Dark patterns in browser choice architecture

A behavioural science perspective and their potential impact on users

BIT

October 2026

BIT is a global research and innovation consultancy which combines a deep understanding of human behaviour with evidence-led problem solving to improve people's lives. We work with all levels of government, nonprofits and the private sector, applying behavioural science expertise with robust evaluation and data to help clients achieve their goals.

Find out more at bi.team

If you'd like this publication in an alternative format such as Braille or large print, please contact us at: info@bi.team

Authors
Andreea Faluvegi, Libby Woodhouse and
Dr Sujatha Krishnan-Barman

Click the **BIT** logo on any page to return to the Contents

Acknowledgements

This project was conducted by The Behavioural Insights Team (BIT) and commissioned by the Browser Choice Alliance (BCA).

We would like to thank the BCA and its members for supplying evidence, documentation, and feedback throughout the research process.

Glossary of terms

- **Choice screen:** In the context of browser choice, a choice screen presents users with different browsers and allows them to select their preferred option, which can then be installed and set as their default browser.
- **Competition and Markets Authority (CMA):** The UK regulatory body responsible for promoting competition and preventing anti-competitive activities.
- **Dark patterns:** Deceptive tactics in digital interface design and online choice architecture that seek to subvert a user's intended choice and thereby violate users' control over their digital experience.
- **Defaults**: In the context of browser choice, defaults are the operating system settings that determine which browser opens automatically when the user clicks a web link or opens certain web-related files which – in principle – any number of browsers could handle, without the user being asked to make an individual browser selection each time. The default can be set by the operating system or by the user.
- **Digital Markets Act (DMA):** European Union regulation designed to make digital markets fairer and more contestable.
- **European Economic Area (EEA):** An economic region comprising European Union member states and three European Free Trade Association countries, bound by single-market rules including digital market regulations.
- **EdgeDeflector:** was a workaround that "intercepted URIs that force-open web links in Microsoft Edge and redirected it to the system's default web browser"
- **Framing:** How text-based information is worded and visually presented. It can be considered a dark pattern when one option is made more salient and attractive than the other, without substantiation.

- **Friction:** Additional steps or obstacles in user journeys that make setting or maintaining preferred choices more difficult.
- **Loss aversion:** A psychological principle where the pain of losing something is felt more strongly than the pleasure of gaining an equivalent benefit, leading individuals to avoid losses.
- **Messenger effect:** The tendency for people to be influenced by who is communicating information, often giving greater weight to messages from perceived authority figures or trusted entities.
- **Nudge:** Any change in how choices are presented that guides people toward specific decisions without forbidding options.
- **Obstruction:** Design practices or technical barriers that prevent users from easily accessing or completing their intended actions.
- **Operating System (OS):** The foundational software that manages computer hardware, software resources, and provides common services for computer programs.
- **Pre-selected option:** An option included in, for example, a user flow or customer journey that a user will automatically receive if they proceed without actively choosing the alternative option(s) they may be presented with (i.e. opt out of the pre-selected option). For example, individuals may be automatically ticked on a form to register as organ donors unless they choose to opt out, or a pop-up may include a pre-highlighted option to update an app's settings unless the user actively clicks 'no', as distinct from 'Defaults' (see definition above).
- **S mode:** A restricted configuration of Windows designed for security and performance, limiting software installation exclusively to Microsoft Store apps and restricting default browser changes.
- **Salience:** How prominent or noticeable a choice or piece of information is made to stand out to users within an interface.
- **Sludge:** Excessive or unjustified friction that adds burdens to users' limited time, attention, and cognitive resources.
- **Widgets:** An operating system feature providing quick-access content panels (such as news or weather reports) built into the desktop interface.
- **Workarounds:** In the context of the Windows and Microsoft Edge browser choice, workarounds are third-party tools, code tweaks, or browser configurations designed to bypass Microsoft's forced actions and allow users to switch their preferred browser with a single click.

Contents

Acknowledgements **2**
Glossary of terms **2**
Contents **3**
Executive summary **4**
Introduction **7**
Background 7
Research aims 8
Phase 1. Identified dark patterns **9**
Categorisation of tactics used in design and choice architecture 9
Stage 1. A PC user installs a browser on a new Microsoft device 10
Stage 2. A PC user uses a browser for the first time 15
Stage 3. A PC user updates their operating system 18
Phase 2. Literature review **20**
Contextualising harm 20
Mechanisms and wider evidence 21
Browser-specific evidence 28
Phase 3. Personas **31**
Conclusions **33**
Appendix **36**
Method 36
References **38**

Executive summary

The Behavioural Insights Team (BIT) was commissioned by the Browser Choice Alliance (BCA) to conduct an independent report mapping any harm to users from Microsoft's PC browser choice practices. The BCA is a coalition of browsers dedicated to the principle that users should have the right to use their browser of choice on Windows devices and to have that choice respected.

The project was conducted in three phases. BIT (1) reviewed evidence supplied by the BCA and mapped the identified dark patterns alongside a typical user journey, (2) conducted an AI-assisted literature review to evaluate the potential user harm from these dark patterns, and (3) developed personas to illustrate how they may affect different types of users.

Findings

BIT identified 10 dark patterns that either make it harder to choose a browser other than Edge, or that subvert a user's choice of an alternative browser after that decision has already been made, thereby limiting users' control over their digital experience (see Figure 1).

Figure 1. *Dark patterns identified across the browser choice user journey*

Dark pattern	Type
Stage 1. A PC user installs an alternative browser on a new Microsoft device	
Intrusive and misleading banners become salient when users seek out alternatives to Edge *Identified when using Bing browser in Edge*	Sludge Nudge Framing
Changing default browser in settings only changes http and https file types; other file types remain set to Edge (e.g. pdf); users must go through a granular setting-by-setting process to change defaults *Windows 11; overrides the chosen default browser*	Sludge
S mode limits the installation of alternative browsers *When using Windows devices set to S mode*	Obstruction

Stage 2. A PC user uses a browser for the first time	
Windows Search forces links to open in Edge *Overrides the user's chosen default browser*	Sludge Obstruction
Widgets Board and Lock Screen force content to open in Edge *Windows 11; overrides the chosen default browser*	Sludge Obstruction
"News and Interests" forces content to open in Edge *Windows 10; overrides the chosen default browser*	Sludge Obstruction
Links in Outlook and Teams ignore the user's default browser (unless a user opts out) *Overrides users' choices*	Sludge
Microsoft blocks workarounds allowing one-click-switch and EdgeDeflector *Blocks users' choices*	Sludge
Microsoft forces tabs from the chosen default browser to open in Edge at login *Overrides users' choices*	Nudge
Stage 3. A PC user updates their operating system	
Microsoft pushes users back to Edge after system updates *After operating system updates; Overrides users' previous choices*	Nudge Framing
**S mode is a more* restricted version of Windows designed for security and performance, exclusively for apps that are installed from the Microsoft Store and where only Edge can be the default browser. Microsoft has publicly stated that it has removed S mode globally, though many S mode devices are still in circulation.	

In addition, BIT identified design practices that continue to make Edge feel easier and safer to use (potentially without substantiation), such as: not being able to uninstall Edge; strongly worded safety warnings from Microsoft if users attempt to opt out of S mode. While these additional practices did not meet the threshold of a dark pattern on their own, they can still create an asymmetrical decision space by making Edge noticeably easier to use, compounding the cumulative effect of the dark patterns identified above.

Impact of dark patterns

The rapid literature review showed that dark patterns are most effective when they integrate multiple mechanisms simultaneously:

- **Added friction:** Making alternatives noticeably harder to find, install, or keep.
- **Risk and trusted framing:** Making one option feel like the safest option without adequate information.
- **Easiest option:** Making one option feel like the easiest option, contrary to a user's intent.

Together, these exploit people's natural tendency to stick with what is easiest, trust system recommendations, and abandon setup journeys when repeatedly frustrated or when their choice is overwritten. Impact may be strongest when users lack established preferences, encounter choices for the first time, are operating under time pressure, have characteristics of vulnerability, such as low vision, or face reinforcing tactics.

Dark patterns can cause potential harm by leading to reduced autonomy and ability to make informed decisions.

The impact of dark patterns that subvert a user's intended choice by pushing users to stay with Edge while making alternative browsers noticeably harder to choose or maintain depends on how often the patterns are used, when they occur in the user journey, how strongly they steer users, and whether several tactics are combined. The impact can include:

- **Time and cognitive burden:** Strongest evidence
  Extra steps, repeated prompts, and restoring settings could increase effort and reduce follow-through.
- **Loss of autonomy:** Strong to moderate evidence
  Pre-selected options and asymmetric design can lead users to remain with options that do not fully reflect their stated preferences.
- **Reduced ability to make informed choices:** Moderate to limited evidence
  Unsubstantiated risk framing or hidden information may make alternatives harder to assess objectively.
- **Frustration and reduced trust:** More limited evidence
  Repeatedly challenging or overriding a user's choice can create frustration and reduce confidence that the operating system will respect the user's chosen settings.

Introduction

The Behavioural Insights Team (BIT), commissioned by the Browser Choice Alliance (BCA), synthesised global evidence gathered by the BCA on Microsoft practices that hinder the adoption of web browsers other than Microsoft Edge (Edge), and conducted an independent literature review to map the potential user harm associated with the identified dark patterns.

Background

BCA is a coalition of browser developers that advocates for greater user choice and fair competition in the desktop browser market on Windows. Its members are: Google Chrome, Opera, Vivaldi, Wavebox, Midori and Waterfox (via BrowserWorks).

The BCA has already undertaken significant work to identify the dark patterns Microsoft uses to give Edge an unearned advantage, including persuasive pop-ups, difficulties uninstalling Edge, operating system (OS) updates resetting browser defaults back to Edge, and Outlook/Teams overriding user browser preferences.

For the purpose of this research, dark patterns are defined as deceptive tactics in digital interface design and online choice architecture that seek to subvert a user's intended choice and thereby violate users' control over their digital experience. This definition is aligned with both BCA's existing definition and the wider literature (e.g. Gray et al., 2018; Luguri & Strahilevitz, 2021; OECD, 2022).

Broader regulatory efforts

This research is taking place in parallel with broader regulatory efforts to ensure that online choice architecture, including in relation to browser selection and defaults, supports fair competition and respects user autonomy. These concerns are reflected in regulatory developments, including Microsoft's obligations under the European Union's Digital Markets Act (DMA) in respect of Windows, which have led to changes addressing some of the practices identified by the BCA, particularly in relation to choice, defaults and interoperability.

Research aims

The research had three aims. First, to review evidence gathered from the BCA regarding Microsoft's practices and assess what dark patterns are used at each stage of the user journey. Second, to conduct an AI-assisted literature review to examine the potential harms these design and online choice architectures may inflict on users, and third, to design personas to illustrate the impact of the dark patterns on different segments of the population.

The AI-assisted literature review was guided by four key research questions:

1. Why are dark patterns effective at changing browser choice, and how large are the effects?
2. What harm could users experience as a result of dark patterns influencing their PC browser choice?
3. Are some users more affected than others by dark patterns which influence PC browser choice?
4. How does the presentation of Microsoft's PC browser choice practices differ inside and outside the European Union (EU), and what effect does that have?

Disclaimer: The findings in this presentation are based exclusively on materials provided by the BCA. Some of the dark patterns presented may only be relevant in certain jurisdictions. As such, the overall scale of the identified patterns cannot be fully quantified.

The rest of this report showcases the findings from each phase of the research. The full method can be found in Appendix 1.

Phase 1. Identified dark patterns

This section first explains how the design and choice architecture tactics evidenced in the materials provided by the BCA were grouped into categories. It then illustrates what dark patterns and other design and online choice tactics were identified at key stages of the user journey: when a PC user installs a browser on a new Microsoft device; when a PC user sets up and uses a browser for the first time; and when a PC user updates their OS. Screenshots from the evidence are used throughout to illustrate how the dark patterns look in practice.

Categorisation of tactics used in design and choice architecture

The identified design and choice architecture tactics can be considered along three related dimensions: the type of behavioural tactic used, the potential effect of that tactic on the user's intended browser choice, and the interaction between different features of the choice architecture.

The type of tactic describes how the design or choice architecture pattern operates and can be divided into three categories: sludge & obstruction, deceptive framing and nudges:

Sludge & obstruction include tactics that introduce friction or barriers which can make a user's intended choice noticeably harder to access, implement or maintain.

Deceptive framing includes framing that could subvert a user's intended browser choice by presenting options asymmetrically to make one choice seem safer or easier, without substantiation.

Nudges include tactics that make the use of one browser noticeably easier compared to the use of another browser.

Phase 2 explains the theoretical principles behind how these patterns affect behaviour and details their potential harms.

While these categories describe how the tactics operate, the use of some of the tactics is not always inherently problematic and does not necessarily constitute a dark pattern. Responsible use of choice architecture can support user journeys: fast setup via pre-selected options can be a genuine, well-evidenced digital principle; a warning that stops a non-technical user from opening an unrecognised .exe can protect users. However, these can become dark patterns when they are used to hinder users' preferences, thus-violating user control or when they are unsubstantiated.

In addition, we believe that the use of these tactics can also have a cumulative effect. When nudges that can be considered a good design practice are used in combination with dark patterns, it can create an asymmetry in design that makes one option significantly easier to choose and maintain than the other, and thus potentially amplifies the effects of the dark patterns. A summary of all the dark patterns and additional nudges identified in the evidence review can be found in Figure 1 (see Executive Summary).

Stage 1. A PC user installs a browser on a new Microsoft device

The first stage of the journey is when a user purchases a new PC that comes pre-installed with Edge and actively chooses to install an alternative browser. This can include: setting up a new device, installing an alternative browser, adjusting browser preferences for the first time, uninstalling Edge.

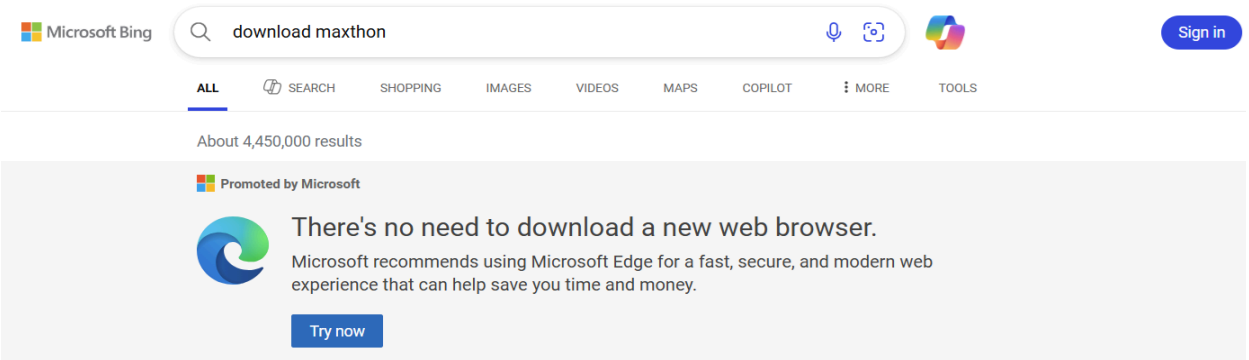
Several dark patterns were identified during the early stages, including:

- Intrusive and misleading banners become salient when users seek out alternatives to Edge (framing, sludge, nudge)
- Changing default browser in settings only changes http and https file types; other file types remain set to Edge (e.g. pdf); users must go through a granular setting-by-setting process to change defaults (sludge)
- S mode limits the installation of alternative browsers (obstruction)

Microsoft visually pushes users to Edge over the browser they are actually searching for.

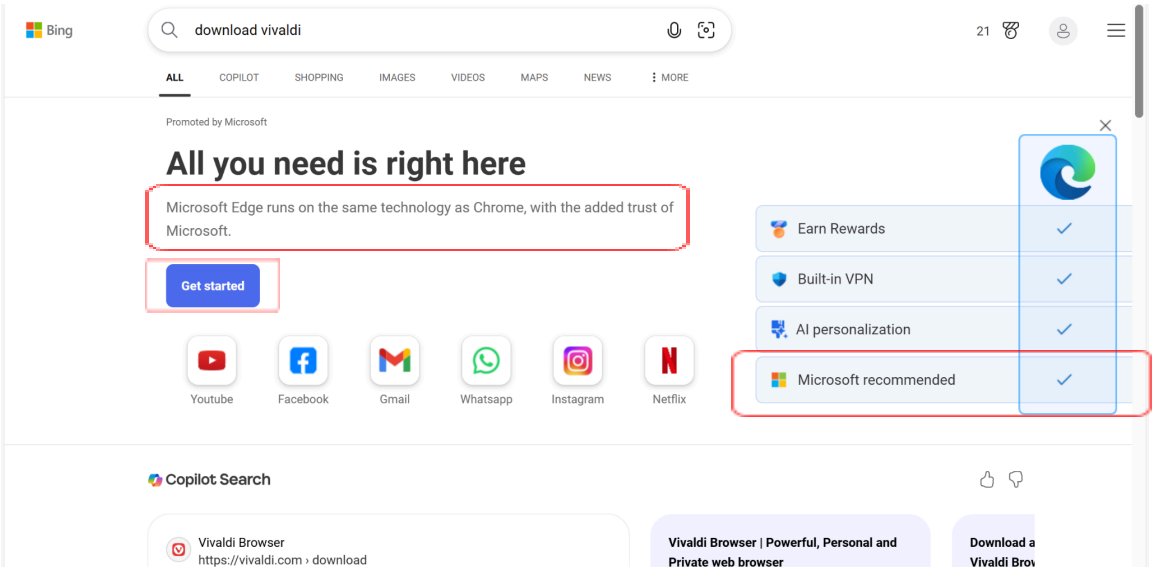
Specifically, when users search for a browser that is not Edge using Bing search on a Windows PC, a salient message appears at the top of the screen that discourages users from downloading the alternative browser (see Figures 2 and 3). The options to download the searched browser are only visible below the prominent banner at the top of the Bing results page.

Figure 2. *Example 1 banner displayed on Bing in Edge when users search for installing certain alternative browsers*



Note*: This banner appears within a Microsoft-exclusive space, where Microsoft controls the entire environment and the context in which the choice is presented.*

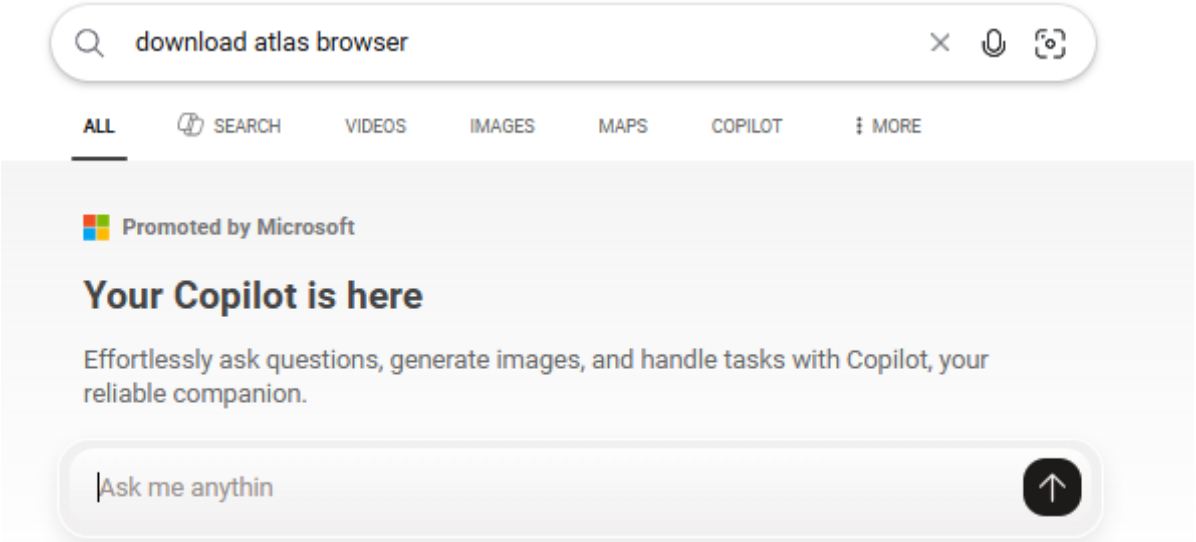
Figure 3. Example 2 banner displayed on Bing in Edge when users search for installing certain alternative browsers



The banner in Figure 3 combines different behavioural tactics that could steer users back towards Edge rather than their preferred browser. Firstly, the messenger effect could influence users, as the recommendation comes directly from Microsoft, which users may perceive as a trustworthy source, particularly when choosing software for a Windows PC. Salience is also used through a large, colourful banner promoting Edge's benefits and a prominent, clickable "Get Started" button, which draw attention towards Edge and make this option particularly noticeable and easy to select. Additionally, loss aversion could influence users through safety messages that emphasise the potential risks of switching browsers, appealing to users' tendency to be more motivated to avoid losses than achieve equivalent gains. Together, these design choices could also create an asymmetrical design space that makes switching to another browser feel less appealing and more difficult than continuing with Edge.

Similar banners are displayed when users search for AI-powered browsers that could compete against both Edge and Microsoft's preinstalled AI solution (Copilot, see Figure 4). However, following Microsoft's commitment in its 22 November 2023 DMA announcement, these banners are not shown in the EU.

Figure 4. Microsoft displays a prominent search box for Copilot when users (outside of the EU) search for AI-powered browsers



When trying to set up an alternative browser as a default, users experience friction they would not encounter if staying with Edge.

When an alternative browser is installed, and Edge is pre set as the default browser, selecting the "Set default" option does not automatically set the new browser as the default across all browser-relevant file and link types. In Windows' "Default apps" settings, clicking on the "*Set default*" button under the "*Make [your desired browser] your default browser*" prompt does not automatically set all file types or links to open in the chosen browser (which remain set to Edge). Instead, users have to click on some of the options one by one. This is illustrated in the transitions from *Figure 5* to *Figure 6*, where the interface shows that Edge remains set as the default browser for opening PDF files as well as other specific file and link types that are relevant to a user's browser experience (see Figure 7 for additional web browsing files that remain set to Edge).

Figure 5. Screen before clicking on "Set default" when trying to set Chrome as a default browser – PC 1

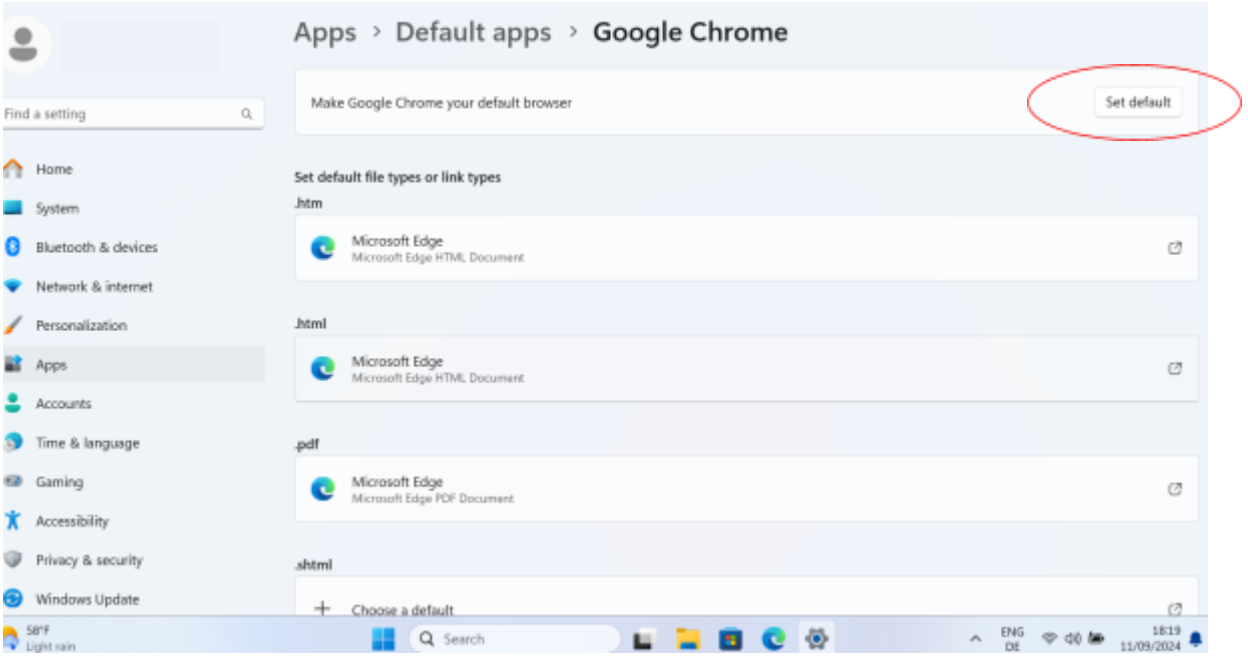


Figure 6. Screen after clicking on "Set default" when trying to set Chrome as a default browser – PC 1

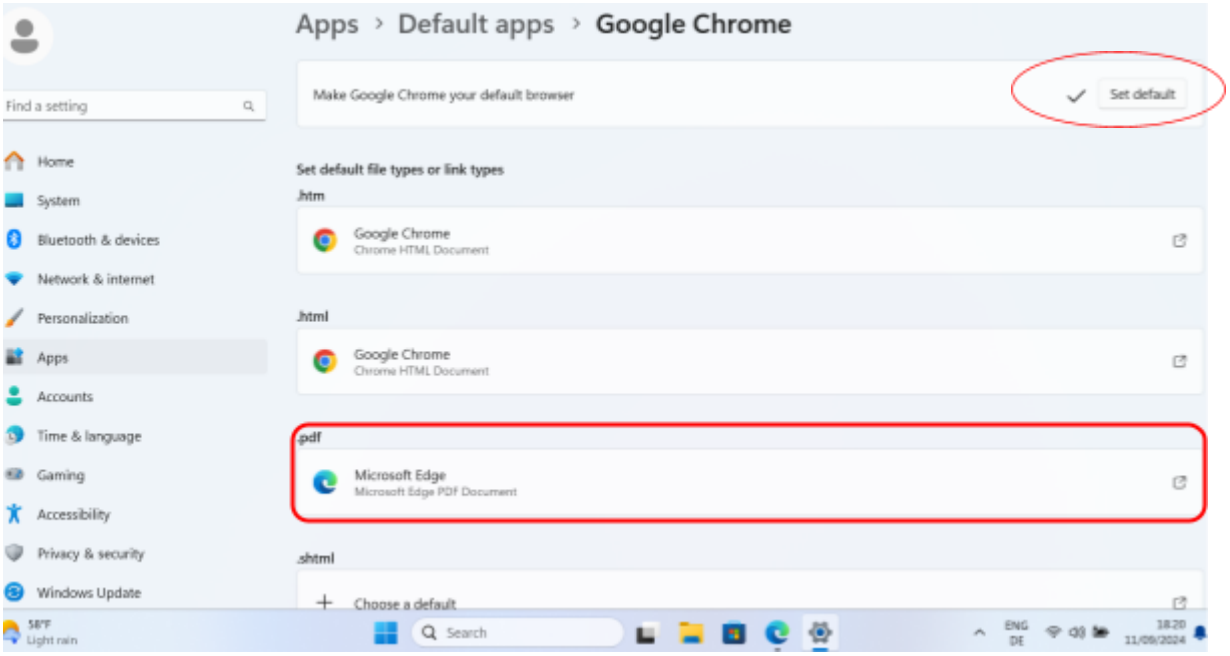
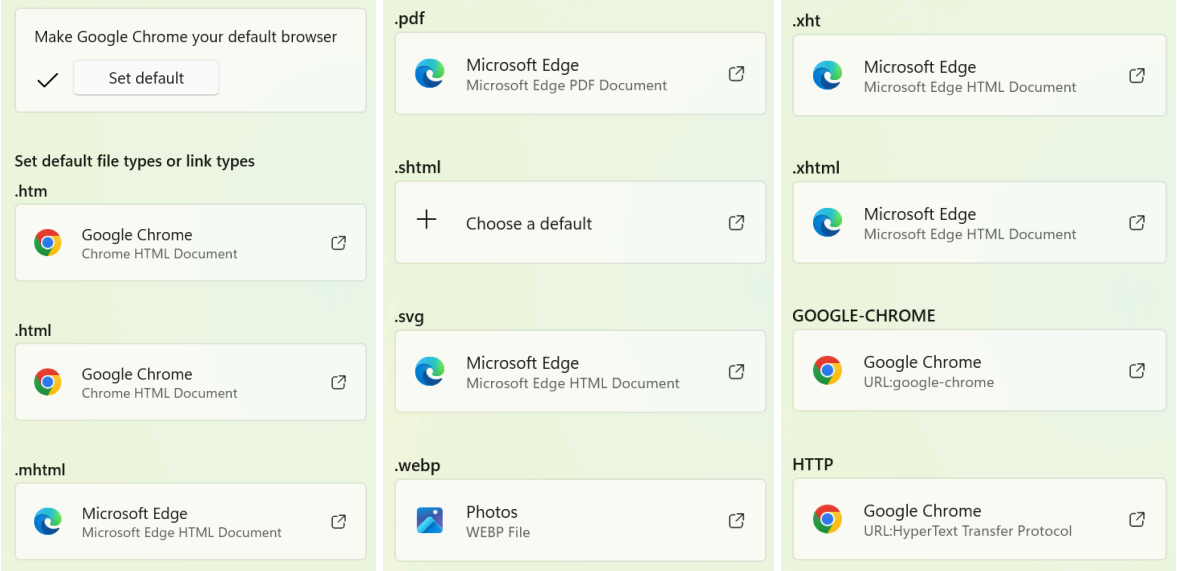


Figure 7. Screen after clicking on "Set default" when trying to set Chrome as a default browser – PC2



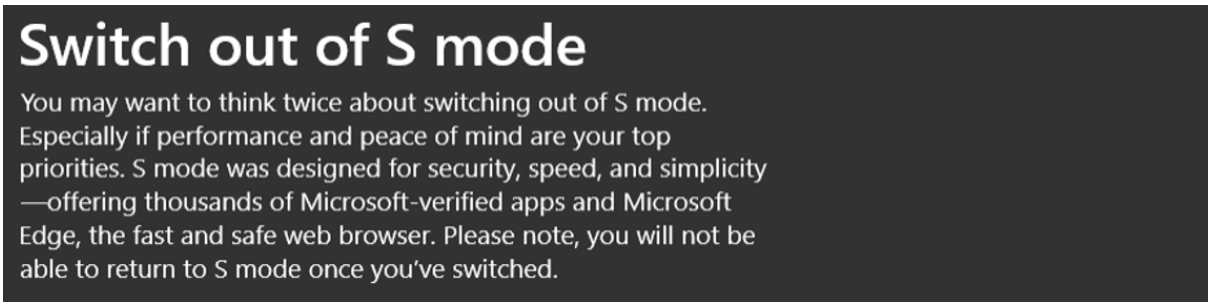
When trying to leave S mode, users are shown security-focused messaging that may undermine trust in alternative browsers without substantiating those concerns.

Microsoft states S mode[1] was designed as a security and performance feature,[2] but it also restricts access to alternative browsers. While a device is in S mode, users cannot set another browser as the default or download rival browsers directly from the open Internet; they must instead use the Microsoft Store, where some browsers may be unavailable or blocked, creating additional friction and obstructing the use of alternative browsers.

Microsoft also displays prominent warnings when users attempt to leave S mode, highlighting its security, speed and simplicity, while stressing that the switch is irreversible (see Figure 8). The warning specifically describes Microsoft Edge as "the fast and safe web browser". Because the warning does not substantiate this comparative implication, it may undermine users' trust in alternative browsers without providing a clear evidential basis.

[1] S mode is a more restricted version of Windows, designed primarily for segments such as education and enterprise. It limits users largely to Microsoft-approved apps and configurations, with the stated goals of improving security, performance, and simplicity.
[2] See Microsoft | Support, "Switching out of S mode in Windows", available at: https://support.microsoft.com/en-us/windows/experience/platform-variants/switching-out-of-s-mode-in-windows.

Figure 8. *Notification displayed when users try to leave S mode*



Microsoft said in an October 2025 Brazilian filing that it had discontinued Windows S mode for new devices manufactured after 30 September 2025, and it has since confirmed that this change applies worldwide, including in the EU, where S mode had raised concerns under the DMA. However, according to BCA members, Microsoft did not indicate that it would remove the screens that discourage existing S mode users from switching out of S mode.

Other design features can amplify these effects

The evidence also identified other features that are not necessarily dark patterns in isolation, as they can support a smoother user experience. During initial setup, for example, Microsoft encourages users to continue using Edge and configure settings using pre-selected options. These features can make setup quicker and easier. In addition, users are unable to uninstall Edge. When combined with other dark patterns, they can reinforce the overall advantage given to Edge by making continued use of Edge easier and more convenient.

Stage 2. A PC user uses a browser for the first time

At this stage of the user journey, the BCA evidence covered the design and online choice architecture users encounter when opening a browser they had set as a default, clicking on links, and downloading and opening different file types.

Several dark patterns were identified:

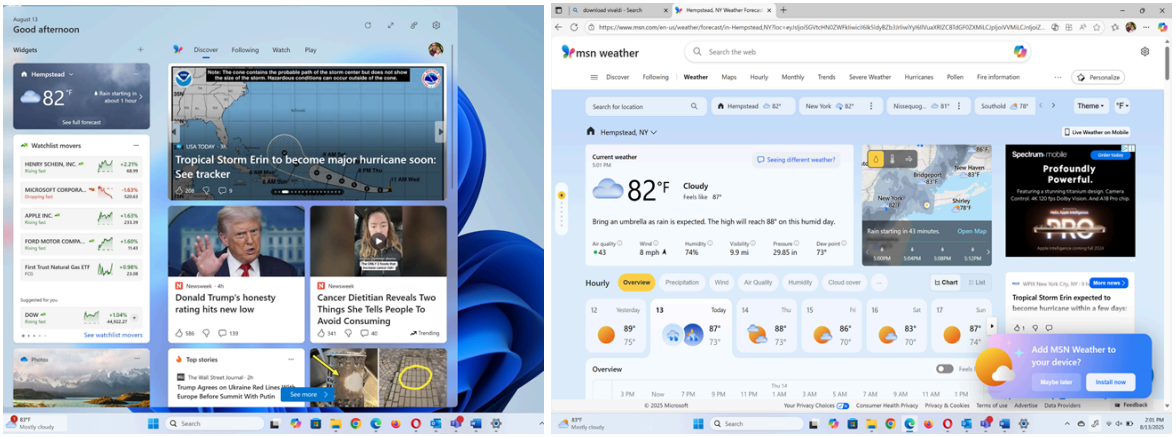
- Windows Search forces links to open in Edge (sludge, obstruction)
- Widgets Board and Lock Screen force content to open in Edge (sludge, obstruction)

- "News and Interests" force content to open in Edge (sludge, obstruction)
- Links in Outlook and Teams ignore the user's default browser (unless a user opts out; sludge)
- Microsoft blocks workarounds allowing one-click-switch and EdgeDeflector (sludge)
- Microsoft forces tabs from the chosen default browser to open in Edge at login (nudge)

Certain features always open in Edge, regardless of the user's default choice

Once a user has selected their preferred browser, Microsoft continues to make it harder to apply that preference consistently. Links from Widgets and Lock Screen web content, such as links to weather reports or news stories, always open in Edge even when users have selected a different default browser (see Figure 9). This overrides the user's OS-level browser preference, directing users to Edge when they interact with Microsoft's built-in content. Users must therefore use Edge for some web journeys even after actively selecting another browser as their default, making their preferred browser hard to maintain.

Figure 9. *Links from Widgets and Lock Screen always open in Microsoft Edge*

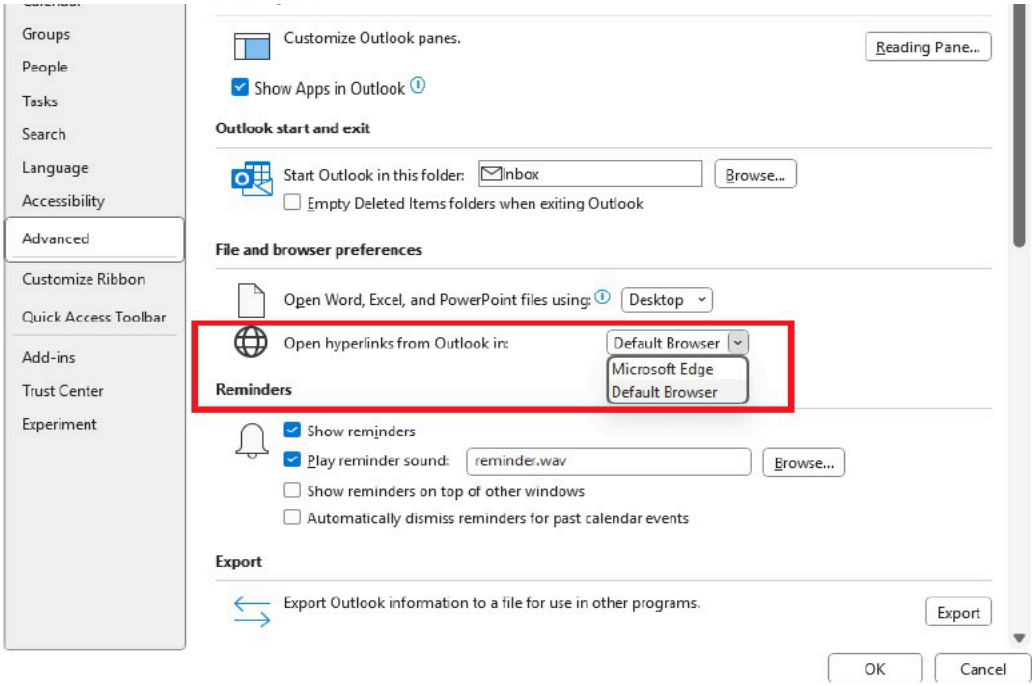


A similar pattern was observed in Windows Search: when a user clicks on a link in Windows Search (the taskbar pinned to the bottom of the screen on Windows devices), it opens automatically in Edge, even if the user has set an alternative browser as the default.

Links from certain Microsoft productivity applications first open in Edge regardless of the user's defaults, making users take extra steps for their default to be respected.

Links from core Microsoft productivity applications such as Outlook and Teams do not automatically open in the user's selected default browser. Members of the BCA observed cases where these applications opened links directly in Edge unless a user takes active steps to opt-out, which overwrites prior choices. To make these applications open in the chosen browsers, users have to take additional steps, such as searching through separate Outlook settings to find the 'advanced' sub-menu to make a choice, which creates friction around a choice the user has already made (See Figure 10).

Figure 10. *Friction when trying to set Outlook files open in the default browser*



Microsoft blocked workarounds that counteracted its obstruction and sludge.

As a way to overcome Microsoft's forcing web links to open in Edge over the default browser (e.g. for Windows Search links) some developers created technical workarounds, such as EdgeDeflector, that would reroute these links to a user's default browser. However, Microsoft blocked EdgeDeflector in 2021. Similarly, in 2023

Microsoft blocked a technical workaround rival browsers had engineered to allow users to change their default browser in just one click from within their browser.[3]

The override of choice, additional settings and blocked workarounds create an asymmetrical choice environment in which using Edge is noticeably easier than maintaining the user's preferred browser. Similarly, users who want all relevant links and files, such as PDFs, to open in their preferred browser must navigate through granular settings and set their chosen default for each file and link type. Following Microsoft's DMA-related changes in summer 2025, Microsoft took steps to address such issues in Europe: when users change their default browser in Windows 11, the default now updates automatically across a broader range of link and file types that previously remained assigned to Edge (albeit excluding PDFs). And web links from Windows Search, Widgets and the Lock Screen now respect the default browser. However, these patterns are still visible in many countries in the rest of the world. Moreover, Microsoft itself explicitly stated that these changes were made in the European Economic Area (EEA) specifically to comply with the DMA.[4]

Microsoft Edge can restore tabs from users' chosen browser, nudging them to continue browsing in Edge instead.

The BCA and the industry press have observed a new practice where Edge opens automatically after Windows sign-in, and restores tabs that were previously open in an alternative browser the user was using.[5] This is a practice which disregards the user's previous browser choice and may lead users to believe they are resuming a

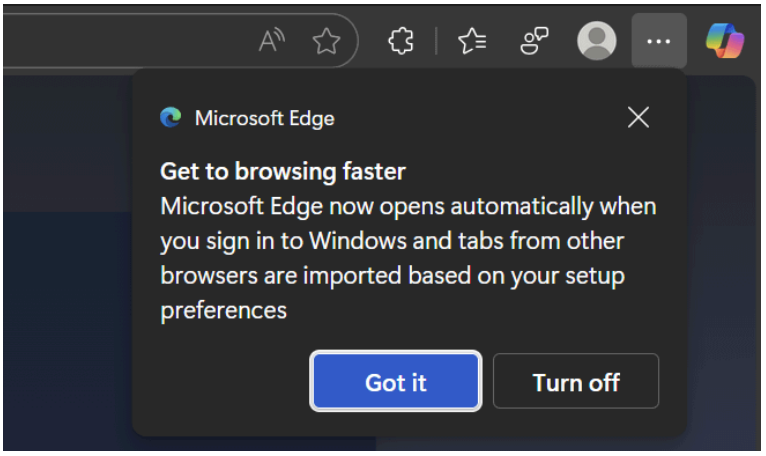
[3] Until Windows 8 / 8.1, Microsoft offered a public API enabling user one-click switch for its Windows OS. However, Microsoft then deprecated this API, while reserving it for Edge on Windows 10. Rivals created their own workarounds but Microsoft then blocked these workarounds in April 2023.

[4] See Microsoft | Windows Blogs, "Updates to Windows for the Digital Markets Act", 2 June 2025, available at: https://blogs.windows.com/windows-insider/2025/06/02/updates-to-windows-for-the-digital-markets-act/.

[5] See The Verge, "Microsoft Edge is trying to forcefully get your Chrome tabs again", 12 November 2024, available at: https://www.theverge.com/2024/11/12/24294454/microsoft-edge-chrome-tabs-prompt-trick; see also The Verge, "Microsoft stole my Chrome tabs, and it wants yours, too", 29 January 2024, available at: https://www.theverge.com/24054329/microsoft-edge-automatic-chrome-import-data-feature.

previous session in their preferred browser, rather than being redirected back to Microsoft's browser, Edge. As shown in Figure 11, the button to accept this change (moving away from the user's preferred browser) is made more salient than the button to reject the change. This creates an asymmetrical decision space where the option to use Edge is easier. Beyond salience, the interface also uses framing ("Got it" / "Turn off" instead of a clear "Accept" / "Reject"). It is also designed as an opt-out flow, forcing an active decision to reverse. This creates an asymmetrical decision space making the option to use Edge easier.

Figure 11. *Nudging users to use Microsoft Edge over the user's chosen "other browser[s]"*



Stage 3. A PC user updates their operating system

The last stage of the user journey is when users update their OS and try to use their previously chosen default browser.

Dark patterns identified at this stage include:

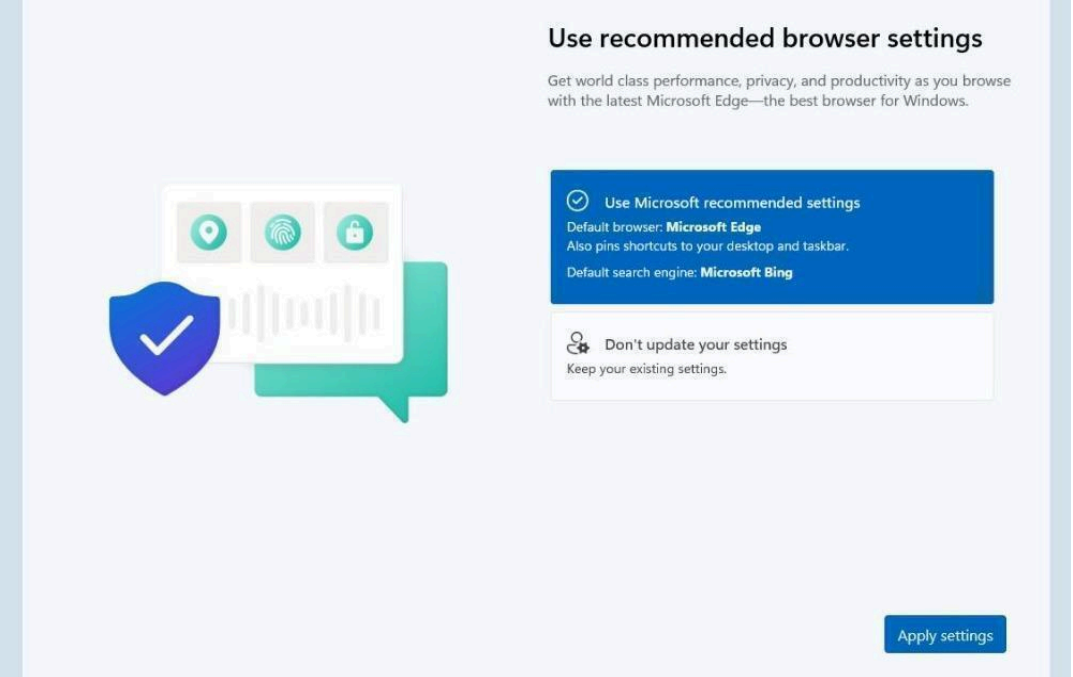
- Pushing users back to Edge or reestablishing Edge as the system default browser after OS updates (nudge, framing)

Windows 11 OS update prompt was identified that encourages users to revert their default browser to Edge.

The prompt appears at a point where users would not typically expect to be making a browser choice, as they are completing an OS update. The prompt was identified

as a dark pattern because of this context and the fact that it uses several features of the choice architecture to make accepting the change easier than rejecting it (see Figure 12).

Figure 12. *Framing and nudges to use Edge after OS updates*



The button to accept the change to the default browser is made more salient than the option to reject it, drawing greater attention towards accepting the change. The interface also uses framing, with "Use recommended browser settings" and "Don't update your settings" rather than clear and neutral alternatives such as "Accept" and "Reject". This framing also reinforces the messenger effect, as the recommendation comes from Microsoft, which users may perceive as a trustworthy authority, particularly regarding software on Windows PCs. The prompt also uses an opt-out flow, requiring users to actively reject the suggested change while moving through a series of screens to complete the update and get their PC running again.

These features create an asymmetrical OS-level choice architecture, making it easier for users to accept the change and revert Edge to the default browser. OS updates can also occur repeatedly throughout the life of a device, meaning users may encounter this choice multiple times and have repeated opportunities for their browser preference to be reset.

Phase 2. Literature review

The behavioural science literature helps to explain how design and online choice architecture tactics such as those identified in this report may influence users' browser choices and lead to potential harm.

This section first explores how harm is contextualised within online choice architecture. It then examines, for each of the three mechanisms identified in Phase 1 (nudges, sludge, and framing), the behavioural principles underlying how the mechanism operates, the evidence for its effects, and the potential harms that may arise for users. It first considers the wider mechanisms and their impacts by assessing the broader literature, before narrowing the focus to evidence from studies exploring browser choices specifically.

Contextualising harm

To assess the potential harm that design and online choice architecture can have on users' browser choices, we drew upon multi-dimensional harm taxonomies developed across recent behavioral and policy literature (Mathur et al., 2021; OECD, 2022; Santos et al., 2025; Yi & Li, 2025). Rather than adopting any single framework in full, we synthesised the elements most relevant to this context and developed a practical framework spanning three levels of harm: individual, collective, and societal. Our analysis focuses on individual harm, and specifically on harms that arise in an asymmetrical choice environment: where one option exposes users to costs, friction, or constraints that an otherwise equivalent alternative does not.

We identified three principal forms of individual harm:

- **Loss of autonomy** arises where the choice environment asymmetrically restricts meaningful freedom of choice, for example by making information about one option noticeably more difficult to select than an equivalent alternative.

- **Mental energy, effort and time costs** occur where users must expend additional mental effort, attention, time, or physical effort to act on one choice because of obstacles that would not be present if they selected another, functionally equivalent option.
- **Emotional distress and resignation** capture the frustration, fatigue, or exhaustion that can result from this unequal friction, particularly where repeated obstacles make maintaining a preference harder.

Together, these dimensions allow us to assess harm not only in terms of whether a user's final browser choice changes, but also whether differential treatment between comparable options imposes unnecessary constraints, effort, or psychological costs that make one option meaningfully harder to use than another. The cumulative effect could also impact users' ability to make informed decisions or lead to "resignation", giving up on previously made choices.

Mechanisms and wider evidence

Research shows that relatively small changes to how choices are presented can influence what people notice, choose, and follow through on. The evidence spans methods ranging from experiments and quasi-experimental studies that provide stronger evidence of causal effects, to interviews, usability studies, surveys, and observations that provide more detailed insight into user experiences and the mechanisms through which effects may arise. While these studies do not directly test browser choices, they provide evidence of the underlying behavioural mechanisms and potential harms of the dark patterns and asymmetric design and online choice architecture practices.

Sludge and obstruction

Strong theoretical models explain why introducing extra steps or making information harder to find can increase the effort required to make or maintain a choice. Thaler (2018) and Sunstein (2020) describe excessive or unjustified friction of this kind as sludge: burdens on users' limited time, attention and cognitive resources. Repeatedly bypassing, reversing or challenging a user's choices can compound these burdens, making it harder to maintain an existing preference and potentially steering users towards alternatives they would not otherwise choose.

This is particularly relevant where a user has already expressed a preference. A choice can be undermined when links or files continue to open in Edge after another browser has been selected as the default, when system updates reset that choice, or when removing Edge creates additional disruption or loss of functionality. The user may then need to spend further time and attention re-establishing the same preference. This is consistent with the idea of "slippery defaults", where consumers can be repeatedly steered towards a "firm-preferred option" after making a different decision about their preferred browser (Willis, 2013). The extra mental effort and time required to maintain their preference can wear down user resistance, causing them to abandon their original preference and stick to the platform's preferred option (Willis, 2013).

A growing body of experimental evidence supports these effects, showing that added friction can increase time, effort and cognitive burden and, in some cases, alter user choices.

There is strong experimental evidence showing that making certain options harder to choose or maintain increases time, effort, and cognitive burden. Luo et al. (2023) conducted a meta-analysis of 184 randomised field experiments, involving 2,245,373 participants. Interventions that changed the effort required to complete an action, such as adding steps to a cancellation process or making settings harder to locate, had among the strongest effects of the cognitive mechanisms examined. The findings support the idea that increasing the effort required to act can reduce follow-through, although they do not show how much additional effort would be needed to deter someone from switching browsers. Importantly, the authors also identified evidence of publication bias, with studies reporting successful interventions appearing more likely to be published than those reporting unsuccessful interventions.

The visibility of information can also affect whether people act in line with their preferences. Bogliacino et al. (2026) asked 7,430 participants across six European countries to state their privacy preferences before exposing them to different interface designs. Where key information required additional steps to access, choices inconsistent with participants' previously stated preferences increased by around 12.25 percentage points. In a separate consumer experiment, Luguri and Strahilevitz (2021) found that 30.1% of participants accepted a free trial when the price they would be charged after the trial ended was presented less prominently,

compared with 14.8% when it was presented more clearly. Together, these findings suggest that information has less influence on decisions when it is harder to notice or access, while making one option more noticeably salient than others may influence individuals' choices and behaviour.

Evidence suggests that resisting more aggressive designs can create frustration and emotional strain or decision fatigue.

In two large randomised online experiments involving around 4,000 US participants, Luguri and Strahilevitz (2021) found that mild designs such as pre-selected options and visually asymmetric choices more than doubled sign-up rates to a dubious service, while aggressive combinations involving repeated prompts, obstruction and confirm-shaming nearly quadrupled them. Participants who accepted the designs showed no immediate change in mood. Those who successfully resisted the aggressive conditions and declined reported significant increases in anger, displeasure and aggravation. This provides evidence that the effort involved in resisting repeated prompts and obstruction can sometimes be accompanied by frustration and other negative emotional responses.

A survey of 408 adults aged 60+ examined links between dark-pattern exposure, cognitive effects, unintended purchasing and digital literacy (Zhang, Chen & Hu, 2026). Greater exposure to dark patterns was associated with more cognitive overload, decision fatigue and trust bias, which were linked to unintended purchases. Higher digital literacy weakened the link between trust bias and unintended behaviour. The cross-sectional, self-reported design shows associations rather than causation.

The negative impact of friction can be greater for users with accessibility needs and lower digital literacy, but the evidence comes from small studies.

Stanczyk et al. (2026) examined in an 18-participant study how blind and low-vision users experienced six dark patterns using screen readers and magnification.They found that assistive technology could amplify the effects of dark patterns: screen readers made multi-step obstructions more time-consuming, and magnification sometimes moved genuine alternatives out of view. Screen reader users also took longer to complete tasks than those using magnification. The OECD (2022) conducted a cross-national synthesis that examined how digital literacy and

education affect susceptibility to dark patterns, including evidence from a large EU experiment under time pressure. They found that less-educated consumers were more susceptible to subtle dark patterns and less likely to recognise them. Under time pressure, inconsistent choices increased from 47.2% to 50.9% among more vulnerable consumers. However, these are small studies that are not directly testing browser choices, so the findings should be interpreted cautiously.

Busy workers could be particularly susceptible to deceptive practices, however, the evidence is not direct.

While little research directly tests workplace conditions and the impact these have on dark patterns directly, some studies examined how working conditions impact the decision environment (e.g. increasing pressure on people, having to complete multiple time-sensitive tasks). Dark patterns work partly by exploiting heuristics: pre-selected options, visual prominence, framing, friction asymmetries, and repeated prompts. Under cognitive load, people have fewer resources to scrutinise those cues and may be more likely to take the easiest available path.

For example, Williams, Hinds & Joinson (2018) analysed responses to nine simulated phishing emails sent across a large UK organisation of about 62,000 employees, examining which email features were associated with clicking. Authority cues were linked to higher click rates. In focus groups, employees also described being more vulnerable when busy, distracted, rushed, interrupted or tired, as they tended to process emails more quickly and rely on shortcuts rather than scrutinising them carefully. A smaller study found that having less time (7 seconds vs 15 seconds) reduced participants' ability to identify phishing emails and assess URL safety, although time pressure did not significantly amplify the effects of specific persuasion techniques (Auton & Sturman, 2025). While this evidence does not directly concern online dark patterns, it suggests that time pressure and divided attention may reduce the scrutiny users apply to framing, alternatives and implications, particularly where the platform-favoured option is presented as the quickest or easiest route.

Nudges

People naturally take the easiest path, trusting that pre-checked settings are the safe, expert standard. This removes the effort of choosing, so staying feels easy while switching can feel like risky extra work (Duque, 2024; Jachimowicz et al., 2019; Smith et al., 2013). If Edge imports a user's other browser's history, open tabs, or other

familiar browsing data, this could make the change of browser less noticeable. This may reduce awareness that the user is now using Edge and make continued use more automatic rather than a deliberate choice. When these patterns are combined with features that make the use of other browsers harder, they could contribute to reduced autonomy and a weaker ability to make informed choices.

Pre-selected choices[6] and the structure of choices are among the more consistently supported ways of influencing behaviour.

Mertens et al. (2021) pooled 447 effect sizes from 212 publications across health, food, environmental and financial decisions, finding that interventions which changed the structure of the choice environment, including pre-selected options, effort and the arrangement of options, had the largest average effect of the categories tested (d = 0.54). However, the study mainly examined nudges intended to benefit users, and the authors identified publication bias in the wider evidence base. Therefore, the evidence supports the view that choice structure can influence behaviour; however, there is less certainty about the size of the effect.

Jachimowicz et al. (2019) examined pre-selected choices specifically. They pooled 58 studies involving 73,675 participants and found a substantial average effect of pre-selecting an option (d = 0.68), with people around 27% more likely to choose the pre-selected option when choosing between two alternatives. Pre-selected options were particularly effective in various scenarios, including where people interpreted the option as an official recommendation. However, effects varied considerably between studies, which suggests that the influence of a pre-selected option

[6] It is important to distinguish between a 'default app' and a 'pre-selected option'. In the context of browser choice, a default app is the browser that the OS automatically uses to open relevant web links or file types, without requiring the user to select a browser each time. The default can be set by the OS or by the user.

In some behavioural science literature, 'default' can be used more broadly to refer to any pre-selection of one choice option that applies unless a person actively chooses an alternative (i.e. opts-out of the pre-selected option). Examples include automatic enrolment as an organ donor unless a person opts out. A pre-selected option may also be highlighted in a pop-up and applied unless the user chooses otherwise.

For clarity, this report uses 'default' exclusively to refer to the browser that opens automatically for the relevant links or file types (whether set by the OS or the user) and 'pre-selected option' to refer to the pre-selection of one choice option that applies unless the user actively chooses an alternative (i.e. opts-out of the pre-selected option).

depends in part on how users interpret the option and the context in which it is presented.

Some nudges could have a disproportionate impact on some vulnerable groups.

Schafer et al. (2024) showed 66 children aged 10–11 four dark patterns, including a pre-selected data-sharing option, and asked to identify manipulative elements. Only 3 of 51 children (5.9%) noticed the pre-selected option, compared with 47.1% who spotted an obvious button-colour manipulation. Barber and Suri (2025) ran two studies (N = 82 and N = 181) to test whether older and younger adults differed in their tendency to accept a pre-selected option. Older adults were more likely than younger adults to stick with the pre-selected option shown. This held for both positive and negative pre-selected options, regardless of participants' own preferences. Importantly, these are relatively small studies, and further research is needed to assess how these effects apply to these groups across different choice settings.

Zac et al. (2025) tested three dark patterns using a fictitious online investment product. Participants were led to believe that they could genuinely purchase the product and were asked first whether they wished to proceed and, if so, whether they would continue at a simulated payment stage. One condition made the "Reject" option less visually prominent while leaving the wording of the offer unchanged, and significantly increased initial acceptance compared with the neutral design. The authors also found some evidence that older participants were slightly more susceptible to this type of dark pattern. But, they only found weak evidence that susceptibility was related to general vulnerability proxies such as age, income, or education. It is important to keep in mind that the study used a fictitious financial product and measured an immediate decision, so the size of the effect may not translate directly to browser choice or longer-term behaviour.

Framing

Perceptions of risk are an additional mechanism. People respond to choices partly according to how those choices are presented. Kahneman and Tversky's (1979) work on framing and loss aversion suggests that potential losses can have greater psychological weight than equivalent gains. In a browser choice context, presenting an alternative browser in terms of what the user could lose or the risks they could

face may therefore make switching feel more consequential than remaining with a familiar option. This is relevant if and when the warning is unsubstantiated.

Where a genuine security threat exists, prominent warnings combined with friction can strongly reduce follow-through.

Felt et al. (2014) tested six designs of Chrome's SSL certificate warning across 130,754 impressions, varying wording, visual treatment, imagery and how difficult the warning was to bypass. More prominent warnings and designs that made bypassing less immediate reduced click-through. Egelman, Cranor and Hong (2008) similarly found that 79% of participants followed active phishing warnings that interrupted the task and required a decision, while passive warnings were largely ineffective in their sample of 60 participants. However, both studies tested real threats, so this doesn't establish that the same design would be justified or would work the same way in a browser choice warning.

Experimental evidence shows loss-framed messaging can increase caution, though findings aren't fully consistent across studies.

Rodríguez-Priego et al. (2020) conducted a real-money laboratory experiment with 120 participants and found that loss-framed cybersecurity warnings led to more secure behaviour, reducing the probability of suffering a cyberattack by 4.61 percentage points compared with gain framing. Tay et al. (2020), by contrast, found no significant effect when 91 UK participants were shown the same low-privacy app framed either as privacy protection or as a privacy risk. The different findings suggest that framing can influence behaviour in some settings, but the effect is not consistent. Given the small samples and the use of a fictional app and hypothetical installation decision, more research is needed to understand when and how framing influences behaviour.

There is little evidence testing how vulnerable groups react to safety-related messages.

Anaraky et al. (2023) exposed 206 participants to different combinations of positive vs negative framing, opt-in vs opt-out options, and justification messages in a Facebook photo-tagging application. Positive framing and opt-out designs increased disclosure overall. Older adults experienced a 53.1% increase in the likelihood of disclosure under positive framing, compared with 33.1% for younger

adults. However, the older-adult subgroup was small (44 participants), and the study examined photo tagging, not browser choice.

Browser-specific evidence

The evidence directly testing the impact of different online choice and design architectures on browser choice is more limited than the wider behavioural science literature and draws on several types of evidence, including usability testing, natural experiments, regulatory evidence, and expert design audits. These studies show how the mechanisms described above can operate in real-world browser environments, including the practical effort involved in changing a default, what happens when a user's choice is subsequently disrupted, and how browser use can change when people are given a more active opportunity to choose.

Friction and complex navigation can directly influence which browser users select and stick with.

Petrie (2025) used task-based usability testing to assess whether non-technical users could find and change their default browser settings across Windows 10, Windows 11 and iOS. Some participants were unable to complete the task or gave up, reporting hidden or confusing settings, ineffective search and misleading navigation. On Windows, participants were also sometimes directed towards Edge. The study indicates that friction within the interface can create a practical barrier to switching, requiring users to spend additional time and effort finding and completing the necessary steps. However, the research was a usability study rather than a randomised experiment, it cannot fully isolate the effect of individual design features.

There is also evidence that this difficulty can continue after a user has changed their settings. The ACCC (2021) observed instances in which Microsoft Edge disabled the DuckDuckGo Privacy Essentials and Ecosia browser extensions after users had actively selected and installed them. Restoring the extensions required several additional steps, including navigating to settings and visiting Microsoft's website. Microsoft stated that the feature was intended to protect users' browser settings, providing a potential security rationale for the behaviour. The example concerns extensions and search settings rather than the default browser itself, but it illustrates how a choice a user has made can later be disrupted, requiring further effort to

restore it. ACCC (2021) expressed concern that such dark patterns can impede choice and harm users.

More recent technical evidence shows that users' browser choices can also be affected by changes made at the OS and system-service level.

Brignull and Bowles (2026), in an expert audit of browser choice journeys across Windows 10 and Windows 11, found that customised browser defaults were reset during the Windows Backup process when moving to a new Windows 11 device in the EEA, UK, USA and India. They also found that links clicked through Windows Search results (via the taskbar) or Widgets were forced to open in Edge, ignoring users' selected defaults in the USA, India and UK, but not in the EEA. These findings show how users' browser choices can be overwritten, forcing them to use Edge even after they have selected their preferred browser. As an expert design audit, however, the evidence demonstrates that these behaviours occur rather than measuring their effect on users' subsequent decisions.

There is also direct evidence that giving users a more active browser choice can change browser use.

Akesson et al. (2026) examined the introduction of browser choice screens required under the EU Digital Markets Act, comparing changes in Firefox usage on iPhone Operating System (iOS) and Android with the levels that would have been expected without the mandate. From month 15 onwards, Firefox usage was estimated to be 91% higher on iOS and 13% higher on Android than it would otherwise have been. The effect was substantially larger on iOS, where the choice screen was shown to existing device owners as well as people setting up new devices, than on Android, where it was shown primarily to new devices. This suggests that when presented with alternative options in a choice screen, users may give greater consideration to alternative browsers (on new devices) or reconsider their existing browser choice (on existing devices). However, the study does not directly establish users' motivations or whether their decisions were more informed or led to greater satisfaction.

Earlier evidence from Microsoft's own browser choice screen shows a similar pattern, although with a smaller effect.

Following a European Commission investigation into Microsoft's tying of Internet Explorer to Windows, Microsoft introduced a choice screen for users in the EEA,

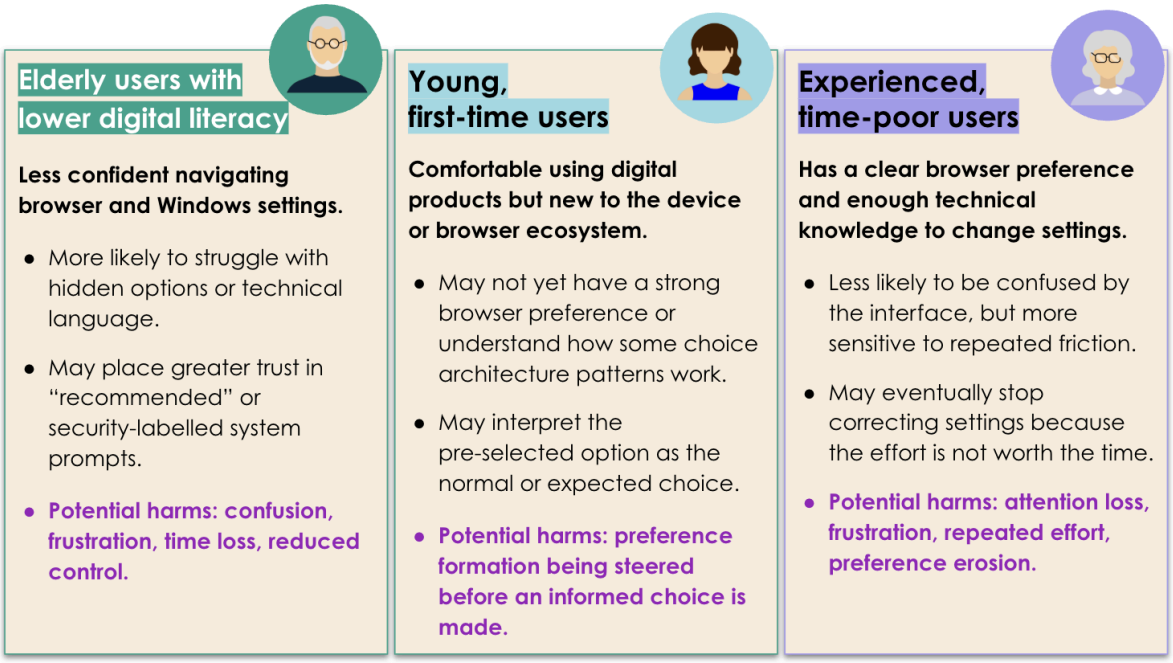
allowing them to select between Internet Explorer and competing browsers (a binding commitment set by the European Commission that expired in 2014, meaning that Microsoft has not been obliged to show the desktop browser choice screen to EEA Windows users since then). Vásquez Duque (2023) compared changes in Internet Explorer's market share in countries where the choice screen was shown with changes in other developed jurisdictions used as a comparison group. The study estimated that Internet Explorer's market share fell by around 1.4 to 2 percentage points more in the countries where the choice screen was introduced. The relatively modest effect may reflect the fact that the choice screen was introduced after users had already become familiar with Internet Explorer, meaning that existing habits and familiarity may have limited the effect of the active choice. Still, the difference between these findings and those from the more recent DMA choice screens may also suggest that how choice screens present browser options and enable users to make their selection can influence their effectiveness, although the studies do not directly test this.

The browser-specific evidence shows how the mechanisms identified in the wider literature can play out in real browser environments. Some Windows users struggle to change their browser even when they are trying to do so, while other evidence shows that Windows users' preferences can be disrupted or overridden after a choice has been made. The choice screen studies also show that changing the structure of the decision can alter browser use, although the size of the effect varies substantially depending on the setting, how and when the choice is presented, and the users reached. This provides a more direct basis for considering what the combined effect of Microsoft's design tactics could mean for users' ability to choose and maintain their preferred browser on Windows.

Phase 3. Personas

This section explores how different population segments may be affected by Microsoft's online choice architecture. Drawing on the literature review and the dark patterns identified by the BCA, it uses three hypothetical scenarios to illustrate how these effects may vary across users (see Figure 13).

Figure 13. *Overview of personas that could be disproportionately impacted by dark patterns*



Elderly users with lower digital literacy.

This segment relates to older PC users who are less confident navigating browser and Windows settings, and who may have lower familiarity with concepts related to choice architecture, including how options are presented, pre-selected options, file-type associations or system-level prompts.

The literature suggests that older users and those with lower digital literacy may be more susceptible to framing, pre-selected choices, trust cues and subtle dark patterns, particularly where choices are complex or not fully transparent (Anaraky et al., 2023; Zhang, Chen & Hu, 2026; Barber & Suri, 2025; OECD, 2022, Petrie, 2025).

In the Microsoft journey, this could make them more affected by framing and nudges, such as security-related messaging around Edge or prominent banners discouraging alternative browsers, as well as sludge and obstruction, where changing the default browser does not fully redirect all file types or where Windows features continue to open links in Edge. These patterns may be especially consequential where users are less likely to discover hidden settings, understand why their stated preference is not being respected, or know how to reverse the outcome.

Young, first-time users.

This segment relates to users who are generally comfortable with digital products but are new to a particular device, Windows environment or browser ecosystem, and may not yet have a strong browser preference or a clear understanding of how dark patterns work.

The literature suggests that users with less established preferences can be more influenced by pre-selected options, visual prominence and choice architecture, particularly when one option is presented as the normal or expected route (Schafer et al., 2024; OECD, 2022).

In the browser choice journey, this could make them more affected by nudges and framing, such as prominent banners discouraging alternative browsers or security-framed messaging around Edge, as well as sludge where an apparent browser choice is only partially implemented. These patterns may shape initial preferences before users have had a chance to make a fully informed choice.

Experienced, time-poor users.

This segment relates to users who are technically confident and may already have a clear browser preference, but who use their device under time pressure, interruption or competing work demands.

The literature suggests that time pressure and cognitive load can reduce the scrutiny users apply to prompts and increase reliance on the quickest or easiest available option (Williams, Hinds & Joinson, 2018; Auton & Sturman, 2025; Pooladvand & Hasanzadeh, 2022; Zhang, Chen & Hu, 2026).

In the Microsoft journey, this could make them more affected by sludge and obstruction that repeatedly override or reintroduce Edge despite an existing

preference, such as Windows Search, Widgets, Lock Screen, Outlook or Teams opening links in Edge, workarounds being blocked, tabs being imported into Edge at login, or Edge being pushed again after system updates. For this group, the main impact may be less about confusion and more about repeated effort, interruption and the cumulative time cost of having to reassert an existing preference.

Conclusions

The effects of dark patterns

The wider evidence indicates that the structure and presentation of a choice can influence users' decisions when multiple dark patterns are used simultaneously.

The evidence suggests that making Edge the easiest option can reduce the effort required to remain with it, while using dark patterns to add friction can make an alternative browser harder to find, choose or maintain, contrary to a user's intent. Framing can also then affect how users perceive the risks of switching, but this evidence is less robust at this stage. The individual tactics do not all have the same evidential basis, but together they can create a more demanding and less balanced choice for the user.

The effects of dark patterns that encourage users to stay with Edge while making alternative browsers harder to choose or maintain tend to be stronger when users lack an established preference, encounter the choice for the first time, or face multiple reinforcing tactics at once.

Due to regulatory pressure following Windows designation under the DMA, the EEA encounters fewer Windows tactics that discourage installing another browser, make it harder to keep, or cause Windows to ignore that choice later (Brignull & Bowles, 2026). However, some tactics remain present. The exact impact is harder to assess, but they follow the same theoretical principles that could cause potential harm by creating a 'mental tax' for using other browsers and impacting users' ability to make informed decisions.

Evidence of harms

The evidence highlights several interrelated harms resulting from dark patterns, particularly cognitive effort and a potential loss of autonomy.

Strong evidence indicates that additional steps and complex navigation can increase the time and cognitive effort required to act on a preferred browser choice, potentially discouraging users from following through and leading to time loss. Strong to moderate evidence also suggests that system-level overrides and

asymmetric online choice architecture could impact user autonomy, making it harder to maintain a chosen browser and increasing the likelihood that users remain with options that do not fully reflect their preferences. Evidence is more moderate to limited on the effects of unsubstantiated risk messaging and reduced visibility of alternative browsers, but these practices may influence perceptions of risk and make informed comparison more difficult. Finally, more limited evidence suggests that persistent friction and settings that are changed or overridden may contribute to frustration and negative emotional responses.

Impact on vulnerable users

Evidence on vulnerability is mixed and appears to depend on both user characteristics and the type of dark pattern involved.

Some studies suggest that older adults, users with lower digital literacy, less experienced users, and those under time pressure or high cognitive load may be more susceptible to particular forms of deceptive framing, pre-selected options or friction. However, other studies find these differences only for certain dark patterns, or find little evidence that vulnerability characteristics consistently predict responses across different interventions. This suggests that the relationship between user vulnerability and dark patterns is complex and context-dependent, rather than uniform across users or design practices. Further research is therefore needed to understand which users are more susceptible to which types of dark patterns, and under what conditions.

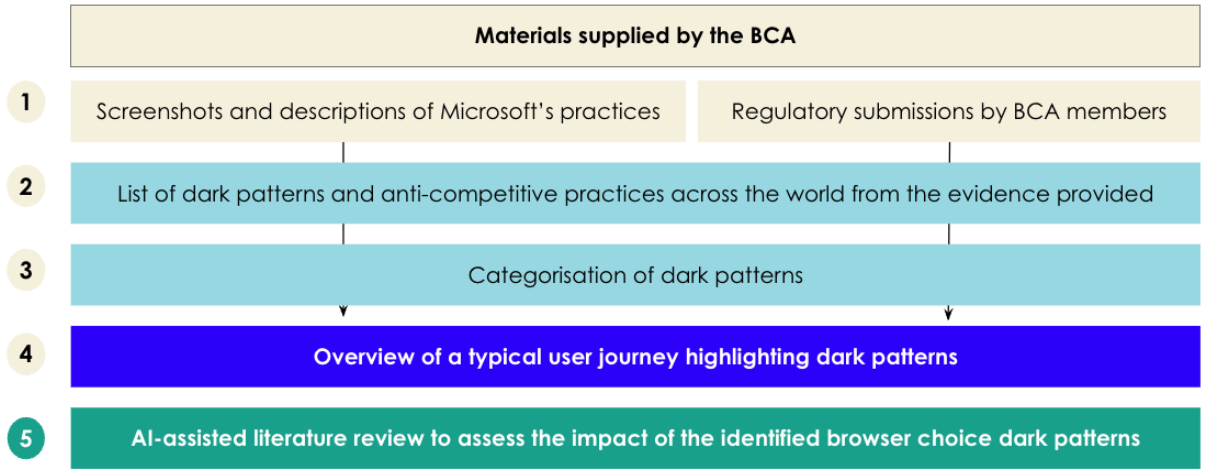
In summary, the reviewed evidence shows instances where online choice architecture created an asymmetrical decision space, making Edge easier to use while introducing friction that made it harder to leave. In these instances, user choice was not removed, but it was made harder to act on, less transparent, or less attractive. In other cases, user choice was structurally constrained or overwritten. These choice architecture practices can diminish user autonomy, create cognitive burden and time loss and may impair users' ability to make informed decisions, and lead to frustration.

Appendix

Method

The project was conducted in three phases, as illustrated in Figure 14.

Figure 14. *Overview of the method used to assess the dark patterns*



Phase 1

To understand how and whether Microsoft may be using dark patterns to make the use of Edge noticeably easier than the use of other browsers, BIT reviewed evidence supplied by the BCA and mapped the identified dark patterns alongside a typical user journey.

BCA members supplied BIT, in June 2026, with documents illustrating examples of design and online choice architecture used by Microsoft in relation to Edge. This evidence ranged from screenshots illustrating steps users encounter when trying to install and continue using a browser that is different from Edge on Microsoft devices, alongside response documents to the Competition and Markets Authority's (CMA) investigation and Opera's complaint in Brazil, revealing the persistence of practices such as, intrusive and misleading banners discouraging users who search for rival browsers from downloading those browsers, preselected "recommended settings" prompts that reset Edge after updates, and forcing links from Outlook and Teams to open in Edge regardless of the user's chosen default browser. The evidence spanned different jurisdictions, differentiating practices from the European Union

(EU) in particular, in light of its obligations under the EU Digital Markets Act (DMA) and the rest of the world.

The BCA-supplied evidence was then reviewed by BIT and categorised into dark patterns or other design and online choice architecture practices using the newly developed definition of dark patterns (see Introduction). The findings were then organised based on the user journey, mapping the potential dark patterns and anti-competitive practices used at each step of the journey (see Figure 1, Executive Summary).

Phase 2

To evaluate the potential user harm from the identified dark patterns, BIT conducted an AI-assisted literature review guided by a structured search plan.

We integrated AI tools across three specific stages of our research process. First, for retrieval and screening, we used targeted keywords alongside Consensus and Elicit (supplemented by Google Scholar) to locate literature and rank papers based on their relevance to our research questions and overall quality. Second, for analytical synthesis, we used NotebookLM to group key evidence directly applicable to our Phase 1 dark patterns. Third, for drafting support, we used general-purpose LLMs (including Gemini) to assist with writing. To maintain strict academic rigour, all AI-generated categorisations and outputs were reviewed and verified by human researchers, followed by senior quality assurance checks for accuracy, consistency, and potential bias.

This methodology enabled a comprehensive review of the dark patterns literature, from which we developed a taxonomy mapping primary markers of user harm. Finally, we mapped this evidence to specific design patterns, analysing how potential harms vary across demographic groups and jurisdictions.

Personas development

Three personas were developed to illustrate how the identified dark patterns may affect different types of users. This was done by drawing on literature examining how dark patterns can impact users with different characteristics, contexts, and levels of vulnerability.

References

Akesson, J., et al. (2026). Active Choice Interventions at Scale: Browser Defaults under the Digital Markets Act. NBER Working Paper Series, Working Paper No. 35112.

Anaraky, R. G., et al. (2023). Older and younger adults are influenced differently by dark pattern designs. Working Paper / Empirical Study.

Australian Competition and Consumer Commission (ACCC). (2021). Digital Platform Services Inquiry: September 2021 Interim Report (Report No. 3). Commonwealth of Australia.

Auton, J. C., & Sturman, D. (2025). Persuasion under pressure: the influence of persuasion principles and time constraints on phishing email susceptibility. Information & Computer Security, 33(5), 845-859.

Barber, S. J., & Suri, R. (2025). Sticking with the status quo: Default effects and age differences in decision making. Psychology and Aging.

Bogliacino, F., et al. (2026). Information Prominence and Privacy Choice Inconsistency: A Multi-Country Experiment. European Economic Review.

Brignull, H., & Bowles, C. (2026). Over The Edge 2.0: Do Microsoft's Design Tactics Still Compromise Free Browser Choice? Mozilla Research.

Egelman, S., Cranor, L. F., & Hong, J. (2008). You've been warned: An empirical study of the effectiveness of web browser phishing warnings. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '08) (pp. 1065–1074). ACM.

European Commission (2022). *Behavioural study on unfair commercial practices in the digital environment: Dark patterns and manipulative personalisation: Final report*. Directorate-General for Justice and Consumers, Publications Office of the European Union.

Felt, A. P., Reeder, R., Almuhimedi, H., Consolvo, S., Nissenbaum, H., & Egelman, S. (2014). Experimenting at scale with Google Chrome SSL warnings. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '14) (pp. 2667–2676). ACM.

Gray, C. M., Kou, Y., Battles, B., Hoggatt, J., & Toombs, A. L. (2018). The dark (patterns) side of UX design. In *Proceedings of the 2018 CHI conference on human factors in computing systems* (pp. 1-14).

Herman, J. (2024). Dark patterns: EU's regulatory efforts. Security and Privacy, e1388.

Isola, C., & Esposito, F. (2025). *A systematic literature review on dark patterns for the legal community: Definitional clarity and a legal classification based on the Unfair Commercial Practices Directive*. Computer Law & Security Review, 58, 106169.

Jachimowicz, J. M., Duncan, S., Weber, E. U., & Johnson, E. J. (2019). When and why defaults influence decisions: A meta-analysis of default effects. Behavioural Public Policy, 3(2), 145–186.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. Econometrica, 47(2), 263–291.

Luguri, J., & Strahilevitz, L. J. (2021). Shining a light on dark patterns. Journal of Legal Analysis, 13(1), 43–109.

Luo, Y., et al. (2023). A meta-analytic cognitive framework of nudge and sludge. Royal Society Open Science, 10(8), 230489.

Mertens, S., Herberz, M., Orth, U. H., & Brosch, T. (2022). The effectiveness of nudging: A meta-analysis of choice architecture interventions across behavioral domains. Proceedings of the National Academy of Sciences (PNAS), 119(1), e2107361119. (Corrigendum published 2022, PNAS, 119(22), e2206767119).

Mathur, A., Kshirsagar, M., & Mayer, J. (2021). What makes a dark pattern... dark? Design attributes, normative considerations, and measurement methods. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (Article 360, pp. 1–18). Association for Computing Machinery.

OECD. (2022). *Dark commercial patterns* (OECD Digital Economy Papers No. 336). OECD Publishing.

Petrie, H. (2025). Easy Default Browser Settings on iOS and Windows: Task-Based Usability Testing. Mozilla Research Report.

Pooladvand, S., & Hasanzadeh, S. (2022). *Neurophysiological evaluation of workers' decision dynamics under time pressure and increased mental demand*. Automation in Construction, 141, 104437.

Santos, C., Morozovaite, V., & De Conca, S. (2025). No harm no foul: How harms caused by dark patterns are conceptualised and tackled under EU data protection, consumer and competition laws. *Information & Communications Technology Law, 34*(3), 329–375.

Samuelson, W., & Zeckhauser, R. (1988). *Status quo bias in decision making*. Journal of Risk and Uncertainty, 1(1), 7–59.

Schäfer, R., Sahabi, S., Karl, L., Hahn, S., & Borchers, J. (2024). Growing up with dark patterns: How children perceive malicious user interface designs. In Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems (CHI '24) (Article 427, pp. 1–18). ACM.

Smith, N. C., Goldstein, D. G., & Johnson, E. J. (2013). Choice without awareness: Ethical and policy implications of defaults. Journal of Public Policy & Marketing, 32(2), 159–172.

Stanczyk, A., et al. (2026). Revealed or reinforced: How assistive technologies shape the experience with dark patterns for blind and low-vision users. In Proceedings of the 2026 CHI Conference on Human Factors in Computing Systems (CHI '26). ACM.

Sunstein, C. R. (2020). Sludge audits. Behavioral Public Policy, 4(2), 173–187.

Thaler, R.H. (2018), 'Nudge, not sludge', Science 361(6401): 431.

van Bavel, R., Rodríguez-Priego, N., Maghiros, I., & Thibuly, M. (2020). Framing effects on online security behaviour. Theory and Decision, 89(4), 425–448.

Vásquez Duque, O. (2023). Active choice vs. inertia? An exploratory assessment of the European Microsoft case's choice screen. Working Paper. (See also: Vásquez Duque, O. (2024). Taking Behavioural Antitrust Seriously: On Default Agreements as Exclusive Dealing. Maryland Law Review).

Willis, L. E. (2013). When nudges fail: Slippery defaults. U. Chi. L. Rev., 80, 1155.

Williams, E. J., Hinds, J., & Joinson, A. N. (2018). Exploring susceptibility to phishing in the workplace. *Human Factors, 60*(6), 893–904.

Yi, W., & Li, Z. (2025). Mapping the scholarship of the regulation of dark patterns: A systematic review of concepts, regulatory paradigms, and solutions from law and HCI perspectives. *Computer Law & Security Review, 59*, 106225.

Zac, A., Huang, Y. C., Von Moltke, A., Decker, C., & Ezrachi, A. (2025). Dark patterns and consumer vulnerability. Behavioural Public Policy, 1-50.

Zhang, Y., Chen, X., & Hu, L. (2026). Dark pattern exposure, cognitive overload, and decision fatigue among older adults. Computers in Human Behavior, 152, 108112.

58 Victoria Embankment
London EC4Y 0DS
+44 (0)20 7438 2500
info@bi.team
𝕏 @B_I_Team
www.bi.team

Nesta is a registered charity in England and Wales with company number 7706036 and charity number 1144091. Registered as a charity in Scotland number SCO42833.

Registered office: 58 Victoria Embankment, London EC4Y 0DS.

CC BY NC SA