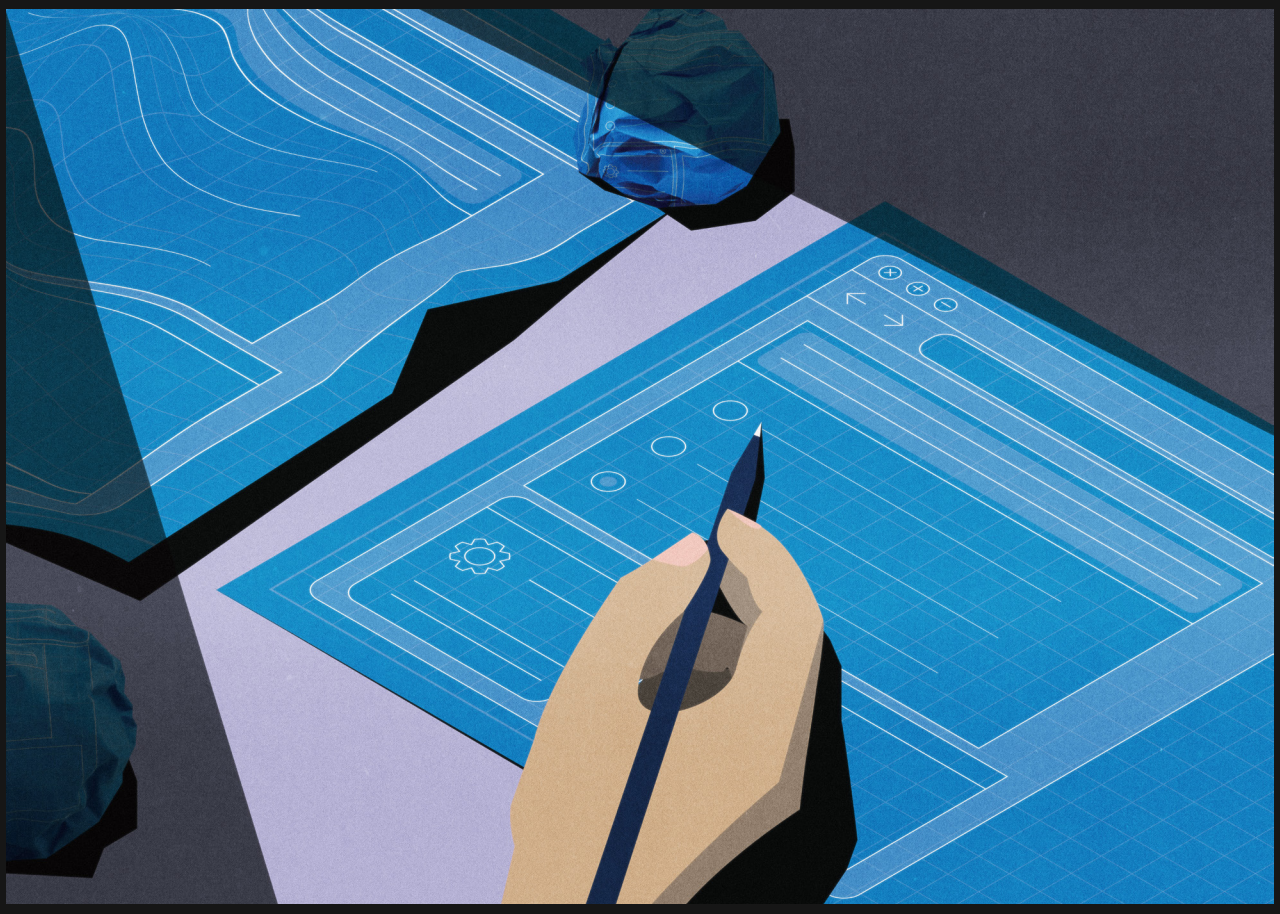
Designing Better Digital Competition Remedies

Lessons from User Research

GEMMA PETRIE



Mozilla

Designing Better Digital Competition Remedies: Lessons from User Research

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ABSTRACT

As digital markets become increasingly complex, regulatory authorities face significant challenges when designing and implementing effective competition remedies, whether ex post or ex ante. Through an analysis of Mozilla's browser competition research, this paper demonstrates how user research can guide competition remedy design by providing systematic evidence of user behavior and experiences. We examine three complementary approaches—concept testing, usability testing, and behavioral experiments—applied at different stages of remedy development. Our findings reveal how early-stage concept testing identified potential implementation barriers before significant resource investment, large-scale behavioral experiments validated specific design elements that influence remedy effectiveness, and systematic usability testing exposed critical gaps between regulatory intent and user experience in practice. By integrating these user research methodologies throughout the remedy design process, regulators can develop more effective remedies grounded in evidence about how users actually interact with and make choices in digital markets.

01

INTRODUCTION

01.

INTRODUCTION

Competition remedies are interventions undertaken by regulatory authorities to promote market competition—whether in the context of a regulatory initiative or traditional antitrust enforcement. Both ex post and ex ante interventions are referenced here as "remedies." Effective remedies are essential to maintaining competitive markets and protecting consumers.[1] While regulators invest significant effort understanding distortions in digital markets and crafting regulations to address them, the design and implementation of resulting remedies are often left to the very operating system providers being enforced against or regulated.[2] Unsurprisingly, while these companies may technically comply with legal requirements, the absence of important steps like stakeholder consultation, testing, and trialing of remedy proposals means the intended impact often falls short. Enacting technology regulation is a massive undertaking, and it is vital that these rare opportunities to restore competition are maximized to benefit consumers.

Effective regulation and remedies demand a deep understanding of how people interact with technology. In a digital landscape defined by rapid changes, innovation and increasingly complex user interactions, policymakers face significant challenges in keeping pace. Employing user research to test and refine ideas before they reach users is not a radical notion, but rather standard practice in the tech industry. Companies of all sizes routinely conduct research throughout their product development process, from early exploration to post-launch refinement. To understand how people use technology in their daily lives, companies conduct observational research like ethnographic studies and diary studies. When designing new features, they use structured methods like card sorting to organize information effectively and prototype testing to validate design concepts. Companies also gather direct feedback through user interviews and design workshops,

1 European Commission: Directorate-General for Competition, Montjoye, Y., Schweitzer, H., & Crémer, J. (2019). *Competition policy for the digital era.* Publications Office. https://op.europa.eu/en/publication-detail/-/publication/21dc175c-7b76-11e9-9f05-01aa75ed71a1/

2 Bostoen, F., & Van Wamel, D. (2023). Antitrust Remedies: From caution to creativity. *Journal of European Competition Law & Practice.*

while measuring actual behavior through A/B testing and controlled experiments. This research continues after launch through analysis of usage data and ongoing user studies to identify areas for improvement.[3, 4]

Yet when it comes to competition remedies, the same rigorous approach to user research is often absent. While companies invest significant resources in testing and refining their own interfaces, remedies intended to promote competition often reach users without being evaluated for whether they achieve their intended effect. This creates a striking disparity: interface changes that would never be deployed without thorough user testing in a commercial context are implemented as competition remedies without similar evidence about their impact on user choice and behavior. Competition authorities in multiple jurisdictions have recognized the importance of behavioral insights, drawing on behavioral economics, psychology, and empirical research methods.[5, 6] Leveraging this expertise and integrating user research into the development of regulatory remedies, particularly those involving user interface design, can greatly enhance their relevance and effectiveness.

3 Hall, E. (2024). *Just Enough Research* (3rd ed.). A Book Apart.

4 Ladner, S. (2019). *Mixed Methods: A short guide to applied mixed methods research.*

5 Netherlands Authority for Consumers and Markets (ACM). (2013). *Behavioral Economics & Competition Policy.* https://www.acm.nl/sites/default/files/old_publication/publicaties/11586_acm-behavioural-economics-competition-policy.pdf

6 UK Competition and Markets Authority (CMA). (2022). *Experiments at the CMA: How and when the CMA uses field and online experiments.* https://www.gov.uk/government/publications/experiments-at-the-cma-how-and-when-the-cma-uses-field-and-online-experiments

02

RESEARCH METHODS

02.

RESEARCH METHODS

A wide range of research methods are available to inform remedy design, each offering unique strengths and trade-offs.[7] The choice of methods depends on several factors, including available resources, project timelines, the need for breadth versus depth of insights, and the stage of the design process.[8] In this paper, we highlight three research methods that have proven particularly effective for Mozilla in the context of regulatory remedy design: **concept testing, usability testing, and behavioral experiments.**

Concept testing serves as an early-stage research method for evaluating potential solutions before significant resource investment. Through visual stimuli such as mock-ups or low-fidelity prototypes, concept testing assesses whether initial ideas align with user needs and expectations. This method proves particularly valuable when existing remedies have yielded inconsistent results, allowing researchers and regulators to explore and iterate on a wide range of ideas.

Usability testing evaluates how users interact with specific interface implementations through systematic observation. By collecting empirical data from representative users completing realistic tasks, usability testing identifies gaps between interface design and user needs.[9] This method provides concrete evidence of how proposed remedies function in practice, making it especially valuable for assessing compliance with regulatory requirements and identifying necessary refinements.

Behavioral experiments measure the impact of specific design elements. By isolating variables while controlling for other factors, these experiments provide statistical

7 Davies, S. W., & Ormosi, P. L. (2010). *Assessing competition policy: Methodologies, gaps and agenda for future research* (CCP Working Paper 10-19).

8 Rohrer, C. (2024, January 12). *When to use which user-experience research methods.* Nielsen Norman Group. https://www.nngroup.com/articles/which-ux-research-methods/

9 Rubin, J., & Chisnell, D. (2008). *Handbook of usability testing: How to plan, design, and conduct effective tests* (2nd ed.). Wiley.

evidence about how different implementations influence user behavior.[10] While more resource-intensive than other methods, behavioral experiments offer unique value in validating design choices and predicting outcomes at scale.

Through an analysis of Mozilla's browser competition research, this paper demonstrates how user research methodologies can provide valuable evidence to improve remedy effectiveness.

- Concept testing identified potential implementation challenges early in the process, allowing exploration of different approaches before significant resource investment.
- Usability testing exposed critical gaps between regulatory intent and user experience, particularly in how interface design choices impact users' ability to exercise meaningful choice.
- Behavioral experiments provided statistical evidence about specific design elements that influence remedy effectiveness, enabling evidence-based decisions about implementation details.

10 Gergle, D., & Tan, D. S. (2014). Experimental Research in HCI. In Olson, J. S., & Kellogg, W. A. (Eds.), *Ways of Knowing in HCI* (pp. 191–227). Springer.

03

CASE STUDIES

03.

CASE STUDIES

3.1 Concept Testing

This case study examines how concept testing can inform the early stages of regulatory remedy design through an analysis of Mozilla's research into browser choice interventions.[11] The study, which involved 108 participants across three countries, evaluated four distinct design concepts aimed at improving user engagement and comprehension in browser selection. This research demonstrates how concept testing can generate valuable insights before significant resource investment.

3.1.1 Context

Digital markets present unique regulatory challenges, particularly regarding operating system defaults and platform self-preferencing behaviors. Operating system providers typically pre-install and set their own browsers as defaults, a practice that has attracted regulatory scrutiny due to its potential to inhibit competition. While previous regulatory interventions, such as browser choice screens mandated in the 2009 Microsoft[12] and 2018 Google Android[13] cases in the European Union, have attempted to address this issue, their effectiveness has been limited.[14]

The European Union's Digital Markets Act (DMA) has renewed focus on browser choice

11 Petrie, G. (2023). *Beyond choice screens: Exploring browser choice design interventions.* Mozilla Research. https://research.mozilla.org/browser-competition/remedyconcepts/

12 European Commission. (2010). *Microsoft – Choice of web browser: Notice published pursuant to Article 27(4) of Council Regulation (EC) No 1/2003 in Case COMP/39.530 – Microsoft (tying). Official Journal of the European Union,* C 36, 7–8. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:036:0007:0008:EN:PDF

13 European Commission. (2018). *Case AT.40099 – Google Android: Commission decision of 18 July 2018.* https://ec.europa.eu/competition/antitrust/cases/dec_docs/40099/40099_9993_3.pdf

14 Caffarra, C., & Morton, F. S. (2021, January 5). *The European Commission Digital Markets Act: A translation.* CEPR Policy Insight No. 111. https://cepr.org/voxeu/columns/european-commission-digital-markets-act-translation

interventions, creating an opportunity to improve upon past approaches. Mozilla's concept testing research emerged in this context, seeking to explore alternative design interventions that could more effectively promote meaningful consumer choice.

3.1.2 Research Design

The concept development process began with cross-functional collaboration, bringing together Mozilla engineers, designers, and product managers to explore potential approaches to browser choice. This initial ideation phase generated a range of solutions captured in low-fidelity sketches, with the most promising concepts developed into prototypes for testing.

To evaluate these concepts, Mozilla conducted remote structured interviews with 108 participants across Australia, France, and the United Kingdom. The research assessed user responses across four key metrics: comprehension, usability, desirability, and engagement, using both verbal responses and numeric ratings. The study tested four distinct concepts representing different approaches to browser choice:

> **Concept 1: 2019 Android Browser Choice Screen:** Upon accessing the Play Store, users encounter a pop-up screen allowing them to choose "additional web browsers." The interface displays browser logos alongside names, with expandable descriptions available through drop-down arrows. Google Chrome appears at the top, marked as "installed," and users can dismiss the screen via a prominent "No Thanks" button. (See Figure 1 below.)

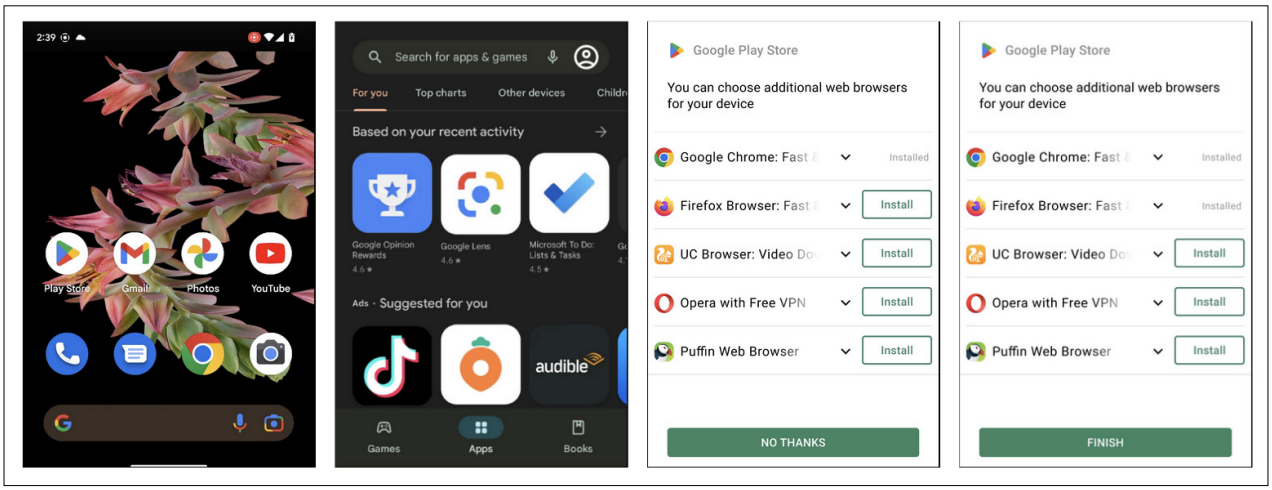

Figure 1: Screenshots of 2019 Android Choice Screen concept.

Concept 2: Play Store Quiz: This concept introduces an interactive approach through a green banner advertising “App Quiz: Find the best browser for you.” Users who engage with the banner encounter a single question: “What do you value the most in your browser?” After selecting multiple preferences from pre-defined options, users receive a personalized browser recommendation matched to their stated needs. (See Figure 2 below.)

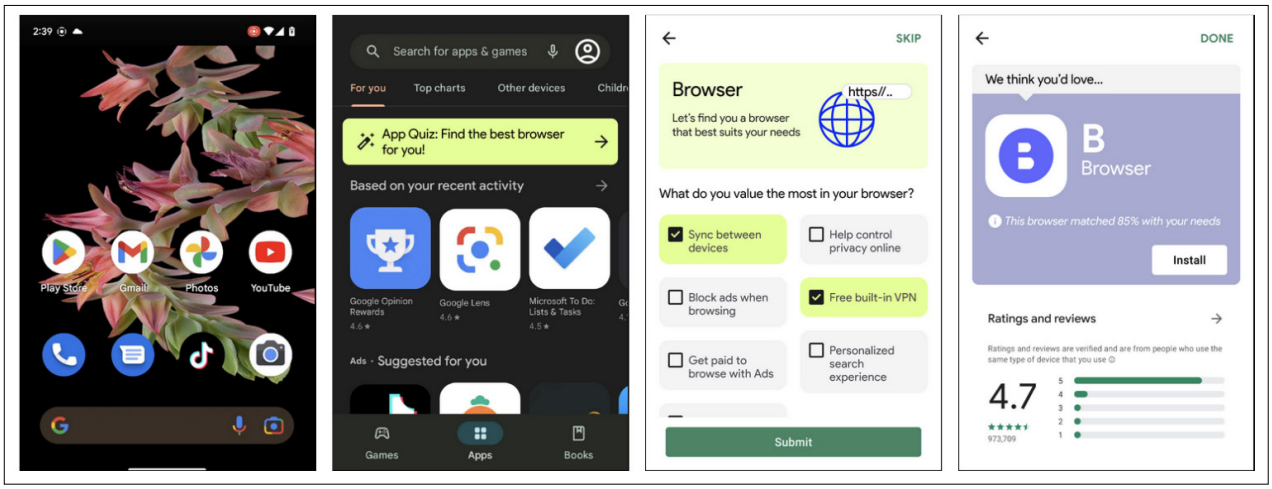

Figure 2: Screenshots of the Play Store Quiz concept.

Concept 3: “Hot Seat” Update: This intervention presents users with a notification asking them to “Please choose your preferred default browser” while viewing their home screen. Users who select “Choose” access an enhanced choice screen featuring star ratings and detailed browser information, with no browsers pre-marked as installed. The concept includes automated installation and default setting of the chosen browser, and it replaces the previous preinstalled default in the “hot seat.” The previous default browser remains available on the device. (See Figure 3 below.)

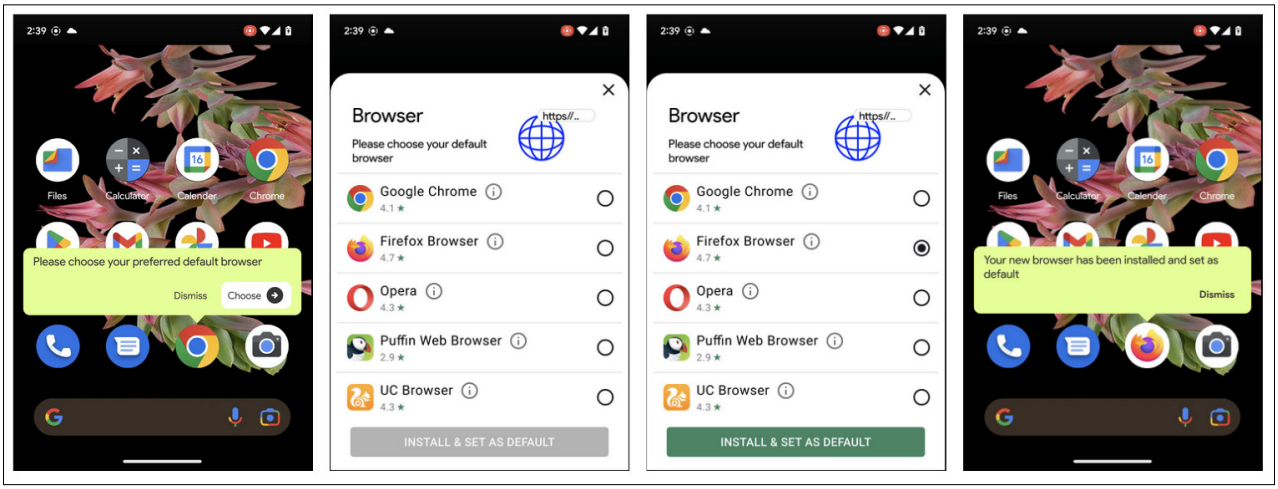

Figure 3: Screenshots of the “Hot Seat” Update concept.

Concept 4: Play Store Defaults Tab: This concept introduces a dedicated "Defaults" section within the Play Store, subtly marked as new with a small dot. The section organizes essential app categories (browsers, email, messaging, etc.) into tabs, allowing users to review current defaults, explore alternatives, and modify default settings directly within the app store interface. (See Figure 4 below.)

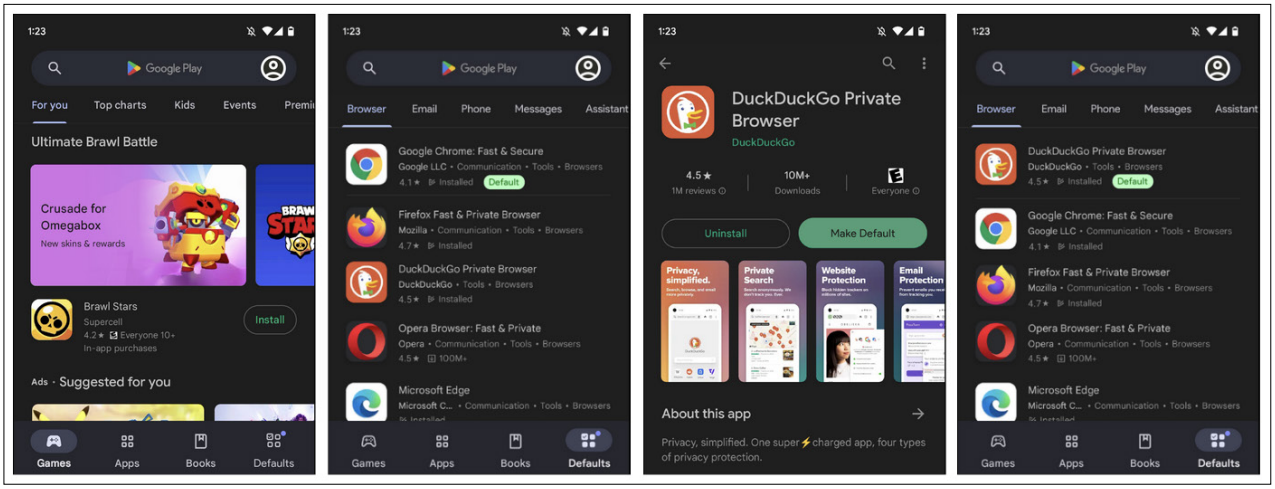

Figure 4: Screenshots of the Play Store Defaults Tab concept.

3.1.3 Key Findings

The research revealed several important insights for browser choice remedy design. First, the timing of interventions significantly impacts user engagement. Interruptions during unrelated tasks, such as accessing the Play Store, generated user frustration and reduced thoughtful consideration of alternatives. Instead, interventions should align with natural decision points to improve meaningful engagement.

Second, the study identified a significant challenge in notification fatigue. Users frequently dismissed pop-ups and banners without meaningful engagement, suggesting that non-disruptive, persistent features accessible at the user's discretion may be more effective. This finding has important implications for the traditional choice screen approach to browser selection, including underlining the importance of designing effective interventions the first time around.

Third, the research highlighted the substantial impact of default inertia impacting browser choice. Pre-installed browsers and complex operating system default settings create a strong status quo bias that is difficult for users to overcome. This suggests that effective interventions should present alternatives in a neutral manner and provide ongoing opportunities for users to explore and manage their browser defaults, rather than relying entirely on a single choice moment.

3.1.4 Implications

This research demonstrates the value of concept testing in the early stages of regulatory remedy development. Through systematic evaluation of alternative approaches, concept testing can help advance beyond previously attempted remedies to identify more innovative and effective solutions. This concept testing research revealed important insights about browser choice interventions before significant resources were invested in implementation. The findings identified specific challenges, such as notification fatigue and the impact of timing on user engagement. The research also suggested potential limitations of single-intervention approaches like traditional choice screens, highlighting opportunities to explore complementary design solutions for promoting browser choice.

3.1.5 Limitations and Future Research

This concept testing research, while valuable for early-stage remedy design, has several important limitations that should be considered when interpreting its findings. The qualitative nature of this research limits its ability to predict large-scale adoption patterns or long-term behavioral changes. Additionally, due to time and resource constraints, the research evaluated only a subset of possible design concepts. While the four tested prototypes provided valuable insights, they represent just a fraction of potential approaches to promoting browser choice. (See Figure 5 below.)

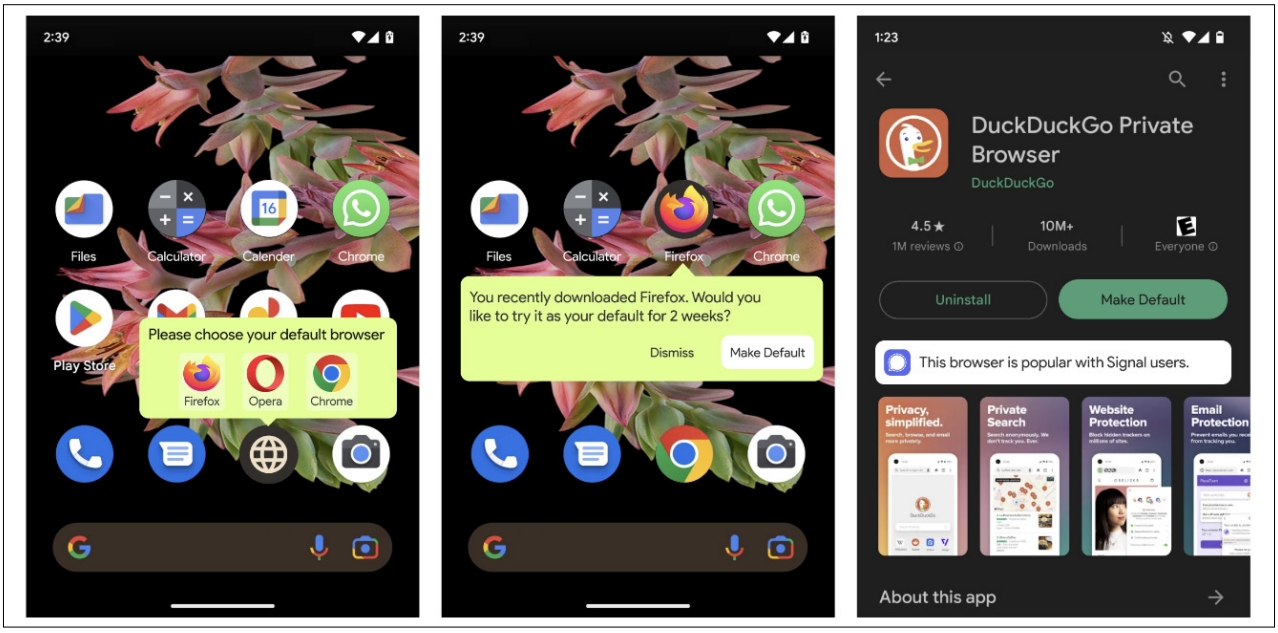

Figure 5: Additional browser choice concepts.

3.1.6 Conclusion

Mozilla's concept testing research demonstrates the value of early-stage user research in regulatory remedy design. By identifying key principles such as intervention timing, notification fatigue, and default inertia, this methodology can help regulators develop more effective interventions before significant resources are committed to implementation. This study demonstrates the value of concept testing as one component in a comprehensive approach to remedy design. While early-stage testing can inform design directions and potential pitfalls, subsequent research methods are needed to refine and validate these initial insights before large-scale implementation.

3.2 Usability Testing

This case study examines how Mozilla's usability research revealed substantial gaps between the Digital Markets Act's requirement for "easily" changeable defaults and users' actual experiences changing default browsers on iOS and Windows platforms.[15] The study investigated whether users could successfully change their default browsers, uncovering specific interface design patterns that impacted users' ability to exercise meaningful choice.

3.2.1 Context

The DMA requires platform gatekeepers to enable users to "easily" change default settings, including web browsers. However, the concept of "ease" remains undefined in the regulatory framework. This ambiguity is particularly significant given that approximately half of users report that they would need help changing or be unable to change their default browser.[16] These challenges are compounded by the role of default browsers in shaping user behavior.[17]

15 Petrie, G. (2025)*"Easy" Default Browser Setting on iOS & Windows.* Mozilla Research https://research.mozilla.org/browser-competition/

16 Amlani, K., & Petrie, G. (2022). *Five walled gardens: Why browsers are essential to the internet and how operating systems are holding them back.* Mozilla Research. https://research.mozilla.org/browser-competition/5wg/

17 OECD. (2022). *OECD Handbook on Competition Policy in the Digital Age.* OECD Publishing. https://www.oecd.org/daf/competition/oecd-handbook-on-competition-policy-in-the-digital-age.pdf

3.2.2 Research Design

Mozilla conducted unmoderated usability testing with 26 participants in Germany, equally divided between iOS 17 and Windows 10/11 platforms.[18] Participants represented diverse demographics with self-reported average technology expertise. The study employed a qualitative methodology that used a structured task sequence to observe user interactions with default browser settings, enabling us to observe natural navigation behaviors and identify specific points of friction in the user journey.

3.2.3 Key Findings

This usability testing study revealed substantial challenges on iOS and Windows, with users encountering both shared and platform-specific obstacles that undermined the DMA's requirement for "easily" changeable defaults.

- **Shared Challenges Across Platforms:**
    - **Navigation Challenges:** Users on both iOS and Windows encountered fundamental difficulties locating default browser settings. On iOS, the settings were buried within individual app settings rather than in an intuitive central location, causing users to search unsuccessfully through general menus.[19] Windows users frequently became lost in unrelated categories such as "Network & Internet" or "Personalization," indicating a non-intuitive information architecture.
    - **Search Functionality Issues:** The research revealed critical failures in settings search functionality across both platforms. On iOS, common search terms like "default," "browser," and "internet" yielded either irrelevant results or no results at all. (See Figure 6 below.) Windows users faced similar challenges, with searches for "web browser" leading to dead ends or, more problematically, to Microsoft's "Recommended Browser Settings," which primarily served to promote Edge rather than facilitate user choice. (See Figure 7 below.)

18 The usability research was conducted in early 2024 with participants using iOS 17, Windows 10 or Windows 11.In December 2024, Apple's iOS 18.2 release introduced changes to the settings menu architecture. While some of the identified usability issues were addressed in this update, others documented in this study persist.

19 Apple resolved this issue in iOS 18.2 by introducing a centralized "Default Apps" menu.

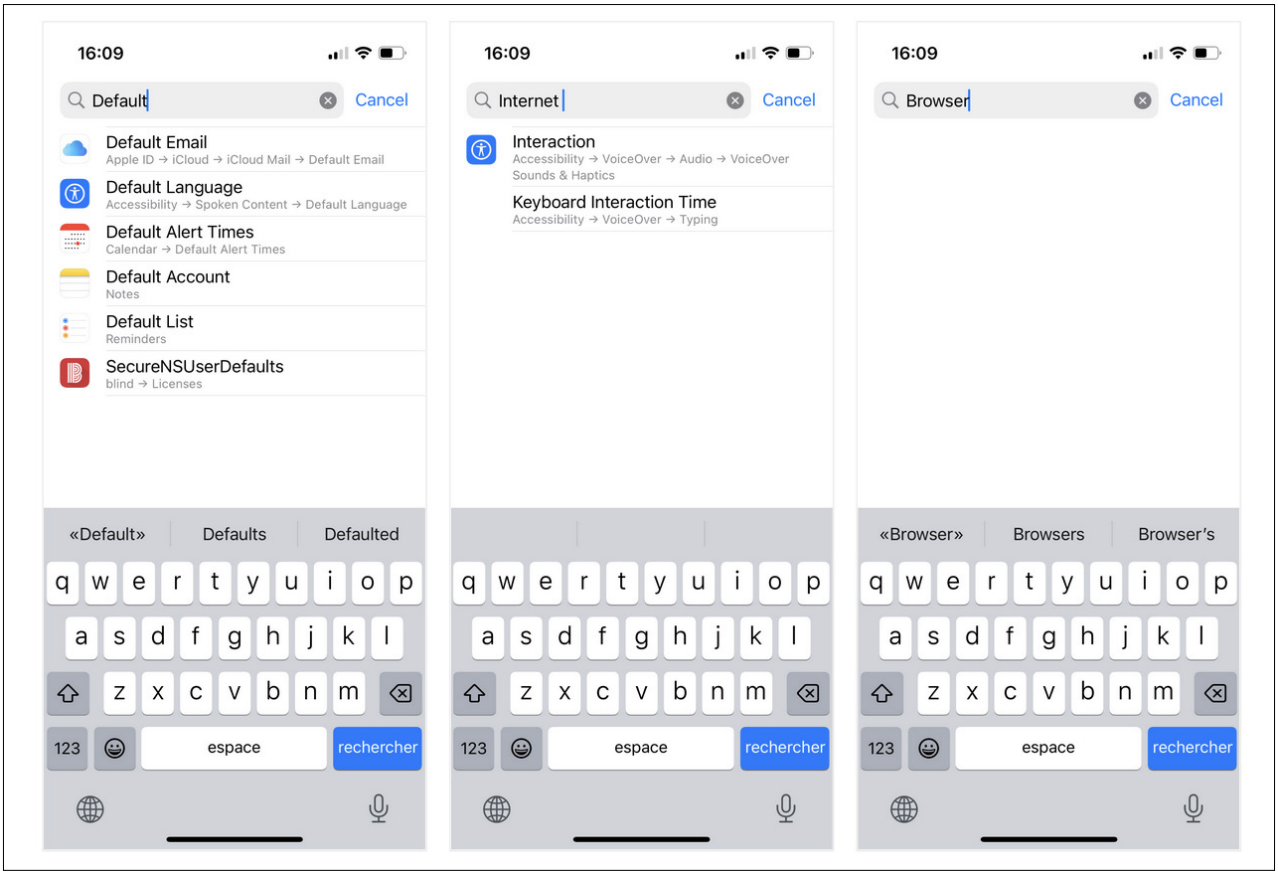

Figure 6: Searching for “Default”, “Internet” and “Browser” in the iOS 17 settings menu.

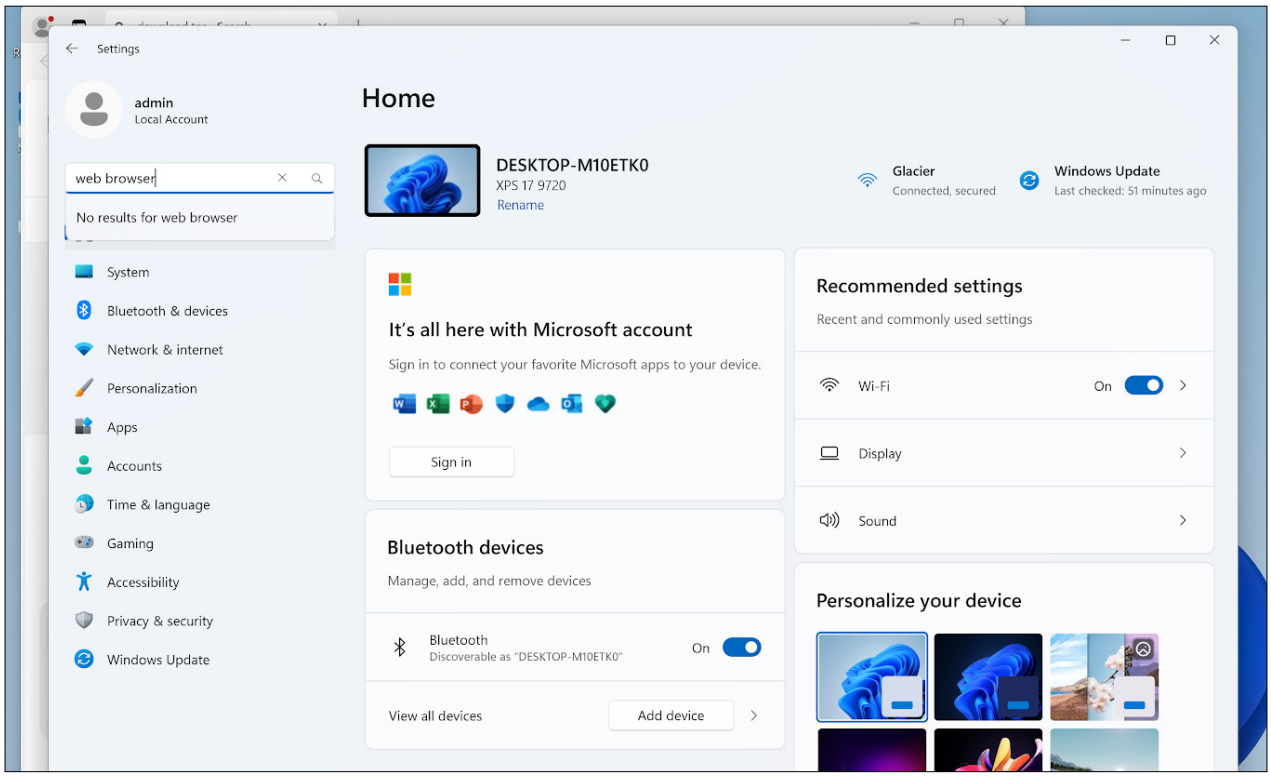

Figure 7: Searching for “web browser” in the Windows 11 Settings does not return any search results.

- **Self-Preferencing:** Both platforms subtly or explicitly nudge people toward the default browser provided by the gatekeeper. iOS steered users toward Safari by hiding default browser settings when Safari was the current default. Windows similarly promoted Edge through the prominent placement of "Recommended Browser Settings," which users often mistook for general browser settings. We discuss each of these platform specific barriers in detail below.

- **Platform Specific Barriers:**

  - **Hidden Settings on iOS**: iOS exhibited a particularly problematic design pattern where default browser options would disappear from the settings menu when Safari was set as the default. (See Figure 8 below.)[20]
    This hidden-settings approach created unnecessary confusion—even among participants who initially demonstrated a clear understanding of how to change their default browser—and posed a significant barrier to user choice by contradicting fundamental principles of interface clarity and consistency.
    Some participants, confident in their ability to change the setting, were disoriented when they accessed Safari's settings and found the option missing. Others confirmed their knowledge by temporarily switching back to Safari, only to discover they could no longer easily return to their preferred browser because the option had vanished. To change their default, users were required to navigate instead to the settings menu of an alternative browser—an unintuitive and unnecessarily convoluted path.
  - **"Recommended" Settings on Windows:** Windows presented a different but equally significant barrier through its "Recommended Browser Settings" interface. This feature's prominent placement and misleading name led many users to mistake it for general default browser settings, when in fact it was designed specifically to promote Edge as the default browser. The confusion was compounded by the menu's high visibility in search results and prominent placement in the Windows Settings interface.
    (See Figure 9 below.)

20 Apple resolved this issue in iOS 18.2.

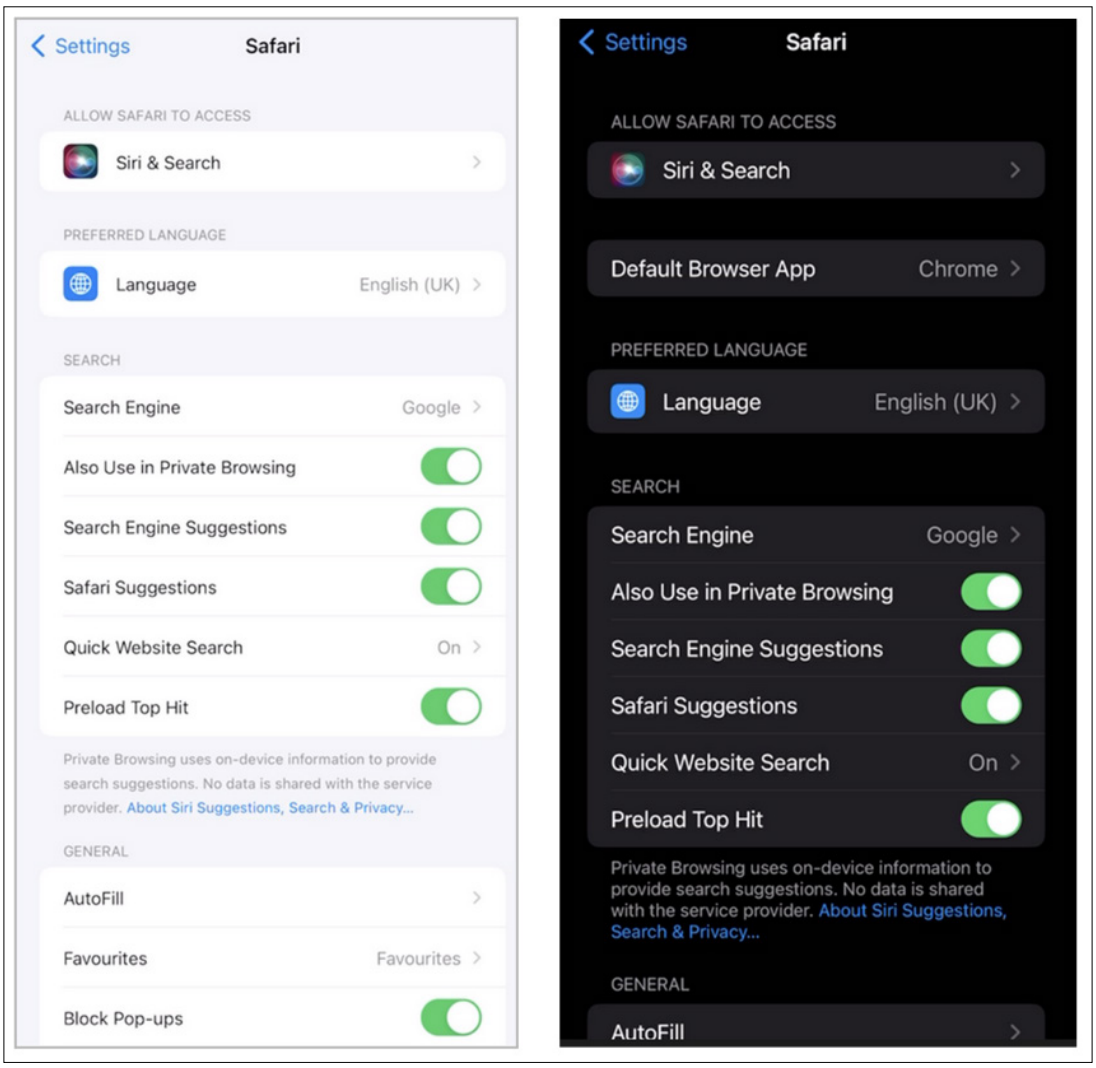

Figure 8: iOS 17 settings showing (left) Safari set as default with no “Default Browser App” menu item displayed and (right) Safari not set as default with “Default Browser App” menu item displayed.

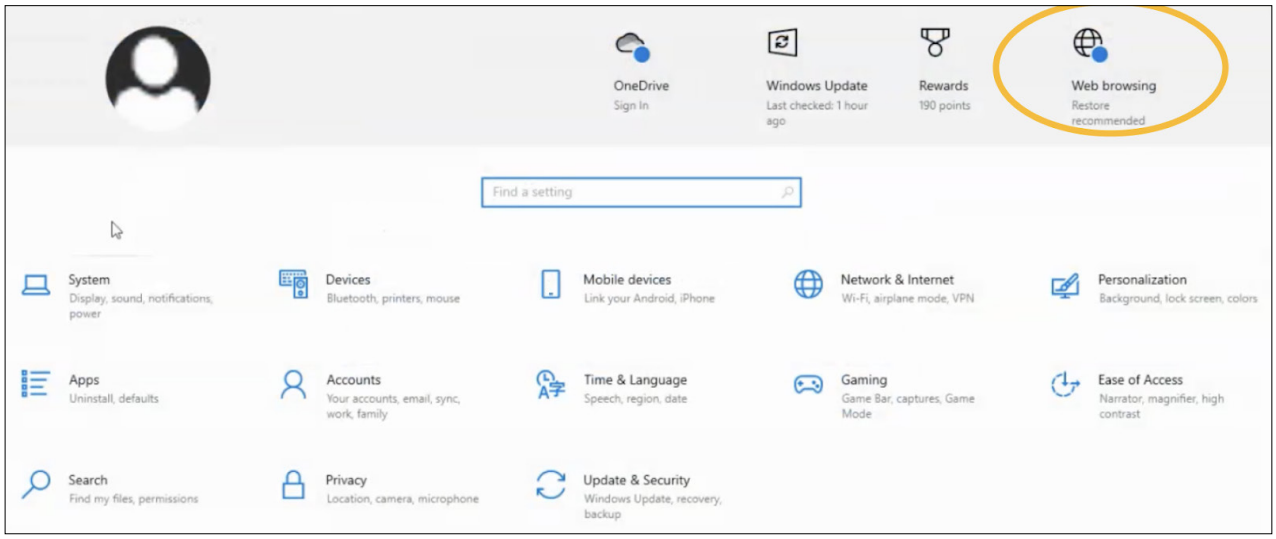

Figure 9: Windows 10 Settings with Microsoft’s call to action to restore the recommended browser settings.

While most iOS participants (11 out of 13) eventually succeeded in finding where to change their default browser, the process was time-consuming and unnecessarily difficult.[21] Windows participants faced considerable difficulty with only a few (3 out of 13) successfully finding where to change their default browser. The remaining Windows users either abandoned the task entirely or incorrectly believed they had changed their default when they had not.[22]

3.2.4 Implications

These findings highlight how interface design choices significantly impact users' ability to change their default browser. The research revealed specific barriers including challenges navigating the settings, ineffective search functionality, and interface designs that created obstacles to changing defaults. These insights suggest opportunities for more specific guidance about what constitutes "easily" changeable default settings, such as:

- **Centralized Access:** Default settings available through clear, consistent, and easily accessible paths rather than scattered across different menus.
- **Effective Search Implementation:** Settings search functionality that accommodates common search terms.
- **Interface Design:** Clear presentation of options without hidden settings or misleading menu labels.

3.2.5 Limitations and Future Research

While the study provides valuable insights into default browser changing experiences, several limitations warrant consideration. The focused sample of German users and two specific platforms suggests the need for broader research across operating systems and regions. Additionally, long-term research could examine how users maintain or modify their default choices over time, especially in response to platform updates or interface changes.

21 On iOS, one participant incorrectly believed they had found where to change their default browser and one participant became frustrated and gave-up.

22 On Windows, five participants incorrectly believed they had found where to change their default browser and five participants became frustrated and gave-up.

3.2.6 Conclusion

Mozilla's usability testing research demonstrates the critical role of empirical user research in evaluating regulatory compliance and effectiveness. The study reveals that iOS 17 and Windows 10/11 implementations of "easily" changeable browser default settings fall short of the DMA's intentions, with both platforms creating unnecessary friction through navigation challenges, poor search functionality, and self-preferencing interface designs. These findings highlight how interface design choices affect users' ability to exercise meaningful choice in practice. For regulators, this research emphasizes the value of empirical evidence about what constitutes "easily" changeable browser default settings, particularly regarding centralized access, effective search functionality, and interface neutrality.

This case study demonstrates how usability testing can provide important evidence to inform regulatory implementation and enforcement. By observing real user interactions, regulators and platforms can better understand how interface design choices impact user autonomy and market competition.

3.3 Behavioral Experiments

This case study examines how behavioral experiments can inform regulatory remedy design through an analysis of Mozilla's large-scale browser choice screen experiment.[23] The study, involving 12,000 participants across three European countries, systematically evaluated how choice screen design can influence user decision-making and satisfaction. This research demonstrates how controlled experiments can provide quantitative evidence to guide regulatory interventions while identifying potential implementation challenges before large-scale deployment. While platform providers have inherent advantages in conducting large-scale behavioral experiments on their operating systems, this research also demonstrates that independent entities (such as challenger firms, regulatory agencies, civil society organizations etc.) can produce rigorous behavioral research about these platforms. This suggests opportunities for broader stakeholder participation in evaluating competition remedies.

23 Åkesson, J., Luca, M., Petrie, G., Amlani, K., & Keystone Strategy. (2023). *Can browser choice screens be effective? Experimental analysis of the impact of their design, content and placement.* Mozilla Research. https://research.mozilla.org/files/2023/09/Can-browser-choice-screens-be-effective_-Mozilla-experiment-report.pdf

3.3.1 Context

Web browsers play a critical role in internet access, yet most users never actively choose their default browser. Operating system providers typically pre-install their own browsers and set them as defaults, creating strong behavioral inertia. DMA Article 6(3) requires gatekeepers to enable users to easily change default browsers and mandates choice screen implementation. Given mixed results from previous browser choice screen implementations, Mozilla's experimental study aimed to provide empirical evidence for more effective design.

3.3.2 Research Design

Mozilla conducted a large-scale experiment on the factors that influence the effectiveness of choice screens with 12,000 participants across Germany, Spain, and Poland. Participants engaged in a simulated mobile or desktop device setup process that allowed researchers to systematically evaluate how different choice screen implementations influenced user behavior and satisfaction.

TABLE 1				
GROUP	**INFORMATION**	**# BROWSERS**	**PLACEMENT**	**BROWSER SHOWN**
Control	N/A	N/A	N/A	Pre-set: Samsung/Edge
Treatment #1	Low - Information	12	Device first use	Chosen
Treatment #2	High - Information	12	Device first use	Chosen
Treatment #3	High - Information	5	Device first use	Chosen
Treatment #4	High - Information	5	Browser first use	Chosen

Table 1: Browser choice screen experiment conditions.

Participants were randomly assigned to either a control condition or one of several treatment conditions that varied along three dimensions. (See Table 1 above.)

- **Information Level:** The "low information" condition displayed minimal information for 12 browsers, with descriptions accessible only through a drop-down menu. The "high information" condition provided an initial information screen explaining browser choice, followed by comprehensive browser descriptions, star ratings, and review counts displayed directly on the screen. (See Figure 10 below.)
- **Number of Browsers:** Participants either saw 5 browsers (limited selection) or 12 browsers (expanded selection). The browser order was randomized across all treatment groups to minimize ordering effects.
- **Timing:** Choice screens appeared either during device setup or upon first clicking the pre-installed default browser. Each participant completed a simulated device setup process that closely mimicked real-world conditions while allowing for controlled variation in these key elements.

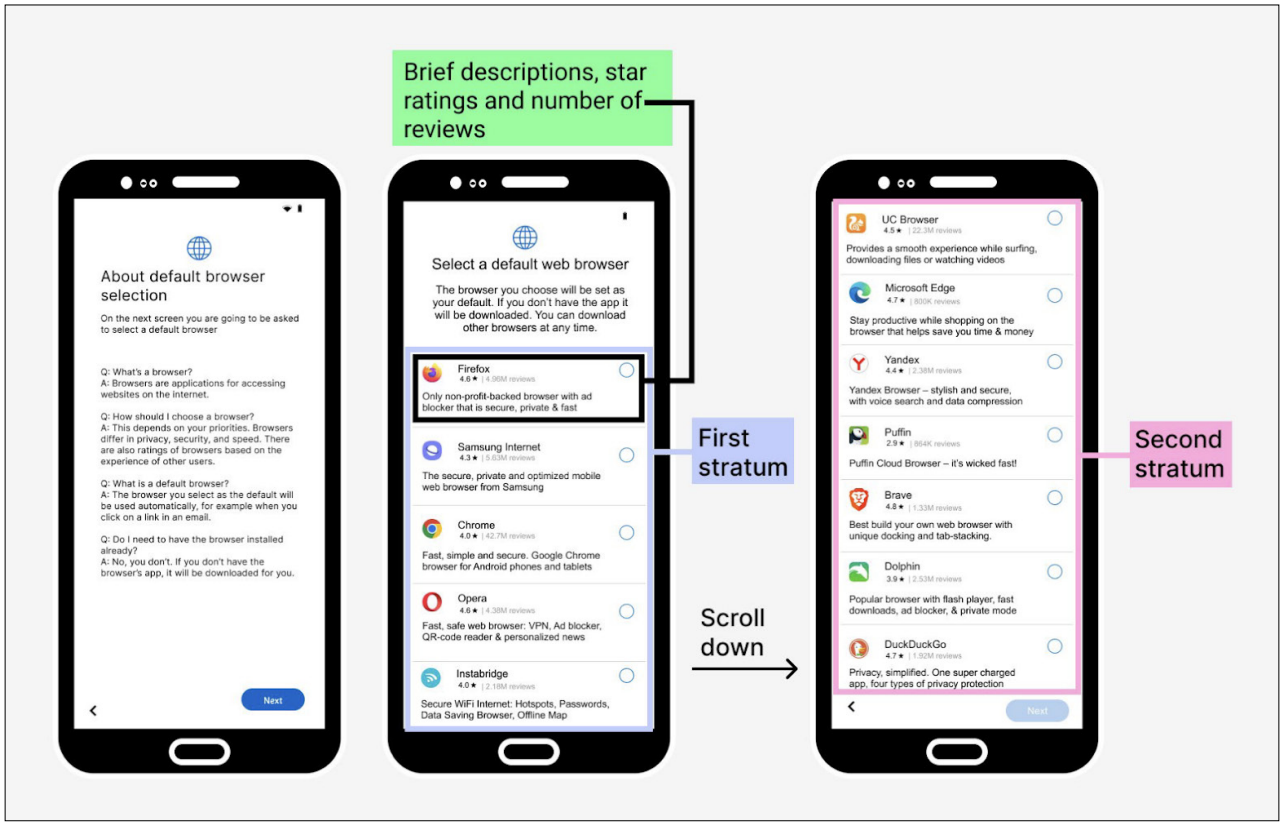

Figure 10: Screenshots of Treatment #2.

3.3.3 Key Findings

The experiment yielded several important insights about choice screen effectiveness:

- **User Retention and Satisfaction:** The experiment demonstrated that active browser selection through choice screens led to stronger anticipated user commitment. In the control group, only 54% of participants expected to keep the pre-installed default browser, while 98% of participants who actively selected a browser through a choice screen expected to maintain their selection. Notably, choice screens improved user satisfaction with the setup process and sense of device control without significantly increasing setup time.
- **Design Element Effects:** Choice screens that provided comprehensive information and displayed more browser options modestly increased the selection of independent browsers. Users also favored this comprehensive approach, with most expressing a preference for seeing more browser options rather than fewer. This suggests that limiting information or restricting browser options may undermine the effectiveness of choice screen interventions.
- **Timing Impact:** Presenting choice screens during initial device setup proved significantly more effective at promoting diverse browser selection compared to showing them at first browser use. When users encountered choice screens only after clicking their pre-installed browser, they were significantly more likely to stick with that pre-installed option—often because the prompt interrupted their immediate browsing task. This finding suggests that early intervention, before users develop habits with pre-installed browsers, is vital for promoting meaningful choice.
- **Position Effects:** Browser placement within the choice screen has a powerful influence on user selection. The study found consistent and strong position bias across all experimental conditions, with browsers listed first receiving significantly higher selection rates regardless of information level or timing.

3.3.4 Implications

This study provides clear direction for choice screen remedy design. The timing of choice screen presentation significantly influences their effectiveness. The strong performance of choice screens during device setup, combined with the poor performance of prompts at browser first-use, demonstrates the importance of presenting choices at natural decision points rather than interrupting users who are actively trying to accomplish a task. Based on these findings, regulators should require choice screens during initial device configuration (and perhaps at major updates) rather than at first browser use.

Information design is a key factor in promoting meaningful choice. Users not only prefer comprehensive information about their browser options, but this information also supports more diverse browser selection. This suggests that regulatory guidelines should establish clear standards for information presentation, ensuring that users have ready access to relevant details about their options without requiring additional steps to access this information.

The substantial effect of listing order indicates that regulations must explicitly require randomized browser presentation to prevent manipulation of user choice through strategic positioning. Without such requirements, the effectiveness of choice screens as a competitive remedy could be significantly undermined. Based on these findings, regulators should also consider whether gatekeeper browsers should appear in the top position at all.

Mozilla's research has not only informed theoretical recommendations and public discourse but has also directly influenced the implementation of DMA browser choice remedies. Google cited Mozilla's findings during its 2023 compliance workshop, where it introduced a choice screen timed at device first-use rather than browser first-use. Apple likewise adopted several design changes aligned with Mozilla's recommendations in the second iteration of its choice screen, including improved presentation of browser information, the removal of the "Not now" button that previously allowed users to bypass the browser choice screen entirely, and placing the selected browser in the prominent "hot seat" position on the device.

While implementation challenges remain, the early impact has been significant. Since the launch of the first DMA browser choice screens on iOS in March 2024, Mozilla's data shows meaningful shifts in user behavior: Firefox daily active users in Germany have increased by 99%. And in France, Firefox's daily active users on iOS grew by 111%.[24] These results underscore both the potential for competition remedies to influence user choice when implemented thoughtfully, and the real-world relevance of empirically grounded design guidance.

24 Mozilla. (2025). *Browser choice? Here's how EU's DMA is helping make it real.* https://blog.mozilla.org/en/firefox/eu-digital-markets-act/

3.3.5 Limitations and Future Research

This experimental study provides valuable insights for regulatory remedy design but has several important limitations that suggest directions for future research. While the large sample size and controlled conditions enabled precise measurement of immediate effects, the study's focus on short-term outcomes limits our ability to predict long-term impacts on user behavior and market competition. Understanding how well-designed choice screens influence browser selection and usage patterns over extended periods remains an important area for investigation.

The research also revealed significant gaps in user understanding that warrant further study. Many participants demonstrated limited comprehension of fundamental concepts, including the distinction between browsers and search engines, even after exposure to choice screens. This persistent knowledge gap suggests a need to explore opportunities to support user comprehension without compromising usability or increasing cognitive burden.

Several design elements merit additional investigation. While the experiment tested key variables in choice screen implementation, it could not examine all possible design variations. Questions remain about optimal frequency for presenting choice screens and whether periodic prompts for browser selection might help maintain competitive dynamics. Additionally, future research should investigate how operating system providers might attempt to circumvent choice screen effectiveness through repeated prompts or other interface strategies that could drive users back to incumbent browsers.

3.3.6 Conclusion

Mozilla's browser choice screen experiment demonstrates the value of behavioral research in regulatory remedy design. By systematically studying the effects of specific design elements, the study provides empirical evidence to guide the development of more effective browser choice screen interventions.

The research reveals that choice screens can meaningfully influence user behavior and satisfaction, but their effectiveness depends heavily on implementation details. Early intervention during device setup, comprehensive information presentation, and careful attention to position effects are important factors. These findings suggest that regulatory guidelines should incorporate specific requirements about timing, information display, and randomization while maintaining flexibility in areas where evidence remains limited.

This study demonstrates how experimental research can inform evidence-based regulation. By identifying both opportunities and limitations in choice screen design, the research helps regulators set realistic expectations and develop more nuanced approaches to promoting competition in digital markets. As regulatory frameworks like the Digital Markets Act continue to evolve, empirical evidence becomes increasingly valuable for crafting effective interventions that align with user behavior while advancing competitive objectives.

04

DISCUSSION

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DISCUSSION

Effective competition remedies require careful attention to user behavior and experience throughout the development process. These case studies from Mozilla's browser competition research demonstrate how user research can provide valuable evidence about remedy effectiveness and how user research can reveal critical implementation barriers that might otherwise undermine regulatory objectives.[25] These three case studies demonstrate how different user research methodologies can inform regulatory remedy design at distinct stages of development. Each method offers unique advantages while addressing different aspects of remedy design and implementation.

4.1 Early Stage Exploration

Concept testing proves most valuable in the early stages of remedy development, allowing regulators to explore a broad set of innovative solutions before committing significant resources. Mozilla's browser choice research revealed how this method can identify promising design directions and potential pitfalls before full-scale implementation. The method's strength lies in its ability to generate qualitative insights about user preferences and behavior patterns while remaining relatively resource-efficient. However, its limitations in predicting large-scale adoption patterns suggest it should be used primarily for initial exploration and refinement of remedy ideas.

4.2 Remedy Refinement

During the refinement phase, both usability testing and behavioral experiments play complementary roles. Initial usability testing can quickly identify fundamental design flaws and opportunities for improvement through direct observation of user interactions.

25 Akman, P. (2022). *A web of paradoxes: Empirical evidence on online platform users and implications for competition and regulation in digital markets*. *Virginia Law & Business Review*, 16(2), 217–292.

Behavioral experiments then offer particular value in providing quantitative evidence about the effectiveness of specific design elements. Mozilla's choice screen experiment demonstrated how controlled testing can study the impact of variables like timing, information presentation, and option quantity. This method's strength lies in producing statistically significant findings about user behavior, though it requires substantial resources and carefully controlled conditions. The method proves especially useful when regulators need to make evidence-based decisions about specific implementation details.

4.3 Implementation and Monitoring

Usability testing serves another important role during implementation, revealing how remedies function in the real world and exposing gaps between regulatory intent and user experience. This makes it particularly valuable for understanding how interface design choices impact users' ability to exercise meaningful choice. Mozilla's default browser settings research illustrated how this method can identify specific interface patterns that affect whether users can successfully change their defaults. The iterative nature of usability testing also makes it well-suited for ongoing monitoring, allowing regulators to assess whether implementations remain effective as platforms update their interfaces and user expectations evolve.

4.4 Recommendations for Regulators and Policymakers

4.4.1 Recommendations for Remedy Development

In designing digital competition regulation and regimes, governments and lawmakers should take into account the importance of user research for effective competition interventions or compliance measures. Similarly, regulators should take advantage of research insights when implementing and enforcing such regimes. Based on Mozilla's browser competition research, we recommend the following approaches to improve competition remedy effectiveness:

1. **Integrate user research throughout remedy development,** from initial concept testing through implementation and monitoring.

2. **Require systematic evaluation of remedies,** including:
    - Test and refine proposed remedies through iterative evaluation to identify potential barriers and implementation challenges.
    - Mandate that gatekeepers conduct and share user research results about remedy testing and effectiveness.
    - Include mechanisms for ongoing assessment as platforms update their interfaces and user expectations evolve.

3. **Base remedy requirements on empirical evidence about user behavior** rather than broad principles or technical specifications alone:
    - Evaluate effectiveness through systematic observation of actual user behavior.
    - Consider the full user journey when designing remedies, including initial discovery, engagement, and long-term usage patterns.
    - Establish clear standards for successful implementation based on measurable user outcomes.

4. **Design innovative remedies that work for all users:**
    - Explore the possibility of new, innovative solutions rather than simply falling back on previously attempted remedies.
    - Consider complementary interventions that work together.
    - Provide ongoing opportunities for user choice rather than one-time interventions.
    - Ensure accessibility for varying levels of technical expertise.

5. **Foster collaboration with stakeholders:**
    - Establish mechanisms for stakeholder feedback throughout the remedy development process, not just during initial design.
    - Share research methodologies, results, and access to testing environments.
    - Contribute user research and user experience expertise.
    - Consider the role of communications to users explaining, highlighting, or educating about remedies.

4.4.2 Recommendations for Specific Interventions

Based on Mozilla's research, we recommend the following specific design guidelines for browser choice screens and default browser settings to enhance their effectiveness as competition remedies:

- **Browser Choice Screens:**
    - Present during device setup or major system updates, not at first browser use.
    - Provide comprehensive information about browser options.
    - Require randomized presentation order.
    - Include detailed browser descriptions and features.
    - Remove pre-marked or pre-installed indicators.
    - Consider restrictions on gatekeeper browser positioning.
    - Place the newly selected browser in the “hot seat,” dock, or home screen for easy access.

- **Browser Default Settings:**
    - Require centralized access through clear, consistent paths.
    - Mandate effective search functionality that works with common search terms.
    - Prohibit hidden settings or disappearing options.
    - Ban misleading labels or interface elements that promote platform browsers.
    - Ensure settings remain easily accessible regardless of current default selection.

- **Ongoing Browser Choice:**
    - Provide persistent access to choice mechanisms.
    - Allow users to modify selections over time.
    - Include opportunities to review and change browser defaults in relevant contexts.
    - Ensure choice mechanisms do not rely solely on one-time interventions.
    - Consider periodic prompts or reminders about choice availability.

05

CONCLUSION

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CONCLUSION

This paper demonstrates how user research can provide valuable evidence about competition remedies in digital markets. Through three detailed case studies examining browser competition, Mozilla's research demonstrates the value of incorporating user research throughout the remedy development process. Concept testing can explore potential solutions early. Usability testing can reveal gaps between regulatory intent and user experience. Behavioral experiments can provide statistical evidence for key design decisions. This systematic evidence helps ensure that remedies achieve their intended competitive objectives.

The research also highlights opportunities for more specific guidance regarding implementation details. Rather than broad principles, user research can help regulators provide concrete recommendations that will more effectively promote meaningful user choice.

This work demonstrates how research-informed remedy design can advance competition policy, particularly for complex digital markets where user interface decisions significantly impact competitive outcomes. By incorporating these methodological approaches, regulators can develop more effective interventions that meaningfully promote competition in digital markets.

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