction accuracy declines as sampling frequency decreases



How can we determine when preferred intervention difficulty changes?

If we periodically ask users their preferred intervention difficulty:

- What are the costs of asking? (Time? Attrition? Response rate?)
  - Low time cost (1.2 seconds)
  - Response rate declines if more frequent than daily
- How frequently do we need to ask to get accurate results?
  - Daily still gets reasonably high (80%) accuracy

## HabitLab: Our in-the-wild behavior change platform

Do interventions remain effective as time passes?

What are the side effects of interventions?

How do users' preferences change over time?

- Users initially are optimistic about how difficult they want their interventions
  - “No intervention” is least frequently chosen during onboarding
- Intervention difficulty choices decline over time
  - Half of users eventually choose “no intervention” nearly always
- **Desired difficulty can be predicted with periodic experience sampling**

User preferences change over time, and our results suggest asking once a day should get a good balance between accuracy vs sampling costs

What do users actually want?

How aggressive would you like HabitLab to be in helping you reduce your time online?

Don't do anything

JUST TRACK TIME

Light touch

E.G., SHOW A TIMER WHEN YOU VISIT FACEBOOK

Medium

E.G., REMOVE YOUR FACEBOOK FEED UNTIL YOU CLICK TO SHOW IT

Heavy handed

E.G., CLOSE THE SITE AFTER 60 SECONDS

Ask me again about difficulty:

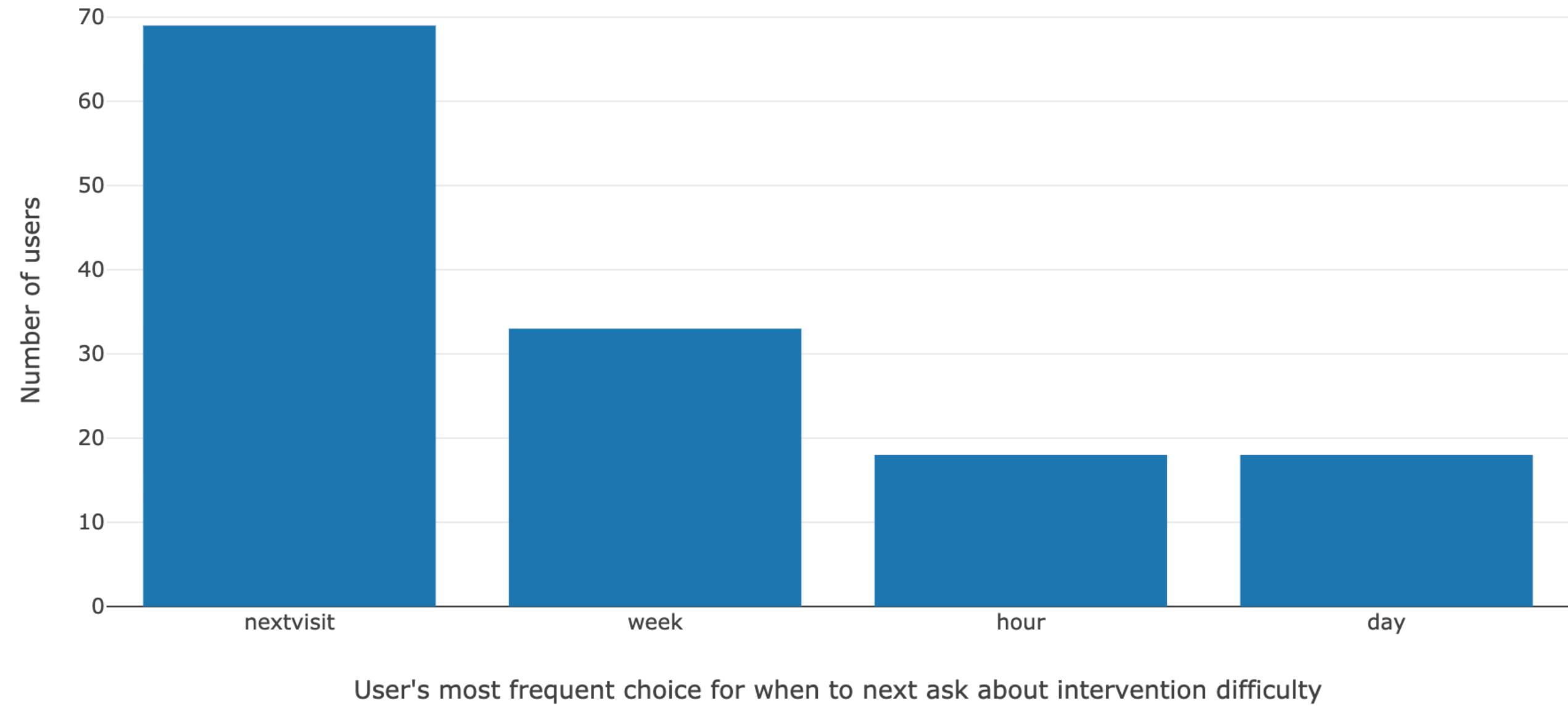
Next visit

1 hour later

1 day later

1 week later

# Most frequent choice for when to ask next about intervention difficulty, by number of users



# Most frequent choice for when to ask next about intervention difficulty, by number of users

Some users want to be asked every time

Number of users

70  
60  
50  
40  
30  
20  
10  
0

nextvisit

week

hour

day

User's most frequent choice for when to next ask about intervention difficulty

## Most frequent choice for when to ask next about intervention difficulty, by number of users

Number of users

70  
60  
50  
40  
30  
20  
10  
0

nextvisit

week

hour

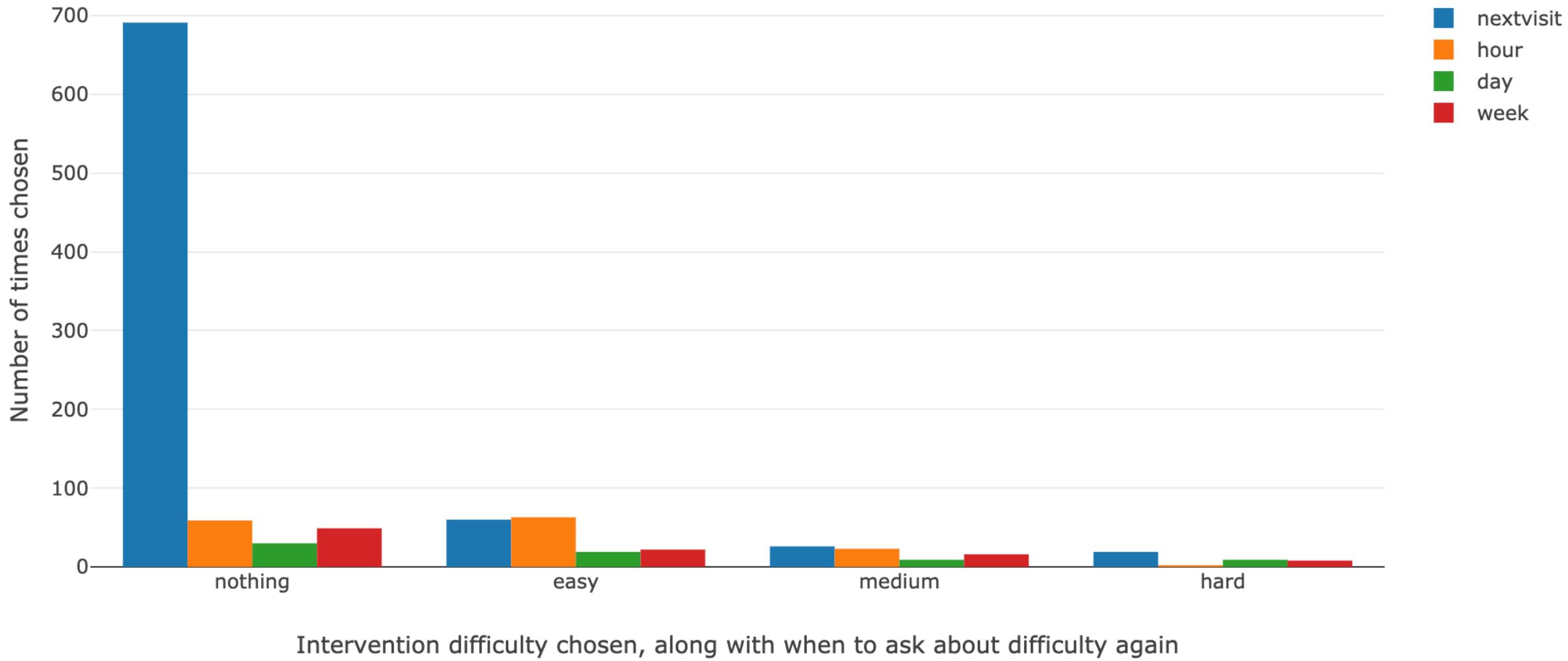
day

Some users want to be asked every time

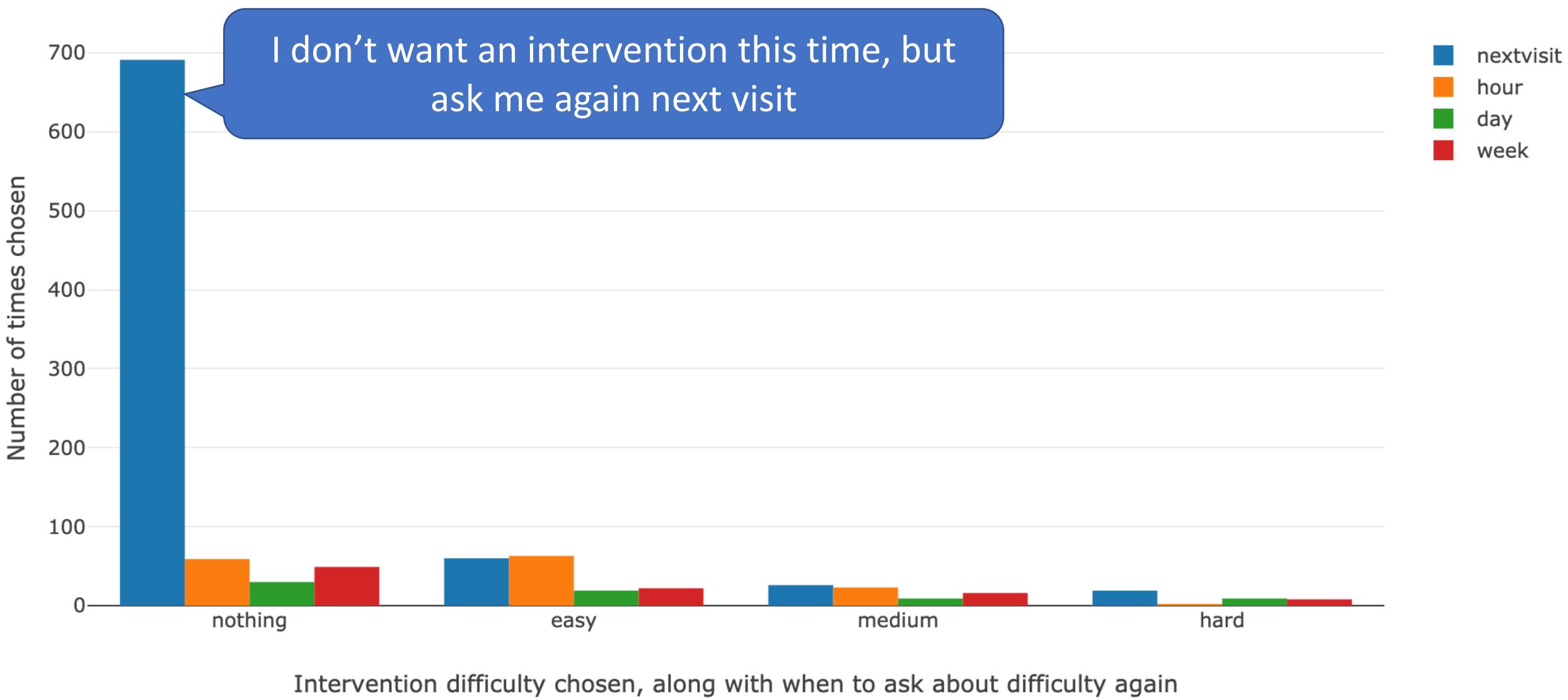
Other users want to be asked as little as possible

User's most frequent choice for when to next ask about intervention difficulty

## Choices for intervention difficulty and when to ask about difficulty again



## Choices for intervention difficulty and when to ask about difficulty again



## HabitLab: Our in-the-wild behavior change platform

Do interventions remain effective as time passes?

What are the side effects of interventions?

How do users' preferences change over time?

- Users initially are overly optimistic about how difficult they want their interventions
  - “No intervention” is least frequently chosen during onboarding
- Intervention difficulty choices decline over time
  - Half of users eventually choose “no intervention” nearly always
- Desired difficulty can be predicted with periodic experience sampling
- **Hope springs eternal: Don’t want an intervention this visit, but ask next time**

People initially overestimate their motivation

Give people choices and many will eventually gravitate to the easy path

Posted by u/tracedef 5 months ago

**How do I disable the "How aggressive would you like HabitLab to be in helping you reduce your time spent this visit?" message when going to Facebook?**

I find myself mindlessly clicking "don't do anything".... would prefer to have nudges on by default without an option to determine the strength BEFORE each FB visit ... this seems to be a new feature, that enables me to spend more time on FB without nudges ... how do I disable this??? TIA.

0 Give Award

Share

Approve

Remove

Spam

...

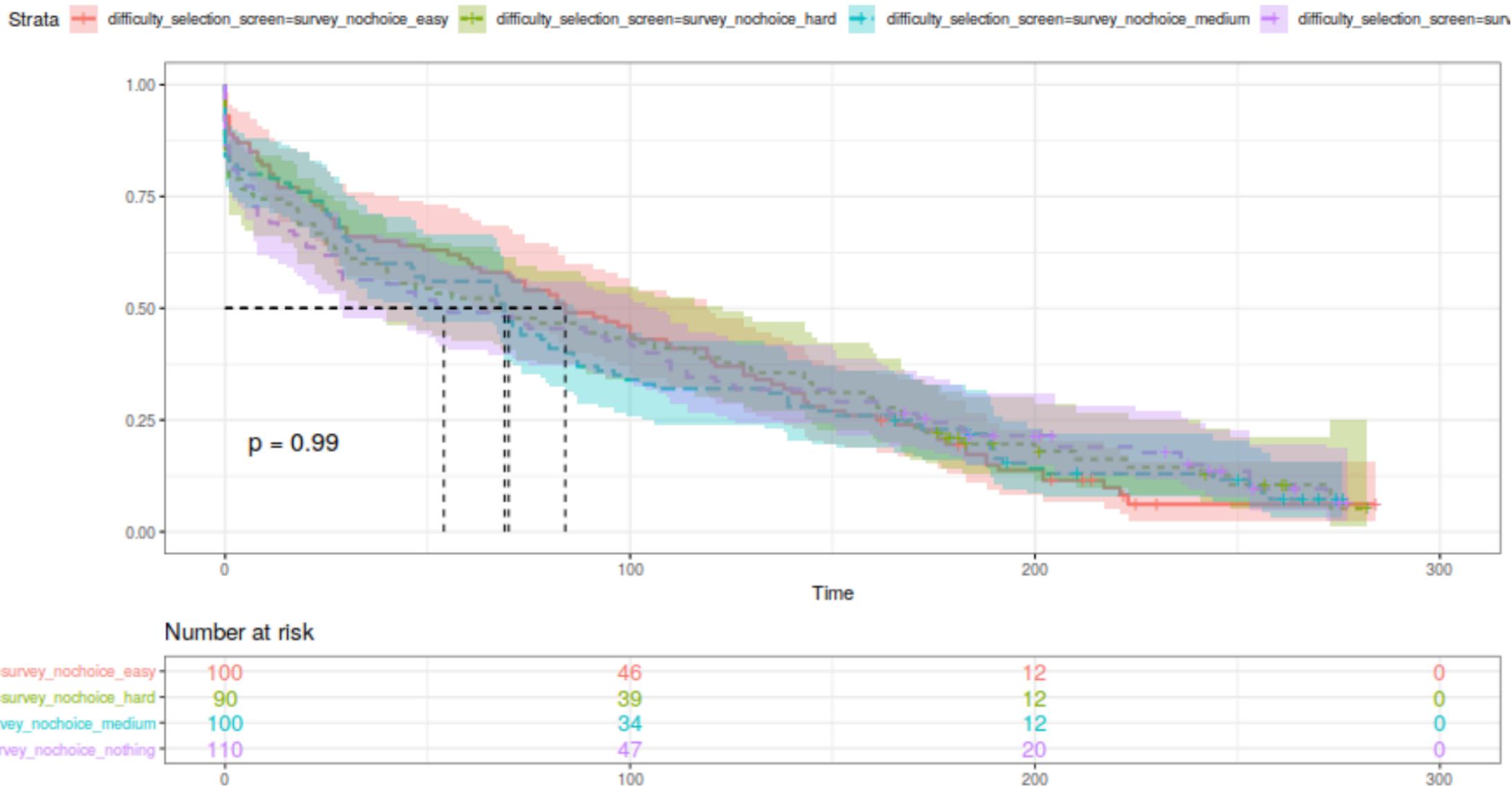
100% Upvote

# What happens when we remove choices?

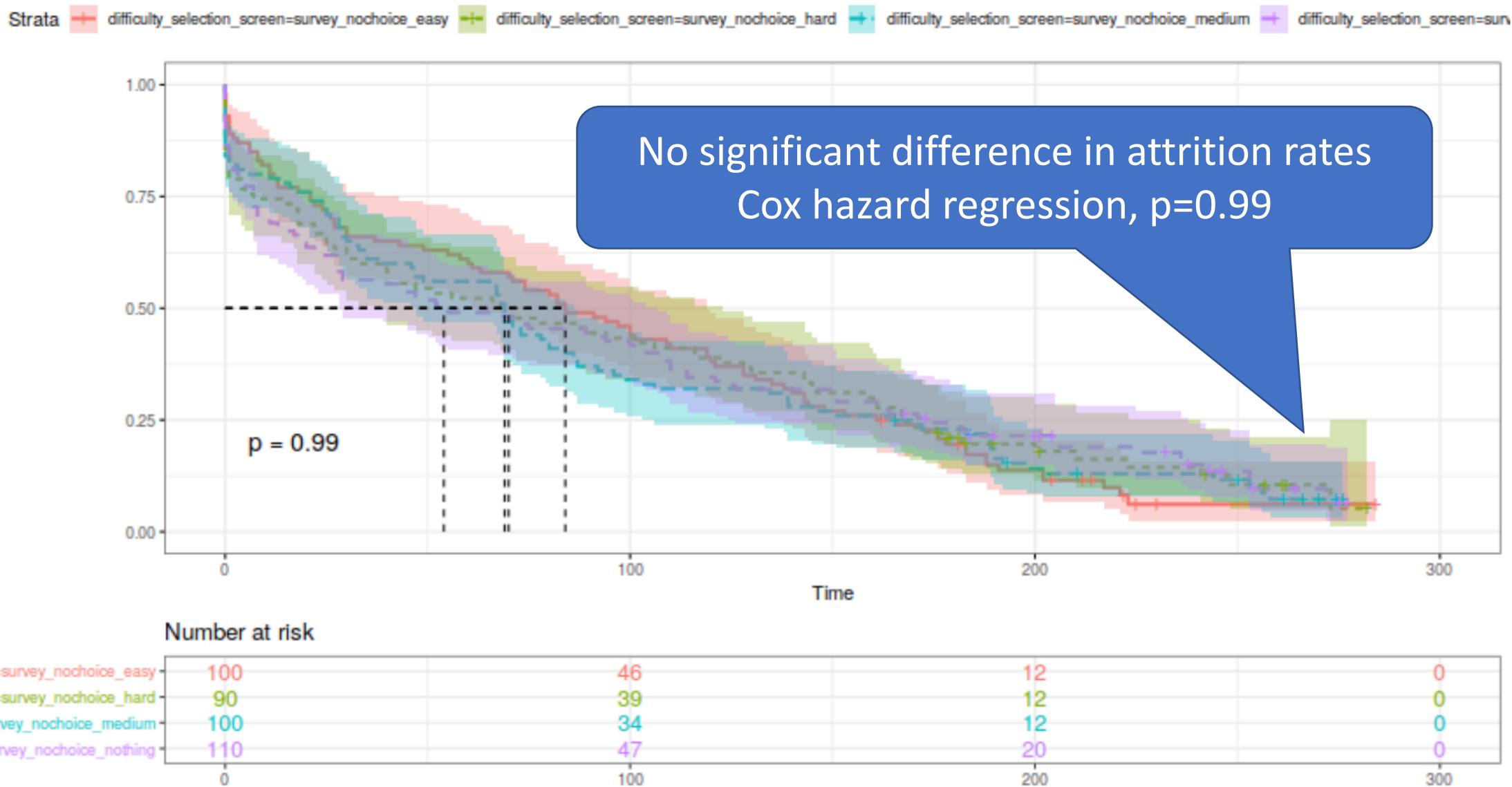
Asked users for their initial preferences during onboarding

Ignored their preferences and assigned them randomly to various intervention difficulty levels

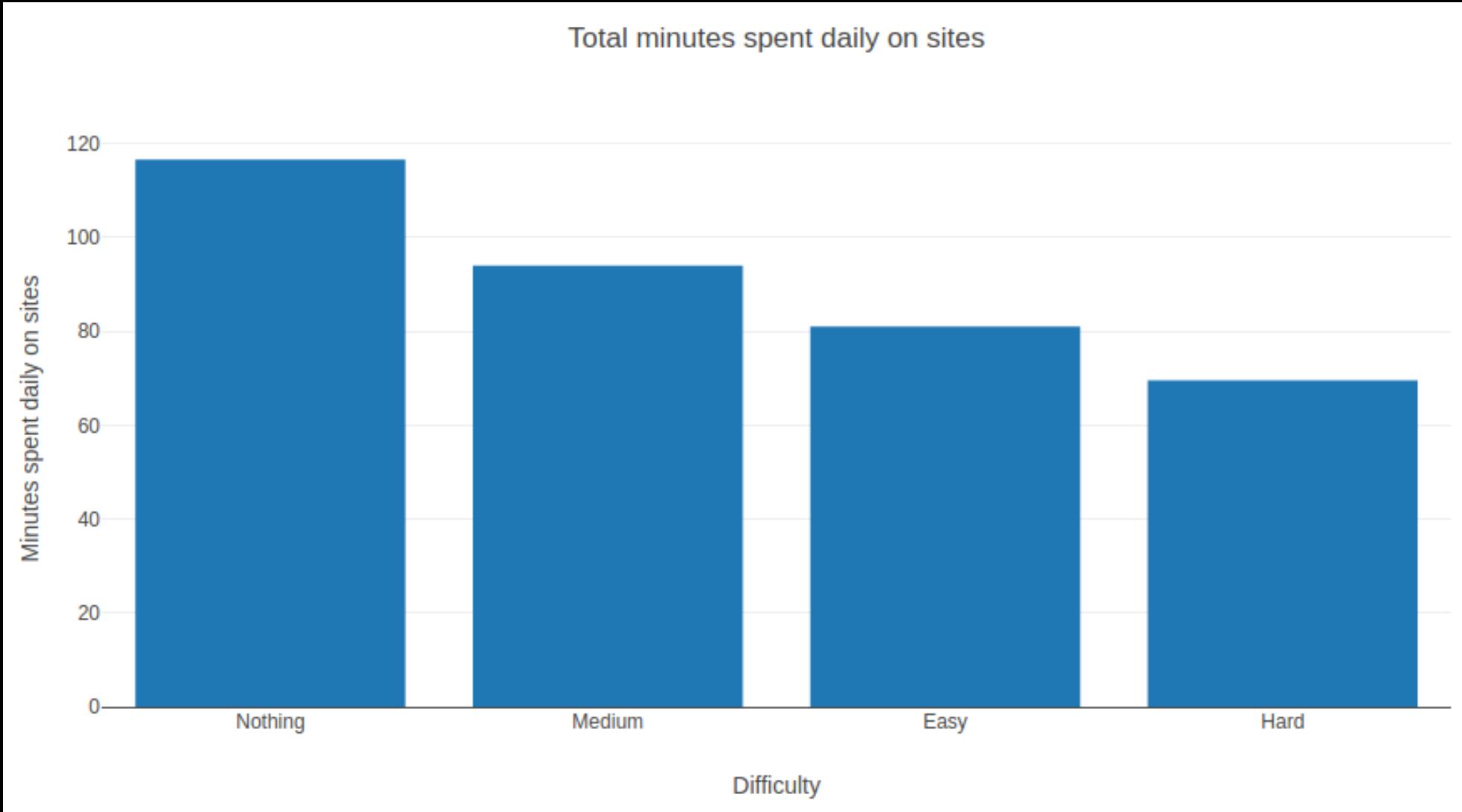
# Randomly assigning difficulty levels has no effect on attrition



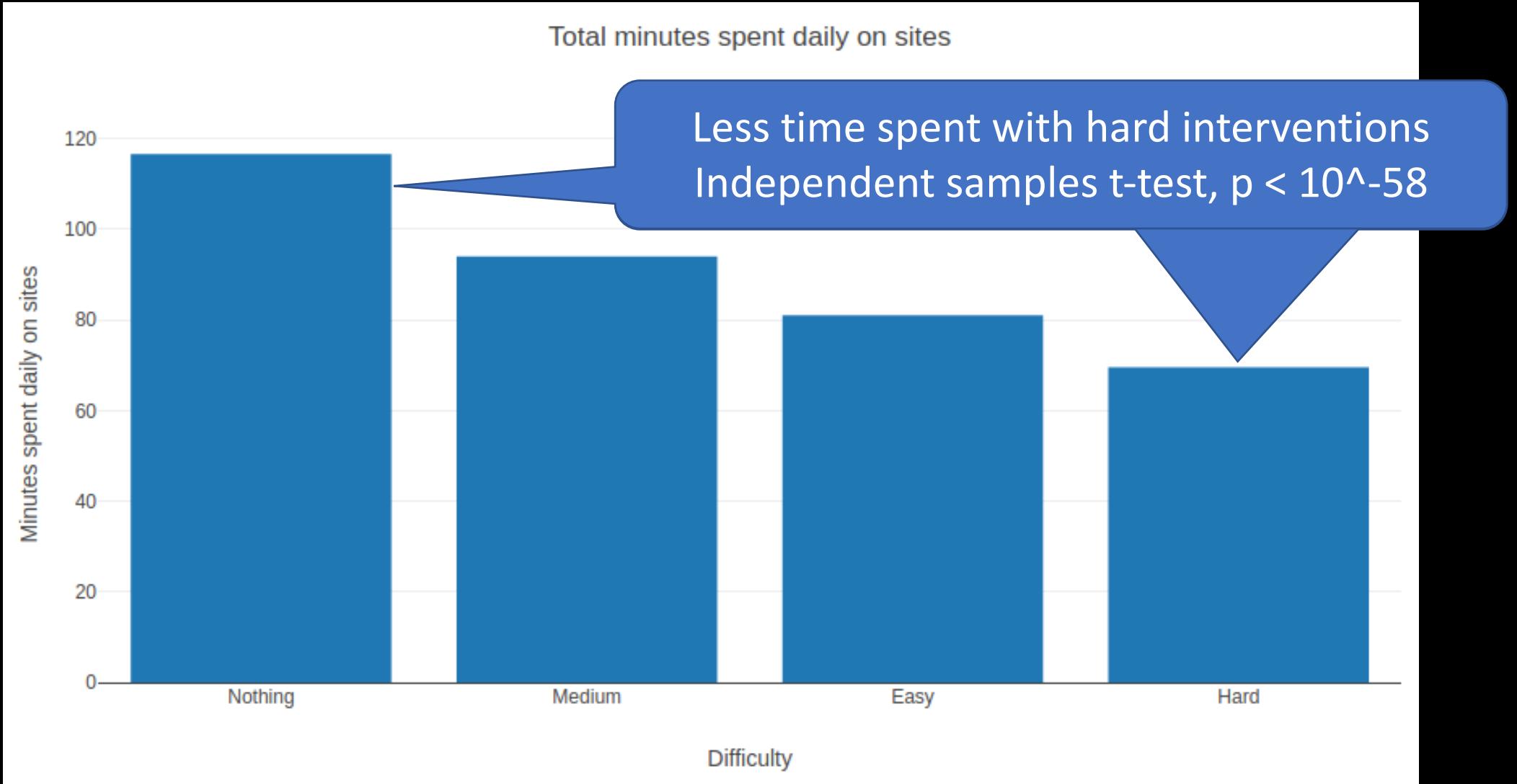
# Randomly assigning difficulty levels has no effect on attrition



# Randomly assigning difficulty levels improves the efficacy of interventions



# Randomly assigning difficulty levels improves the efficacy of interventions



## HabitLab: Our in-the-wild behavior change platform

Do interventions remain effective as time passes?

What are the side effects of interventions?

How do users' preferences change over time?

- Users initially are overly optimistic about how difficult they want their interventions
  - “No intervention” is least frequently chosen during onboarding
- Intervention difficulty choices decline over time
  - Half of users eventually choose “no intervention” nearly always
- Desired difficulty can be predicted with periodic experience sampling
- Hope springs eternal: Don’t want an intervention this visit, but ask next time
- **Assigning users harder interventions works to combat these issues**

# Discussion

Randomly giving users harder interventions seems to perform better than giving users a choice

We would still prefer to respect user preferences

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Perhaps we can solve this issue by changing the set of choices?

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Perhaps we can solve this issue by changing the set of choices?

- Instead of giving a choice between fries or salad, make the choice between broccoli or spinach?

# Discussion

Randomly giving users harder interventions seems to perform better than giving users a choice

We would still prefer to respect user preferences

Perhaps we can solve this issue by changing the set of choices?

- Instead of giving a choice between fries or salad, make the choice between broccoli or spinach?
- Instead of giving a choice to not see an intervention, make the choice between intervention A or B?

# Project summary

Users differ in preferences for intervention difficulty

Users initially overestimate their motivation

Give users choices and many will eventually gravitate to the easy path

Giving them harder interventions without asking improves outcomes

Future work: Give users choices without adverse effects

## HabitLab: Our in-the-wild behavior change platform

Do interventions remain effective as time passes?

What are the side effects of interventions?

How do users' preferences change over time?

Conclusion

# Discussion and Implications

Behavior change systems' effects on users change constantly

- Users' preferences during onboarding may not be true a week later
- Initial observations of effectiveness are subject to novelty effects

There are secondary effects in addition to the targeted outcomes

- By reducing time on aggregator sites, time elsewhere is also reduced

# Recommendations

Behavior change systems' effects on users change constantly

- Periodically do non-intrusive experience sampling and changes if possible. Don't assume everything during onboarding will be true forever

There are secondary effects in addition to the targeted outcomes

- When measuring how well your behavior change system works, measure outcomes holistically in addition to the target behavior

# Future work

There are many behavior change taxonomies organizing theories for how behavior change interventions can work

Which of these theories actually work? How much does theory matter, as opposed to the implementation?

Implement interventions covering a taxonomy (90 total), and measure intervention effectiveness and attrition for each

# Future work (more distant future)

We have focused on online behavior change

With the increasing ubiquity of sensors and wearables, could we build an in-the-wild behavior experimentation platform in the physical world?

# Thesis Statement

In-the-wild experimentation is a powerful tool to gain insights about behavior change systems at scale – specifically, allowing us to conduct a wide range of studies about interventions and their outcomes.

# Acknowledgements

Advisor: Michael Bernstein

Many contributors: Zhengxuan Wu, Jianghezi Zheng, Lisa Liao, Helen Qiu, Drew Gregory, Zilin Ma, Golrokh Emami, Jacob Ray, Matthieu Rolfo, Sarah Sukardi, Matthew Mistele, Julie Ju Young Kim, Wenqin Chen, Radha Jain, James Carroll, Sara Valderrama, Catherine Xu, Esteban Rey, Lewin Cary, Carmelle Millar, Colin Gaffney, Swathi Iyer, Sarah Tieu, Danna Xue, Britni Olina Chau, Na He Jeon, Armando Banuelos, Kaylie Zhu, Brahm Kapoor

Labmates in the HCl group

# HabitLab: In-the-wild Behavior Change Experiments at Scale

## Outcomes

Does effectiveness remain constant as time passes?

Effectiveness of static interventions falls over time, rotating them helps

What externalities exist?

On browsers, reducing time on one site leads to reductions elsewhere

## Interventions

How do users' preferences change over time?

Users initially choose harder interventions, but choice of difficulty falls over time

# Backup slides

## Examples of research questions we can potentially study using HabitLab

Question type	Questions related to goals of users	Questions related to choice of intervention	Questions related to outcomes of interventions
Observed state	What goals do users have?	What interventions do users choose?	What interventions are effective?
Changes	How and why do user goals change over time?	How and why do intervention choices change over time?	How and why does intervention effectiveness change over time?
Measures	How do users' stated goals differ from their actual goals?	How do users' stated intervention preferences differ from their actual choices?	How does effectiveness measured for an intervention differ from overall effect?

# Why study online behavior change?

Can measure effectiveness (time spent per visit)

Many interventions possible (can modify sites)

Can frequently alter interventions (can change intervention every visit)

# US adults spend 4.2 hours each day browsing the web and using phone apps

