



“Shhh...be quiet!” Reducing the Unwanted Interruptions of Notification Permission Prompts on Chrome

I. Bilogrevic, B. Engedy, J. L. Porter III, N. Taft, K. Hasanbega, A. Paseltiner,
H. Kyoung Lee, E. Jung, M. Watkins, P. Mclachlan, J. James

Google LLC

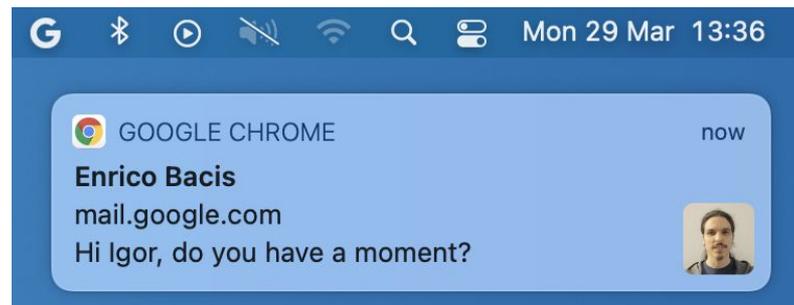


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Web Push Notifications

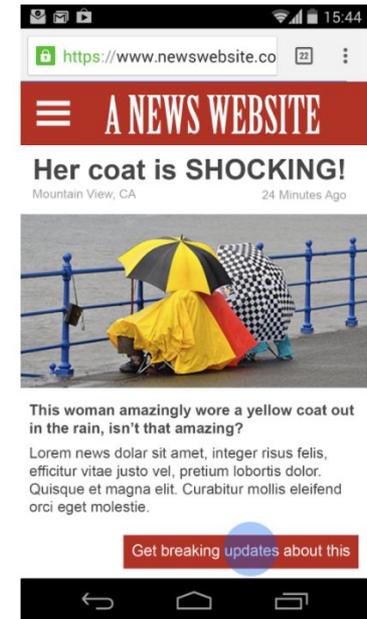
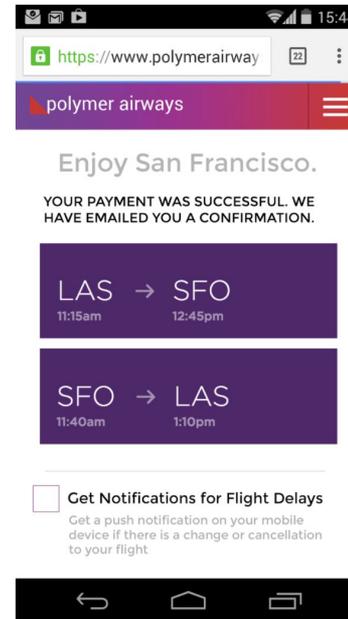
Operating systems provide APIs that allow apps to display push notifications as native system notifications

Chrome, like many other browsers, implements the web Notifications API, which allows websites to send push notifications to users

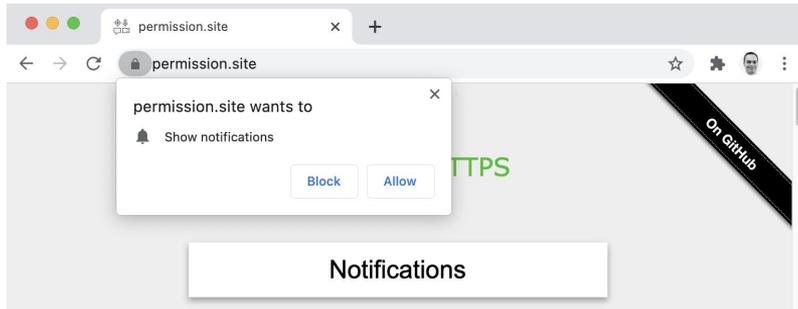


Best Practices for Web Push Notifications Permission Requests

- User should show intent before the site asks for permission
- Notifications should be time-sensitive and useful
- Sites should have in-site management controls for notifications

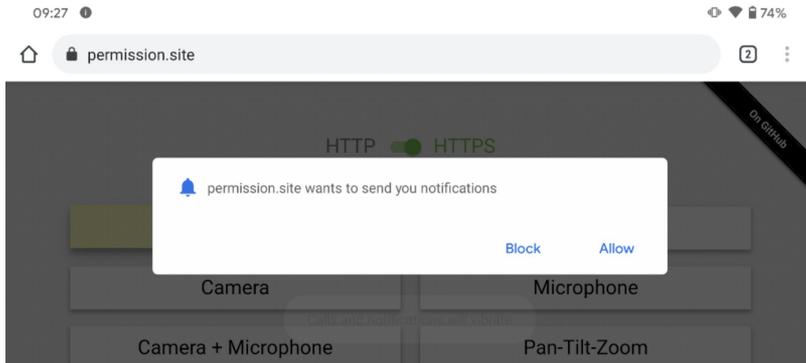


Notifications Permission Prompts on Chrome



Desktop (Linux, Mac OS, Windows)

- Anchored bubble UI
- Users can continue browsing the website without having to interact with the prompt

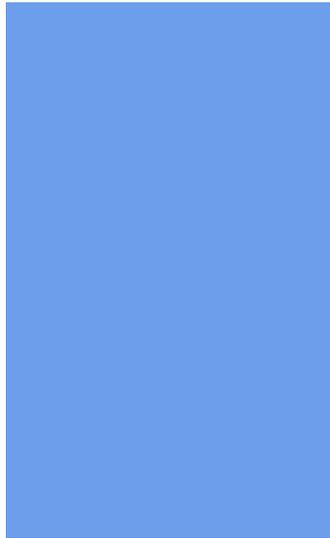


Mobile (Android)

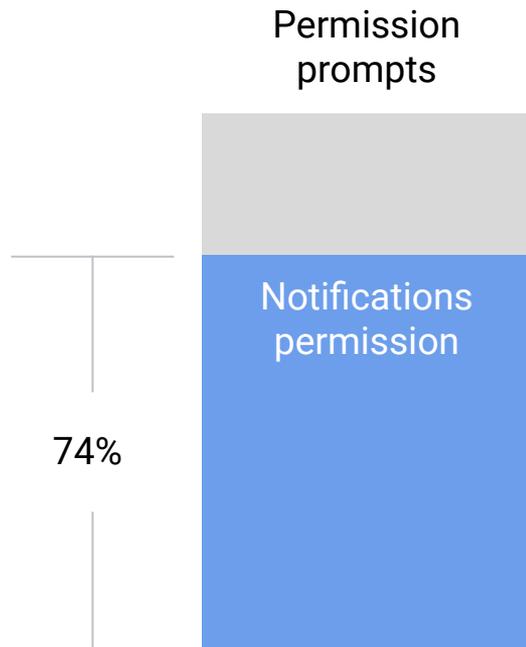
- Modal dialog UI
- Users need to interact with the prompt in order to continue browsing the website

Notifications Permission Prompts on Chrome

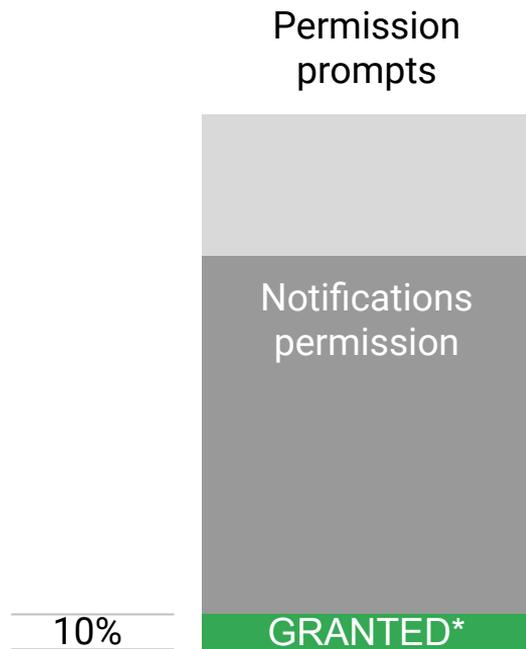
Permission prompts



Notifications Permission Prompts on Chrome

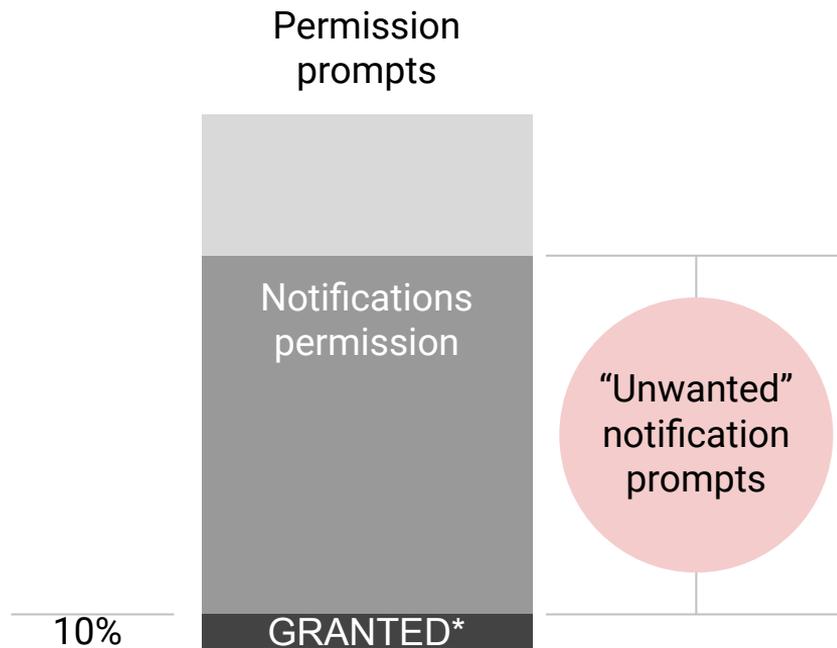


Notifications Permission Prompts on Chrome



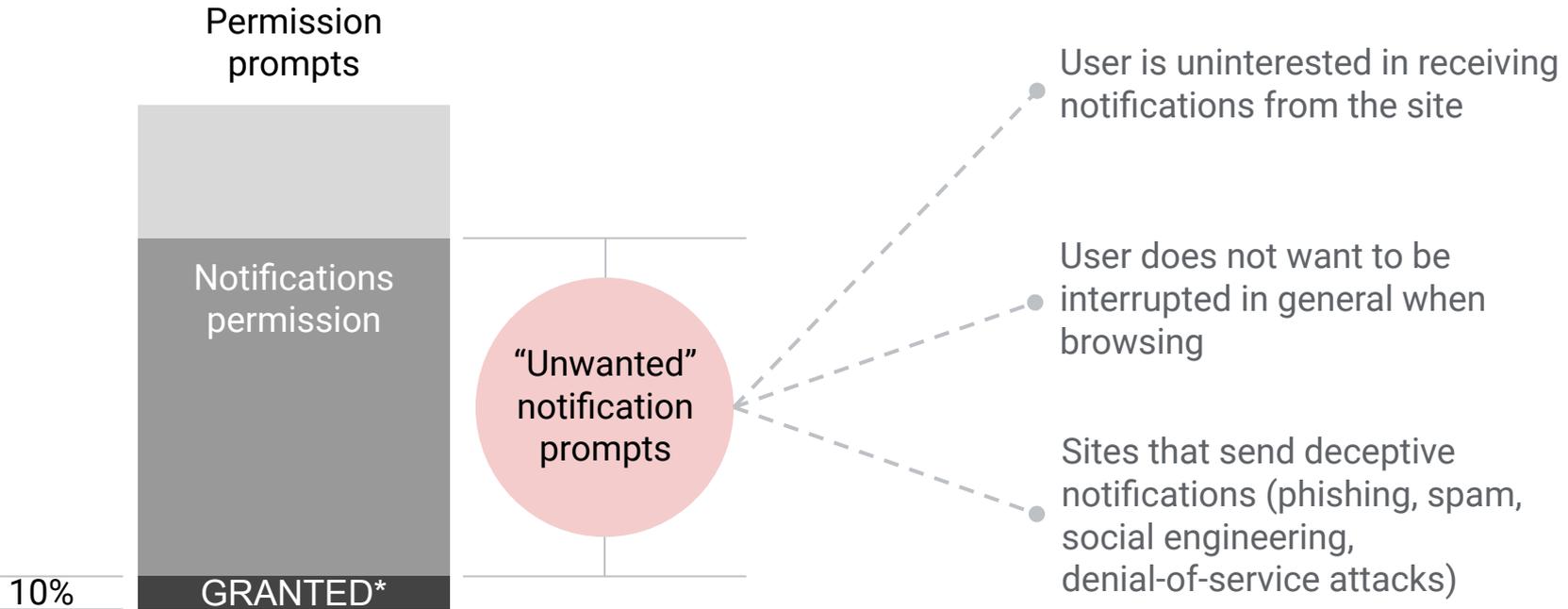
* 10% and 21% of all notifications permission prompts are granted on desktop and Android, respectively, over a 28-day period in March 2020.

Notifications Permission Prompts on Chrome



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Unwanted Notifications Permission Prompts



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This Work

Goal

Reduce unwanted notification permission prompts for the majority of users without significantly impacting those who want to receive them

Contributions

- 2 large-scale studies of notifications prompt usage in-the-wild
- Defined proxy measures of unwanted notification prompts
- Designed new “quiet” permission prompt UI
- Introduced adaptive activation mechanisms for new UI

Main Result

- Significant reduction of unwanted notification prompts (decrease by 31%)
- Minimal impact on wanted notification prompts (decrease by < 5%)



Notifications permission prompts in-the-wild

First Experiment

Study goal

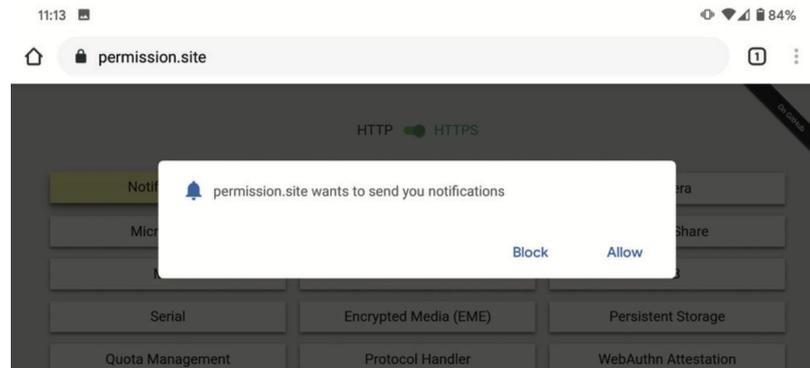
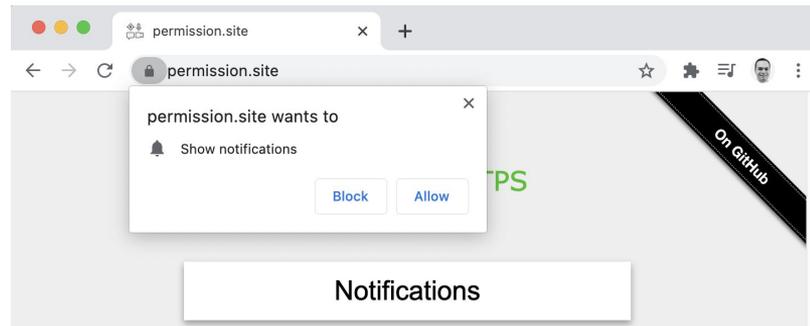
Understand how Chrome users interact with the default (or legacy) notifications permission prompts in-the-wild

Dataset

Actions (allow, block, dismiss or ignore) on notification permission prompts from a random sample of Chrome users who opted-in to sharing telemetry with Google¹

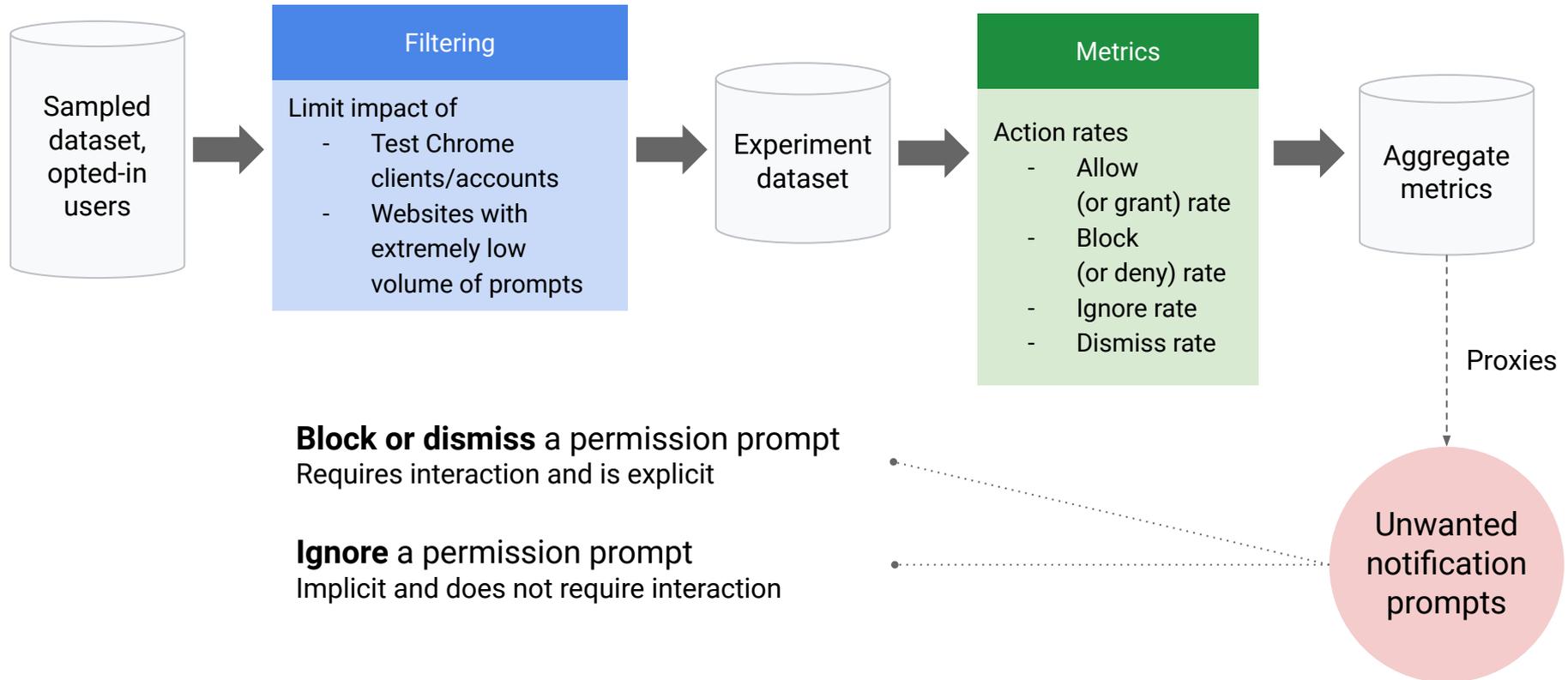
Study ethics

Before conducting any experiment with behavioral data, we obtained approval from key Google stakeholders (legal, UX, privacy, engineering and product)



1. At the time of the experiment, this sample included only users who had enabled the setting “Share usage reports and crash analytics with Google”, signed-in to their Google account in Chrome and enabled the browser “Sync” feature without a custom passphrase. Entries in this dataset are keyed by random Chrome client identifiers and are not associated with the users’ Google accounts. This random identifier can be reset at any time by the user by enabling and disabling the Sync feature.

Methodology and Metrics

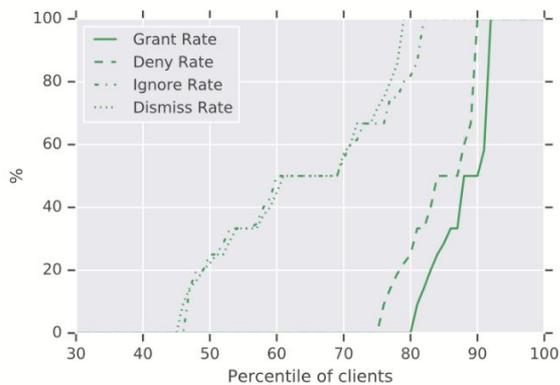


Results

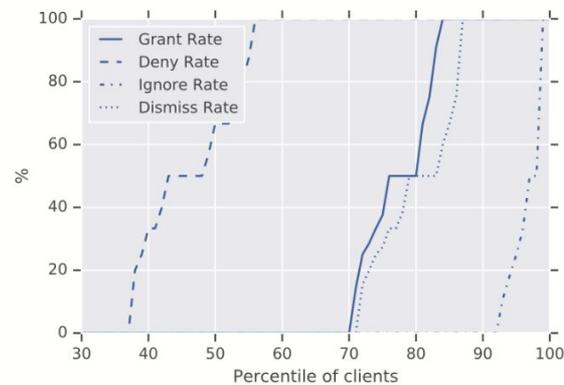
Period	Duration	Actions analysed	URL origins*	Chrome clients
March 2020	10 days	> 800 million	> 70 thousand	> 300 million

80% of desktop (and 70% of Android) clients in our sample never granted any prompts they saw.

Action rates by client percentile



Desktop
(Linux, Chrome OS, Mac OS, Windows)



Mobile
(Android)

* We use the terms "URL origin" and "site" or "website" interchangeably in this presentation.



Reducing the Interruptiveness of Unwanted Notification Permission Prompts

Approach

1 Less interrupting prompt UIs

Guiding principles

Reduce number of prompts that users have to act upon

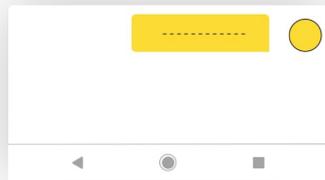
Provide more obvious “escape hatch” if users want to change their choice after they have made it

Desktop



(a) Variant 1: Animated icon.

Android



(c) Variant 3: Info-bar.

2 Per-site activation mechanism

Show only the quiet UI on websites that have a very low average grant rate

3 Per-user activation mechanisms

Users can choose to always see the quiet UI by enabling it in the Chrome settings

Adaptive activation heuristic: Enable quiet UI after 3 consecutive “Block” actions

Second Experiment - Quiet UIs

Study goal

Evaluate the impact of the quiet UIs on interaction metrics and its effectiveness in reducing unwanted interruptions

Methodology

A/B test where new UIs were **disabled** for the **control** groups and **enabled** for the **experiment** groups

Results

Period	Duration	Actions analysed	URL origins	Chrome clients
March 2020	10 days	> 100 million	> 70 thousand	> 40 million

Quiet UI has minimal impact on grant rates (< 5% lower average grant rate) while significantly reducing unwanted interruptions (31% lower average deny rate)



Conclusion

Conclusion

On Chrome, notification permission prompts represent 74% of all prompts but they are rarely granted

- Standard prompt UI creates unwanted interruptions

- Need to rethink notification permission prompt UI

We conducted 2 large-scale studies

- Unwanted prompts appear across all types of websites for most users

- Designed new prompt UIs for the notifications permission in Chrome

- The activation mechanisms depend on crowd-sourced data and the users' own past interactions

Analysis showed that new UIs are successful in reducing unwanted interruptions while keeping utility for users who want notifications

Ongoing work

- Improve the precision of activation mechanisms in cases where the user is unlikely to grant the permission

- Extend the use of less interrupting UIs to other permission types (e.g., geolocation)

Thank You!

More information

Our paper

<https://www.usenix.org/conference/usenixsecurity21/presentation/bilogrevic>

Chromium blog post about quieter UIs

<https://blog.chromium.org/2020/01/introducing-quieter-permission-ui-for.html>

Chrome User Experience Report (action metrics)

<https://developers.google.com/web/tools/chrome-user-experience-report>

Contact author

Igor Bilogrevic, ibilogrevic@google.com