Examining the Design of Choice Screens in the Context of the Digital Markets Act

Research commissioned by BEUC and conducted by Bonanza Design GmbH

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This study was commissioned by BEUC – the European Consumer Organisation. The opinions expressed in this document are the sole responsibility of Bonanza Design GmbH. They do not necessarily represent the official position of BEUC or its members.

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1 Introduction

The rapid growth of digital technology and mobile devices usage has significantly altered how individuals access information. Notably, the dominance of one gatekeeping player in the Search Engine market causes concerns within the European Union about contestable and fair markets and user exposure to alternative Search Engines. In response to this development, the Digital Markets Act (DMA) provides a framework for addressing these issues and promoting a more equitable competitive landscape. The goal of this study is to investigate how distinct design elements can enhance the fairness of Choice Screens to enable competing Search Engine providers to have better visibility.

2 Problem Statement

The dominance of one player (Google Search) over the European Search Engine markets results in reduced visibility for any alternative Search Engines available to users, who may not be aware of their options or benefits. Consequently, there is a need for a design solution that not only empowers users to make informed decisions about their preferred Search Engine but also fosters fair competition among various industry players and complies with the new DMA rules.

3 Objective & Hypothesis

This research looks to investigate the impact of various design elements on user perception and decision-making processes, while also ensuring that competing players have an equal and fair opportunity for selection. The goal of this study is to find and promote best practices in Choice Screen design and implementation, with the aim of creating a more equitable competitive environment for all participants in the European Search Engine markets.

To achieve the overarching goal of this UX (User Experience) research study we have collaboratively developed, refined, and evaluated multiple iterations of Search Engine Choice Screens, with the aim of effectively empowering users to make informed decisions concerning their preferred Search Engine. This study aims to determine an effective Choice Screen design by actively involving stakeholders and conducting user testing across diverse European Union demographics.

3.1 Central Hypothesis

The design variables[1] and placement strategies of Search Engine Choice Screens significantly influence user decision-making processes when selecting their preferred Search Engine. By collaborating closely with stakeholders and conducting user tests, we can find the effects of alterations in design variables, thereby improving the design of Choice Screens to aid users in discovering alternative Search Engines. These enhanced practices in Choice Screen design and implementation can facilitate contestability in the European Search Engine markets, potentially leading to a fairer competitive environment for all players.

In section 4 we detail the process of filtering and selecting each design variable considered in this study. This sets the groundwork for section 5 where we explore corollary hypotheses for every design variable, their formulation, and introduce them visually as design mockups.

4 Methodology

Our methodology covers multiple angles to ensure a thorough research approach. For a comprehensive understanding of our process, we subdivided our approach into specific sections. Namely,

1. **Design Principles:** We present a set of principles that guide our design process. These principles serve as the foundation for creating an optimally designed Choice Screen for Search Engine choice.
2. **Design Limitations:** We recognize that certain limitations may exist beyond our design process and within the software and techniques we use. By acknowledging these limitations, we aim to provide transparency and ensure that our findings are interpreted within their appropriate context.
3. **Design Process:** This section outlines the step-by-step process followed in our study. It gives readers an overview of our research, from literature review to data analysis.

4.1 Design Principles

These principles ensure that users from various backgrounds and needs can engage effectively with Choice Screens, promoting fair competition within the Search Engine market.

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[1] A "Design Variable," in the context of this study, refers to any unique visual alteration that can be made within a given design. For instance, color changes, typography adjustments (like font type, size, boldness), layout modifications (such as element positioning or spacing), or even the incorporation of new elements like images or icons. Thus, each unique change that can visually distinguish one design from another is considered a separate design variable.

- **Switchability**: This principle allows users to conveniently switch to their preferred Search Engine. The process should be effortless, ideally requiring only a few clicks, and without any barriers or complicated procedures. The key here is user empowerment; users should have complete control over which Search Engine they use.
- **Fairness:** This principle advocates for a balanced Search Engine Choice Screen environment to ensure that no provider has an unfair advantage over others. In other words, all options should be displayed in a way that allows them to be considered and the user given full autonomy to make their choice based on personal preference rather than influence from the platform itself.
- **Education:** Users lean towards familiar names or brands, overlooking potentially better alternatives due to familiarity bias. The aim is to inform users about the various Search Engines besides the mainstream ones to enable users to make well-informed decisions.
- **Inclusivity**: Refers to designing interfaces that cater to all users irrespective of their IT ability levels. Users show varying levels of technological proficiency, where some possess advanced knowledge while others may lack expertise. Therefore, Choice Screens should be designed keeping both extremes in mind – they should be simple enough for less tech-savvy and efficient for more adept individuals.

4.2 Design Limitations

In this section, we discuss various limitations met during the design and implementation stages of our study. While our goal was to conduct comprehensive and thorough research, there were certain unavoidable constraints that could potentially affect the overall outcome.

- **Sample diversity**: Despite efforts to include a diverse range of participants within all European Union member states, there may still be gaps in the representation of user groups, limiting the generalizability of the findings.
- **Cultural nuances:** Although the study aimed to be inclusive, it might only partially capture cultural nuances and preferences, which could influence user interaction with Choice Screens in ways not considered in the design process.
- **Evolving technology:** Rapid technological advancements may introduce new challenges or opportunities in Search Engine competition that must be addressed continuously in Choice Screen designs, potentially limiting the study's relevance over time.
- **Limited scope:** The study primarily focuses on the Android onboarding process and its Search Engine Choice Screen, not addressing other use cases where Search Engine selection might occur. This could limit the study's applicability to a broader context.
- **Regulatory changes:** The study is based on the current state of the Digital Markets Act, and any changes to the Regulation or the way the European Commission and the courts interpret it could affect the study's findings or relevance.
- **Fixed random order:** To avoid introducing an added variable in each design and because of the technical limitation of the online testing platform, the order in which the Search Engines were displayed in the different designs of the Choice Screen was decided randomly and then fixed. This was done based on the "stratified" random order of the current Android Choice Screen, where the top five Search Engines by market share are ordered randomly first, and then another set of Search Engines are randomly ordered below. In this study, once this stratified random order was set up, it was fixed and applied to all the designs so that all participants would see the same list of Search Engines

appearing to be ordered randomly.

- **Testing on desktop/laptop:** Testing was carried out on desktop/laptops to collect data insights, as explained below in <u>Section 4.3.9 A</u>. The Android onboarding process is a mobile experience, therefore testing on a desktop or laptop computer provides different user interactions or visual cues. For instance, touchscreen gestures like swiping and pinching are inherent to mobile devices but do not translate well to mouse clicks. This discrepancy may affect how users interact with and respond in a testing environment.
- **Software**: The software and tools we used to conduct our studies and analysis may have limitations beyond our control. These limitations can potentially affect the scope of our findings since they may restrict the available data.
- **Language:** All tests were conducted in English to parse data and generate insights more efficiently. However, communicating exclusively in English may have some drawbacks, such as limiting the participant pool to only those who are fluent in English, which could lead to a lack of diversity and representation in the study sample. Additionally, non-native English speakers may feel less comfortable expressing themselves fully or accurately due to language proficiency challenges.
- **Collection of Personal Information:** During the testing process, when participants engaged with specific input fields (e.g., Google account email and password), these fields were automatically populated with generic data. This feature is designed to prevent the unwarranted collection of Personally Identifiable Information (PII). However, this might inadvertently impact the precision of our research findings. By bypassing the step where participants must typically type in their own details, we eliminate a critical aspect of user interaction and may indirectly influence their experience with the interface.

To minimize these challenges as far as possible, we involved participants from various backgrounds, age groups, and professions to ensure diversity. Additionally, we sought representation from every member country in the European Union to provide a more comprehensive outlook. Even though we targeted English speakers, we also incorporated multilingual individuals to account for variations in understanding and perception due to language differences.

4.3 Design Process

The following section provides a detailed account of the design process that our team followed. This approach ensured that we achieved a design that was user-friendly and data-informed, while also being properly aligned with our research goals.

4.3.1 Literature Review

To begin, our team conducted a review with the objective of thoroughly analyzing and examining the underlying requirements, legal aspects, and extensive literature related to the psychology of choice and Choice Screens. Moreover, we organized numerous brainstorming sessions with BEUC where we discussed and expanded on perspectives and ideas, allowing us to learn from their perspective.

4.3.2 Design Principles, Research Goal & Central Hypothesis

Subsequently, in collaboration with BEUC, we established a set of design principles, provided further details regarding the research objective, and formulated the central hypothesis.

4.3.3 Ideation Phase

Our team generated different ideas and sketched over eighty concepts to reimagine the presentation of the Search Engine Choice Screen. During this creative process, we refrained from imposing any limitations on ourselves, exploring all possibilities without considering their feasibility.

4.3.4 Prioritization Phase: Filtering the Ideas Through the Lens of Feasibility

After reviewing all ideas based on design principles and common practices in user experience design, we evaluated their feasibility and narrowed them down to twenty-five proposals. To prioritize, we considered the amount of effort that would be needed to implement each idea and whether the expected benefits justified this effort.

4.3.5 Further Prioritization of Ideas and Narrowing Down

Given our limited resources for testing, as detailed in Section 4.3.9, we further narrowed down the number of designs to maximize the insights we could acquire. Our primary focus was on one central question: Which of these ideas would yield the most valuable insights to effectively investigate our general hypothesis? With this question in mind, we filtered our ideas down to five and converted each one into a high-fidelity design. The objective was to test these five designs against a control, modelled on the existing design of the Choice Screen in the Android onboarding process and evaluate the strengths of each final design.

Each design differs from the control only in one design variable. We concluded that increasing the number of design variables would yield weak results because it would be difficult to prove causation between variables and the observed effects. Therefore, each final design intentionally focused on a single design variable, which included:
1. The absence of logos,
2. The inclusion of an expanded description field,
3. The positioning of Google "below the fold,"
4. The inclusion of an education screen,
5. The inclusion of an information screen.

More details on these variables are presented in section 5 where we visually present and explain the control and challenger experiments.

An overview of all final designs for the Search Engine Choice Screens can be found in Annex E.

4.3.6 Placement, Interaction, and Content

After deciding which designs to evaluate, it was important to determine the placement, interaction, and content of each design in order that our prototypes could be tested by our participants. To

accomplish this, we consulted the public documentation provided on the Android official website (https://www.android.com/choicescreen). According to this publication, aided by Figure 1 as visual description:

- The Choice Screen appears during the initial setup of new Android devices in the EEA, UK, and Switzerland.
- It is displayed if the Google Search app is pre-installed on the device.
- Users are presented with a scrollable list of up to twelve eligible general search services.
- The list includes the five most popular eligible general search services in each country, determined by Stat Counter (https://statcounter.com) data, displayed at the top.
- The remaining eligible search services are randomly ordered below the initial five with a maximum of seven Search Engines.
- The order of display on the Choice Screen is randomized each time it is shown.

In addition, regarding the interaction design, *"The user is required to choose one search provider from the Choice Screen during setup. The effect of a user selecting a search provider from the Choice Screen is to (i) set the search provider in a home screen search box to the selected provider, (ii) set the default search provider in Chrome (if installed) to the selected provider, and (iii) install the search app of the selected provider (if not already installed). Note that in the case where a user takes an action to remove the search box (including by restoring a previous device configuration where the search box had been removed), the search box will not be shown."*
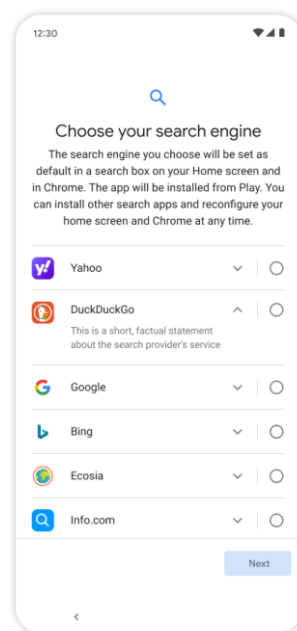
Figure 1. The Search Engine Choice Screen as presented on the official Android website.

The guidelines did not provide a fully comprehensive description of the choice screen design. In response, we tested several Android phones at our disposal to discover the position of the Search Engine Choice Screen during the onboarding process and to determine which Search Engines would be presented on the Choice Screen (this last point is further discussed in Section 4.3.7). During this preliminary testing we discovered that the Search Engine Choice Screen would appear close to the end of the onboarding process, only before setting up the Google Assistant and receiving a congratulatory message about successfully completing the onboarding. For the

position of the Search Engine Choice Screen in our experiments, we chose to keep the same position to avoid introducing another design variable into an already complex system.

Regarding interaction design, we initially planned for the five screens to feature distinct types of interaction, including checkboxes, radio buttons, and other buttons. However, we recognized that this would introduce an additional variable, so we opted to solely use radio buttons for interaction, modelled on the current approach in the Android Choice Screen.

Lastly, to ensure that Search Engine descriptions and features were accurate, we consulted each Search Engine's respective official website. If sufficient information was not available, we compiled and integrated information from other publicly available sources. This approach was taken to keep objectivity and prevent any personal bias from being introduced.

4.3.7 List Items and Order

In our prototypes, we included two sets of Search Engines based on the current structure of the Android Choice Screen (where the top 5 Search Engines are ordered randomly first, and then another set of Search Engines are randomly ordered below). These Search Engines were:
- At the top: Yahoo, Microsoft Bing, DuckDuckGo, Google, Ecosia
- At the bottom: Yandex, Yep, Qwant, KARMA, OceanHero, Ask.com, GMX and Mojeek.

The five Search Engines included in the top five were selected based on market shares. The ordering of the Search Engines within the two sets was random and provided by BEUC, and remained consistent in all designs, the only exceptions being Experiment A4 and Experiment B1.

4.3.8 Building the Prototype

Building a functional prototype was a collaborative effort that required multiple iterations, several types of design software and an accurate representation of the Android onboarding process before and after the Choice Screen itself.

A. **Low and Mid Fidelity Mockups on Figma:** After gathering information and sketching ideas, we moved to Figma, a collaborative web-based user interface design tool. We created low and mid fidelity mockups (Figure 2) that provided a rough representation of the final product's layout and functionality. These mockups served as a starting point for discussions with BEUC and allowed us to gather valuable feedback early in the process.
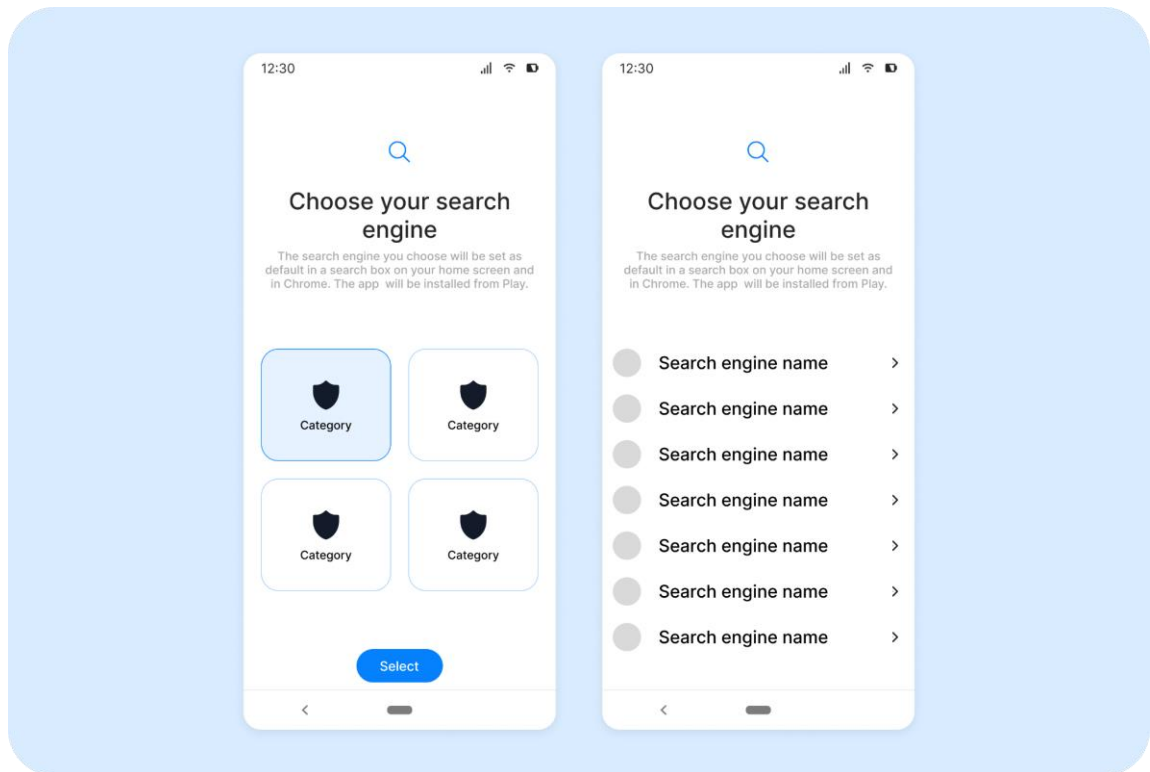
Figure 2. Example of a mid-fidelity design proposal.

B. **Hi-Fidelity Prototypes:** Once we had finalized the low fidelity mockups, we focused on creating high-fidelity prototypes using Figma, as seen in Figure 3. These prototypes were modelled on the current Android onboarding experience. By refining the visual elements, interactions, and overall user flow of the design, we were able to better convey our vision and obtain more accurate feedback while also minimizing the time between revisions.
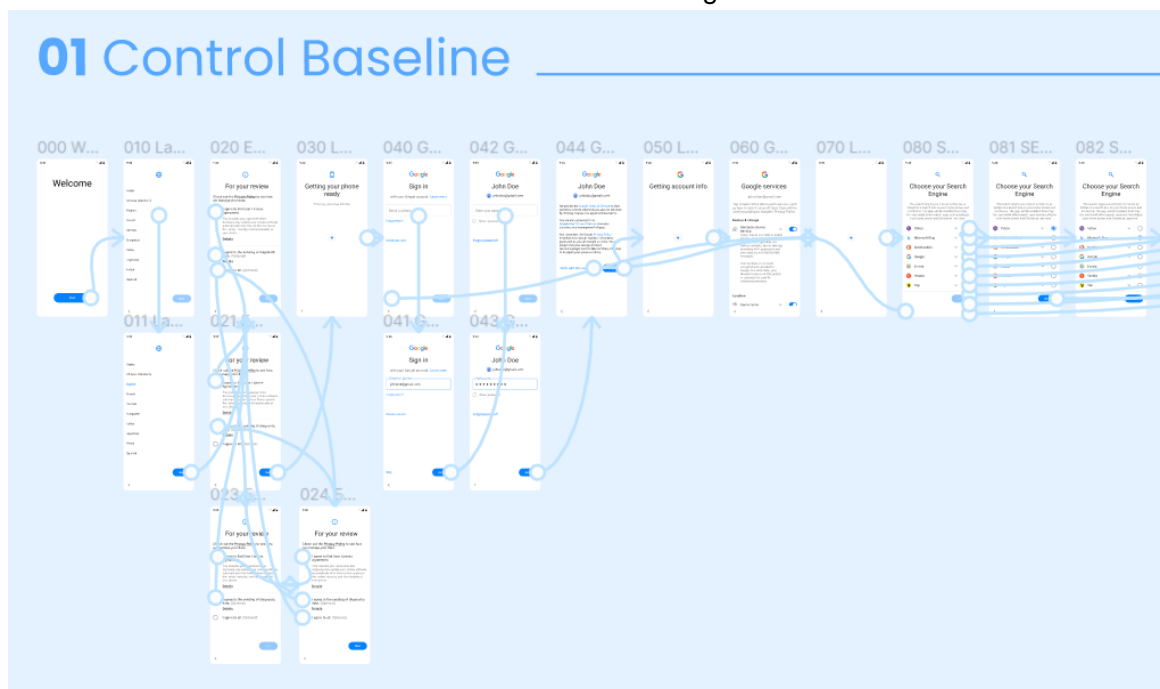

Figure 3. Example of hi-fidelity design proposal with interaction arrows visible in the canvas.

C. **Internal Testing:** To ensure that our prototypes met the intended objectives and presented no errors while participants were engaging with them, we conducted thorough internal testing. This involved evaluating the usability of the prototype with other members of our team. Feedback from this testing phase helped identify areas for improvement before moving forward.

D. **External Testing:** After thoroughly validating our prototypes for production, we employed UseBerry, a robust software solution that seamlessly integrates prototypes into a testing environment. This powerful tool not only automatically captures data but also efficiently manages participant engagement. To ensure the utmost quality, we carefully selected participants from a trusted and pre-vetted tester pool provided by Prolific.

4.3.9 Qualitative & Quantitative Testing

We employed two approaches to gather insights: quantitative analysis and qualitative interviews. Each has its own unique strengths and contributes to our understanding in separate ways.

- *Quantitative analysis* provided us with hard data and statistical evidence. From this, we could determine patterns and trends, measure outcomes, and make predictions about future behavior based on those measurements. This approach allowed us to gather a large amount of data from a significant sample size that would give us more reliable results.
- *Qualitative interviews* captured people's experiences, opinions, feelings, and perceptions in greater depth. This approach allowed for open-ended exploration of topics and gave us insights beyond what can be quantified. The richness of information gathered through qualitative interviews helped us to understand the context around the numbers generated by the quantitative analysis.

By combining both methods, we were able to harness the strengths of each: numerical data from quantitative analysis along with nuanced, contextual insights from qualitative interviews.

A. Quantitative Testing

We tested with 1437 participants. Specifically, 1237 participants for the first round and an additional 200 participants for the second round, as outlined in Section 4.4. Participants in our quantitative research were carefully selected from all European Union member states using the Prolific platform mentioned above. To prevent any potential bias or influence on responses, during the study, participants were compensated at a fixed rate per hour. The payment was made directly by Prolific to ensure fairness and impartiality.

To maintain data integrity and prevent duplicate entries, we took several measures. Participants were only allowed to participate in the study once, ensuring their input was unique. They also had to provide a code at the end of their participation, which was checked manually against a unique tester ID provided by Prolific. This double verification process helped ensure the accuracy and uniqueness of the data.

During the study, participants were instructed to use their laptops to interact with our prototypes. We provided them with access to the UseBerry platform, which allows researchers to monitor and record interactions in real-time. UseBerry captured various data points, including mouse movements, clicks, and timestamps of actions performed by participants. The recorded data

provided valuable insights into how participants engaged with our prototypes and by analyzing this data, we were able to identify patterns, trends, and areas of improvement in terms of user experience and usability. By using UseBerry for data collection, we ensured that all participant interactions were accurately captured and documented. The platform's reliability and robustness enabled us to maintain data integrity throughout the study. Additionally, its user-friendly interface made it easy for participants to navigate and provide feedback on the prototypes.

B. Qualitative Testing

To complement the quantitative findings, we conducted online interviews with thirty-five participants from five EU countries: Sweden, Spain, France, Hungary, and Germany. We chose these countries to provide a comprehensive overview of different regions of the European Union and to ensure that our testing groups were large enough to capture at least 85% of usability issues, as detailed by Nielsen Norman Group[2]. The participants were allocated in an arbitrary but symmetrical manner to ensure that the control group had five participants and the other experiments each had six participants. As a result, the control group included one participant from each country, while the challenger experiments were assigned per country. For example, all German participants, except for the one assigned to the control, engaged with Experiment A2.

All interviews were conducted online using Zoom and were led by members of the Bonanza Design team who were directly involved in the project. Participants interacted with a live prototype on their computer screens while we recorded their interactions and asked questions about their reactions and perceptions. Our primary objective was to gather user feedback on preferences and behaviors. Additionally, we aimed to validate the observations obtained from the quantitative analysis.

After the participants had completed the exercise using the interactive prototype, for both the quantitative and the qualitative parts of our research, participants were presented with a series of questions to gather additional insights and feedback. These questions were carefully designed to enhance the overall comprehensiveness and depth of our study and can be found in the Annex D: Quantitative and Qualitative Questionnaire.

All testing took place in the first three weeks of May 2023, and participants were not informed beforehand about the involvement of BEUC or the DMA that motivated this study, or the overall purpose of the study.

4.4 Follow-Up Study: Quantitative Assessment of a Combination Choice Screen

After analyzing the results of the initial round of tests, we were able to generate valuable insights that led us to design an additional experiment with a new screen. To gather more data, we conducted further quantitative testing with this screen. The development and testing process followed the principles as set out in our methodology and incorporated elements from the top-performing experiments discussed in Section 5. By leveraging the strengths of these experiments,

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[2] Nielsen, J., & Landauer, T. K. (1993). A mathematical model of the finding of usability problems. In Proceedings of ACM INTERCHI'93 Conference (pp. 206-213). Amsterdam, The Netherlands. Retrieved from https://www.nngroup.com/articles/why-you-only-need-to-test-with-5-users/.

our objective was to create an optimized user interface that would strengthen or confirm our initial discoveries.

A separate section, Section 7, explains and presents the results of this second round of testing.

5 Final Experiment Designs

As mentioned in the previous section, each of our experiments underwent multiple filters, iterations, and workshops before arriving at their definitive version. Below we outline how each of the final experiments looked, the hypothesis behind them, as well as the differences compared to the control experiment.

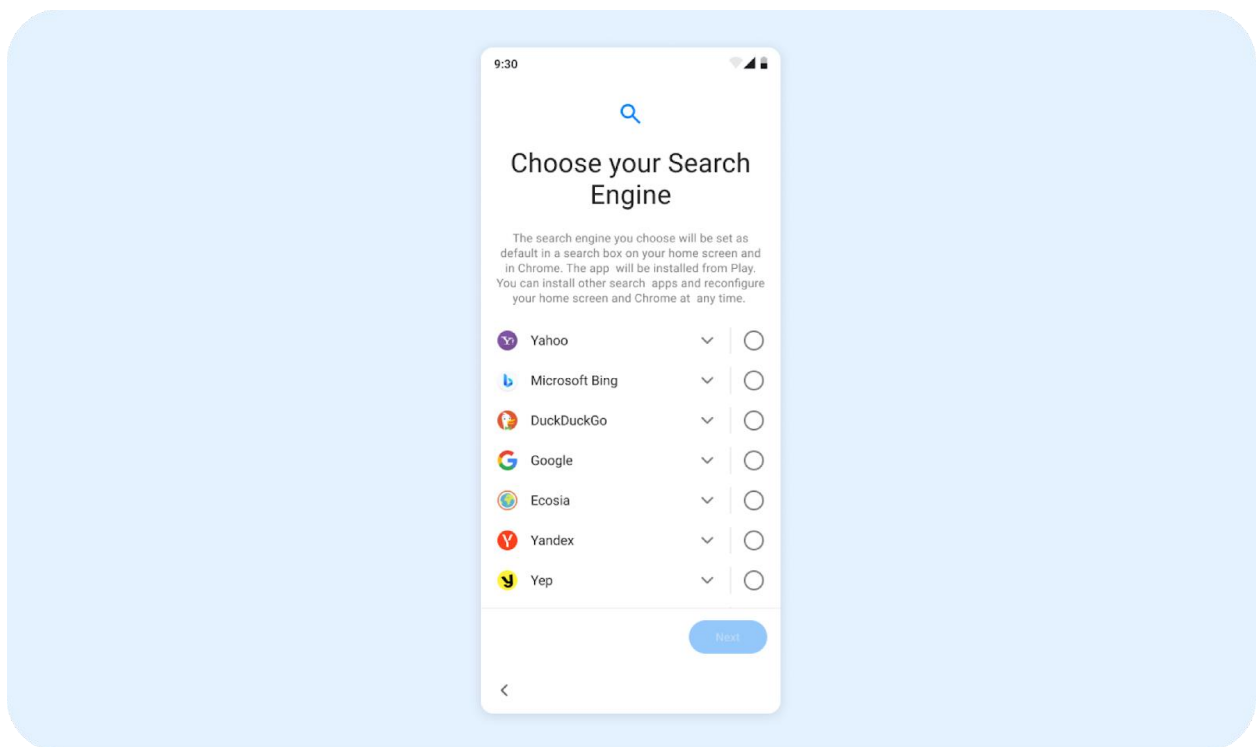## 5.1 Control (Experiment A1)

Figure 4. "Control" variant of the Search Engine Choice Screen.

The control experiment, modelled on the existing Android Choice Screen, was devised to set a foundational understanding of user conduct, inclinations, and trends, thereby providing a benchmark for comparing outcomes from other experiments in this study.

In section 4.3.6, we explored how Android presents the Search Engine Choice Screen on the Android website. However, when interacting with an Android phone, we noticed minor differences compared to the version described by Android as seen in Figure 1. These differences include the absence of dividers between list items and different Search Engine logos. Therefore, the control was modelled and based on our direct experience with the actual version of the Android Choice Screen.
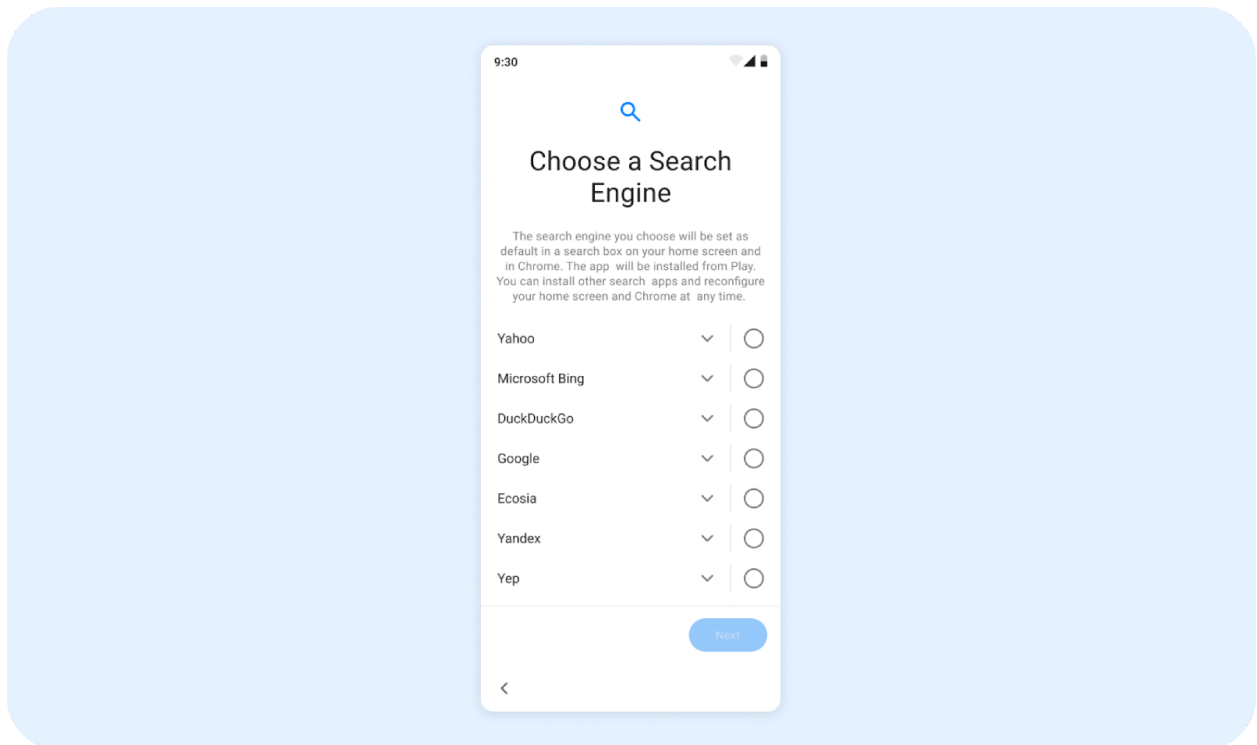
5.2 No logos (Experiment A2)

Figure 5. "No Logos" variant of the Search Engine Choice Screen.

5.2.1 Visual Changes

Compared to the control, this experiment removed all logos from the list. It also changed the header text from "your" to "a" Search Engine. To ensure consistency, this change in the header text was made on all the experiments aside from the control Experiment A1. The change from "your" to "a" was introduced to encourage users to not interpret the Choice Screen as requiring users to simply choose "their" *existing* Search Engine but to think about potential alternatives.

5.2.2 Hypothesis

We hypothesized that the presence or absence of logos on the Search Engine Choice Screen would affect how participants viewed and perceived the Search Engine list, and their selection of a Search Engine. By removing the logos from the Search Engine Choice Screen, we sought to assess the impact on participants. The removal of logos could lead to a non-negligible change in participants' choice of Search Engine.
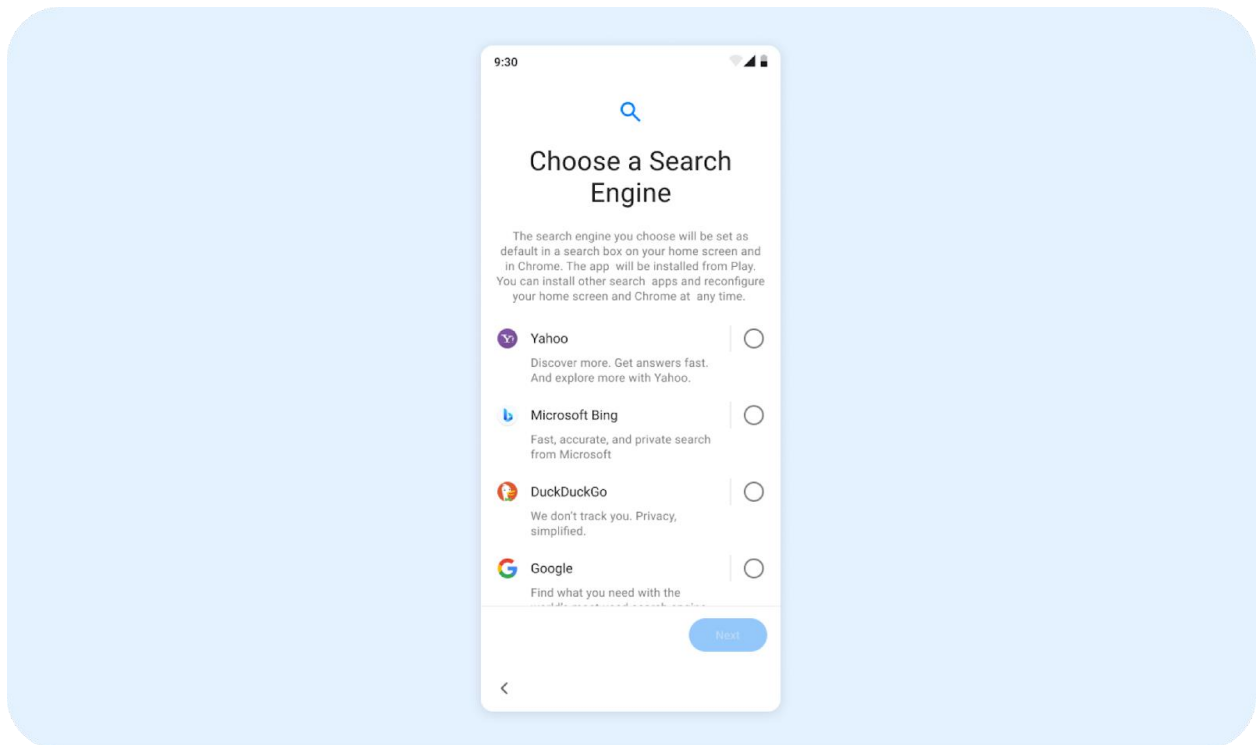
5.3 Expanded Description (Experiment A3)

Figure 6. "Expanded Description" variant of the Search Engine Choice Screen.

5.3.1 Visual Changes

Compared to the control experiment, this experiment removed the drop-down arrow that hid the Search Engine description. The description was presented automatically without the ability to hide it, making it more prominent.

5.3.2 Hypothesis

We hypothesized that the direct display of descriptions for each Search Engine, without the option to click-to-expand using the drop-down, would result in a higher number of participants reading these descriptions, leading to measurable changes in user behavior and preferences regarding Search Engine choice. Specifically, we anticipated observing a greater proportion of participants choosing an alternative Search Engine.

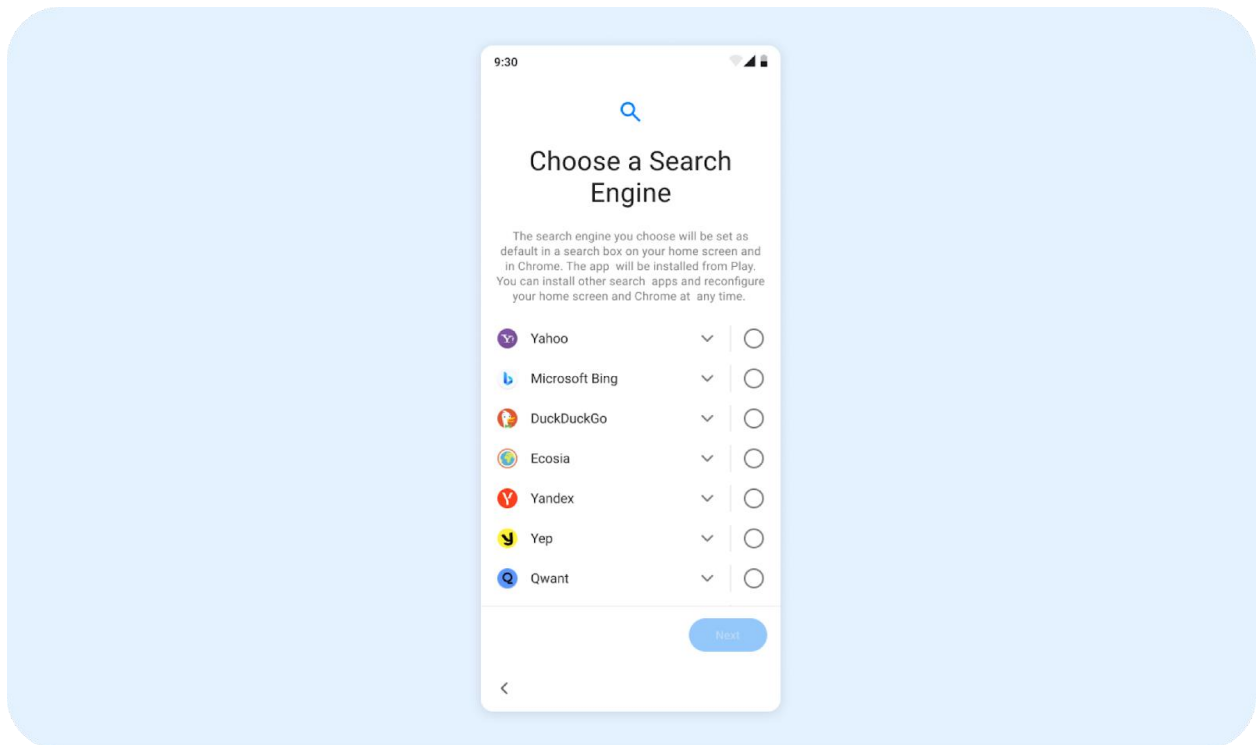# 5.4 Placement of Google Below the Fold (Experiment A4)

Figure 7. "Placement of Google Below the Fold" variant of the Search Engine Choice Screen.

5.4.1 Visual Changes

Compared to the control experiment, this experiment removed Google from the first five options and placed it among the bottom set of other Search Engines below the fold. This meant that Google was not immediately visible when participants reached the Choice Screen and had to scroll down to find it.

5.4.2 Hypothesis

We hypothesized that shifting Google's position out of a top five position to one below the fold, requiring users to scroll to find it, would cause a measurable shift in user behavior. We anticipated that this change would result in fewer participants choosing Google due to its less immediate visibility on the page.
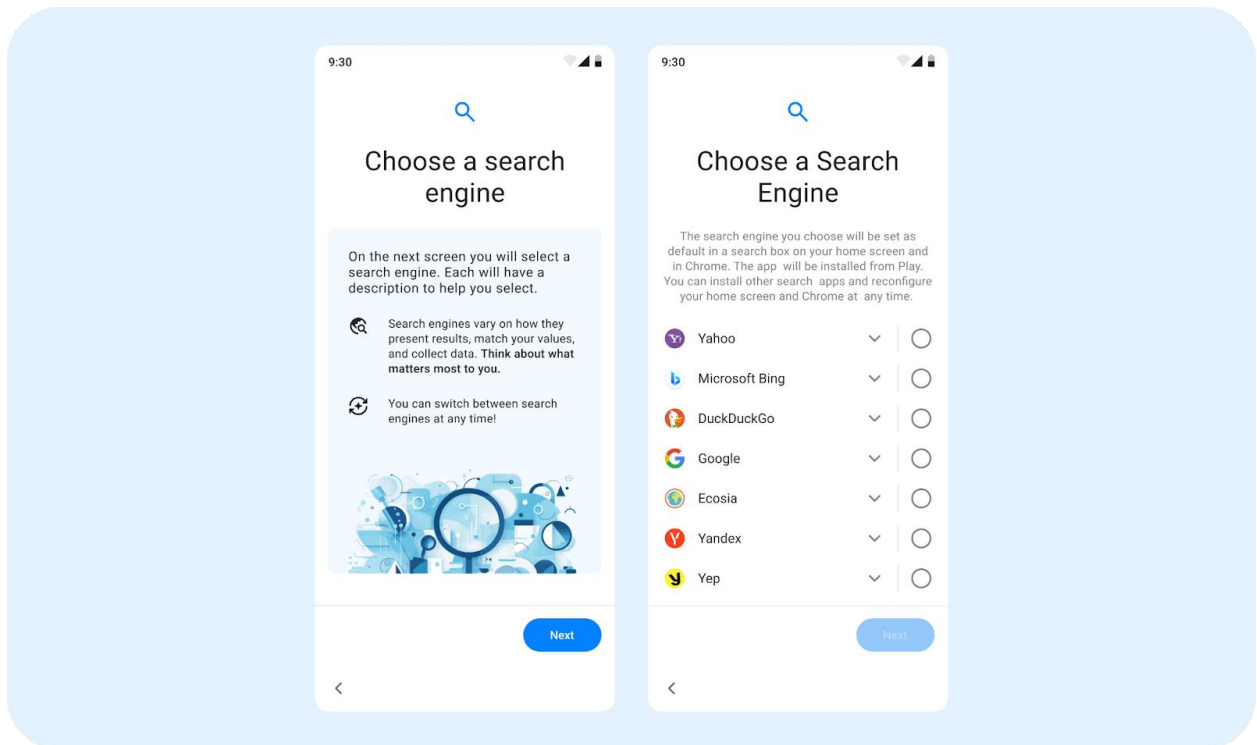
5.5 Education Screen (Experiment A5)

Figure 8. "Education Screen" variant of the Search Engine Choice Screen.

5.5.1 Visual Changes

Compared to the control experiment, this experiment included an additional screen *before* the Choice Screen, while leaving the Choice Screen unchanged. The newly introduced "education screen," was designed to provide educational material and increase users' awareness and understanding of their choices.

5.5.2 Hypothesis

We hypothesized that incorporating an educational screen prior to the actual Choice Screen, designed to promote an exploratory mindset, would have a measurable impact on user behavior. Specifically, we expected that after reading the preparatory information, users would approach the upcoming step with heightened curiosity and awareness leading to more thoughtful decision-making.
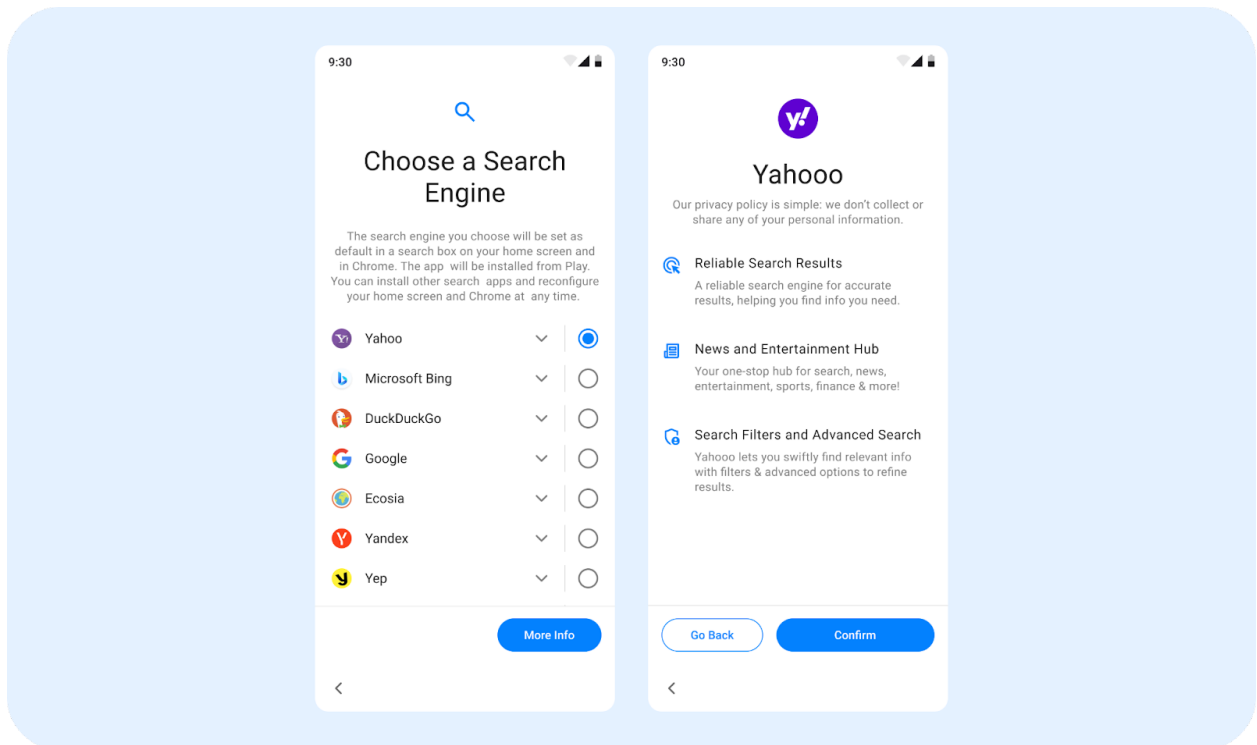
5.6 Information Screen (Experiment A6)

Figure 9. "Information Screen" variant of the Search Engine Choice Screen.

5.5.1 Visual Changes

Compared to the control experiment, this experiment included an additional screen *after* the control Choice Screen. The newly introduced "information screen" was designed to provide participants with additional information about a given Search Engine before they confirmed their choice. We included a button on the Choice Screen labeled "more info" to indicate that there was another step. The information screen presented information that was specific to each of the Search Engines and was taken directly for the Search Engines' respective website as explained above in Section 4.3.6.

5.5.2 Hypothesis

We hypothesized that the incorporation of an additional Search Engine information screen following the control Choice Screen would affect participants' engagement and decision-making. Specifically, we anticipated that supplying more detailed information about a chosen Search Engine might have an impact on participants' selection of a Search Engine.

6 Observations & Findings

This section presents the findings of our testing process, which aimed to evaluate the effectiveness of our Search Engine Choice Screen designs. Throughout the testing, we monitored user behavior, Search Engine selections, and any changes in usage patterns. We considered these factors crucial in assessing the effectiveness of the designs and their potential impact on Search Engine competition in the EU and aimed to provide transparent, data-driven insights into user interactions with different Choice Screen designs.

Sections 6.1 and section 6.2 present a descriptive account of our findings from the testing process. These sections specifically focus on presenting the observations and findings from the conducted tests. Our conclusions and recommendations are presented in Section 8 and Section 9.

6.1 Quantitative Testing

As mentioned in Section 4.3.9, our quantitative study included 1437 participants from various demographics and backgrounds within the European Union member states. This sample size (~200 per experiment) was chosen to obtain statistically significant results that can be generalized to the larger population.

6.1.1 Data Table

To better understand the raw data, we organized it in a table (Figure 10), sorted by experiment and Search Engine name. After this, we analyzed user choices for each Search Engine individually. As part of our analysis process, we recorded the following metrics.

- **Participant Count (#):** This metric reflects the total number of users who selected a specific Search Engine.
- **Absolute Percentage (Abs):** This metric gives the percentage of participants who selected each Search Engine. This enables a more intuitive understanding of the proportion of users who selected each Search Engine.
- **Change in Absolute Percentage (Del):** This comparative metric gives the difference (delta) between the absolute percentage for a given experiment and that of the control group. It determines how much variation occurred from the baseline and is expressed in percentage points.
- **Relative Choice Percentage (Rel):** This comparative metric shows the percentage change between the absolute percentage of a given experiment and that of the control. It offers insight into the relative shift in user preferences between different experiments.

The table below presents these metrics in color coded columns for each experiment. The white "%" column represents the average percentage from Experiments A1 to A6 of the percentage of participants that selected each Search Engines, while the white "#" column gives the total number of participants that selected each Search Engines across those same experiments.

Search Engines	Total %	Total #	A1 #	A1 Abs	A2 #	A2 Abs	A2 Del	A2 Rel	A3 #	A3 Abs	A3 Del	A3 Rel
Yahoo	1.27%	15	2	0.96%	3	1.55%	0.585	160.82%	2	1.00%	0.033	103.48%
Bing	1.94%	23	2	0.96%	4	2.06%	1.100	214.43%	2	1.00%	0.033	103.48%
DuckDuckGO	11.23%	133	28	13.46%	15	7.73%	-5.730	57.44%	27	13.43%	-0.029	99.79%
Google	79.48%	941	163	78.37%	165	85.05%	6.686	108.53%	160	79.60%	1.237	101.58%
Ecosia	3.89%	46	9	4.33%	5	2.58%	-1.750	59.56%	8	3.98%	-0.347	91.98%
Yandex	0.25%	3	0	0.00%	0	0.00%	0.000	-	0	0.00%	0.000	-
Yep	0.08%	1	0	0.00%	0	0.00%	0.000	-	0	0.00%	0.000	-
Qwant	0.68%	8	2	0.96%	1	0.52%	-0.446	53.61%	0	0.00%	-0.962	0.00%
KARMA	0.42%	5	1	0.48%	0	0.00%	-0.481	0.00%	1	0.50%	0.017	103.48%
OceanHero	0.08%	1	0	0.00%	0	0.00%	0.000	-	0	0.00%	0.000	-
Ask	0.42%	5	1	0.48%	1	0.52%	0.035	107.22%	1	0.50%	0.017	103.48%
GMX	0.08%	1	0	0.00%	0	0.00%	0.000	-	0	0.00%	0.000	-
Mojeek	0.17%	2	0	0.00%	0	0.00%	0.000	-	0	0.00%	0.000	-
		1184	208		194				201			

	A4 #	A4 Abs	A4 Del	A4 Rel	A5 #	A5 Abs	A5 Del	A5 Rel	A6 #	A6 Abs	A6 Del	A6 Rel
Yahoo	5	2.53%	1.564	263%	0	0.00%	-0.962	0%	3	1.56%	0.601	163%
Bing	7	3.54%	2.574	368%	4	2.09%	1.133	218%	4	2.08%	1.122	217%
DuckDuckGO	22	11.11%	-2.350	83%	18	9.42%	-4.037	70%	23	11.98%	-1.482	89%
Google	151	76.26%	-2.103	97%	160	83.77%	5.404	107%	142	73.96%	-4.407	94%
Ecosia	9	4.55%	0.219	105%	6	3.14%	-1.186	73%	9	4.69%	0.361	108%
Yandex	1	0.51%	0.505	-	1	0.52%	0.524	-	1	0.52%	0.521	-
Yep	0	0.00%	0.000	-	0	0.00%	0.000	-	1	0.52%	0.521	-
Qwant	1	0.51%	-0.456	53%	1	0.52%	-0.438	54%	3	1.56%	0.601	163%
KARMA	2	1.01%	0.529	210%	0	0.00%	-0.481	0%	1	0.52%	0.040	108%
OceanHero	0	0.00%	0.000	-	0	0.00%	0.000	-	1	0.52%	0.521	-
Ask	0	0.00%	-0.481	0%	0	0.00%	-0.481	0%	2	1.04%	0.561	217%
GMX	0	0.00%	0.000	-	0	0.00%	0.000	-	1	0.52%	0.521	-
Mojeek	0	0.00%	0.000	-	1	0.52%	0.524	-	1	0.52%	0.521	-
	198				191				192			

Figure 10. Overview of Results. The full table is available in Annex A.

Focusing on absolute percentages across all experiments, Google was selected on average by 79.48% of the participants. In contrast, on average, other Search Engines like DuckDuckGo, Ecosia, Bing, and Yahoo were chosen by 11.23%, 3.89%, 1.94%, and 1.27% of the participants, respectively. The combined sum percentage of the remaining Search Engines was 2.20%.

Regarding the Change in Absolute Percentage, three experiments resulted in higher selection rate for Google, where we saw an increase of 6.69 (Experiment A2), 1.24 (Experiment A3), and 5.40 (Experiment A5) percentage points, respectively. The results of these experiments were not in line with our hypotheses, unlike A4 and A6 which promoted the choice of alternative engines as explained below.

In Experiment A4, the Choice Screen design resulted in an increase of 2.1 percentage points in the percentage of participants that selected a Search Engine other than Google. The percentage of participants that selected Google decreased from 78.37% (in the control experiment) to 76.26%. In Experiment A6, this change was more substantial with a change of 4.41 percentage points. The percentage of participants that selected Google decreased to 73.96% compared to the control experiment. Both these experiments displayed a common pattern that is further explained in Section 8.

6.1.2 Heatmaps

Heatmaps are a powerful tool for analyzing user interactions with a digital interface. In the graphics below, using a color-coded system, we visualize the areas users interact with the most. In our heatmaps, red is used to indicate high interaction (a high number of first clicks), while blue represents low interaction (a small number of first clicks). This allows us to quickly identify which elements of the interface participants interact with first and to what degree.
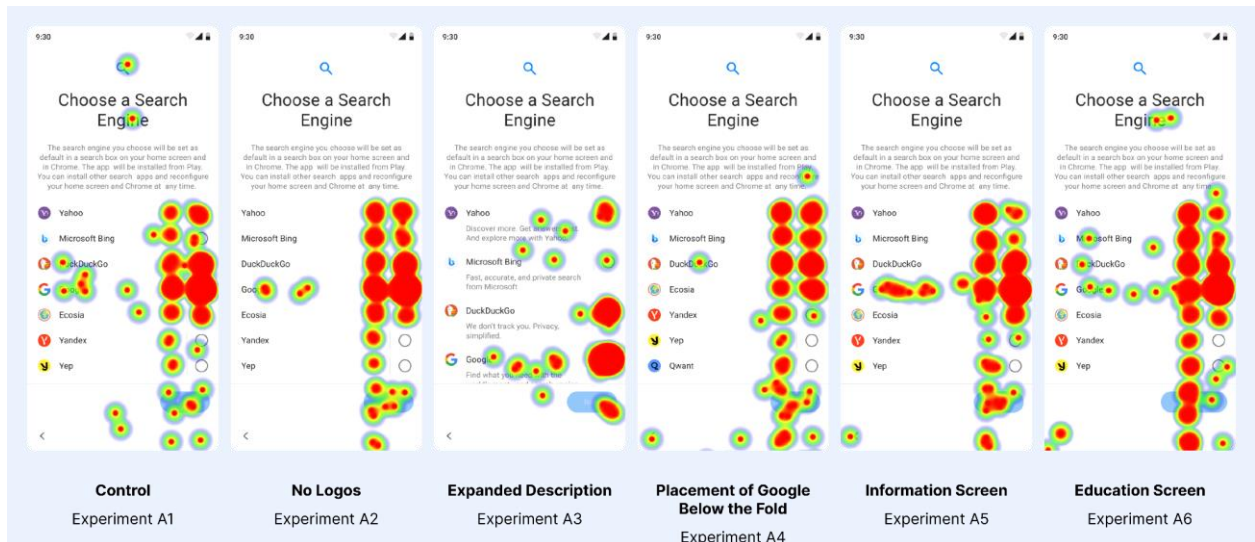

Figure 11. First Click Heatmaps for each experiment.

In our study, heatmaps offered valuable insights into the elements users clicked on and precisely where subsequent clicks were directed. For instance, Figure 11 reveals that, upon analyzing the first clicks from users across all six experiments, the top five spots on the list attracted most of the participants, as indicated by the concentrated red areas. Furthermore, participants clicked frequently on the down arrow. Items positioned below the fifth spot were seldom selected on the first click. Subsequently, upon second and following clicks we observe that most users clicked on the "Next" blue button in the bottom right corner of the Choice Screen (aside from Experiment A6 where the button was labeled "More info") to proceed with the onboarding process rather than selecting another search engine (see Second and Following Clicks Heatmaps in Annex F).

6.2 Qualitative Testing

By conducting User Interviews, our primary objective was to gain a deeper understanding of people's behavior when selecting Search Engines from a Choice Screen and their reactions to the distinct design elements. We conducted an extensive analysis of their feedback and observations to identify the key factors that contribute to the creation of an effective Choice Screen. To facilitate this process, we employed Affinity Mapping, which is a collaborative technique that allows for the organization and categorization of data or ideas by grouping similar concepts together.

Affinity Mapping assists in visually representing relationships and patterns among different pieces of information. By employing this method, we were able to identify common themes and trends within the data, leading to valuable insights and conclusions. Figure 12 shows a visual representation of the Affinity Map capturing input from German participants.
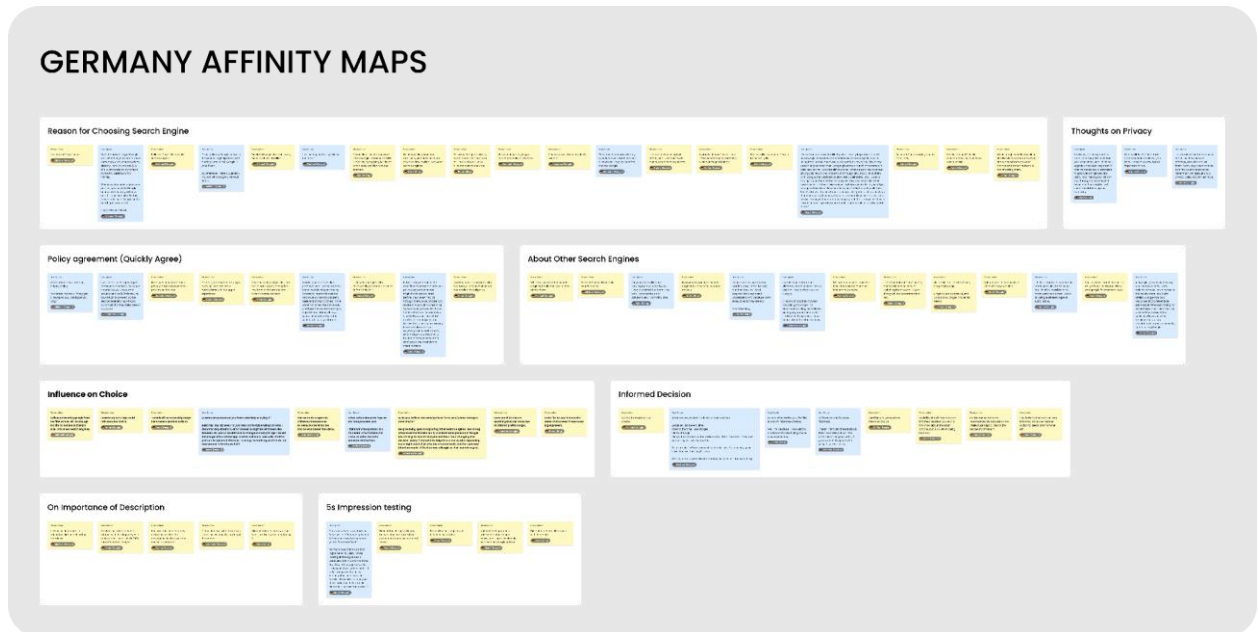
Figure 12. Example of an affinity map for behaviors and comments exhibited by German participants.

To better understand the affinity maps, we split our results into two interrelated categories, providing a comprehensive overview of our findings:

A. General Perspective
This perspective takes a step back to observe overarching trends in the participants' responses. It allowed us to recognize similarities and shared behaviors among participants while selecting a Search Engine.

In this context, we examined themes such as:
- Broad themes influencing Search Engine selection such as privacy concerns, or familiarity. See Annex G for a comprehensive list of themes based on the user interviews conducted in this study.
- Shared preferences for specific Search Engines. For example, Bing is preferred by some users for its integration with other Microsoft products and OpenAI.

B. Specific Perspective
This perspective analyzes individual responses and participants' experiences related to each experiment. By focusing on the particulars of each user's interaction with the Choice Screen, we could unearth unique insights that might not surface when looking at more general trends.

In this context, we considered aspects like:
- Individual thought processes and reasoning behind choosing specific Search Engines.
- Features or functionalities that attracted different users.
- Personal habits, values, or experiences impacting users' decisions.

Detailed accounts of each perspective are provided in the following sections.

6.2.1 General Perspective

By adopting a general perspective, we can gain a broader understanding of the various behaviors and factors that influence participants' Search Engine selection. It enables us to recognize patterns and similarities that may not be immediately apparent when considering individual cases alone.

A. Explanation of themes

The use of themes within the Affinity Maps added depth and structure to our analysis, and although these themes may not be directly related to design, they provided a lens through which we could examine the impact of distinct factors on decision-making processes.

By grouping comments, quotes, and research observations, we could understand users' motivations, preferences, and decision-making processes when choosing a Search Engine. This categorization allowed us to identify crucial areas where the Choice Screen could improve to promote alternative Search Engines.

B. Reasons to Choose a Search Engine

During the qualitative testing, participants were asked why they had selected a particular Search Engine. Their responses revealed numerous factors that influenced their choice. Below are the top insights, a subset of the themes set out in Annex G, ordered by frequency of occurrence:

- **Familiarity**: Fifteen participants selected a Search Engine they were familiar with, comfortable using, and appreciated its features and interface.
- **Supporting Causes**: Three users were drawn to Search Engines like Ecosia that prioritize environmentally friendly initiatives such as tree planting.
- **Others:** A minority of users preferred alternative Search Engines like DuckDuckGo due to *privacy*, while others prioritized *comfort* (see Annex G for a definition of the term); however, limited trust in unknown alternatives caused some users to stick with familiar choices.

C. Exploring Alternative Search Engines & Reasons for Not Choosing Them

We also asked the participants to explain why they had not chosen a particular Search Engine. As a result, we discovered several factors that overlapped with those identified in our previous research question.

The key insights we gathered from their answers were:
- **Familiarity:** Nineteen out of thirty-five participants avoided unfamiliar Search Engines due to distrust or perceived misalignment with their values.
- **Performance, comfort, and convenience:** If users had already found a Search Engine they considered convenient and easy to use without flagrant issues in user experience, they tended to stick with it.
- **Supporting Causes:** While social causes and environmental concerns may pique interest in specific Search Engines, these factors alone often did not drive users to switch from their preferred option unless combined with other influential factors like performance, quality, and trust.
- **Privacy:** Privacy was an essential concern for some users when selecting a Search

Engine; however, it was not the primary factor influencing their choice.

6.2.2 Specific Perspective

Our objective here was to explore the impact of the design changes in each experiment on any potential modifications in the users' decision-making processes.

Our observations are organized per experiment. Information and figures regarding the final designs, their hypotheses, and the changes compared to the control, have been set out above in Section 5.

A. Control (Experiment A1)

- In this experiment, four out of five participants chose Google.
- Familiarity was voiced as the primary driver in the participants' decision-making process.

B. No logos (Experiment A2)

- In this experiment, four out of six participants chose Google.
- Five out of the six participants were drawn to well-known brands such as Google, Microsoft, and Yahoo.
- Four out of six participants reported that their decision would remain unchanged regardless of the presence of logos. However, the quantitative results show that the absence of logos had an impact on participants' selection since this absence led to a higher percentage of participants selecting Google compared to the control experiment (see Annex A).
- Comments made indirectly during the qualitative interviews indicated that seeing logos may encourage people to consider alternative options when selecting a Search Engine.

C. Expanded Description (Experiment A3)

- In this experiment, five out of six participants chose Google.
- Participants mentioned descriptions were helpful in making an informed decision, but familiarity still heavily influenced their choices.
- Three out of six participants found the current descriptions insufficient and would have preferred more detailed information to evaluate and compare different Search Engines effectively.
- Three out of six participants interacted with the description and found it helpful, but the remaining participants did not engage with the descriptions provided.

D. Placement of Google Below the Fold (Experiment A4)

- In this experiment, four out of six participants chose Google.
- The participants preferred Google based on familiarity and trust in its capabilities.
- The absence of Google above the fold prompted two participants to scroll down and search for it. Three other participants did not immediately notice Google was not placed above the fold.
- Half of the participants associated positive emotions such as comfort and safety with seeing Google above the fold or being able to locate it within the list, as Google is a familiar choice that will be present in the daily use of their phones.

E. Education Screen (Experiment A5)

- In this experiment, four out of six participants chose Google.
- Despite the presence of the educational screen, all six participants made their Search Engine choices based on familiarity rather than solely relying on the information presented.
- The educational screen led to varying levels of engagement among participants. Three out of six participants read it thoroughly, only two scanned it, and one did not read it.
- The educational screen did not influence participants' choices when selecting a Search Engine significantly.

F. Information Screen (Experiment A6)

- In this experiment, five out of six people chose Google.
- Four out of six participants expressed the view that the additional information screen had limited or no impact on their decision-making process. It must be noted however that the quantitative results in Experiment A6 showed a drop of 4.41 percentage points in the percentage of participants selecting Google when they were presented with an Information Screen.
- Four out of six participants found the information screen confusing, especially as they already knew about their chosen Search Engine.

The qualitative and quantitative research provided different insights into user behavior when interacting with the Search Engine Choice Screen. The quantitative data highlighted Google as the predominant choice across all experiments, with an average absolute percentage of 79.48%.

Although Google was still the Search Engine that was selected the most often, users cited assorted reasons for their selection, such as familiarity and trust in the brand. Some participants expressed interest in alternative Search Engines, particularly when these were associated with environmental causes or enhanced privacy features. However, their stated intentions did not necessarily align with user actions observed in the quantitative study.

For instance, despite participants acknowledging the value of supporting causes like environmental initiatives, this did not significantly influence users' tendency to select these Search Engines. Similarly, perceived importance of privacy did not translate into a higher selection rate for privacy-focused Search Engines.

This discrepancy between users' stated preferences and actual choices prompted us to design Experiment B1 (discussed in Section 7). This experiment aimed to further investigate the impact of differing Choice Screen designs presented in Experiment A4 and Experiment A6, as well as their potential influences on users' decision-making processes.

7 Combination Choice Screen (Experiment B1)

After analyzing the first six experiments, we designed a final experiment to investigate the combined effects of Experiment A4 and Experiment A6. The rationale for conducting this

experiment came from the behaviors observed in said experiments where we respectively saw an increase in the percentage of participants selecting an alternative Search Engine (a 2.1 and 4.41 decrease in percentage points in the percentage of participants who selected Google) – as well as a disruption in their user journey, leading to confusion or actions.

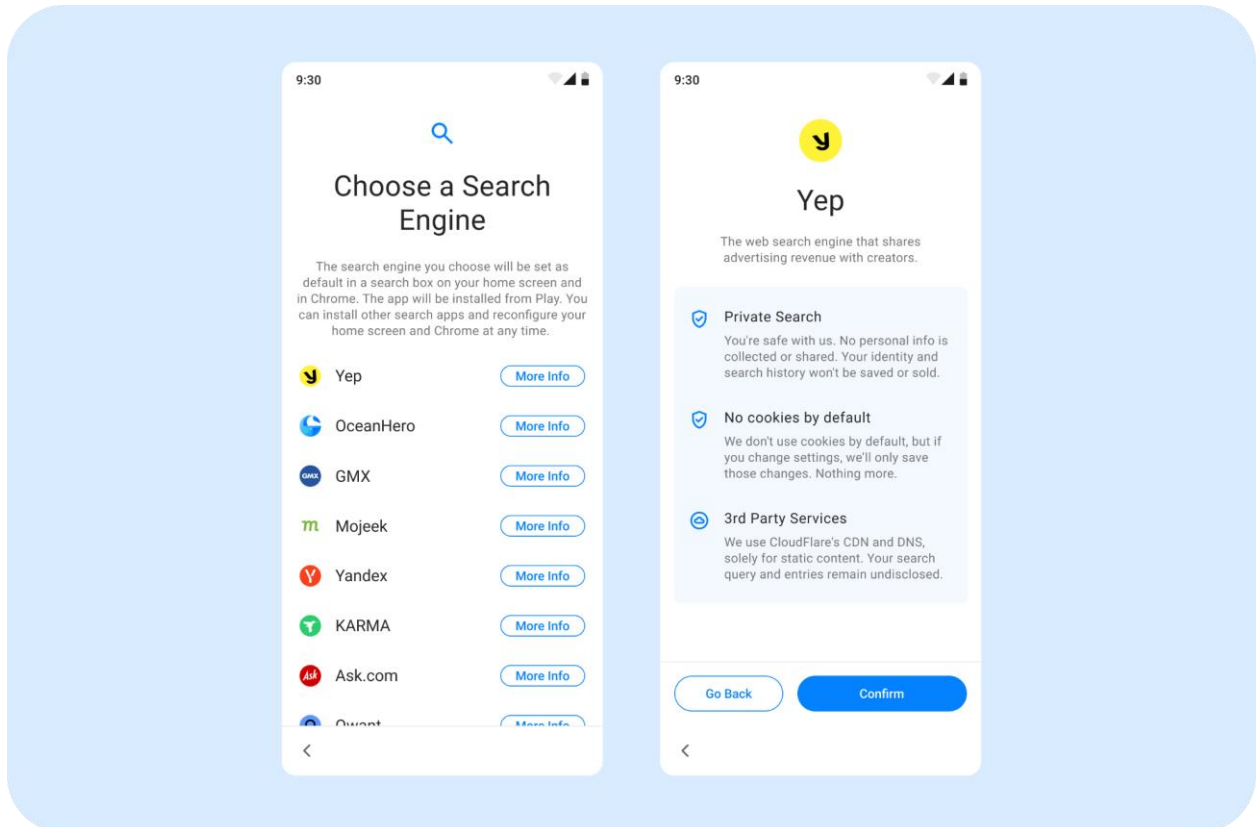By combining these two disruptive elements, we aimed to determine whether their combined impact would amplify the reactions to the Choice Screen design.

Figure 13. "Combination Choice Screen" variant of the Search Engine Choice Screen with focus on Yep.

7.1 Visual Changes & Hypothesis

7.1.1 Visual Changes

Compared to the control experiment, this combined experiment included an additional information screen after the Choice Screen and switching out the radio button on the Choice Screen for a contextual button with the label "more info." Additionally, Google was placed lower on the list following the criteria in Section 7.2, below the fold, requiring participants to scroll down to find it.

7.1.2 Hypothesis

We hypothesized that the incorporation of both an additional Search Engine information screen following the Choice Screen, shifting Google's position below the fold, and replacing the radio button with a contextual button labeled "more info" would affect participants' engagement and

decision-making. Specifically, we anticipated that making Google less immediately visible on the page, along with providing easy access to additional information through the "more info" button, would result in more participants choosing alternative Search Engines.

7.2 Order of Search Engines

In our previous findings, it was revealed that a significant majority of users, around 98%, tended to opt for one of the top 5 Search Engines. These options were Yahoo, Microsoft Bing, DuckDuckGo, Google, and Ecosia.

It was decided to order the Search Engines based on the average percentage of times they were selected in the initial round of testing, in an ascending manner. The re-sorting process took into consideration the data as shown in Figure 14 as a reference point.

Search Engines	Total	
	%	#
Yahoo	1.27%	15
Bing	1.94%	23
DuckDuckGO	11.23%	133
Google	79.48%	941
Ecosia	3.89%	46
Yandex	0.25%	3
Yep	0.08%	1
Qwant	0.68%	8
KARMA	0.42%	5
OceanHero	0.08%	1
Ask	0.42%	5
GMX	0.08%	1
Mojeek	0.17%	2

Figure 14. Table of the average percentage and total number of times a Search Engine was chosen by participants in Experiments A1 to A6. See Annex A for the full table.

This approach aimed to bring more visibility to the lesser-selected Search Engines by positioning them above the fold, and above the top five Search Engines in previous experiments. We hypothesized that this strategic placement would increase their choice rate. Conversely, the more frequently chosen Search Engines were positioned below the fold, ensuring that they would remain accessible but not immediately visible upon landing on the Choice Screen.

7.3 Findings

Based on the first click heat map analysis, viewable in Figure 15, we observed that the Search Engines shown above the fold received between 3 and 6 clicks each on the "More Info" button, meaning participants showed greater interest in them when compared to the previous six experiments.

In Experiment A6, we observed the information screen of the bottom 8 Search Engines (Yandex, Yep, Qwant, Karma, OceanHero, Ask, GMX, Mojeek) was viewed in total 13 times. In Experiment B1, the information screen of those same Search Engines was viewed in total 20 times, indicating a relative visibility increase for the lesser-known Search Engines when they were moved from below to above the fold.

However, as shown by the heatmaps in Figure 15, most participants that viewed the information screen of one of the Search Engines displayed above the fold subsequently clicked on the "Go back" button and returned to the main Choice Screen. They then scrolled and navigated the screen below the fold and selected another more well-known Search Engine.
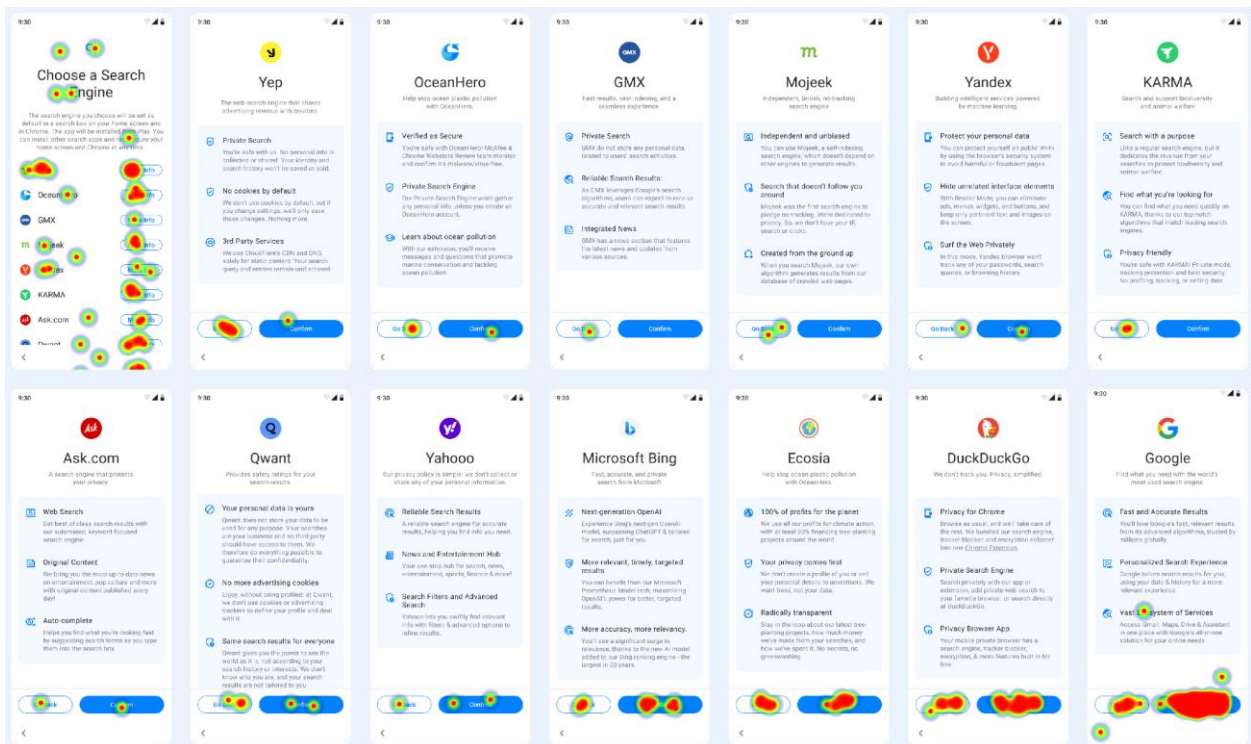
Figure 15. First Click (top left) and Second Click (all other screens) Heatmaps.

The summary of our findings on the Search Engines actually selected in Experiment B1 is depicted in Figure 16. This shows an increase of 0.63 percentage points in the absolute percentage of participants selecting Google compared to the control group. The figures for Bing and Yahoo also increased. Figure 16 furthermore shows that some of the bottom 8 Search Engines' selection rates increased when they were placed above the fold. Across experiments A1 to A6, these 8 Search Engines were selected by a total of 2.20% of the participants, while in Experiment B1 those same Search Engines were selected in total by 3% of the participants. This represents an increase of 0.80 percentage points or a 36.36% increase in the percentage of participants that ultimately selected one of those Search Engines. Conversely, two of the top 5 from experiments A1 to A6 experienced a decrease in their selection. DuckDuckGo experienced the most significant decrease, with a drop of 4.96 percentage points in the percentage of users.

Figure 16. Table comparing the results from the control Experiment A1 with Experiment B1. For

Search Engines	Experiment A1		Experiment B1			
	#	Abs	#	Abs	Del	Rel
Yahoo	2	0.96%	3	1.50%	0.538	156.00%
Bing	2	0.96%	8	4.00%	3.038	416.00%
DuckDuckGO	28	13.46%	17	8.50%	-4.962	63.14%
Google	163	78.37%	158	79.00%	0.635	100.81%
Ecosia	9	4.33%	8	4.00%	-0.327	92.44%
Yandex	0	0.00%	1	0.50%	0.500	-
Yep	0	0.00%	1	0.50%	0.500	-
Qwant	2	0.96%	2	1.00%	0.038	104.00%
KARMA	1	0.48%	0	0.00%	-0.481	0.00%
OceanHero	0	0.00%	1	0.50%	0.500	-
Ask	1	0.48%	1	0.50%	0.019	104.00%
GMX	0	0.00%	0	0.00%	0.000	-
Mojeek	0	0.00%	0	0.00%	0.000	-
	208		200			

the full table see Annex A.

Over 50% of participants indicated that selecting a Search Engine was the most memorable part of the Android onboarding process. This step stood out primarily due to the variety of options available and its novelty. Yet, despite the array of choices presented to them, prior habits seemed to surface. Although the new Choice Screen design compelled more users than previous experiments to explore other options, approximately 68% of them opted for a specific Search Engine simply because they were familiar with it.

In Section 7.1.2, our hypothesis was that by combining two screens, we could increase the percentage of participants choosing alternative Search Engines by combining the effects of positive friction. However, with the change in order of the Search Engines, the results of the experiment did not confirm the hypothesis. It is suggested to conduct further research to investigate the effects of combining two or more types of positive friction, while maintaining the initial random stratified order of the Search Engines.

8 Conclusions

8.1 Power of Familiarity in Search Engine Selection

The qualitative and quantitative data highlight the significant impact of familiarity on users' Search Engine choices from the Choice Screen. This finding remains consistent across all experimental variants, suggesting a general tendency among users to prefer familiar options over unfamiliar

ones. However, the integration of positive friction elements (intentionally introduced challenges or disruptions) resulted in a change in behavior to these familiar patterns. This method was specifically leveraged in Experiment A4 and Experiment A6.

8.2 Positive Friction as a Tool to Overcome Resistance

Positive friction in user experience design refers to the deliberate introduction of obstacles or challenges within an interface to encourage user reflection and exploration during the decision-making process. This technique often involves subtly disrupting the user's habitual patterns or expectations in a way that prompts them to consider alternative actions or choices. By strategically placing these 'frictions,' designers can guide users towards more conscious and informed decisions, thereby potentially enhancing user engagement and satisfaction. In the context of Search Engine choice, for instance, such friction can motivate users to explore options beyond their default choice.

In Experiment A4, when Google was deliberately placed below the fold on the Choice Screen — *design for discomfort*, a form of positive friction — participants appeared uneasy. Despite this initial discomfort, the percentage of users that selected a Search Engine other than Google grew by 2.10 percentage points compared to the control experiment.

Interestingly, Experiment A6 introduced new contextual factors causing confusion and creating friction which may have prompted reflective pauses among participants after they chose a Search Engine from the Choice Screen and were presented with information about their choice. This temporary halt in decision-making may have encouraged some users to adopt an exploratory mindset and reevaluate their choice, and to consider Search Engines' unique benefits leading to the choice of an alternative Search Engine. In this experiment, the effect of the positive friction we introduced is evidenced by the 4.41 percentage points drop in the percentage of participants that selected Google.

8.3 The Potential of Positive Friction

The impact of positive friction, as demonstrated above, suggests that it can inspire people to explore new choices. This is apparent from the 2.1 and 4.41 percentage points increase in participants choosing alternative Search Engines. While familiarity is a key factor in decision-making processes, the 4.41 percentage point shift seen in Experiment A6 stands out. This shift is particularly significant in a crowded marketplace. To provide some context, this change could lead to over 19 million people in the European Union exploring different Search Engine options.[3]

To ensure that results can be generalized, one would need to conduct follow-up tests, to replicate our results and refine our initial findings regarding designs associated with positive friction.

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[3] It must be noted that this number is calculated on the basis of a total EU population of 447 million which includes individuals that would not necessarily use a Search Engine or would have access to electronic devices.

9 Guidelines

In this section we discuss a set of design guidelines based on the results of our research. These guidelines are intended to provide recommendations and suggestions on how to design a Choice Screen that fosters fairness and contestability. We also outline our confidence levels derived from the conclusions presented in the previous section, as well as our familiarity with established practices and learned standards[4] from the User Experience (UX) industry.

9.1 Incorporate Positive Friction

Based on our findings, Experiment A6 led to a significant increase in the percentage of participants selecting alternative Search Engines (the experiment resulted in an increase of 4.41 percentage points). These measures positively influenced choice of alternative Search Engines. Based on this, we recommend incorporating the following forms of positive friction into the design of Search Engine Choice Screens:

- *Design for Discomfort:* While comfort may usually be the goal in UX design, sometimes strategically inducing a level of discomfort can encourage users to explore beyond their habitual choices. For instance, placing familiar options less prominently can motivate users to consider alternatives.
- *Introduce Reflective Pauses:* Instigating moments of uncertainty can cause users to pause and reconsider their choices. This interruption in the decision-making process can lead to more conscious selection and exploration of the unique benefits of each option.

9.2 Show Google Below the Fold

In Experiment A4 and Experiment B1 we learned that when users do not immediately see Google at the top of their search results, the initial challenge encourages users to explore other options on the list and potentially discover new Search Engines they might not have found otherwise. To promote this exploratory mindset, we recommend to:

- Avoid placing Google above the fold to create positive friction, encouraging users to consider alternative Search Engines. As stated in Section 8, a disruption in user expectations leads to greater visibility for other options and supports more diverse Search Engine selections.

9.3 Use Buttons that Contextualize the Expected User Action

The qualitative results from Experiment A6 offered interesting further useful insights: four out of six participants erroneously thought that upon clicking the radio button, they had already made their choice and that clicking the "More Info" button would confirm their selection, rather than lead them

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[4] By industry standards we refer to good practices that have become popular and common ground in the field of User Experience (UX). Some notable books influencing this body of knowledge include:
- Krug, S. (2014). Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability
- Norman, D. A. (2013). The Design of Everyday Things.
- Yablonski, J. (2020). The Laws of UX: Using Psychology to Design Better Products & Services.

to the Information Screen. Hence, the following recommendations are put forward:

- Introduce a more explicit call to action button that motivates users to investigate and compare different Search Engines before settling on a choice.
- Refrain from using ambiguous or misleading language to ensure that users accurately understand the intended action.
- Clearly communicate that actions can be undone and offer a user-friendly way for users to navigate between Search Engines at any time within the Choice Screen. For instance, this could be achieved by incorporating a "Back" button.

9.4 Avoid the Removal of Branding Elements

From [Experiment A2](#), we discovered that users selected Google more frequently when no Search Engine logos were displayed. When users are unable to locate their preferred option immediately, they may feel disoriented and become even more resolute in finding a familiar choice. This can prevent them from exploring other search providers.

To address this issue, it is necessary to ensure Search Engines are accompanied by their respective branding elements in a way that is not overpowering and maintains a fair presentation of all options. The Choice Screen should avoid presenting the list in a text-only format.

10 Next Steps for Further Research

The depth and complexity of Choice Screen design cannot be fully captured in only one research campaign. Exploring the intricacies of Choice Screen design requires extensive research and analysis beyond the scope of this study. To gain a comprehensive understanding, it is highly recommended to continue investigating the following areas:

10.1 Exploration of Other Design Variables

In the current study, we deliberately narrowed down our focus to only five design variables. This allowed us to gain deeper insights into how these specific factors might influence users' Search Engine choices when presented with a Choice Screen. However, it is important to note that this is only a snapshot of the much larger and more complex ecosystem of variables at play when designing effective Choice Screens.

Future research could aim to:

1. Investigate additional changes, beyond the five covered in this study, which may influence user preferences and decision-making when selecting a Search Engine from a Choice Screen.
2. Evaluate how different visual design elements, such as layout, color schemes, and typography, impact users' perceptions of Search Engine options.
3. Examine the impact of cultural differences on preferences for Search Engine Choice Screens across diverse populations.

10.2 Search Engine List Order

Observations suggest that the sequence in which Search Engines appear on the Choice Screen affects user behavior.

Future research could aim to:
- Explore the effect of various list orderings on users' selection of Search Engines.
- Examine the effect of showcasing a variety of popular choices above the fold, establishing a "comfort zone" for users with familiar Search Engines. This approach may discourage users from immediately ignoring unfamiliar options in favor of those they recognize.
- Understand the optimal way to order Search Engine options on a Choice Screen for various user demographics, since different demographics have different preferences in Search Engines.

10.3 Position of the Choice Screen

The position or timing of when the Choice Screen is presented in the user journey can influence the user's selection process. While the current research primarily investigates the effect of having the Choice Screen at the end of the Android onboarding process, a broader understanding is needed to capture the multifaceted nature of 'first use' per the DMA's definition, which may include multiple touchpoints.

Future research could aim to:
- Investigate the impact of presenting the Choice Screen at different stages in the user journey, such as during initial setup, after account creation, or during app usage.
- Examine the influence of different touchpoints on the user's decision-making process, including interactions with other apps such as Google Chrome or Google Assistant.
- Analyze the role of contextual factors in shaping users' responses to the Choice Screen, such as personalization options based on device settings or previous interactions.
- Evaluate whether providing additional information or explanations alongside the Choice Screen enhances users' understanding and subsequent selection.

Annex A: Complete Data Table with Experiments A1 to B1

Search Engines	Total %	Total #	Exp A1 #	Exp A1 Abs	Exp A2 #	Exp A2 Abs	Exp A2 Del	Exp A2 Rel	Exp A3 #	Exp A3 Abs	Exp A3 Del	Exp A3 Rel
Yahoo	1.27%	15	2	0.96%	3	1.55%	0.585	160.82%	2	1.00%	0.033	103.48%
Bing	1.94%	23	2	0.96%	4	2.06%	1.100	214.43%	2	1.00%	0.033	103.48%
DuckDuckGO	11.23%	133	28	13.46%	15	7.73%	-5.730	57.44%	27	13.43%	-0.029	99.79%
Google	79.48%	941	163	78.37%	165	85.05%	6.686	108.53%	160	79.60%	1.237	101.58%
Ecosia	3.89%	46	9	4.33%	5	2.58%	-1.750	59.56%	8	3.98%	-0.347	91.98%
Yandex	0.25%	3	0	0.00%	0	0.00%	0.000	-	0	0.00%	0.000	-
Yep	0.08%	1	0	0.00%	0	0.00%	0.000	-	0	0.00%	0.000	-
Qwant	0.68%	8	2	0.96%	1	0.52%	-0.446	53.61%	0	0.00%	-0.962	0.00%
KARMA	0.42%	5	1	0.48%	0	0.00%	-0.481	0.00%	1	0.50%	0.017	103.48%
OceanHero	0.08%	1	0	0.00%	0	0.00%	0.000	-	0	0.00%	0.000	-
Ask	0.42%	5	1	0.48%	1	0.52%	0.035	107.22%	1	0.50%	0.017	103.48%
GMX	0.08%	1	0	0.00%	0	0.00%	0.000	-	0	0.00%	0.000	-
Mojeek	0.17%	2	0	0.00%	0	0.00%	0.000	-	0	0.00%	0.000	-
		1184	208		194				201			

Search Engines	Total %	Total #	Exp A4 #	Exp A4 Abs	Exp A4 Del	Exp A4 Rel	Exp A5 #	Exp A5 Abs	Exp A5 Del	Exp A5 Rel	Exp A6 #	Exp A6 Abs	Exp A6 Del	Exp A6 Rel
Yahoo	1.27%	15	5	2.53%	1.564	263%	0	0.00%	-0.962	0%	3	1.56%	0.601	163%
Bing	1.94%	23	7	3.54%	2.574	368%	4	2.09%	1.133	218%	4	2.08%	1.122	217%
DuckDuckGO	11.23%	133	22	11.11%	-2.350	83%	18	9.42%	-4.037	70%	23	11.98%	-1.482	89%
Google	79.48%	941	151	76.26%	-2.103	97%	160	83.77%	5.404	107%	142	73.96%	-4.407	94%
Ecosia	3.89%	46	9	4.55%	0.219	105%	6	3.14%	-1.186	73%	9	4.69%	0.361	108%
Yandex	0.25%	3	1	0.51%	0.505	-	1	0.52%	0.524	-	1	0.52%	0.521	-
Yep	0.08%	1	0	0.00%	0.000	-	0	0.00%	0.000	-	1	0.52%	0.521	-
Qwant	0.68%	8	1	0.51%	-0.456	53%	1	0.52%	-0.438	54%	3	1.56%	0.601	163%
KARMA	0.42%	5	2	1.01%	0.529	210%	0	0.00%	-0.481	0%	1	0.52%	0.040	108%
OceanHero	0.08%	1	0	0.00%	0.000	-	0	0.00%	0.000	-	1	0.52%	0.521	-
Ask	0.42%	5	0	0.00%	-0.481	0%	0	0.00%	-0.481	0%	2	1.04%	0.561	217%
GMX	0.08%	1	0	0.00%	0.000	-	0	0.00%	0.000	-	1	0.52%	0.521	-
Mojeek	0.17%	2	0	0.00%	0.000	-	1	0.52%	0.524	-	1	0.52%	0.521	-
		1184	198				191				192			

Search Engines	Total %	Total #	Exp B1 #	Exp B1 Abs	Exp B1 Del	Exp B1 Rel
Yahoo	1.27%	15	3	1.50%	0.538	156.00%
Bing	1.94%	23	8	4.00%	3.038	416.00%
DuckDuckGO	11.23%	133	17	8.50%	-4.962	63.14%
Google	79.48%	941	158	79.00%	0.635	100.81%
Ecosia	3.89%	46	8	4.00%	-0.327	92.44%
Yandex	0.25%	3	1	0.50%	0.500	-
Yep	0.08%	1	1	0.50%	0.500	-
Qwant	0.68%	8	2	1.00%	0.038	104.00%
KARMA	0.42%	5	0	0.00%	-0.481	0.00%
OceanHero	0.08%	1	1	0.50%	0.500	-
Ask	0.42%	5	1	0.50%	0.019	104.00%
GMX	0.08%	1	0	0.00%	0.000	-
Mojeek	0.17%	2	0	0.00%	0.000	-
		1184	200			

Annex B: Previous Literature

This annex provides a list of sources and references related to various aspects of mobile ecosystems, online platforms, choice architecture, current Choice Screens, consumer behavior, and competition in digital markets. These were important for preparing and drafting this research document.

1. Competition and Markets Authority (CMA)
   ○ Mobile ecosystems market study final report
   ○ Online platforms and digital advertising market study – Appendix V: assessment of pro-competition interventions in general search
   ○ Online Choice Architecture
   ○ Evidence Review of Online Choice Architecture and Consumer and Competition Harm
   ○ Online Search: Consumer and firm behavior - A review of the existing literature
2. Australian Consumer and Competition Commission (ACCC)
   ○ Digital platform services inquiry: Interim Report No. 3 – Search defaults and Choice Screens
3. Centre on Regulation in Europe (CERRE)
   ○ Effective and Proportionate Implementation of the DMA
4. Amelia Fletcher for CERRE
   ○ DMA switching tools and Choice Screens
5. Omar Vasquez Duque
   ○ The Potential Anticompetitive Stickiness of Default Applications: Addressing Consumer Inertia with Randomization
6. Amelia Fletcher
   ○ "The EU Google decisions: extreme enforcement or the tip of the behavioral iceberg?"
   ○ Behavioral insights in the DMA: A good start, but how will the story end?
7. The Behavioral Insights Team
   ○ Active Online Choices: Designing to Empower Users
8. Alexander Chernev, Ulf Böckenholt, Joseph Goodman
   ○ Choice overload: A conceptual review and meta-analysis
9. Graeme A. Haynes
   ○ Testing the boundaries of the choice overload phenomenon: The effect of a number of options and time pressure on decision difficulty and satisfaction
10. DuckDuckGo
    ○ 10 Principles for Fair Choice Screens and Effective Switching Mechanisms
    ○ Search Engines Should be Able to Guide Consumers to Search Preference Menus
    ○ Dear Google: We Agree Search Competition Should Be "Only 1 Click Away" – So Why Is It 15+ on Android?
    ○ Google Search Mobile Market Share Likely to Drop Around 20% through Search Preference Menus
    ○ Search Preference Menus: Google Auction Ignores Screen Size and Scrolling

- ○ Search Preference Menus: Improving Choice with Design
- ○ Search Preference Menu Immediately Increases Google Competitors' Market Share by 300-800%
11. Android/Google
    - ○ About the Choice Screen website
12. Ecosia
    - ○ Ecosia – Response to UK CMA Interim Report consultation
13. FairSearch
    - ○ Submission on behalf of FairSearch to the ACCC's Issues Paper
14. Mozilla
    - ● Five Walled Gardens: Why Browsers are Essential to the Internet and How Operating Systems are Holding Them Back
16. Microsoft
    - ● Digital Platforms Services Inquiry 2020-2025.

Annex C: Control Experiment

The images presented below are screen captures from the control experiment. Only the screen area outlined in red was modified in the other experiments.
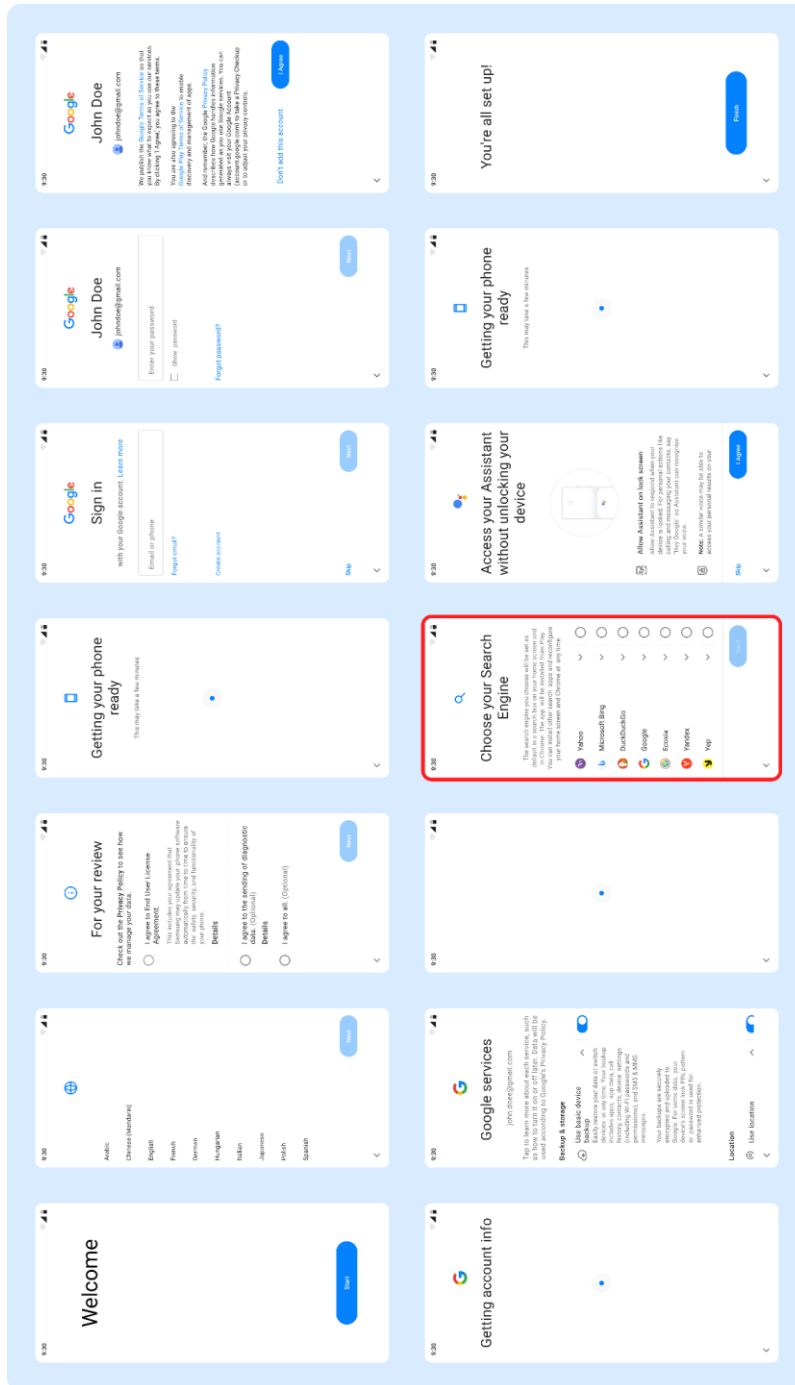
Annex D: Quantitative and Qualitative Questionnaire

The post-test questions provided here aimed to gather valuable feedback on both quantitative and qualitative Experiments A1 - A6. These questions are designed to gauge participants' initial impressions of the screen, evaluate the layout and design, assess the clarity of its purpose, determine ease of selection, identify attention-grabbing elements, explore information adequacy for decision-making, and gather suggestions or feedback for improvements.

Quantitative Experiments:

1. Did you have positive or negative initial impressions of this screen?
2. Do you find the overall layout and design visually appealing?
3. Is the purpose of this screen clear to you?
4. Were you able to select easily and efficiently?
5. Did any elements on the Choice Screen stand out or grab your attention?
6. Did you feel you had enough information to make an informed decision?
7. What additional information, if any, would you have liked to see?
8. Do you have any specific suggestions or feedback related to the Choice Screen?
9. Are there any improvements or additions you would like to see implemented?

Qualitative Experiments:

1. To start, please walk me through your initial impressions of this screen.
2. What are your thoughts on the overall layout and design?
3. What is the purpose of this screen?
4. Can you elaborate on your selection choice and process?
5. Did you find any elements on the screen that attracted your attention? If so, can you please describe these elements and explain how they affected your overall experience?
6. Were you provided with enough information to decide? If not, what additional information would you need to see?
7. Do you have any other suggestions or feedback related to the Choice Screen for this screen?
8. Is there anything else you would like to see improved or added?

For Experiment B1, we slightly modified the questionnaire to better fit the objective of the experiment:

1. What part of the setup process do you remember the most?
2. Before this study, were you aware of what search engine you use?
3. Before this study, were you aware of other search engines?
4. If yes, which one(s)?
5. Remembering your choice in this screen, what search engine did you choose?
6. Why did you choose that specific search engine during the set up?
7. Do you feel like you made an informed choice?

8. How did seeing information about other search engines affect your choice?
9. How much did having an extra screen with information about the search engines impact on your choice?
10. Is there anything else you can think of that would impact your choice?

Annex E: Final Designs of the Search Engine Choice Screens
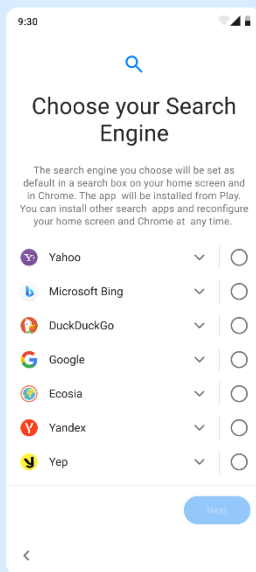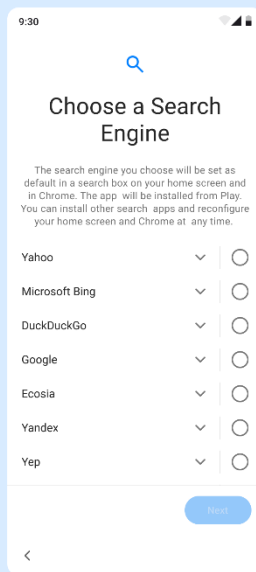
Experiment A1   Experiment A2   Experiment A3   Experiment A4
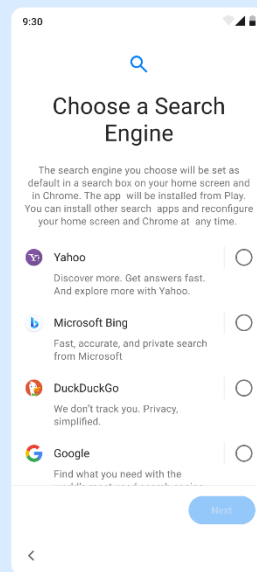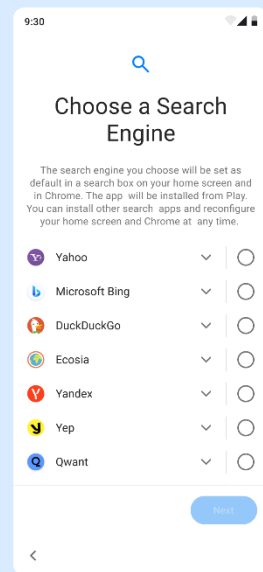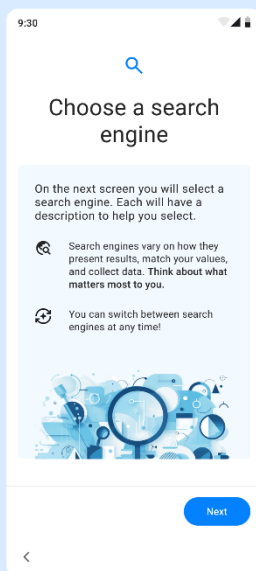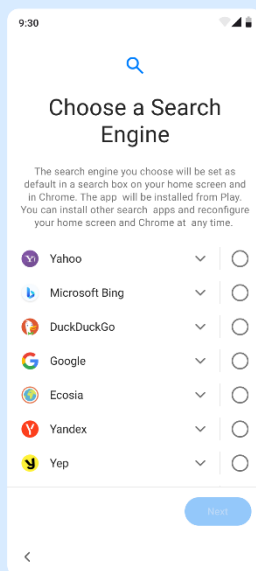
Experiment A5   Experiment A6
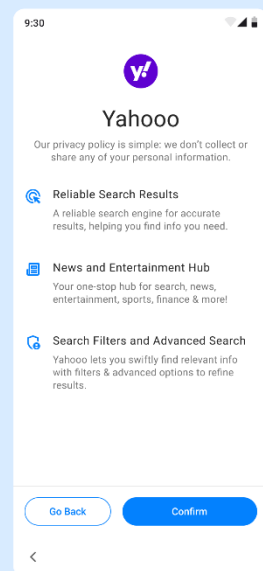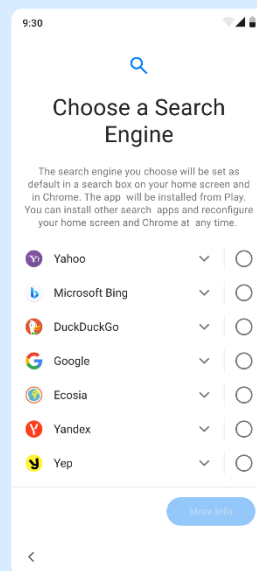
Annex F: Second and Following Clicks Heatmaps for Experiments A1 to A6

For certain Search Engines in some Experiments, no heatmaps are available simply because no participants selected those Search Engines. If no participant clicked on the radio button next to a Search Engine, then no heatmap has been generated for that specific Search Engine. Where this is the case, it is mentioned.

While we have taken into account results from all the Second and Following Clicks Heatmaps, the heatmaps included in this annex are for illustration purposes only and show the Search Engines that were displayed above the fold. Because the heatmaps included in this Annex can only show a static snapshot of users' clicks that were created when users interacted with scrollable prototypes, for certain Search Engines displayed below the fold, the static heatmaps do not accurately capture what we observed in the interactive heatmaps. These have therefore not been included in the Annex.
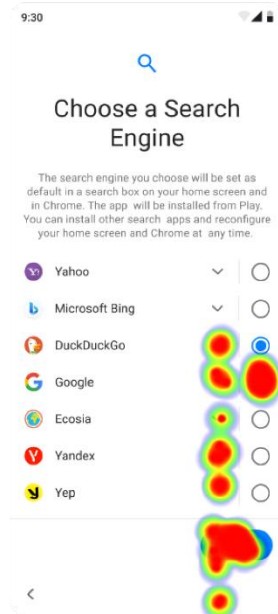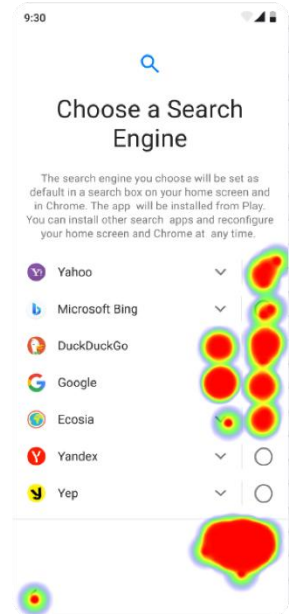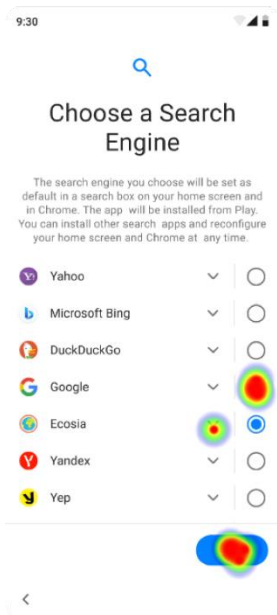
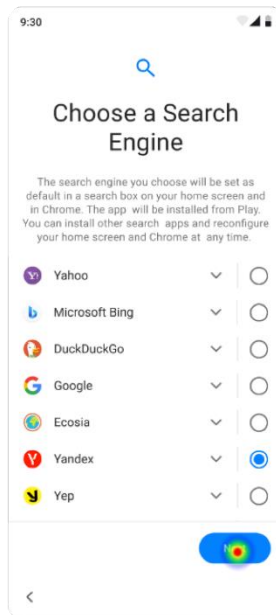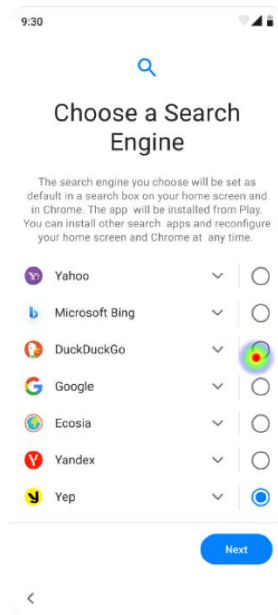**Experiment A1.**

Heatmap not available for GMX.

Yahoo
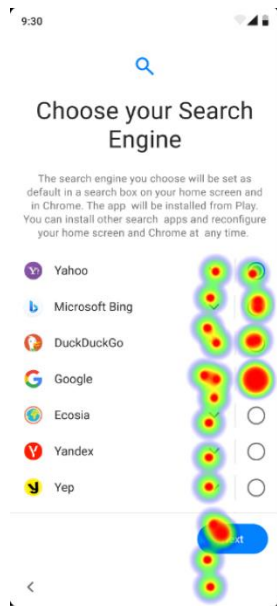
Bing!
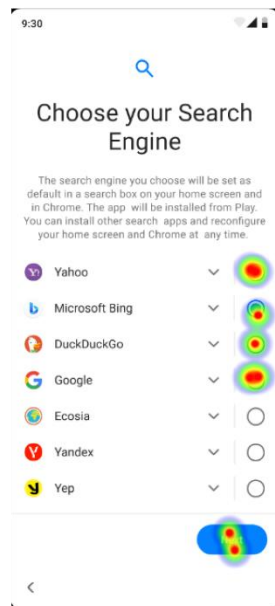
DuckDuckGo
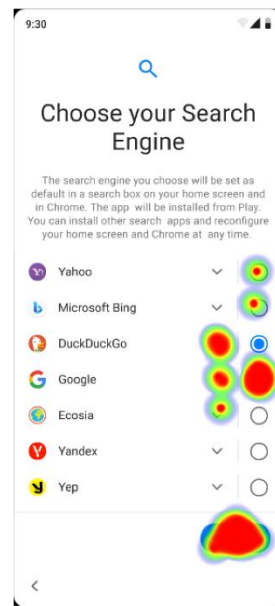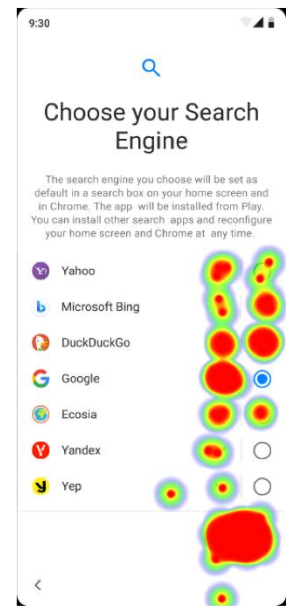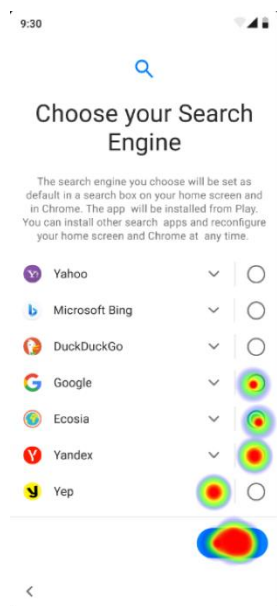
Google
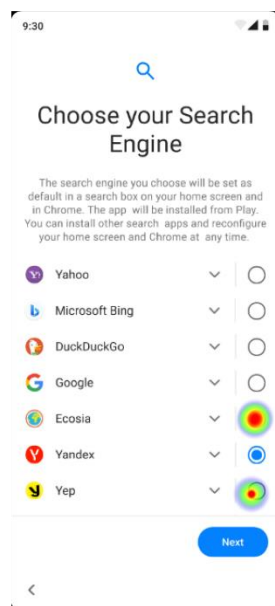
Ecosia

Yandex

Yep
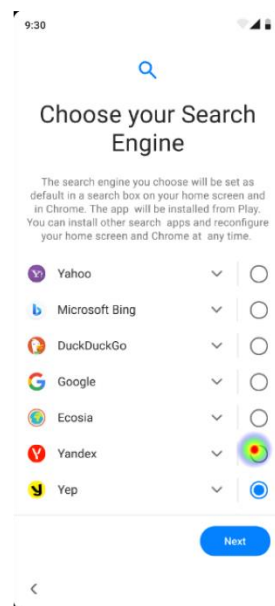
Experiment A2.

Heatmaps not available for Yep, KARMA, OceanHero, GMX, and Mojeek.
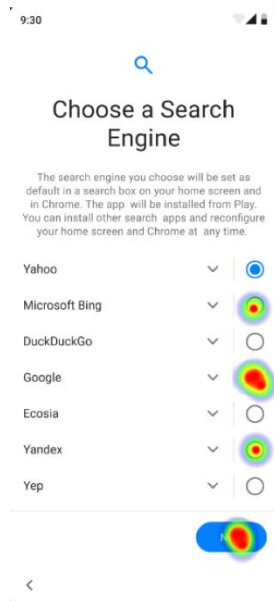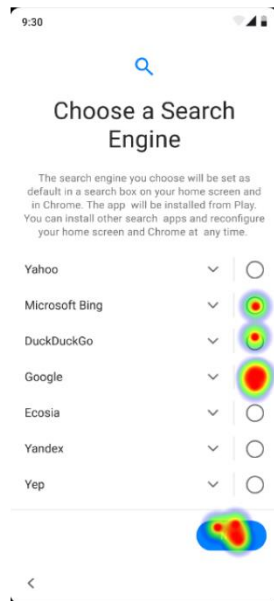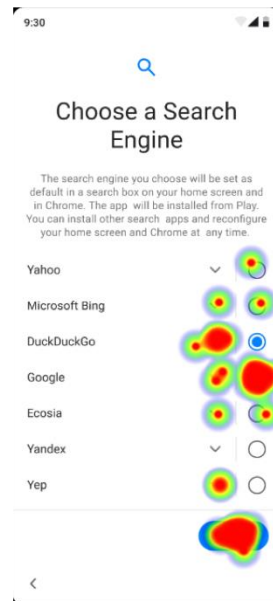
Yahoo   Bing!   DuckDuckGo   Google
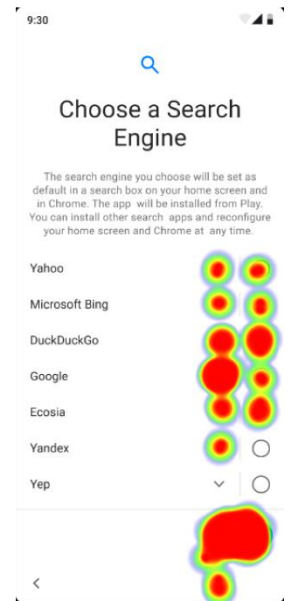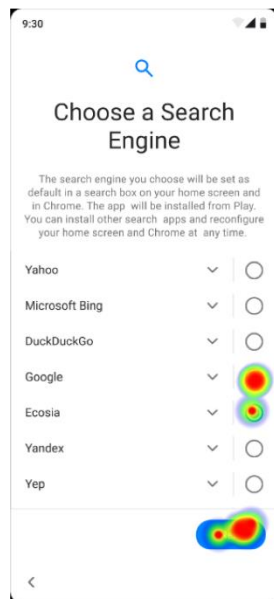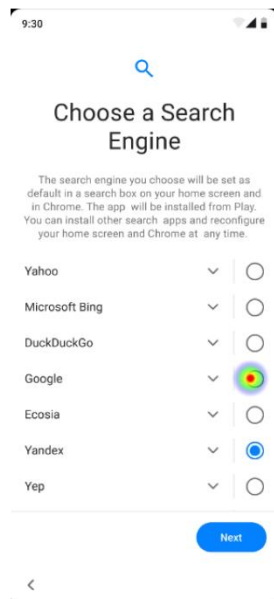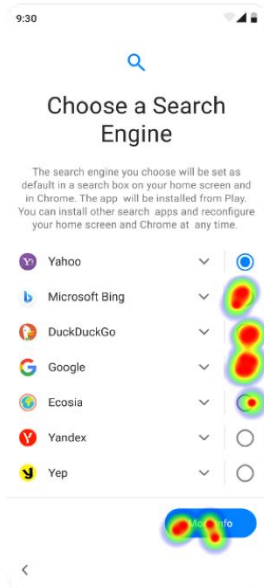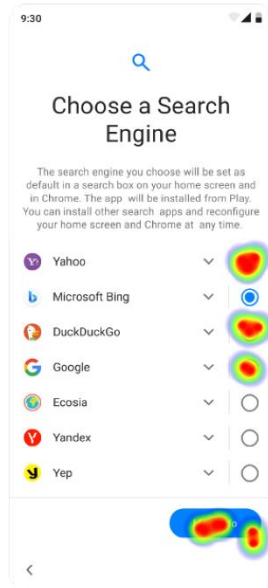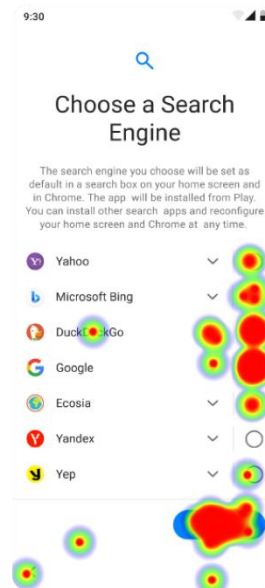

Ecosia   Yandex

Experiment A3.

Heatmaps not available for Yandex, Yep, Qwant, OceanHero, and GMX.
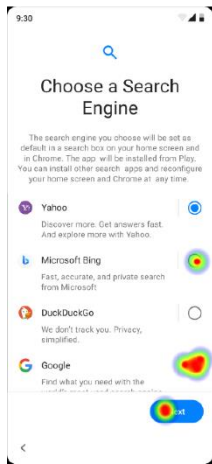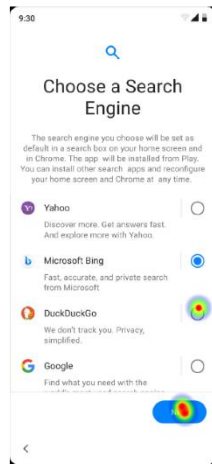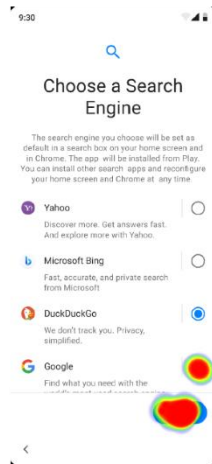
Yahoo   Bing!   DuckDuckGo   Google
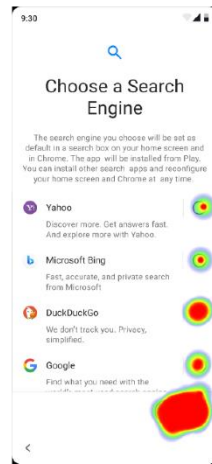
Experiment A4.
Heatmaps not available for Yep, OceanHero, and GMX.
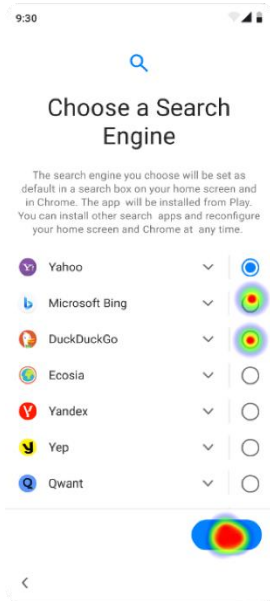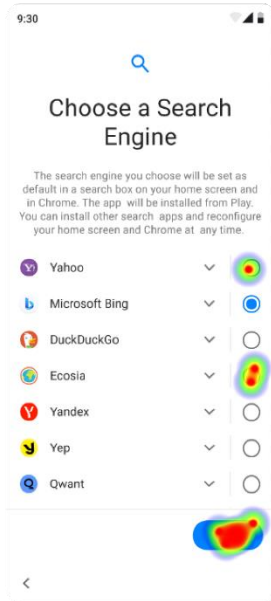
Yahoo
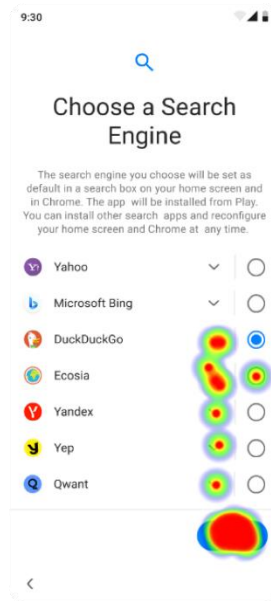
Bing!

DuckDuckGo

Ecosia
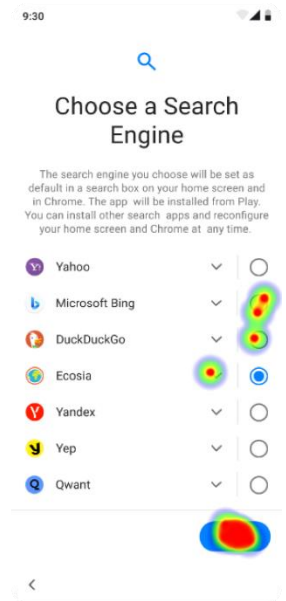
Yandex
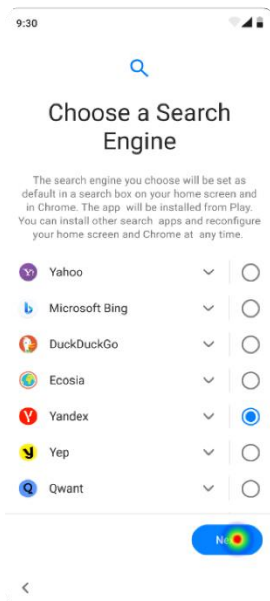
Qwant
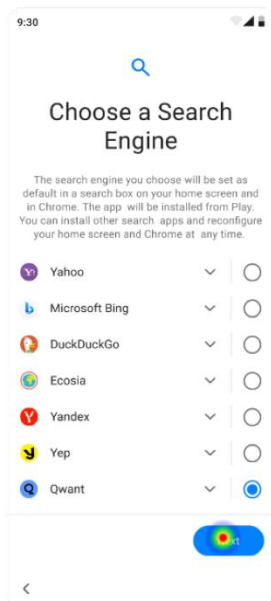
Experiment A5.

Heatmaps not available for KARMA and OceanHero.

Yahoo
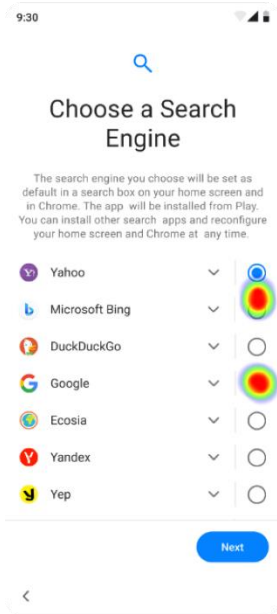
Bing!
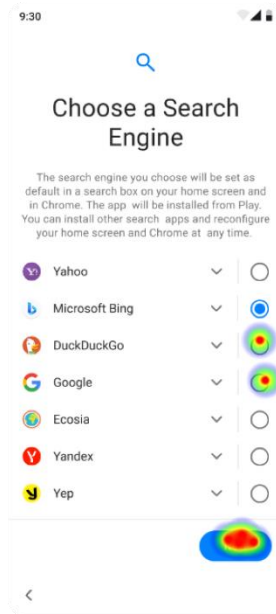
DuckDuckGo

Google

Ecosia

Yandex

Yep

Experiment A6.
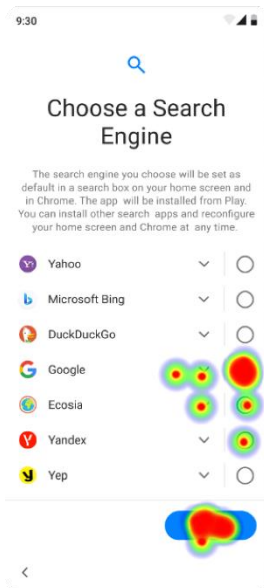
Yahoo
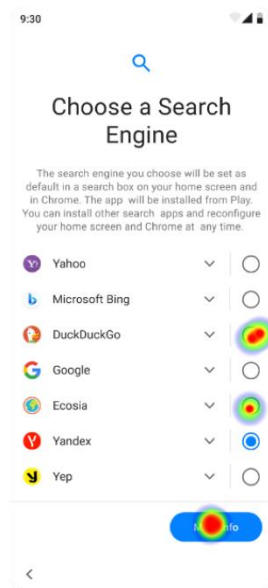

Bing!

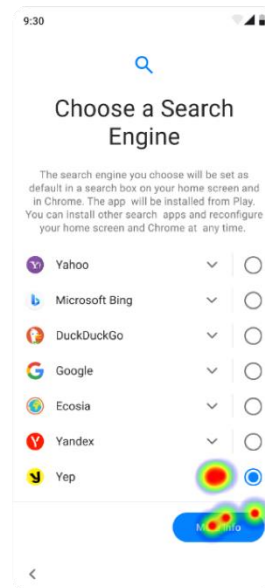### DuckDuckGo

Google
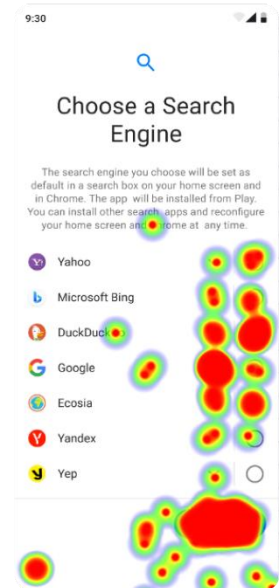
Ecosia

Yandex

Yep

Annex G: List of Themes

- Ease Of Use
  - Comfort: Refers to the degree to which users find the interface and features of a Search Engine comfortable to interact with.
  - Convenience: Refers to how much a Search Engine makes tasks more accessible or convenient for the user.
- Effectiveness:
  - Performance: Measures how well the Search Engine performs regarding speed, reliability, and responsiveness.
  - Efficiency: Refers to how proficiently a Search Engine provides results with minimum wasted effort or resources.
  - Accuracy: Reflects how closely the results of a search align with the user's intention.
- Creative Empowerment
  - Freedom of Choice: Refers to how much a Search Engine empowers a user to feel in control of their choice.
  - Intuition: Refers to how well the Search Engine aligns with the user's natural instincts and thought processes, making it feel more intuitive to use.
  - Innovation: Refers to the Search Engine's adoption of novel or advanced features or technologies.
- Content & Understanding
  - Information: Refers to the quantity and range of information a Search Engine can provide.
  - Knowledge: Refers to a user's pre-existing understanding of a particular Search Engine, even if they do not use it frequently in their daily life.
- Emotional Engagement
  - Brand Loyalty: Refers to the emotional attachment a user has to a specific Search Engine's brand, influencing their preference for that engine.
  - Trust: refers to the user's confidence in a Search Engine's ability to deliver reliable, accurate, and safe results.
  - Personal Connection: Refers to the extent to which a user feels a personal resonance or affinity with a Search Engine.
- Value Alignments
  - Supporting Causes: Refers to a user's preference for a Search Engine that demonstrates a commitment to specific causes or values the user cares about.
  - Privacy: This refers to the degree to which a Search Engine respects and protects the user's privacy.
- Prior Exposure
  - Familiarity: Refers to the user's pre-existing knowledge or experience with a Search Engine, considering their frequent use in daily life.
  - Habit: This refers to the user's tendency to continue using a particular Search Engine out of habit.