



SPECIAL

**Scalable Policy-awareE Linked Data arChitecture for
privacy, trAnsparency and complIance**

Deliverable D4.4

Usability testing report V2

SPECIAL DELIVERABLE

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Table of Contents

1	Introduction	5
2	Scope of this deliverable	6
3	Methodology	7
4	Privacy dashboard	9
4.1	First user study	9
4.2	Second user study	12
4.2.1	Scenario	13
4.2.2	User group	14
4.2.3	Results	16
4.2.4	Conclusion	24
5	Consent control interface	25
5.1	Introduction	25
5.1.1	Use case scenario	25
5.1.2	First interactive wireframe for the consent request	25
5.2	Second interactive wireframe for the consent request	29
5.2.1	Usability evaluation	30
5.3	Third interactive wireframe for the consent request	39
5.3.1	Usability evaluation	40
6	Conclusion and outlook	49
7	References	50
8	Annexes	51
8.1	Second usability evaluation questionnaire	51
8.1.1	Demographic Data Questionnaire	51
8.1.2	Usability evaluation questionnaire	53
8.2	Third usability evaluation questionnaire	57
8.2.1	Demographic Data Questionnaire	57
8.2.2	Usability evaluation questionnaire	59

1 Introduction

In **D4.1 Transparency dashboard and control panel release V1** and **D4.3 Transparency dashboard and control panel release V2** multiple user interfaces are presented including a design for a privacy dashboard, that aims to provide users with transparency concerning the processing and sharing of their processed personal data, and multiple interfaces to obtain user consent enabling users to make informed privacy decisions, while having full control over what happens with their personal data. The evaluation of these interfaces was not discussed in **D4.1 Transparency dashboard and control panel release V1** or **D4.3 Transparency dashboard and control panel release V2**, respectively. Therefore, this deliverable will report on conducted to date evaluations and user tests of the developed prototypes and user interfaces.

Since an agile development methodology is used, user tests with few users to evaluate the prototypes are reasonable and adequate to collect feedback on a more frequent basis and to make adaptations based on the results of these user tests. This approach conforms to Nielsen's Usability Engineering Lifecycle (Nielsen 1994), which we use as our methodology to address usability from the beginning of the development of our functional components. The goal of these early user tests is to identify usability issues and pitfalls that come along with the concept and design of our user interfaces, which can be corrected rather easy early in development but are more difficult to change in a later stage of the development process.

It is also important to emphasize that testing the usability of our system is only one evaluation criterion. Since we propose alternative approaches for consent interfaces, we also want to measure the impact of our user interfaces on the user's willingness to give consent or not. As also stated in deliverable **D4.3 Transparency dashboard and control panel release V2**, it is an important goal to strengthen users in their confidence to give consent by informing them about the intended personal data processing in a more comfortable manner and by increasing the level of control given to them.

In this deliverable, we report on all conducted user studies performed so far, while there are still user tests planned after the submission of this deliverable. We aim to incorporate the results of any following user studies in **D4.5 Transparency dashboard and control panel final release**, which is due in M34.

The remainder of this deliverable is structured as follows: Chapter 2 will reiterate the scope of this deliverable. Chapter 3 gives a rather brief overview of the methodology used to evaluate the prototypes. Chapter 4 reports on the evaluation of the privacy dashboard. Chapter 5 presents the evaluation of the consent interface. Finally, Chapter 6 concludes this deliverable.

2 Scope of this deliverable

This chapter aims to specify and narrow the scope of this deliverable. We therefore refer to the description of the deliverable in the proposal. There it says:

“The results of the usability testing (T4.4) will be documented and used to inform future releases of the platform (D4.3 & D4.5).”

- Description of D4.4 in the proposal

Based on this description, it is reasonable to look at the proposal’s definition of task **T4.4 Front end usability testing**, which says:

“This task will be dedicated to testing the robustness of the transparency dashboard. The objective of the task is threefold: (i) to stress test the individual components and the dashboard both in terms of performance and scalability; (ii) to validate the usability of the dashboard; and (iii) as per T3.6, to expose the front end to open penetration/hacking challenges in WP5.”

- Description of T4.4 in the proposal

Consequently, this deliverable addresses aspect (ii) of the task’s description. In contrast to what the description of **D4.2 Usability testing report V2** indicates (“[...] used to inform future releases of the platform (D4.3 & D4.5)”), planned or already realized adaptations to the interfaces based on the results of our tests are document and presented in this deliverable as well.

3 Methodology

As already stated in the introduction of this deliverable, we follow Nielsen's Usability Engineering Lifecycle (Nielsen 1994) for the design and development of our user interfaces and prototypes to address and pursue usability from the beginning of the development process. Nielsen's work is considered fundamental in the field of usability engineering and is well-suited for the design and development of complex systems that are intended to be used by various user groups including rather inexperienced users. The Usability Engineering Lifecycle consists of the following seven phases (Möller 2003), which are briefly discussed in the following separately:

1. Analysis
2. Design
3. Prototyping
4. Expert evaluation
5. Empirical testing
6. Iterative design
7. Feedback from field

ANALYSIS

The cycle starts with the Analysis phase, in which the target users of the system are defined and analyzed with regard to specific aspects and criteria. Here, users could be categorized by their familiarity with technology or their privacy-awareness for example. The Analysis phase further involves the definition and specification of tasks that the to-be-developed system promises to solve and possible conventional means that are used by the target users to solve the same tasks.

DESIGN

In the Design phase, the system is designed in a manner that includes the development of concepts that take into consideration the target users, the specified tasks, alternative means to solve the tasks, and the context of the system's use. The design phase is passed through in iterations with the intend to refine the design after insights have be gained from the collected feedback. Therefore, it can happen that parallel design versions exist in one or multiple iterations, which are tested separately so that the results of the conducted user tests can be compared.

PROTOTYPING

The Prototyping phase aims to implement the system entirely or certain components of it. Prototypes can be categorized into three different categories: horizontal, vertical, or scenario-based prototypes. Horizontal prototypes aim to present the system completely, while not offering any or only reduced functionality. This is achieved by using placeholders, dummy data, or simulations. Vertical prototypes, on the contrary, are limited to a certain feature of the system, while neglecting all other planned features of it. The combination of both approaches is called scenario-based prototype.

EXPERT EVALUATION

Developed prototypes are then evaluated by so-called usability experts, since these prototypes are in a too early stage to be shown to real users of the target group. To get constructive feedback it requires experienced users who are able to infer from the presented prototype to a possible product that is run in production. Here, smaller groups of users can be used so that evaluations can be conducted on a more frequent basis. However, it is also possible to already work with real users in this phase (Möller 2003) in combination with developers and usability experts.

EMPIRICAL TESTING

In contrast to the expert evaluation, the Empirical testing phase involves real users of the system that test the system in a specific environment for example on a dedicated and tested device with a certain network connection and so on. Feedback is collected in this phase as well, which is considered in following iterations.

ITERATIVE DESIGN

In the Iterative design phase, the next iteration is prepared by gathering the feedback and deciding which adaptations are necessary in the following design phase to address the issues.

FEEDBACK FROM FIELD

Even after the system has been released and the target user group actually uses it, feedback should be collected to identify and resolve usability issues.

We are currently in the expert evaluation phase with our prototypes, i.e. our prototypes are in rather early stages and require further iterations. However, first evaluations show that the designs and concepts for our prototypes are worth pursuing.

4 Privacy dashboard

This chapter reports on the usability testing conducted on the privacy dashboard. In the first user study, we tested an early design of the privacy dashboard, which neglected technical requirements of the SPECIAL platform. This design focused on legal requirements regardless of the feasibility of their technical implementation. In the second user study, we then tested a version of the privacy dashboard that implements the event log and policy visualization. With this user study, we aimed to identify usability issues concerning rather the actual implementation (vertical prototype) than the general design.

4.1 First user study

In the first iteration, a horizontal prototype was developed that was tested by three usability experts using a Thinking Aloud test (Jaspers 2004), which is quite similar to the cognitive walkthrough method (Lewis 1990) that is proposed by Möller (Möller 2003) during the Expert evaluation phase. The tested version of the privacy dashboard can be accessed through the link: <http://raschke.cc/GDPR-privacy-dashboard/>. Figure 1 shows a screenshot of the tested version.

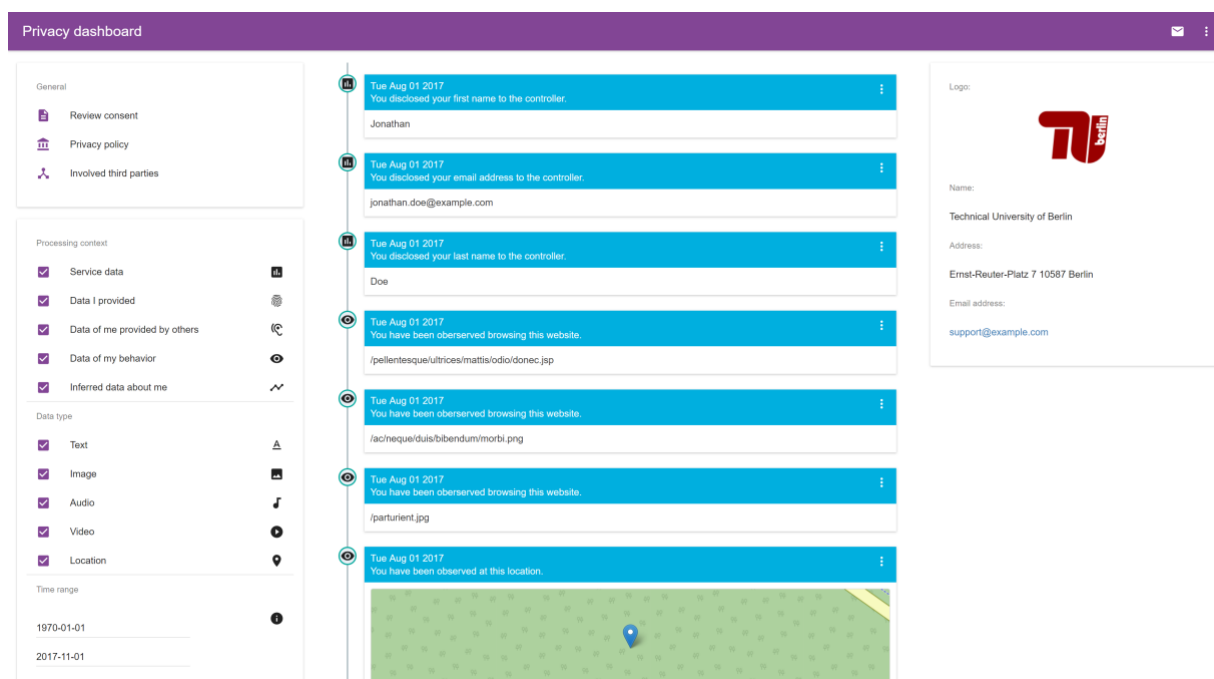


Figure 1: Earliest version of the privacy dashboard.

The main goal of the user test was to assess the applicability of the used data categories, which have been presented in **D4.1 Transparency dashboard and control panel release V1**, and whether those were helpful to the user or not when navigating through the personal data. Therefore, three fellow researchers were given a specific task to answer a set of questions which they were supposed to answer by using the privacy dashboard. A scenario has been made up for which fake data has been produced and used within the user tests to ensure that the test subjects run into certain situations. A description of the task and a list of the posed questions is given below:

“European law gives you the right to request from any entity that processes your personal data access to it. Imagine you requested access to your personal data from a company and you're confronted with the tool in front of you. Please answer the following questions:”

- Which data do you have to provide when creating an account for this service?
- Did you provide any voice recordings to the service?
- Have you disclosed your location voluntarily?
- Has anyone provided the controller with photos of you?
- Does this service provider track your location?
- Has the service provider knowledge about your gender?
- Does the service provider know your income?
- Does the service provider know which websites you visit?

RESULTS

All three participants required some time at the beginning to comprehend the setting of the privacy dashboard and what functionality it provides to them. The scenario plays a major role. Since fake data is used, the test subjects were not required to authenticate, they just saw “their” personal data not knowing whether they installed the privacy dashboard on their computer or had to sign up for a service of a third party. For reasons of simplification, the data subjects were told to assume the privacy dashboard is provided by the controller to achieve compliance with the General Data Protection Regulation’s¹ (GDPR) transparency principle². However, it is noteworthy that the setup of the privacy dashboard plays an important role to the test subjects and might also be important to regular users.

The first question was meant to be solved by using the corresponding data category, however all participants used the chronological order to answer that question by assuming that the data provided first was required to sign up for the service in question. This could have been prevented by generating data items that were processed before the disclosure of service data. Behavioral information, i.e. the user browses the website to sign up, is most probably processed at first in real-life scenarios. However, this behavior of the test subjects indicates that the data category service data is less helpful, since it is also disclosed data.

The participants also found that the filter options were not visible enough. In Figure 1, it can be seen that in the left column general information (like consent given, the controller’s privacy policy, and involved third parties) was placed above the filter options. However, these options rather fit into the right column where general information about the controller is given.

In general, it can be said, that the test subjects were able to answer the posed questions by using the privacy dashboard. Their speed improved during the course of the test, which indicates that the tool is rather easy to learn. As consequence of the test subject’s feedback adaptations to the proposed data categories have been made as well as minor improvements to the appearance of the user interface.

¹ Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), OJ L 119, 4.5.2016, p. 1-88 [hereinafter GDPR]

² GDPR art. 5(1)(a)

See Figure 2 for the second version of the privacy dashboard after the feedback of the test subjects had been considered. The general options are now moved to the right column so that the filter options are the only component in the left column. Moreover, the data categories have been redefined in order to better meet the users' expectations. See deliverable **D4.1 Transparency dashboard and control panel release V1** for our redefined and adjusted data categories. The second version is accessible through the link: <http://raschke.cc/SPECIAL-privacy-dashboard-V1/>.



Figure 2: Second version of the privacy dashboard

Before the second version of the privacy dashboard was tested again with usability experts, further adjustments had been made to test how users respond to a more abstract view. See Figure 3, in which the actual data items are concealed per default and an option to display a certain data item is offered to the user (see Figure 4). Moreover, data items are aggregated over a certain time period (for example a day) to reduce entries in the timeline. This way the privacy dashboard is less overloaded, and data can be shown on demand. However, it could be possible that users prefer to instantly see their personal data to navigate through it. By developing another version based on a parallel design, we can ask the usability experts in the next iteration which of the versions they prefer. This version is available through: <http://raschke.cc/LNDW18/>.

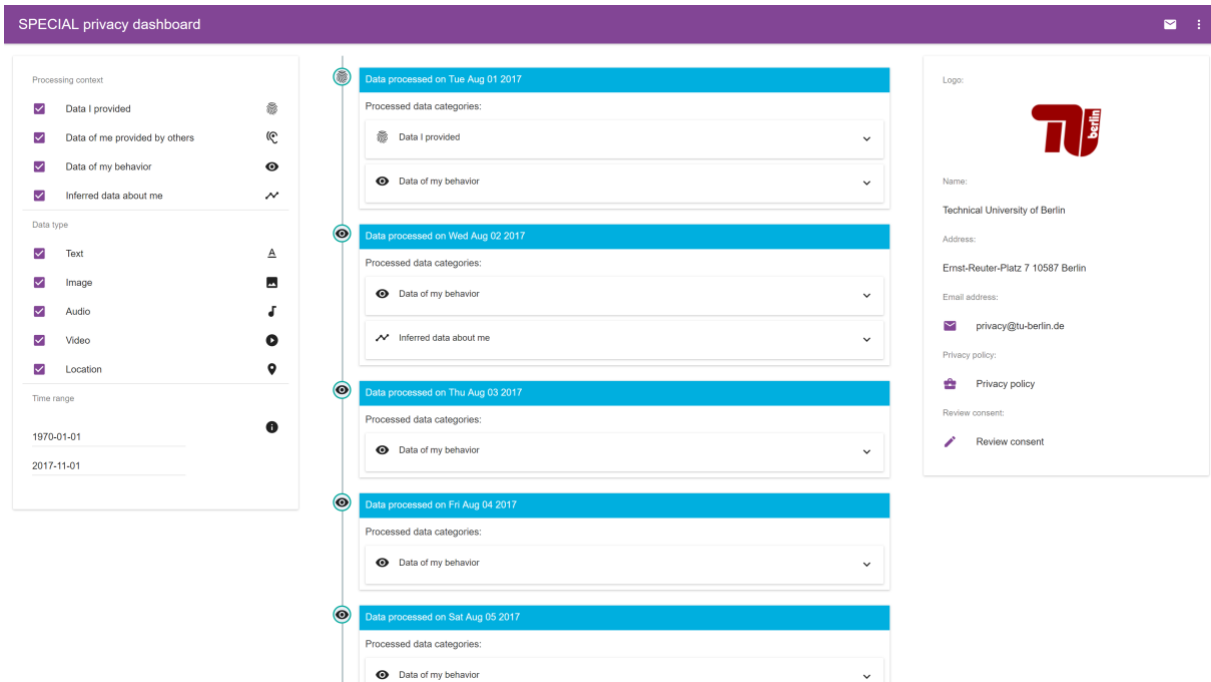


Figure 3: Aggregated data processing items to reduce complexity

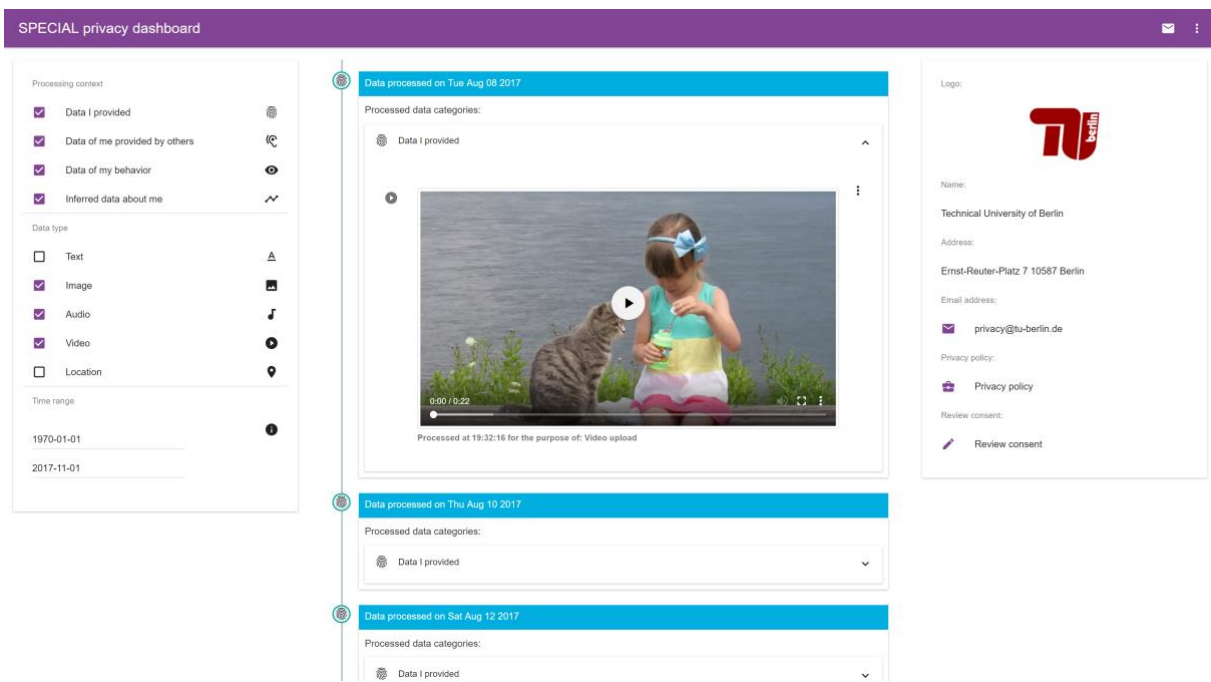


Figure 4: Aggregated data processing items with expanded data item

4.2 Second user study

In the second test iteration, we³ tested the most recent version of the privacy dashboard⁴, which we reported on in **D4.3 - Transparency dashboard and control panel release V2**. The goal of this user

³ The described user study was conducted within the context of the “QU Privacy Seminar” offered by Technische Universität Berlin each winter semester. At this point, we want to thank Aarsal Jalib, Antonia Föhl, Lukas Dippold, Sihan Yuan, and Vladimir Alekseychuk for their commitment.

study was to test whether new implemented functionality negatively affected the usability of the privacy dashboard. In particular, the adaption of the SPECIAL ontology and the log and event visualization required investigation. Since in the current version of the event log, instance data (i.e. the actual data that was processed during the event) is not contained in a log entry, data could not be visualized (like it was in the previous version of the privacy dashboard). One of the main questions is whether users are still able to assess their data privacy based on a broader and more abstract view on the controller's personal data processing practices.

The participants were given a concrete scenario, which is described in 4.2.1. In alignment with this scenario, personal data was simulated, which was written into the event log and visualized by the privacy dashboard. This way, the participants could be asked concrete questions (like in this case: "Does the controller processes your physical location [in this scenario]?") with definitive answers (like in this case: "Yes, the controller processed my location, because there is an entry in the event log."). Questions of this type are important to test if users understand (more specific: correctly interpret) the information provided by the privacy dashboard. In addition to these concrete questions, they were asked general questions concerning the privacy dashboard's appearance, understandability, and helpfulness. These questions are important to get the participants' general impression on the privacy dashboard and to collect general remarks.

4.2.1 Scenario

For the user study, we created a test scenario to simulate a real-life use case for the privacy dashboard. Participants were asked to imagine that they are customers of an online shop called *YouShop*, which offers similar goods and services like real-life comparable online shops (e.g. Amazon). Further specifications were made to align the scenario with the SPECIAL vocabulary. These definitions are as follows:

Data

- YouShop processes personal information like the user's name, physical address, email address, credit card information, and passwords.
- YouShop offers a wish list feature, which consists of items users intend to purchase or show interest in.
- YouShop processes shopping cart items, which indicate that these items are about to be purchased or are very likely to be purchased in near future.
- YouShop processes previously bought products for recommendations of other products.
- YouShop keeps track of items users viewed and how long these items were displayed to the user.
- YouShop keeps track of search queries made on the YouShop website.
- YouShop processes browser information.
- YouShop processes written reviews and feedback to purchased items.

Purposes

- YouShop processes personal data to deliver goods to customers.
- YouShop processes personal data to provide recommendations for goods and services.
- YouShop processes personal data to provide sponsored recommendations.

⁴ The version in question can be accessed via: <http://raschke.cc/SPECIAL-privacy-dashboard-D4.3/>

- YouShop processes personal data to provide reminders for subscriptions.

Data location

- YouShop stores personal data of its customers in Germany and Australia

Data recipients

- YouShop collects personal data and shares it internally.
- YouShop shares personal data with data-broker companies.
- YouShop shares personal data with advertisers.

To simplify the test scenario, no specification of the kind of processing was made, thus the categories of the SPECIAL vocabulary were used. The simulated privacy dashboard used for the test can be accessed via: <http://raschke.cc/youshop-dashboard/>.

4.2.2 User group

In total, 18 test subjects participated in this study. They were asked about their age, computer knowledge and affinity, online shopping experience, and how important privacy is to them. These questions were asked to learn more about prior knowledge and attitudes of the participants with regard to the scenario. Please note, that not all participants answered all questions (see Figure 5).

Age

17 responses

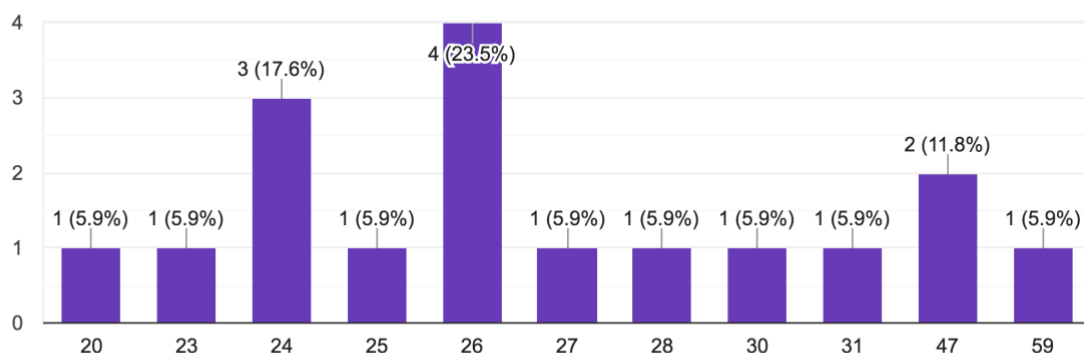


Figure 5: Age distribution of the participants

As it can be seen in Figure 5, the age of our participants ranges between 20 and 59. However, it is noteworthy that the majority of participants is between 20 and 30 years old. In a self-assessment of computer knowledge and affinity, the majority assesses it as high or very high.

Computer knowledge / affinity

18 responses

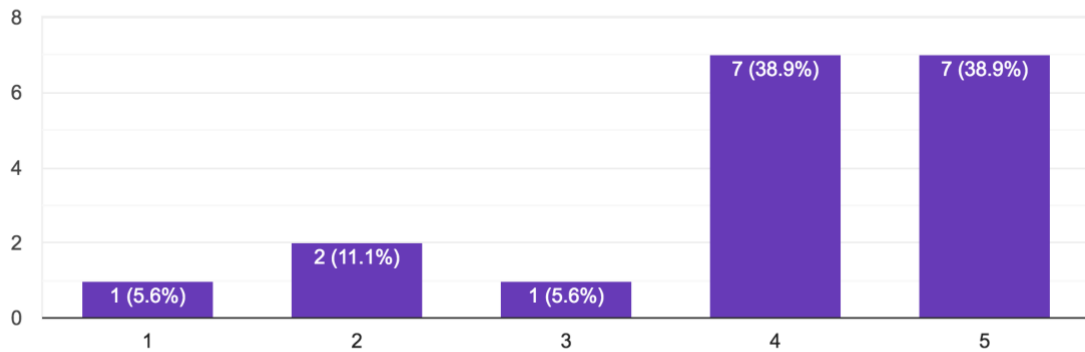


Figure 6: Self-assessment of experience with computers (0 = very low and 5 = very high)

Online shopping experience

18 responses

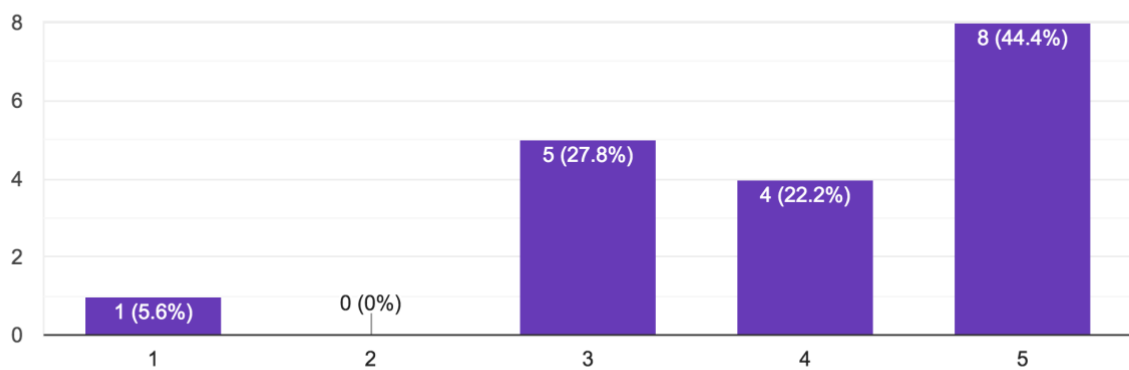


Figure 7: Self-assessment of the online shopping experience of the participants (0 = very low and 5 = very high).

Moreover, the majority of users states that they have a lot of experience in online shopping (as it can be seen in Figure 7) or at least general knowledge about it. While just a single participant rated the online shopping experience as the lowest (few). Figure 8 shows that the majority of users cares about privacy with regard to online shopping. Yet, it is noteworthy, that two participants rather disagree with the statement that privacy is an important topic for them.

Privacy is an important topic for me.

18 responses

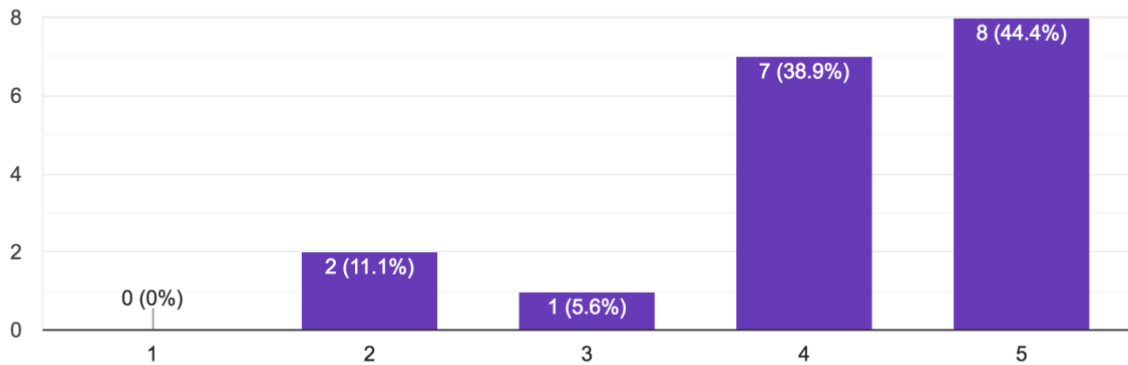


Figure 8: Self-assessment of the attitude towards privacy of the participants (0 = completely disagree and 5 = completely agree).

In general, it can be said that our user group consists of young persons with experience in computers and online shopping, who care about privacy.

4.2.3 Results

In this section, we present the results of the user study by presenting the individual questions asked to and responses given by the participants.

Do you know what a privacy dashboard is?

18 responses

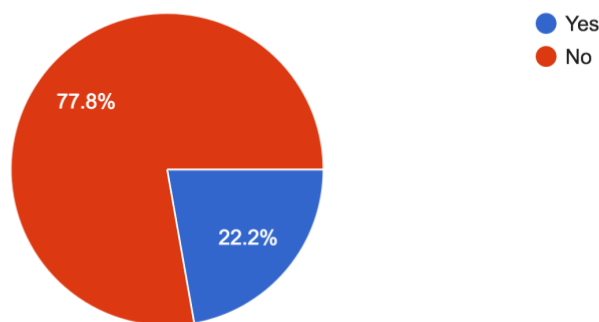


Figure 9: Participants where asked about their prior knowledge of privacy dashboards.

By asking for prior knowledge about “privacy dashboards”, we aimed to investigate whether the term “privacy dashboard” is familiar to users and whether it suits well as name for the tool. As it can be seen in Figure 9, most participants had no association with the term. This circumstance does not necessarily mean that it is not suitable as a good name for the tool. However, alternative names

should be considered like: “privacy settings”, “privacy preferences”, or suchlike. A renaming of the tool could help to meet users’ expectations.

Have you used a privacy dashboard for online shopping or any website at all or reviewed your data and privacy sett...n Google, Facebook, Whatsapp, etc. ?

18 responses

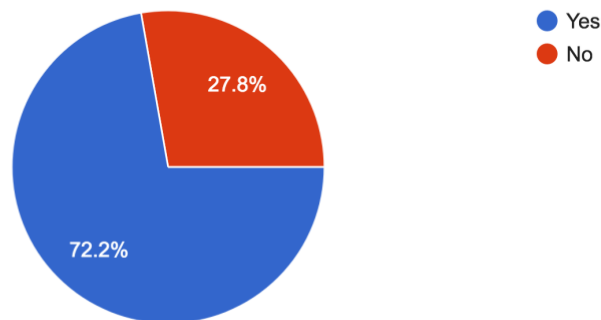


Figure 10: Participants were asked whether they visited the privacy settings page of popular services.

Participants were asked whether they reviewed the privacy settings of popular services they use (see Figure 10), which the majority of the participants answers in the affirmative. This is in alignment with Figure 8 (“Privacy is an important topic for me.”), i.e., the user group consists of rather privacy-aware users, who care about their privacy and are willing to act to protect it.

The following questions address the concrete scenario and can be tested for correctness to see if the self-assessment of the participants matches the actual circumstance.

Were you able to find out for what purposes your data is processed?

18 responses

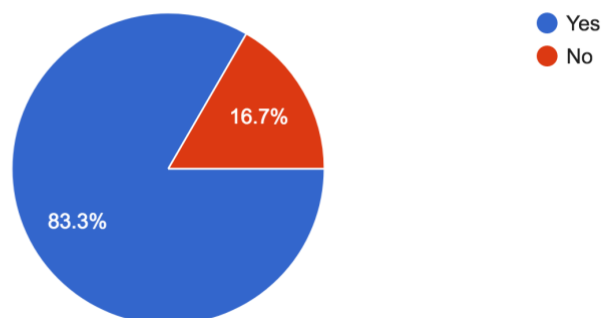


Figure 11: Self-assessment of participants whether they know for which purposes data is processed.

We asked participants whether they were able to find out for which purposes data is processed. The results can be seen in Figure 11. The majority of participants states that they were able to find this information. Since it was provided by a chart at the top of the page, most participants could directly read the purposes from the chart. However, three participants struggled to identify the purposes in

the given chart. Here an individual heading would have helped to guide the participants to the right chart.

We then asked the participants for which purposes their “browser data” is used. To answer this question the participants would had to click on “browser data” in the “Data” table, which shows the top-five most processed data. Afterwards, a new window (modal) would open showing all related information to “browser data”. Here, a chart gives information on the purposes for which the users’ browser data is used. Correct answers would have been: “Recommendations”, “Sponsored Recommendation”, and “Sending reminders for subscription items”. Below the answers of the participants are given:

<i>“Sponsored recommendations “</i>
<i>“every data is handled by the means of the browser “</i>
<i>“sponsored recommendations, Sending reminders of subscription items, Recommendations “</i>
<i>“don’t know where to locate browser data “</i>
<i>“browsing, auxiliary, accounting “</i>
<i>“Sorry, I don't find it “</i>
<i>“I'm not sure “</i>
<i>“none, Dashboard was broken and didn’t show the entry "browser data"”</i>
<i>“accounting, arts and charity “</i>
<i>“Recommendation, Sponsored recommendation, sending reminders “</i>
<i>“Sponsored Recommendation “</i>
<i>“Don't know “</i>
<i>“Recommendations, sponsored recommendations, sending reminders of subscription items “</i>
<i>“collect and aggregate your activity, computer and derived data for accounting, arts and charity purposes. “</i>
<i>“recommendations reminders “</i>
<i>“arts, marketing, charity, accounting “</i>

The answers show that only three participants were able to answer the question fully correct. Three other participants could at least name one or two of the correct purposes, while the rest (10 participants) were not able to find the correct answer. This means, here is potential for major improvements of usability. While the type of task (i.e. “For what purpose is which data used?”) is very specific and rather complex, it is also a very basic and fundamental question users could have.

As it can be seen in Figure 12, we asked the participants whether they were able to find with whom their data was shared. The answer to this question was again easy to find, since there is a dedicated table for it. Surprisingly, only two thirds of the participants stated that they were able to learn this information by using the privacy dashboard. The participants stated that they were rather confused by the broad terms like “advertisers” and “data-broker companies”. They rather expected explicit names of companies with further information on the companies (e.g. where those reside).

Do you know now with whom your data is shared?

18 responses

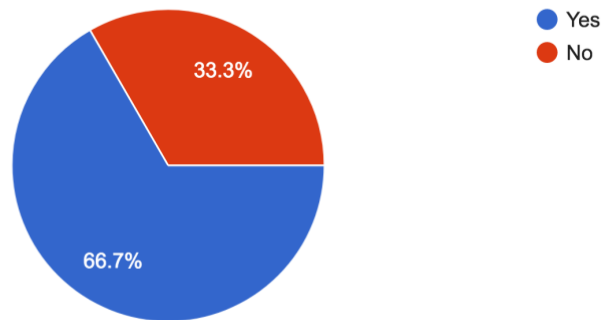


Figure 12: Self-assessment of participants whether they know with whom their data is shared.

Where is your data stored?

17 responses

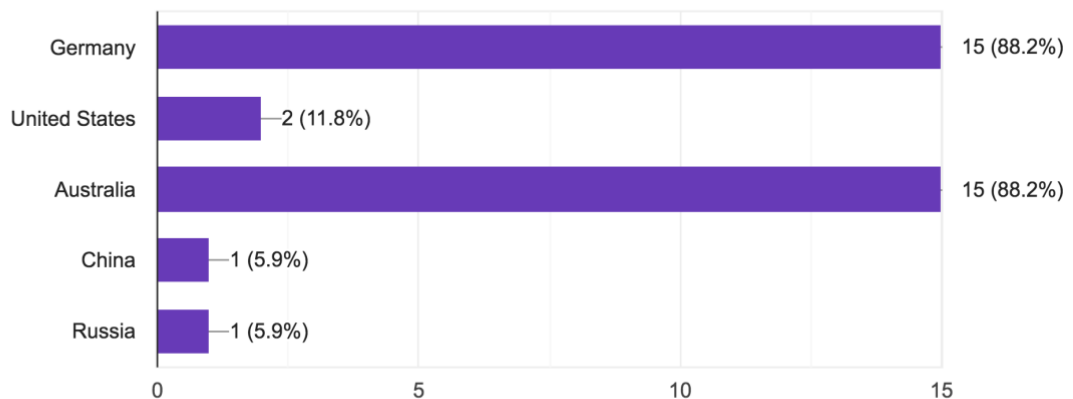


Figure 13: Participants were asked for the physical location of where their data is stored.

We asked participants in which countries their personal data is stored in the YouShop scenario. The answers are visualized in Figure 13. Correct answers for this question would have been “Germany” and “Australia”. The correct answer could be read from the dedicated chart, which is directly on the front page. Therefore, the vast majority answered correctly. Yet, few participants named countries that were not even listed by the privacy dashboard, thus it is surprising that they were given as answer. Either participants gave random country names or were confused by the previous question (“Do you know with whom your data is shared?”). It is thinkable that the participants “guessed” the location of “advertisers” and “data-broker companies”.

Will your location be tracked to send you personalized advertisements

18 responses

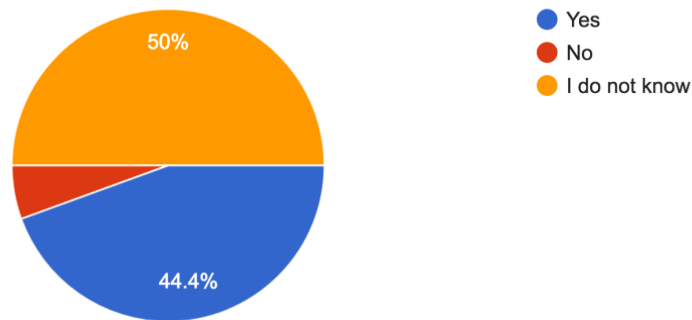


Figure 14: Results to the question whether location information is used for personal advertisements.

We asked the participants whether location information is used to provide personalized advertisements. The correct answer would be “Yes”. The results depicted in Figure 14 show that the majority of the participants could not answer this question correctly. Analogously, as it can be seen in Figure 15, when we asked the participants whether their data is processed outside of the EU for which the correct answer would have been “Yes” as well, one half of the participants was not able to find the right answer. This is a clear usability issue, that needs to be addressed. It seems that the various charts are not all well-suited for the visualization of all necessary information. Their interpretation seems to overwhelm the participants.

Does the site send your data to processors outside the EU?

18 responses

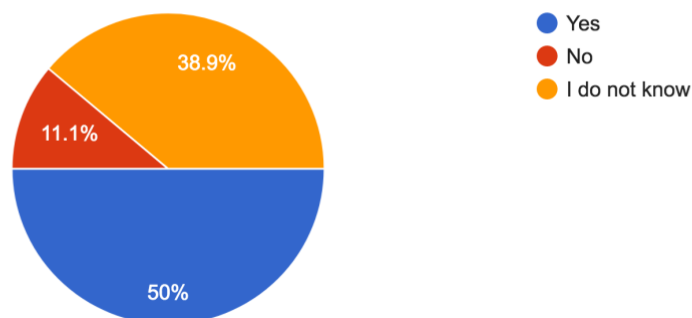


Figure 15: Results to the question whether personal data is processed outside of the EU.

How many policies are there for the application?

13 responses

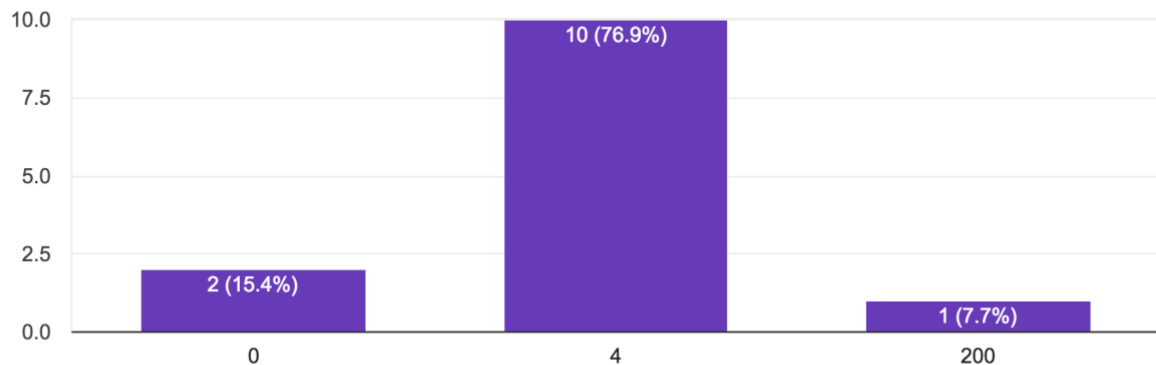


Figure 16: Answers to the question how many policies are defined by the controller (number of participants on the y-axis and number of found policies on the x-axis).

The last specific question with regard to the YouShop scenario was for users to find out how many policies are specified by the controller and which they must have consented to in order to use the service. The results are given by Figure 16. Unfortunately, for 8 participants the correct answer could not be found out, since the backend (from which the policies are loaded) was not reachable during the time of the experiment. However, the other participants were able to find the correct number of policies.

The following four questions were asked to get rather general impressions from the participants about the privacy dashboard. We asked the participants, whether they were able to find information fast, whether the interface is intuitive, whether they like the visual appearance of the dashboard, and if they find the privacy dashboard helpful. The results can be seen in Figure 17, Figure 18, Figure 19, and Figure 20.

I can find the information I want to know about very fast.

18 responses

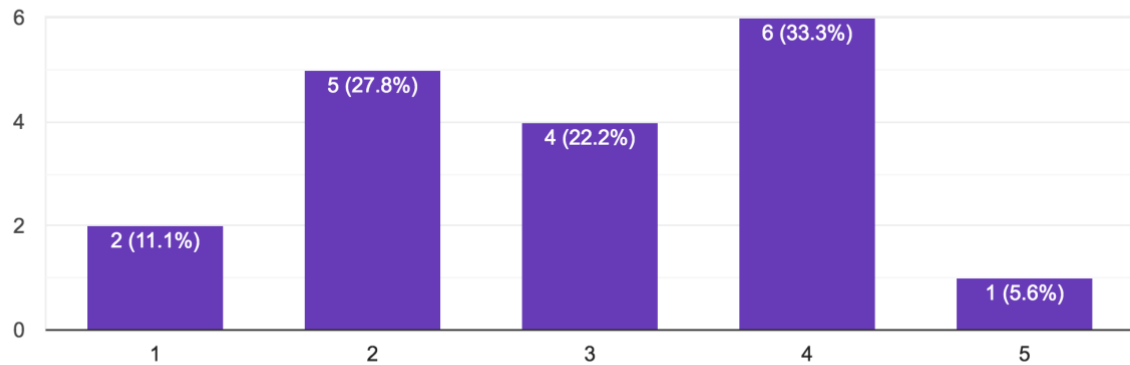


Figure 17: Assessment of the privacy dashboard's efficiency of presenting information in a user-friendly way (0 = completely disagree and 5 = completely agree).

I have no idea how to use it when I first saw the user interface.

18 responses

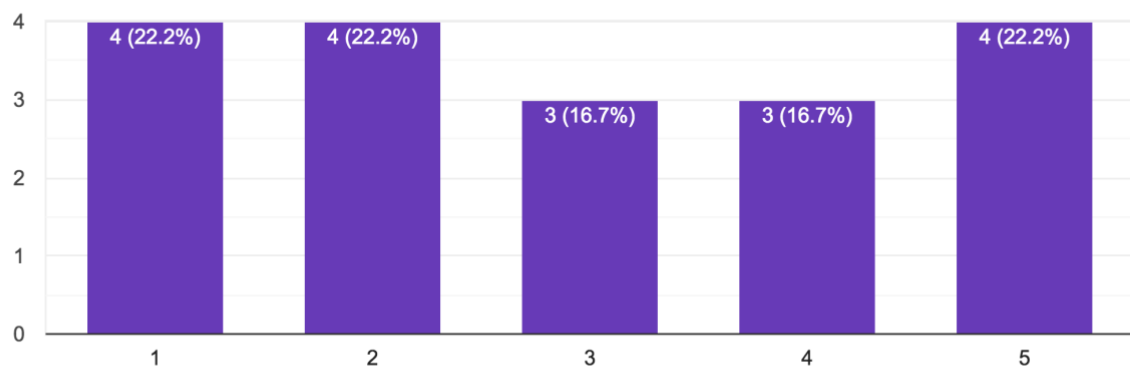


Figure 18: Assessment of how intuitive the participants found the privacy dashboard (0 = completely disagree and 5 = completely agree).

I like the way how data is demonstrated.

18 responses

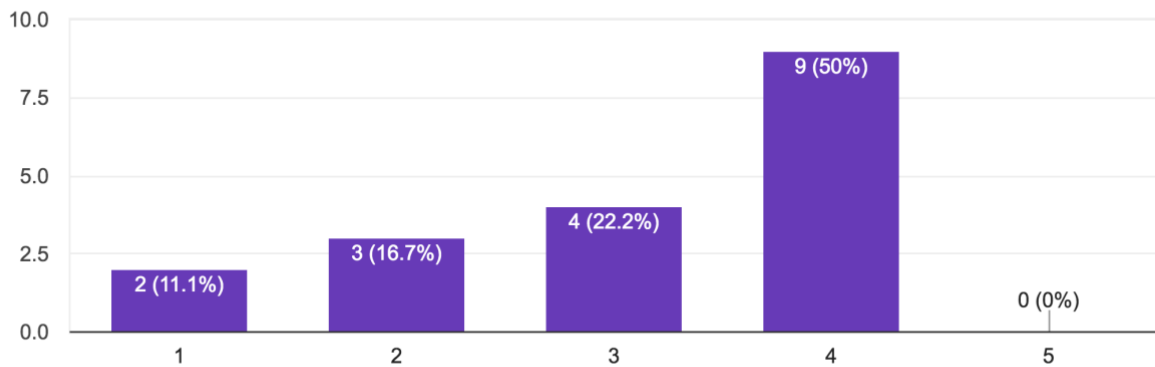


Figure 19: Assessment of the privacy dashboards visualization capabilities (0 = completely disagree and 5 = completely agree).

The dashboard is very helpful for me to handle my privacy.

18 responses

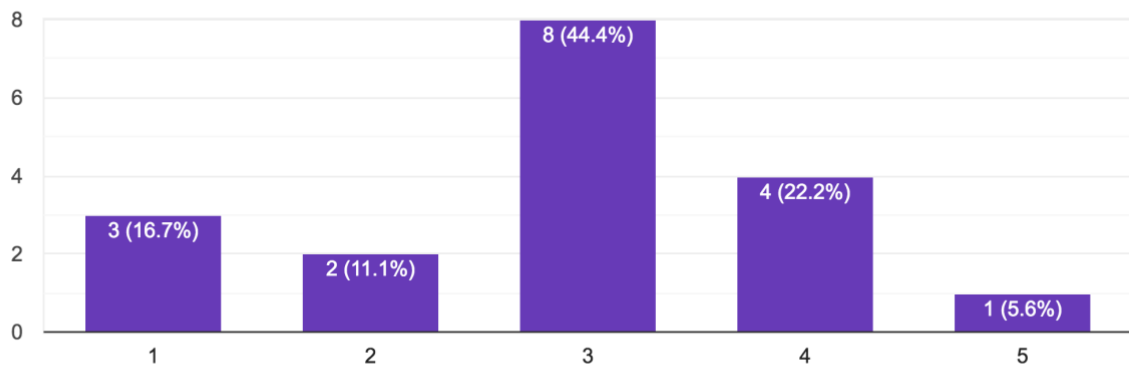


Figure 20: Assessment of the privacy dashboard's suitability to assist users in protecting their privacy (0 = completely disagree and 5 = completely agree).

Answers to the last four questions show, that the participants of the user study have rather mixed feelings about the privacy dashboard. This is also reflected by the general comments they gave, which are presented below:

<i>"I would appreciate categories in order to cluster topics according to their severity"</i>
<i>"The interface is rather confusing, it is difficult to interpret graphs. The labels of graphs kept changing creating confusion as to what they related to. A key for the labels in the type of processing graph would be useful for understanding what each type of processing entailed."</i>
<i>"You can make it more straightforward to represent the data!"</i>
<i>"The Dashboard was broken and didn't show specific data categories. Most of them were just labelled "data"."</i>

<i>“The UI is not user friendly. “</i>
<i>“Interface could be better/simpler “</i>
<i>“Comment: It is not intuitively clear what is possible to do (tabs, clicks) “</i>
<i>“Why does it move? Make it stop! “</i>
<i>„The graphics are not complete; thus, some questions cannot be answered. The timeline is rather confusing, the moving graphics however are rather good. “ [Freely translated from German. Original text: „Die Grafiken sind nicht komplett, dadurch sind die Fragen nicht beantwortbar teilweise, die Timeline ist etwas unübersichtlich, die bewegten Grafiken aber an sich ganz gut „]</i>

4.2.4 Conclusion

The results of the conducted user study clearly show that the current state of the privacy dashboard is not user-friendly. The participants struggled to interpret the information provided by the privacy dashboard and, based on this, assess their data privacy. Some participants highlighted the fact that it only shows “labelled” data, which apparently does not match their expectation. Also due to the technical circumstance that a stream of events is consumed, the graphs were constantly changing, which confused one participant completely (while another one really liked it). The identified issues will be addressed in the final release **D4.5 - Transparency dashboard and control panel release final release**, which is due in M34.

5 Consent control interface

In this chapter, we first describe our exemplifying use case scenario from **D1.3 Policy, transparency and compliance guidelines V1**, the first version of the consent request UI and its usability evaluation results from **D4.2 Usability testing report V1**. Then we provide information about the second interactive wireframe for the consent request and the results of its usability evaluation. At the end of the section, we provide details on our third improved wireframe for the consent request and how it was evaluated by the participants of our third usability evaluation.

5.1 Introduction

Before discussing the second and the third versions of the interactive wireframe for the consent request and their usability evaluations, let us recall the use case scenario that our wireframes are based on, the functionality of the first interactive wireframe, its usability evaluation process and the evaluation results.

5.1.1 Use case scenario

For the development of our interactive wireframes for the consent request we used the exemplifying use case scenario introduced in **D1.3 Policy, transparency and compliance guidelines V1**:

Sue buys a wearable appliance for fitness tracking from BeFit. She is presented with a dynamic informed consent request, comprised of a data usage policy that describes which data shall be collected, why they are collected, how they will be processed, stored and shared in order to give her fitness-related information.

For the purpose of our research and analysis we made the use case more specific by adding the exemplifying concrete data flow (see Figure 21) where we describe what data are collected by BeFit for what purpose and sub-purpose, where the collected data are stored and for how long, how those data are processed, what data are shared with third parties and what third parties are involved.

We would like to stress that our current use case includes only the initial consent request (i.e., before the data subject starts using the device). In future, we could expand the use case to include situations where the consent requests are contextualized, incremental and distributed over time (see deliverable **D1.6 Legal requirements for a privacy-enhancing Big Data V2**).

5.1.2 First interactive wireframe for the consent request

In **D4.2 Usability testing report V1** we provided a detailed description of the first version of the interactive wireframe for BeFit's consent request (see Figure 22). To make our wireframe more realistic and more suitable for the usability evaluation, we developed a fully functional online version⁵.

⁵ BeFit | Consent Request. <https://cr-wizard-en.firebaseio.com/wizard>, last accessed: 13/03/2019.

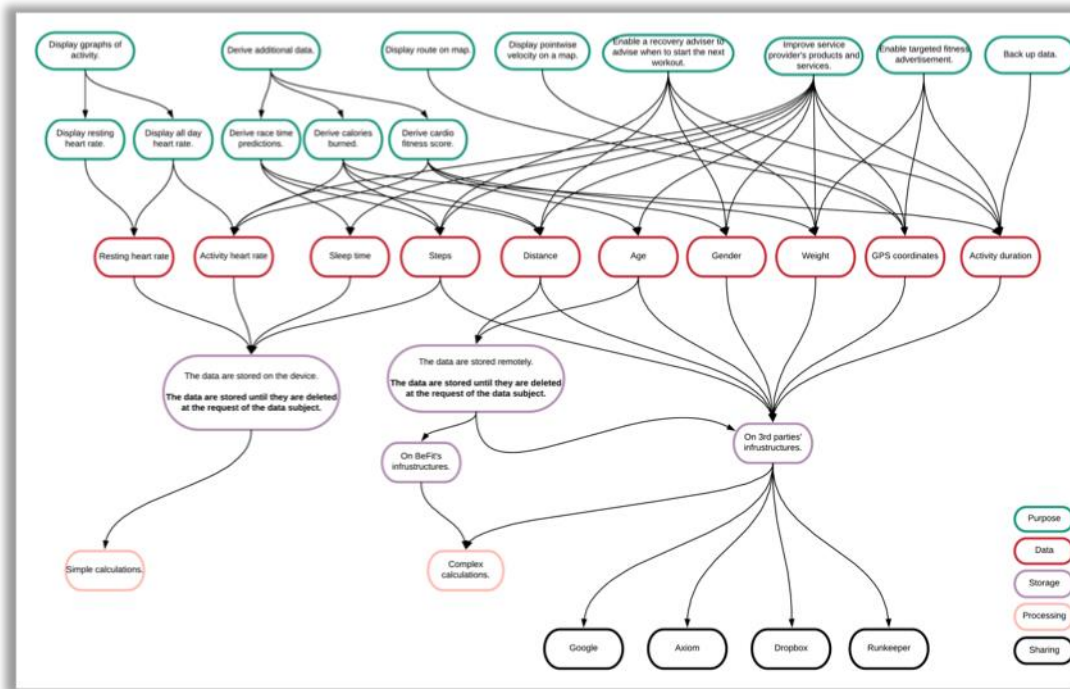


Figure 21: The information that must be presented to the data subject in BeFit's consent request.

While creating this online version we followed Jakob Nielsen’s usability heuristics for user interface design⁶. The online wireframe enables participants to give their consent from any place comfortable for them, making our usability evaluation more realistic.

Our wireframe provides the following features.

Categorization. We grouped information according to five categories, namely purpose, data, storage, sharing and processing. This grouping is realized in the form of tabs (see Figure 22 (1)). To support the visualization, in addition to the name of the category on the tab, we added icons for each category.

Customization. The most important feature of our first version of the consent request UI is the full customization of data subject’s consent. The user can fully adjust their consent specifically to their wishes. Our consent request gives the possibility to review information or give consent according to five categories mentioned in the categorization feature above. The user is given a possibility to drill down a concrete path and agree only to that path. This means that the data subject can also give permissions to process only specific data categories for chosen purposes, etc. The drill down feature is implemented by placing clickable icons of possible drill-down options near each item in the category/tab list (see Figure 22 (2)). The unique path, created by drill-down process, is displayed and can be navigated in the breadcrumb under the tabs (see Figure 22 (3)). The users give their consent just by selecting checkboxes (see Figure 22 (2)) that correspond to their preferences.

Revocation. The user can withdraw their consent by removing the selection in any checkbox at any time.

Understandability. To increase understandability and ease of use of the consent request we are using plain language and standard icons for the content. To help the data subject understand the implications of their consent, our consent request is supported by a graph (see Figure 22 (4)).

⁶ 10 Heuristics for User Interface Design: Article by Jakob Nielsen. <https://www.nngroup.com/articles/ten-usability-heuristics/>, last accessed: 06/12/2018.

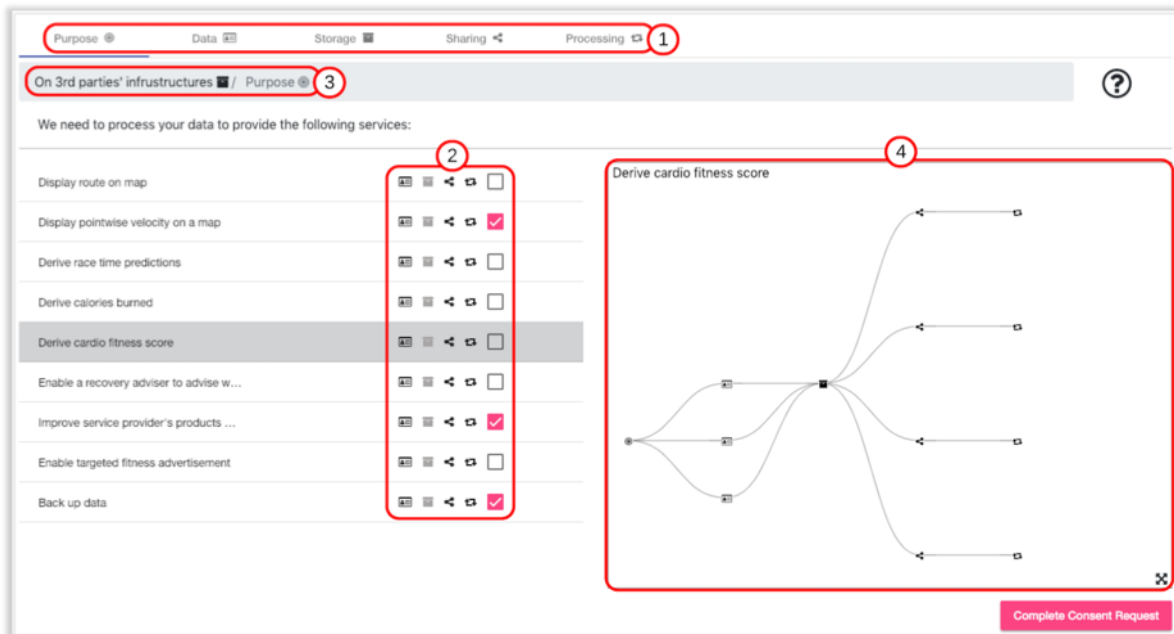


Figure 22: The wireframe of the first version of the consent request UI. (1) Tabs. (2) Drill down. (3) Breadcrumb. (4) Graph.

Summary. After users finish consenting (by clicking “Complete Consent Request” button), they are presented with an overview of all the information that he or she gave his or her consent to be processed by BeFit.

5.1.2.1 Usability evaluation

We checked the usability of our first UI for consent request by conducting a usability evaluation. For the evaluation we selected a think aloud method (van Someren 1994, Seidman 2006, Charters 2003) where we asked our participants to think aloud when testing the UI and record their screen as well as their spoken thoughts.

Twenty-seven participants, who were between 16 and 35 years old, took part in our usability evaluation. We targeted this segment of the population because the imaginary persona (Sue) in our use case was a student and the first UI was developed considering our persona.

Before the actual UI testing, the participants were asked to imagine themselves buying BeFit’s wearable appliance for fitness tracking. As a second step they were presented with BeFit’s instructions. After the participants read the instructions, they were asked to activate the device and give their consent for the processing of their data by BeFit. When the participants clicked the “Activate” button, they were redirected to a short user guide. Then the participants were forwarded to the application prototype for the actual testing. In the beginning the participants completed a set of predefined tasks of giving and withdrawing consent. After this exercise, the participants were asked to just give their own consent, as they would have done this, if they bought the BeFit smart watch. At the end of the assignment each participant filled in a questionnaire providing us with their demographic data as well as their impression of our consent request UI. The results of the evaluation are described in detail in **D4.2 Usability testing report V1**. The short overview of the results is presented below.

5.1.2.2 Evaluation Results

In general, the participants were overwhelmed with the consent information because they needed to read and understand all the details. When we asked users if they were overall satisfied with the

consent request, 44% of the participants reported dissatisfaction (11% - very dissatisfied, 33% - somewhat dissatisfied) with the consent request. 15% of the users remained neutral towards the consent request, 30% were somewhat satisfied and 11% were very satisfied with our UI. However, the question “*how well the consent request meets your needs for privacy policy representation?*” received only 15% of negative answers. Most of the users selected somewhat well (41%), very well (29%) or extremely well (15%) as their answers.

When asked to assess the time it took to give or withdraw the consent, almost half of the participants (48%) answered that it took them *too long* to give or withdraw the consent. 22% selected *too long, but it was worthwhile* as their answer. For the rest of the users it took either *less time* (11%) or about the *right amount* of time (19%).

The users were prompted to select adjectives that they would use to describe the UI they were testing. As we expected a lot of the users (18 out of 27) found the UI *complex* and the whole process *time consuming*. Fifteen participants found the consent representation to be *confusing*. Apart from the negative adjectives, we also received some positive feedback. Nine participants described the UI as being *organized*, eight as *effective*, seven as *innovative*.

When answering open questions, the respondents mentioned that they found the graph functionality very useful and they liked the summary in the end of the process of giving their consent. A lot of the users highlighted that they liked flexibility and customization features. Some participants replied that they liked the readability of the consent. Some users mentioned they found the division of information into tabs very good, because it provided some structure and contributed to understandability.

The participants named four features that were the easiest for them to use, namely the *graph*, the *summary*, *tabs* navigation and structure, as well as giving and withdrawing consent by clicking on *checkboxes*. The hardest part was not to be lost in all the information that was provided to the users. A lot of them mentioned that it was the hardest to keep all the information in mind.

Since a lot of the participants said that they were overloaded with the information, they suggested *shortening* or *simplifying the information* that is presented to the user. Some users suggested simplifying the customization by offering *fewer options* to choose from. The respondents also suggested using *color-coding* for UI simplification.

Based on the usability evaluation results, we developed two improved versions of the UI. We describe the updated UIs and their evaluation results in the chapters below.

5.2 Second interactive wireframe for the consent request

We developed a second UI prototype taking into account the evaluation results of the first version. Since the graph functionality was well received by the users in our usability evaluation, we decided to use the graph as the basis for our next version of the consent request UI. The second version of the UI is depicted in Figure 23. For the purpose of the second usability evaluation we developed an online prototype with two localizations: English⁷ and German⁸. As before, we used Angular Material⁹ and D3.js¹⁰ for the front-end development of the online version and Firebase¹¹, with its real-time database and hosting, for the server side.

The second version of the UI prototype incorporated the following features of consent request: categorization, customization, understandability, revocation.

Categorization. The participants of the first UI evaluation liked the categorization of the consent information into purpose, data, storage, processing and sharing in the previous UI, so we kept this categorization in the second version of the UI.

Customization. The users also highly appreciated the customization and the flexibility of the consent request. However, they expressed their frustration with too many options. In our second UI prototype we retained the customization feature, but we reduced the options by presenting users with the list of available device functionalities and providing a possibility to browse just the functionalities by simply clicking on them (see Figure 23(1)). All the data processing that is required for the selected functionality is represented as a graph (see Figure 23(2)) showing the connections between data categories. If there are any optional items in the graph, they are highlighted with the clickable dashed line in the graph path. After the selection, the dashed line becomes a solid one. If the data subject accepts the offered data processing for the functionality, the corresponding functionality is moved from the "Available Functionality" column to the "Accepted Functionality" column (see Figure 23(3)).

Understandability. From an understandability perspective, the participants of the usability testing positively evaluated the way the consent request was formulated. Since they liked the shortness, the plain language and the icons, we reused the consent text from the first version of the prototype. Every user action is backed up by feedback. In the second prototype we added color-coding to the graph (see Figure 23(4)), as it was suggested by many participants in the usability evaluation. A summary feature was also included in the second UI version. The pop-up with a graph-based overview of the data processing, the users consented to, is always available under the "Summary" button.

Revocation. In terms of revocation, our prototype provides the possibility to withdraw consent at any point in time by selecting functionalities in the "Accepted Functionality" column and clicking the "Revoke" button at the bottom of that column.

⁷ <https://concent-request.firebaseio.com/builder>, last accessed: 12/03/2019.

⁸ <https://consent-request-de.firebaseio.com/builder>, last accessed: 12/03/2019.

⁹ Angular Material. <https://material.angular.io/>, last accessed: 06/12/2018.

¹⁰ D3.js - Data-Driven Documents. <https://d3js.org/>, last accessed: 06/12/2018.

¹¹ Firebase. <https://firebase.google.com/>, last accessed: 06/12/2018.

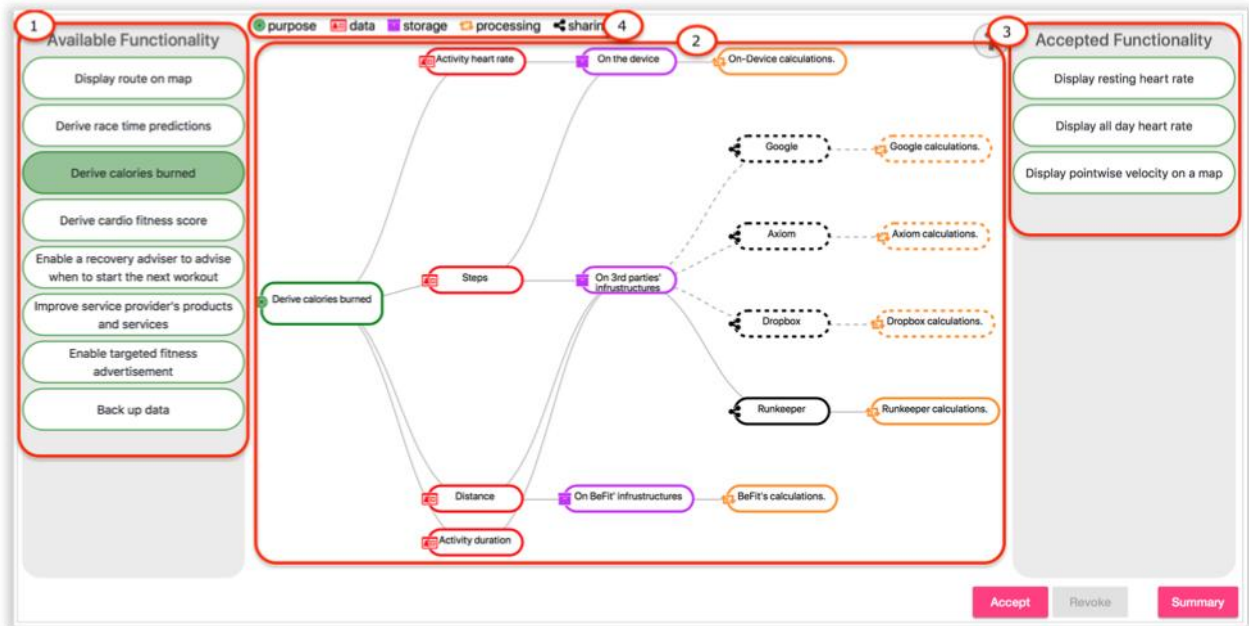


Figure 23: The wireframe of the first version of the consent request UI. (1) Functionalities to select from. (2) Required data processing for the selected functionality. (3) Accepted functionalities. (4) Color-coding by data category.

5.2.1 Usability evaluation

We checked the usability of our second UI for consent request by conducting a usability evaluation. The participants followed the same protocol as in the first evaluation and recorded their screen during the testing. According to Nielsen and Landauer (Nielsen 1993) one needs to test the UI with at least 15 users in a qualitative usability evaluation to identify all usability issues. However, they also argue that a smaller number of participants and higher iterations deliver the same results.

5.2.1.1 Task introduction

Before the actual UI testing, the participants were asked to imagine themselves buying BeFit’s wearable appliance for fitness tracking instead of our imaginary persona - Sue (see Figure 24).

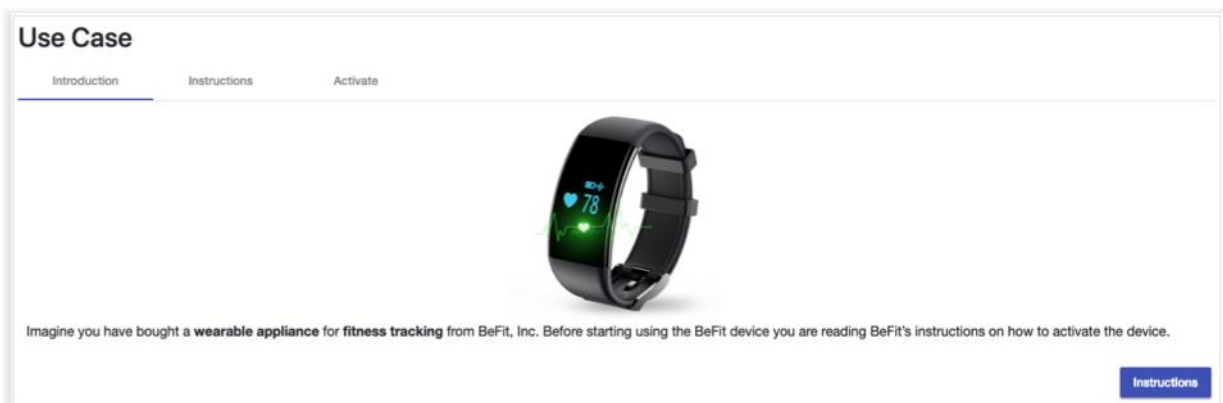


Figure 24: Assignment introduction.

As a second step, they were presented with BeFit’s instructions (see Figure 25).

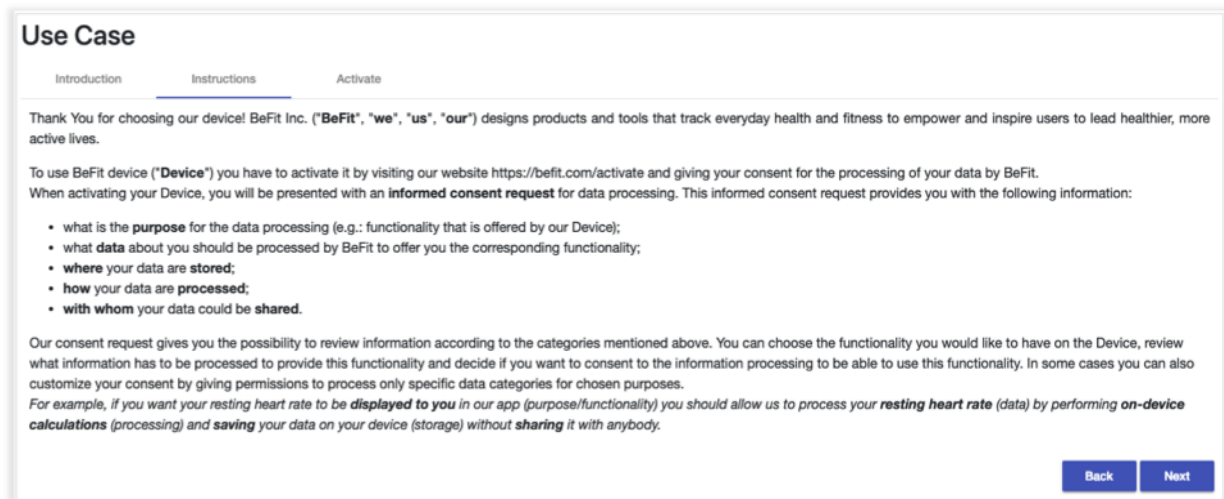


Figure 25: BeFit's instructions.

After the participants read the instructions, they were asked to activate the device and give their consent for the processing of their data by BeFit (see Figure 26).

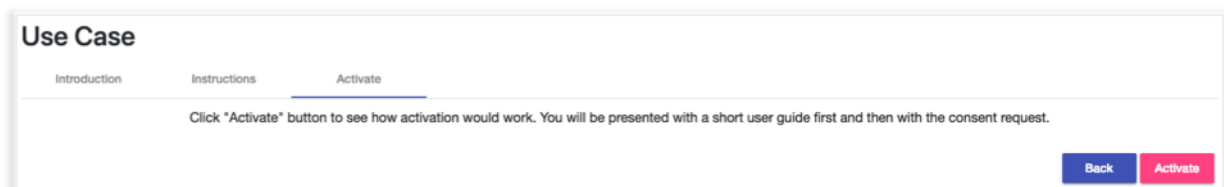


Figure 26: Device activation.

When the participants clicked the “Activate” button, they were redirected to a short user guide (see Figure 27). The user guide explains the functionality and the structure of the application. After reviewing the user guide and clicking “Done” button, the participants were forwarded to the application prototype described in Chapter 5.2 for the actual testing.

5.2.1.2 Testing tasks

In the second usability evaluation the users were given the same tasks as in the first usability testing, albeit slightly adapted to the updated prototype:

1. Please **give your consent**:
 - a. To process your information to **derive how many calories you have burned** by performing **Runkeeper's and Google's calculations**.
 - b. To process your **resting heart rate** to be **displayed to you** in the app by performing **on-device calculations** and **saving your data on your device**.
 - c. To **derive your cardio fitness score** using **Google, Runkeeper and Axiom**.
 - d. To get your **race time predictions**.
 - e. To **back up your data only in Dropbox**.
 - f. To receive **targeted fitness advertisement** only from **Google**.
2. Please **withdraw your consent** to **all the functionalities**.

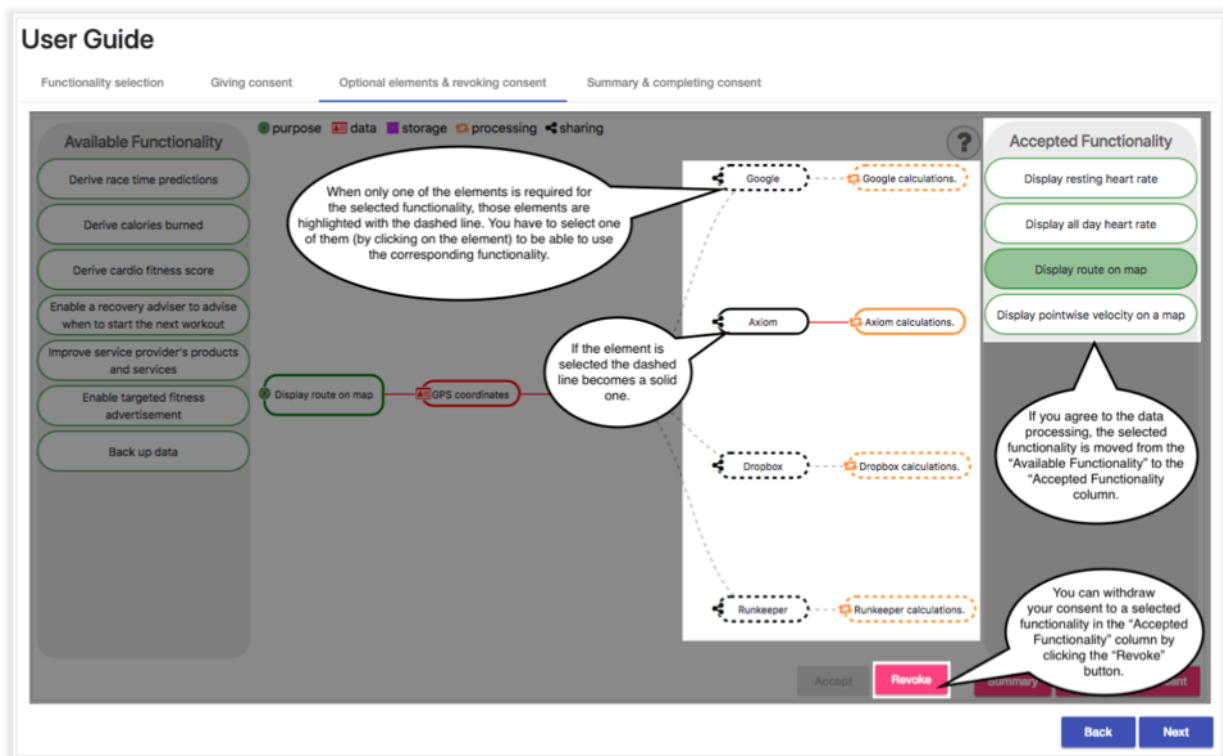


Figure 27: User guide (page “Optional elements and revoking consent”).

After the tasks completion, the users were asked to assess the summary (tree) graph functionality.

*Please have a look at a **summary graph** of your accepted data processing that allows you to use the chosen functionalities.*

Then they were asked to just give their own consent, as they would have done this, if they bought the BeFit smart watch.

*Now, that you’ve got acquainted with how the consent request works, please imagine that you decided to use the BeFit device and give **your** consent according to **your own** preferences.*

During the completion of their tasks the participants took a video recording of their screen and audio of their spoken thoughts. At the end of the assignment each participant filled in a questionnaire providing us with their demographic data as well as their impression of our consent request UI. The questions of both questionnaires can be found in the annexes (see Chapter 8), while the results of the usability evaluation are discussed in the following section.

5.2.1.3 Evaluation Results

The second UI prototype was evaluated by 73 participants. This time we targeted a broader segment of the population. 56% of the participants are male and 44% - female. They belong to different age groups (36% - 26 to 35 years old, 32% - 16 to 25 years old, 16% - 46 to 55 years old, 12% - 36 to 45 years old, and 4% - 55 years old and over). Almost half of the participants (45%) graduated from high school. Others have no degree with some college (14%), Master's (16%) or Bachelor's (15%) degree, and trade, technical or vocational training (6%). The background of 53% of the participants is education. Apart from education, the participants have a wide range of backgrounds: agriculture, environment and related studies (10%), engineering and related technologies (7%), information technology (7%), society and culture (7%), health (6%), management and commerce (5%),

architecture and building (3%), creative arts (1%), natural and physical sciences (1%). 63% of the participants come from Austria. Others come from Bulgaria, Germany, Hungary, Poland, Slovakia, Turkey, and the United States of America. More details on the demographic data can be seen in Figure 28.

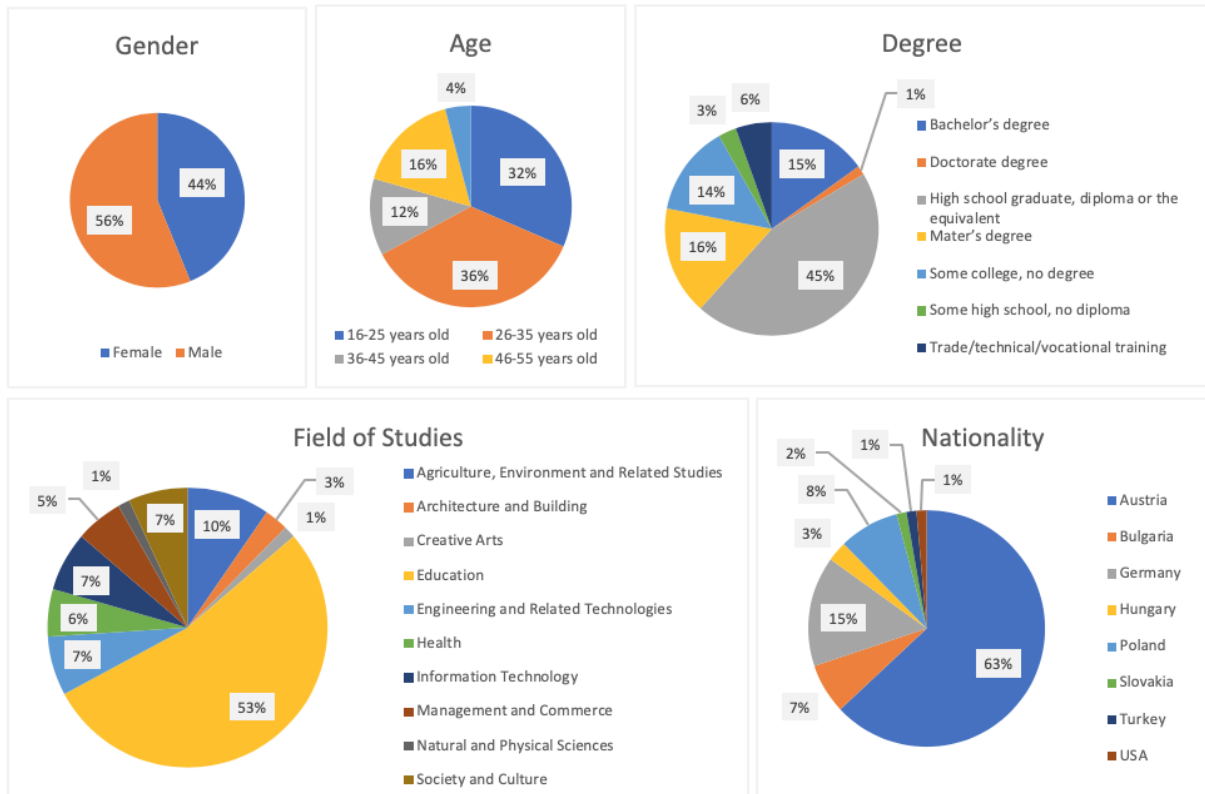


Figure 28: Demographics.

Figure 29 shows that almost all participants rated their Internet surfing skills as competent, proficient and expert. Most of them reported that they usually spend 3 - 6 hours (40%) or 1 - 3 hours (29%) on the Internet per day and preferably use a laptop (53%) or a desktop computer (26%) for the Internet surfing. As can, also, be seen in Figure 29, almost all participants have no difficulty using computers.

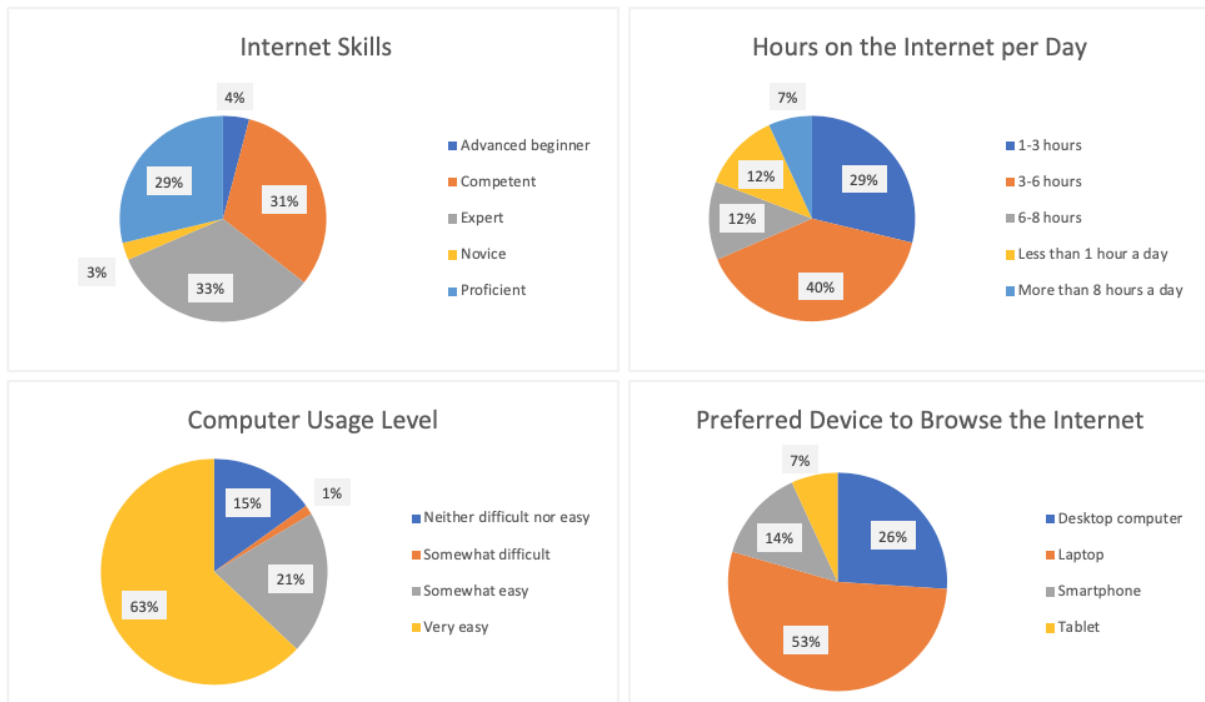


Figure 29: Internet and computer/device usage.

Although the UI prototype was very easy to use, as evidenced in the video recordings, when we asked users if they were overall satisfied with the consent request, 39% of the participants reported dissatisfaction (18% - very dissatisfied, 21% - somewhat dissatisfied) with the consent request (see Figure 30). 36% of the users (31% - somewhat satisfied, 5% - very satisfied) were satisfied with the prototype and 25% of the users remained neutral towards the consent request.

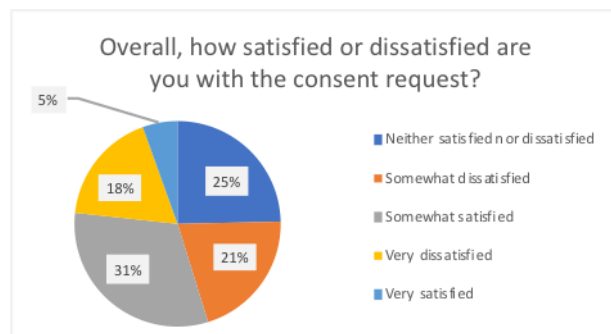


Figure 30: Satisfaction with the consent request.

Two thirds of the participants liked the UI prototype enough to want to recommend it to their friends (see Figure 31). For the 30% of the users it is not likely that they would do so.

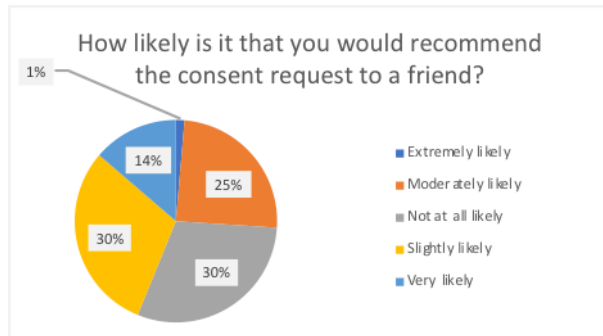


Figure 31: Recommendation of the consent request.

The question “how well the consent request meets your needs for privacy policy representation?” received 37% (26% - not so well, 11% - not at all well) negative answers (see Figure 32). 36% of the participants reported that the way the consent request is presented meets their needs in some way. The others were extremely (7%) and very (20%) satisfied with the representation.

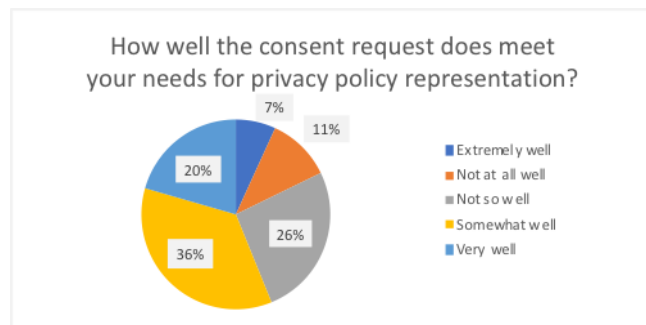


Figure 32: Consent request as privacy policy representation.

The way the users rated the time they spent on the tasks confirms what we observed in the videos (see Figure 33). 38% of the participants were satisfied with the time it took them to complete the tasks and for 15% it took even less than they expected. 19% of the users think that it took them too long, but it was worthwhile. The rest still considered the process to be time consuming.

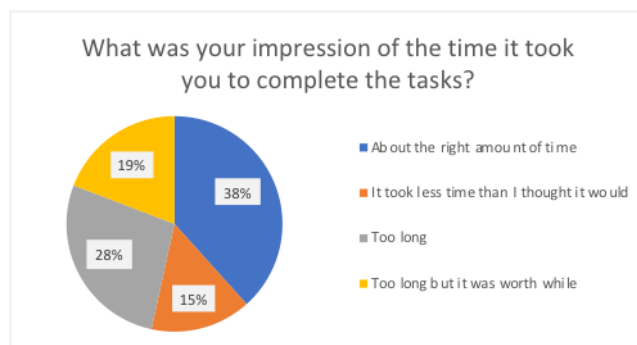


Figure 33: Impression of the time needed for tasks completion.

The users were prompted to select adjectives that they would use to describe the UI they were testing. We used the list of adjectives from Microsoft Desirability Toolkit, developed by Joey Benedeck and Trish Miner (Benedeck 2002). Since the original list consists of 118 words, it is

recommended to shorten and adapt the list¹², which we did in our usability evaluation. The adjectives users selected to describe the UI are listed in Figure 34. The users' interaction in the video left a very good impression about the prototype usability. Surprisingly, users still described the prototype as being "confusing" (40%), "annoying" (33%), "complex" (26%), "frustrating" (18%). From the video analysis and questionnaire answers we can infer that this was caused by the absence of bulk consent withdrawal functionality. Users were first confused and then irritated that they had to repeat the same action. On the other hand, for 15% of the participants the UI was "easy to use", 14% of the respondents considered the UI to be "flexible", 12% - "innovative", and 11% - "effective" and "friendly".

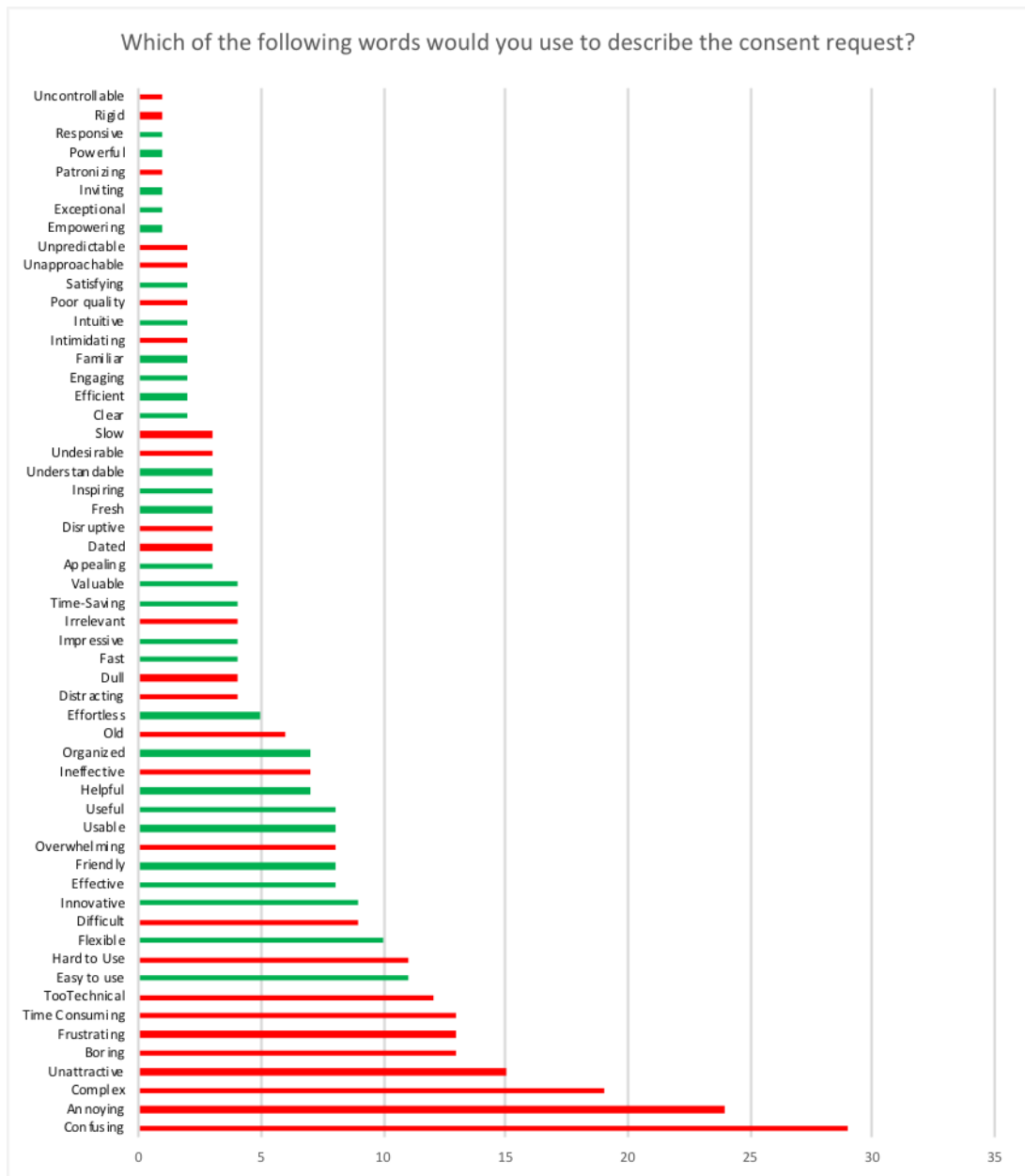


Figure 34: Adjectives that describe the consent request UI.

¹² <https://www.nngroup.com/articles/microsoft-desirability-toolkit/>, last accessed: 06/12/2018.

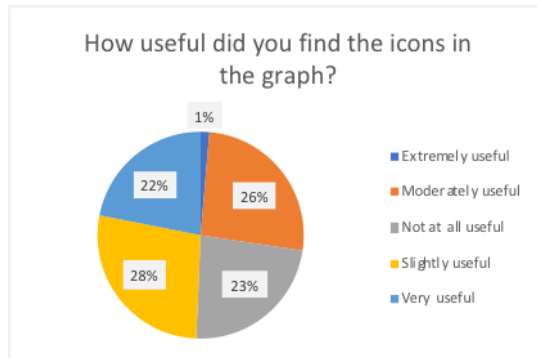


Figure 35: Icon usefulness.

More than two thirds of the participants appreciated having icons in the graph (see Figure 35). 23% of the respondents did not see the need in icons.

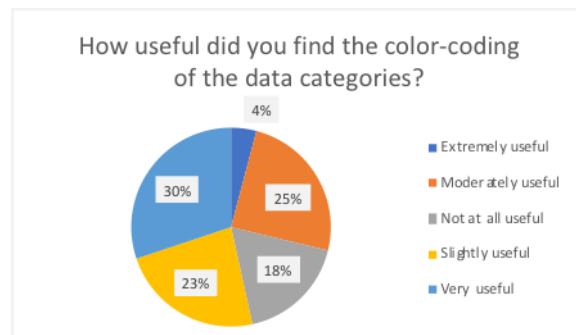


Figure 36: Color-coding usefulness.

The participants positively evaluated the color-coding (see Figure 36). 82% found it useful and only 18% reported that they did not see any usefulness in it.

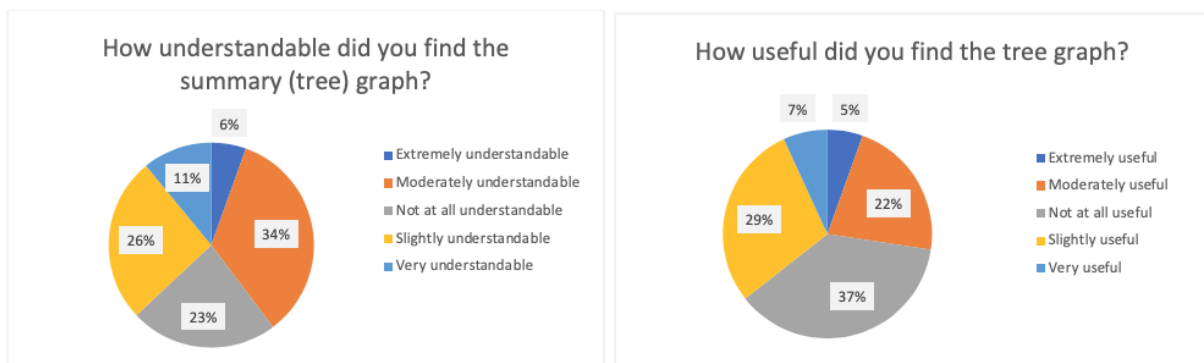


Figure 37: Evaluation of the tree graph.

We asked the participants to answer two questions regarding the tree graph to find out if they understood it and if they found it useful. Figure 37 provides detailed analysis of the received answers. Most of the respondents to some extent (6% extremely, 11% very, 34% moderately, 26% slightly) understood the summary tree graph. 23% of the users did not understand that graph at all. 37% of the participants did not find the tree graph in the summary useful, 29% thought the graph was slightly useful, 22% selected "moderately useful" as their answer. Only a small percentage of the users 7% and 5% found the graph in the summary very and extremely useful respectively.

Apart from the single- and multiple-choice questions, our questionnaire contained open questions. The analysis of the answers to the open questions is presented below.

What did you like most about the consent request in comparison to a traditional consent request?

The respondents named three main points why they liked the second UI prototype better than traditional consent requests. The improved UI is: (i) more understandable (e.g.: *"it was very clear", "it is visual", "the consent request is not long, only few text and symbols for quick processing"*), (ii) provides customization (e.g.: *"it's much better, because it is not just the text to read and then accept everything - you can decide what you accept", "it is good to have a choice and decide what to share"*), and (iii) transparency (e.g.: *"I am more aware that my data is used by so many applications.", "it shows you exactly what you are consenting to."*). We did not receive any negative comments in the answers to this question, however, 2 out of 73 participants wrote that they liked the traditional consent request because it is possible to consent to personal data processing using just a single button.

What was the easiest and the hardest part about using the consent request?

The easiest part for the users was to browse the available functionalities. Some of the participants mentioned that the prototype was in general easy to use after one became familiar with the UI (e.g.: *"the whole prototype is fairly easy, once one has familiarized himself with the options", "I found it a bit complicated at the beginning, but after acquainting myself with the consent, I found it easy to use"*). The hardest part was the fact that the prototype did not allow for the withdrawal of consent for multiple functionalities at once (e.g.: *"the hardest part is that I cannot revoke more functionalities at the same time", "consent withdrawal is time-consuming", "everything had to be removed separately"*). This issue can easily be fixed by adding a feature where the users can select the functionalities in bulk.

What could be done to improve the consent request?

A lot of the participants did not suggest any improvements. They pointed out that they understood the difficulty of the information visualization for the consent request, however they did not know how the prototype could be improved (e.g.: *"I think it is pretty difficult to give a short overview of all the consent information covered on one page, therefore I have no advice", "I would like to have even less text but I understand that the informativeness will suffer, so have no idea how to improve the prototype. It is really difficult"*). For others everything seemed to work well and the prototype did not need any adjustments (e.g.: *"everything was fine", "no improvement necessary", "it is actually quite good"*).

What would you suggest to improve in the summary (tree) graph?

The only issue the users mentioned regarding the summary graph was that the icons were too small (e.g.: *please put bigger icons", "icons are too small", "it would be good to have bigger icons"*).

The evaluation showed that the users did not want to spend extra time on reading information in the consent request. This means, that there is still a need to simplify the customization feature even more. In order to address this issue, the consent request UI could be amended such that the functionalities or purposes for data processing are grouped into more general categories and the consent request allows consenting to a general category but still retains a more granular customization as well as detailed overview of the data processing available on demand. We implemented such a version of a consent request in the third iteration and describe this third interactive wireframe in the chapter below.

5.3 Third interactive wireframe for the consent request

The third version of the UI, that is depicted in Figure 38, simplifies the customization even more, when compared to the second version, in terms of the information that has to be digested at once by data subjects. For the purpose of the third usability evaluation we developed an online prototype with two localizations: English¹³ and German¹⁴. As before, we used Angular Material and D3.js for the front-end development of the online version. Java¹⁵ and PostgreSQL¹⁶ were used for the server side.

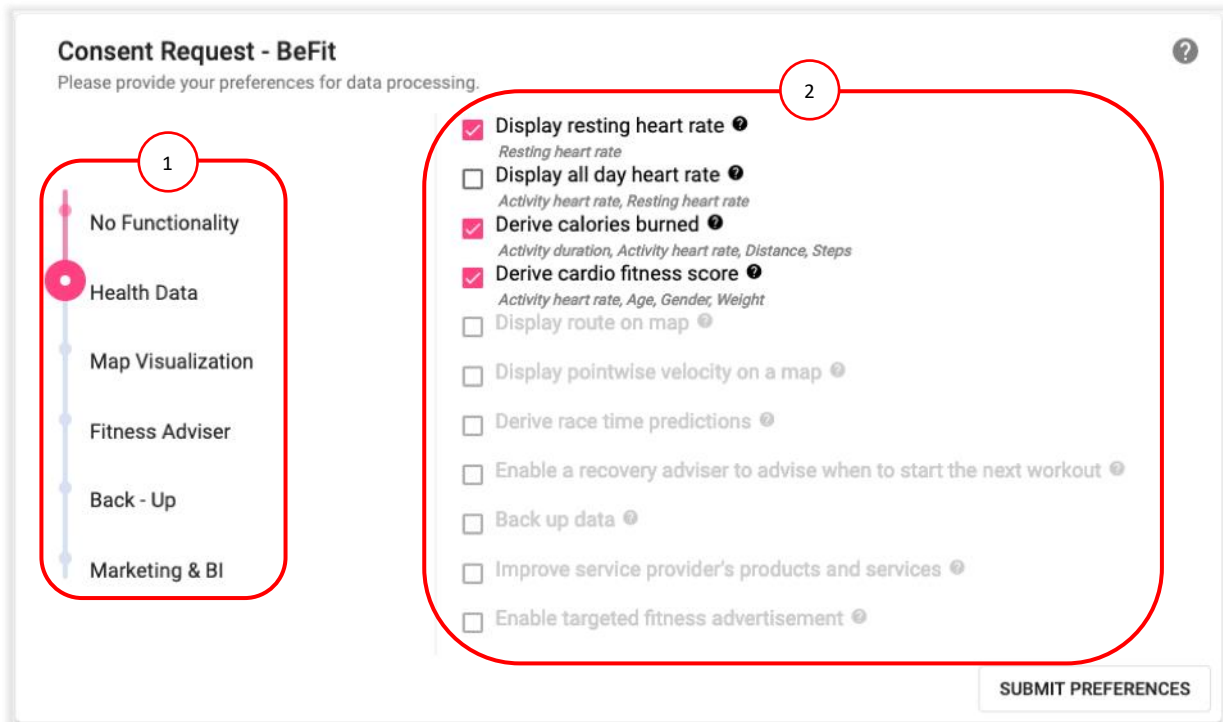


Figure 38: The wireframe of the third version of the consent request UI. (1) Slider. (2) Consent per purpose.

The third version of the UI prototype incorporated the following features of consent request: categorization, customization, understandability, and revocation.

Categorization. In the third UI version we grouped purposes for data processing into more general categories and allowed users to consent to those general categories by using a slider (see Figure 38(1)). The categories are ordered from the most popular (according to the company's statistics) at the top to the least popular group of purposes at the bottom. The participants of the first and the second UI evaluations liked the categorization of the consent information into purpose, data, storage, processing and sharing, so we kept this categorization in the third version of the UI in the overview graph (see Figure 39).

¹³ <http://cr-slider.soft.cafe/en/>, last accessed: 12/03/2019.

¹⁴ <http://cr-slider.soft.cafe/de/>, last accessed: 12/03/2019.

¹⁵ <https://go.java/index.html?intcmp=gojava-banner-java-com>, last accessed: 12/03/2019

¹⁶ <https://www.postgresql.org/>, last accessed: 06/12/2018.

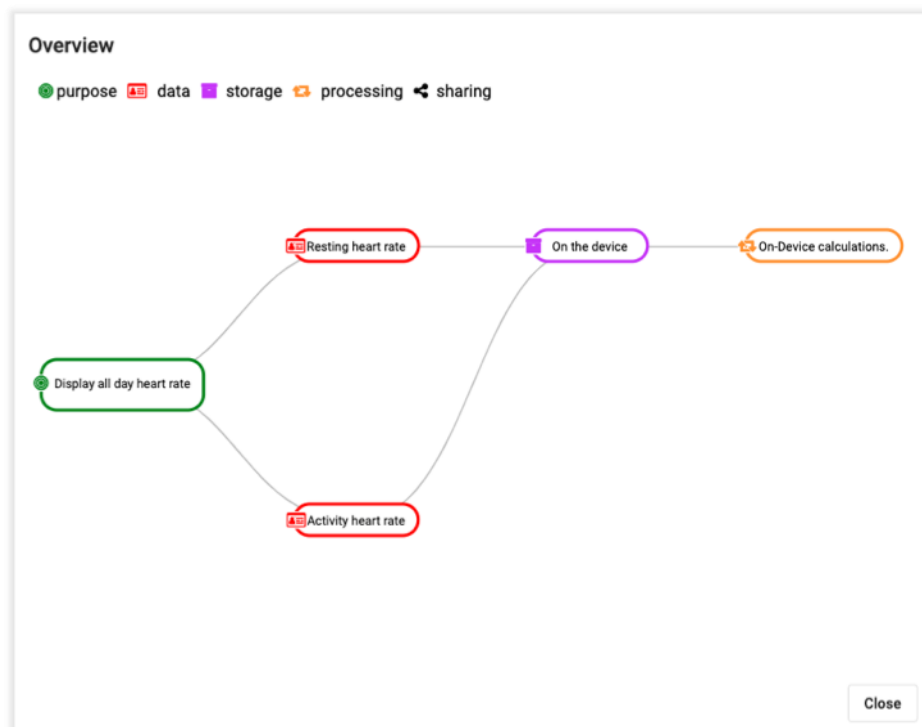


Figure 39: Example of an overview graph for “display all day heart rate” purpose.

Customization. The users also highly appreciated the customization and the flexibility of the consent request. However, they again expressed their frustration with too many options. We reduced the options by presenting users with the list of more general functionality categories and providing a possibility to browse them by just sliding the pointer up and down. We still retained a more granular customization (see Figure 38(2)), where users could adjust their consent by selecting or deselecting checkboxes near each purpose.

Understandability. From an understandability perspective, the participants of the first and the second usability evaluations positively evaluated the way the consent request was formulated. Since they liked the shortness and the plain language, we reused the consent text from the second version of the prototype. Every user action is also backed up by feedback. For those users, who would prefer a more detailed overview of the data processing, we have the detailed overview available, on demand, upon clicking on “?” near each purpose.

Revocation. In terms of revocation, our prototype provides the possibility to withdraw consent at any point in time by deselecting a correspondent checkbox.

5.3.1 Usability evaluation

We tested the usability of our third UI for consent request by, again, conducting a usability evaluation. The participants followed the same protocol as in the first and the second evaluations. They were thinking aloud and recorded their screen during the testing.

5.3.1.1 Task introduction

Before the actual UI testing, the participants were presented with a use case and asked to imagine themselves buying BeFit’s wearable appliance for fitness tracking (see Figure 40).

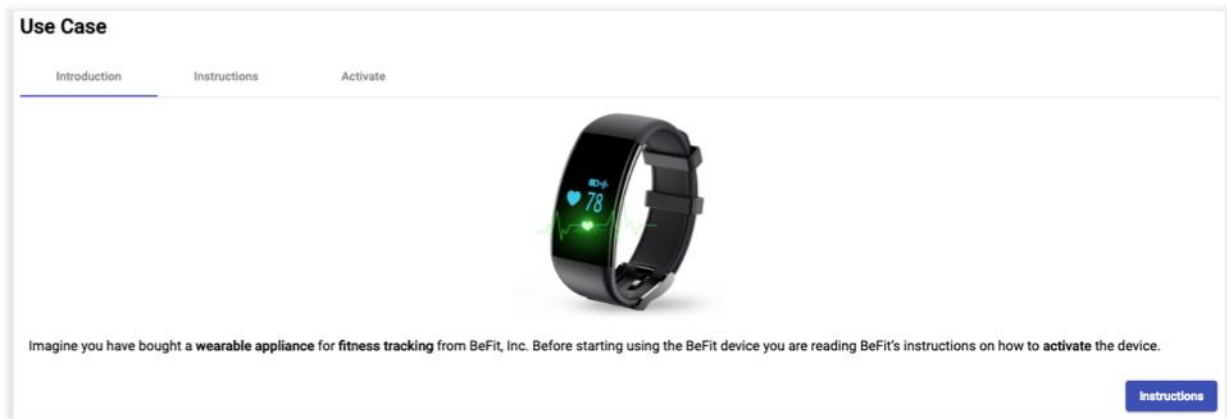


Figure 40: Assignment introduction.

Then, BeFit's instructions (see Figure 41) were shown to the participants.

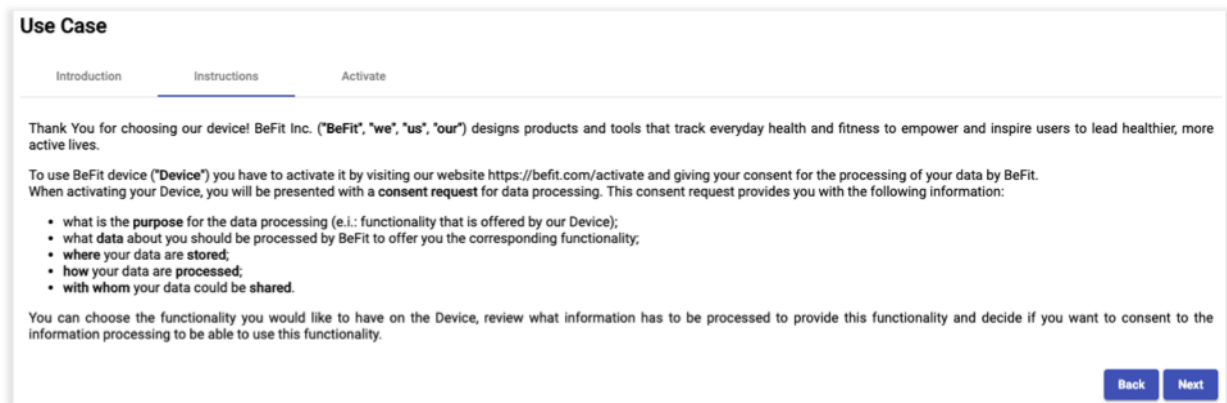


Figure 41: BeFit's instructions.

After the participants read the instructions, they were asked to activate the device and give their consent for the processing of their data by BeFit (see Figure 42).

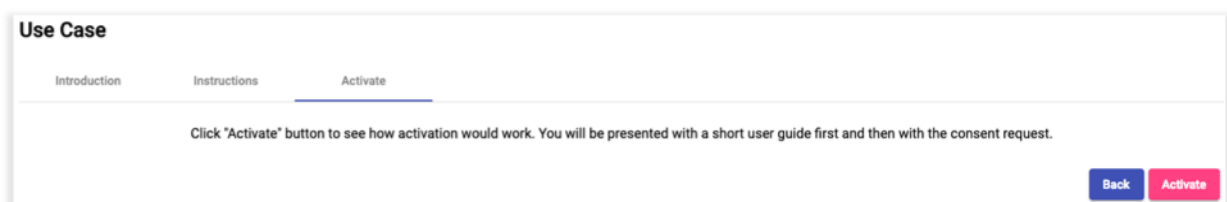


Figure 42: Device activation.

When the participants clicked the "Activate" button, they were redirected to a short user guide (see Figure 43). The user guide explains the functionality and the structure of the application. After reviewing the user guide and clicking "Done" button, the participants were forwarded to the application prototype described in Chapter 5.3 for the actual testing.

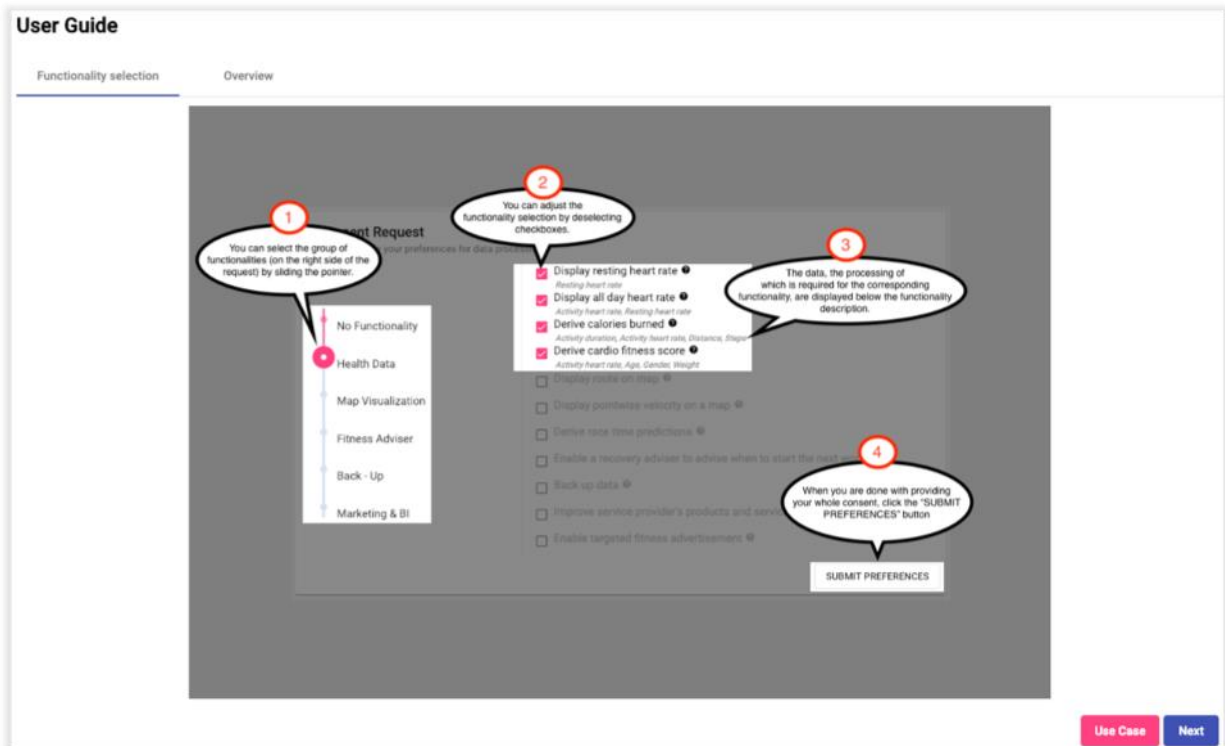


Figure 43: User guide (page “Functionality selection”).

5.3.1.2 Testing tasks

In the third usability evaluation the users were given similar tasks as in the second usability testing. The tasks had to be adapted to the updated prototype:

1. Please **give your consent**:
 - a. To process your information to have **health data** on your device.
 - b. To process your information for your activities to be **visualized** on a map.
 - c. To enable the **fitness adviser**.
 - d. To turn on the **back-up** of your data.
2. Please **withdraw your consent**:
 - a. To **derive your cardio fitness score**.
 - b. To **derive your race time predictions**.
 - c. To **back up** your data.
3. Please **withdraw your consent to all the functionalities**.

Then they were asked to assess the overview (tree) graph functionality.

Please have a look at the **detailed overview** of the required data processing for the functionality “**display route on map**”.

After this exercise, the participants were asked to just give their own consent, as they would have done this, if they bought the BeFit smart watch.

Now, that you’ve got acquainted with how the consent request works, please imagine that you’ve decided to use the BeFit device and give **your** consent according to **your own** preferences.

At the end of the assignment each participant filled in a questionnaire where they provided their demographic data as well as their impression of our consent request UI. The questions of both questionnaires can be found in the annexes (see Chapter 8). We discuss the results of the usability evaluation in the following section.

5.3.1.3 Evaluation Results

Thirty-five participants (69% - male, 31% - female) took part in our usability evaluation. The users belong to different age groups (51% - 16 to 25 years old, 23% - 26 to 35 years old, 17% - 36 to 45 years old, 6% - 46 to 55 years old, and 3% - 55 years old and over). Almost one third of the participants (31%) graduated from high school. The other 31% has Bachelor’s degree. The rest have Master’s (14%) degree, no degree with some college (12%), trade, technical or vocational training (6%), doctorate degree (3%), and some high school (3%). 63% of the participants come from Austria. Others come from Bosnia, Croatia, the United Kingdom, Italy, the Netherlands, Romania, and Serbia. More details on the demographic data can be seen in Figure 44.

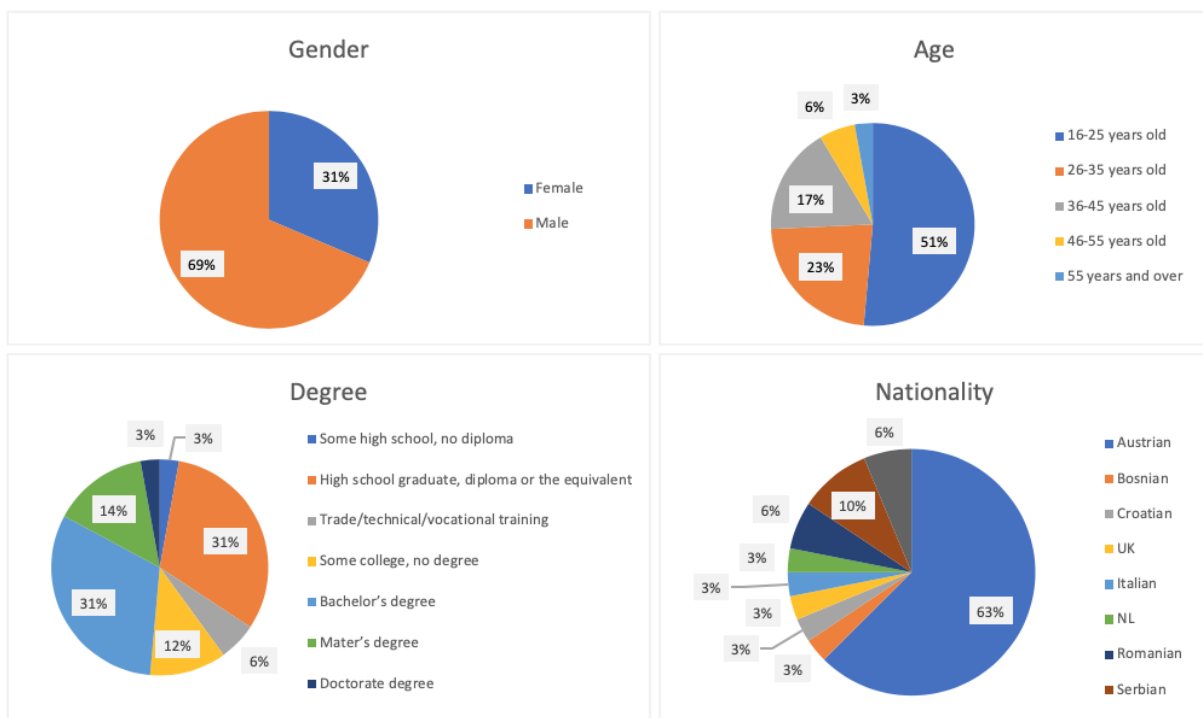


Figure 44: Demographics.

Figure 45 shows that almost all participants rated their Internet surfing skills as competent (43%), proficient (26%) and expert (28%). Most of them reported that they usually spend 3 - 6 hours (43%) or 1 - 3 hours (34%) on the Internet per day and preferably use a laptop (57%) or a desktop computer (23%) for the surfing. As can, also, be seen in Figure 45, all participants have no difficulty using computers.

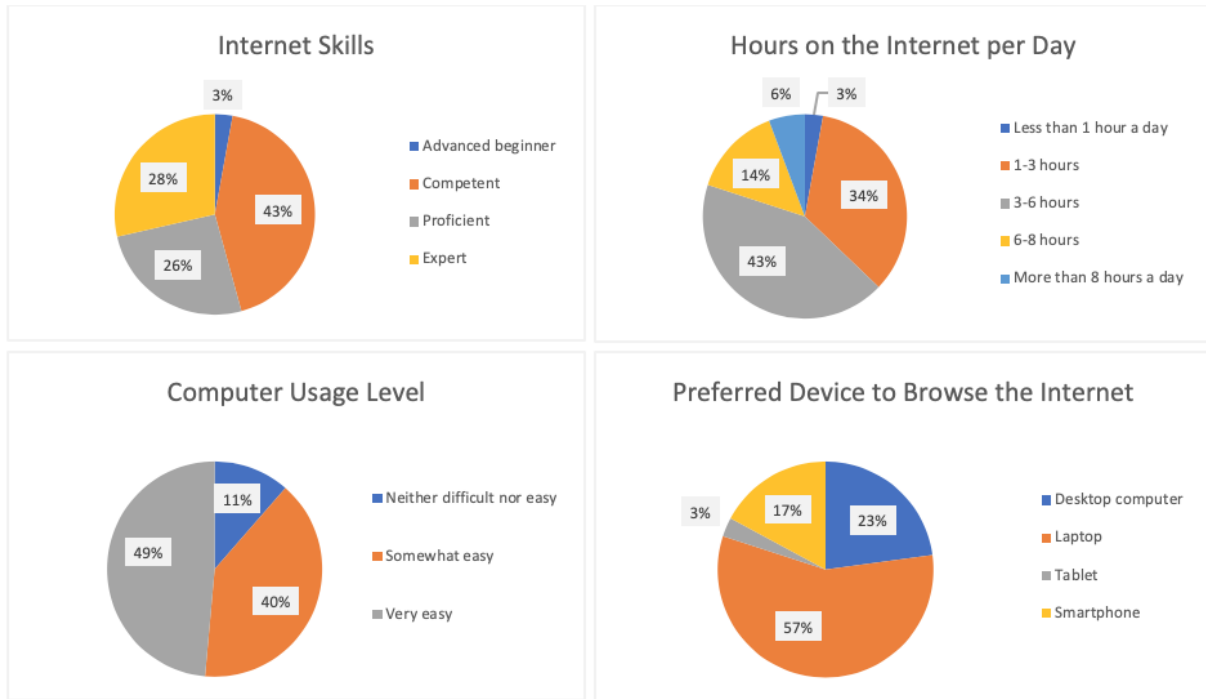


Figure 45: Internet and computer/device usage.

When we asked users if they were satisfied overall with the consent request, 71% of the participants reported satisfaction (51% - somewhat satisfied, 20% - very satisfied) with the consent request (see Figure 46). 20% of the users remained neutral towards the consent request. There were no very dissatisfied users and only 9% were somewhat dissatisfied with our UI.

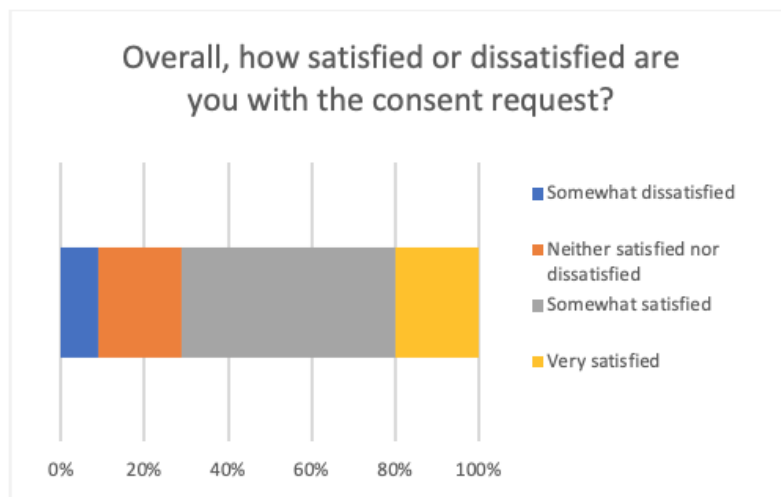


Figure 46: Satisfaction with consent request.

The high overall satisfaction also reflects on the answers to the question about the recommendation of the website with our consent request to a friend (see Figure 47). 40% said that it was very likely that they would recommend the website to a friend and 29% replied that it was moderately likely. 11% of the respondents would slightly likely and 3% would extremely likely advise a friend to use a website with our consent request. 17% of the participants would not recommend it to a friend.

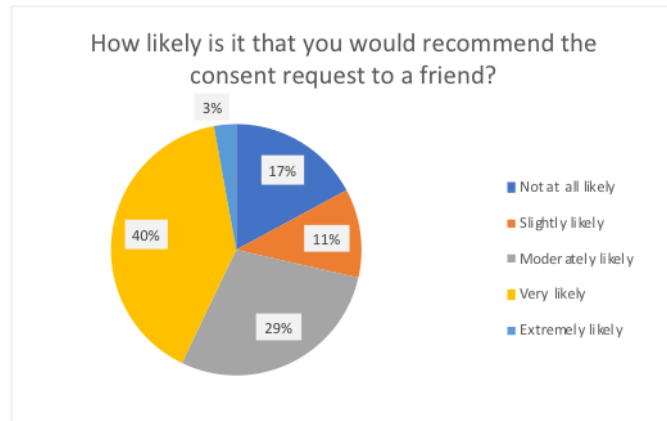


Figure 47: Recommendation of the consent request.

When asked to provide their impression of the time it took to give or withdraw the consent, almost 40% of the participants answered that it took them *about the right amount of time* to give or withdraw the consent (see Figure 48). 29% selected *it took less time than I thought it would* as their answer. 14% reported that it took *too long, but it was worthwhile*. For the rest of the users (17%), it still took too long to give or withdraw the consent.

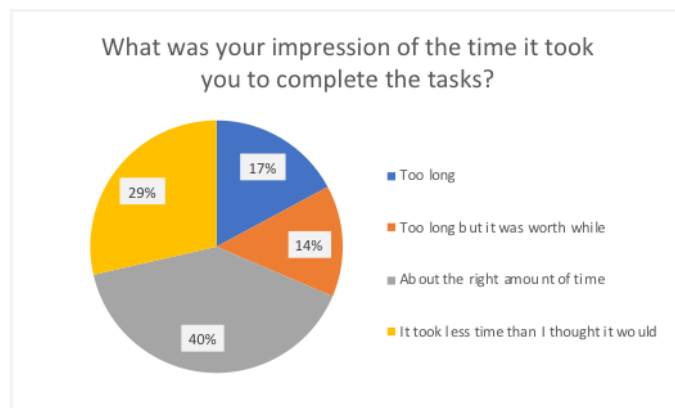


Figure 48: Assessment of the time needed for tasks completion.

The users were asked to select adjectives that they would use to describe the UI they were testing. Here we again used the shortened list of adjectives from Microsoft Desirability Toolkit, developed by Joey Benedeck and Trish Miner (Benedeck 2002). The adjectives users selected to describe the UI are listed in Figure 49. The adjectives that were selected support the results described above. The positive adjectives received most of the participants’ votes. The users found this UI *easy to use, useful, clear, helpful, usable, effective, organized, satisfying, appealing, efficient* and *flexible*. Eight out of 35 participants still found the UI to be complex and time consuming.

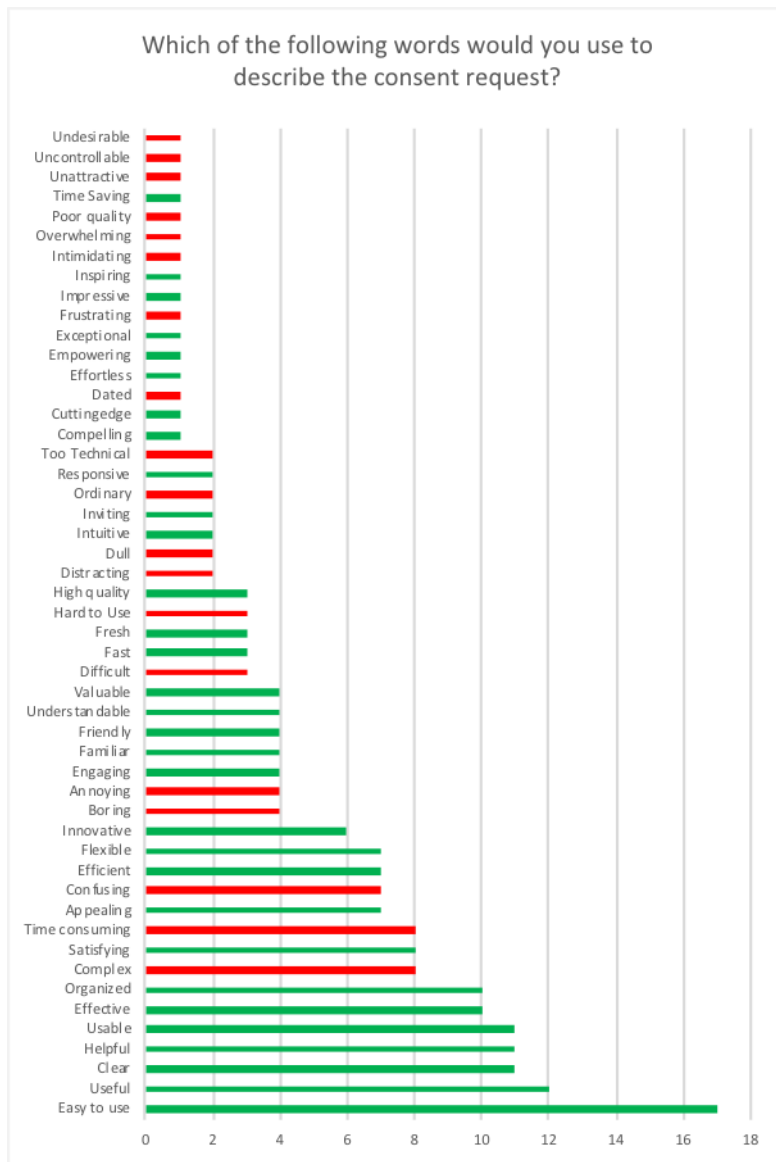


Figure 49: Adjectives that describe the consent request UI.

We asked the participants, if they felt being in control of the processing of their data, when they used our consent request. More than a half of the participants agreed (40% - agree, 17% - strongly agree) that such a consent request gave them control over the data processing (see Figure 50). 23% neither agreed nor disagreed that they felt in control.

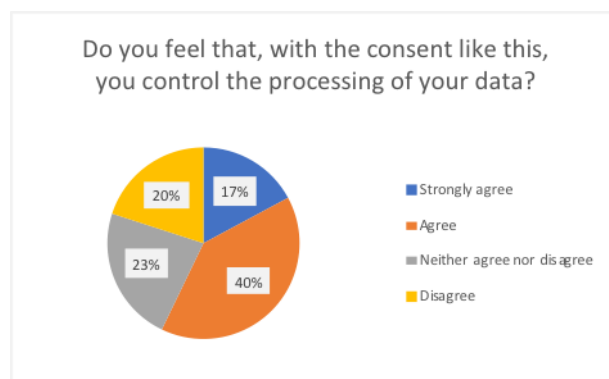


Figure 50: Perception of being in control of the data processing.

20% of the participants did not feel that they controlled the processing of their data. There were no users who strongly disagreed.

The graph that provided an overview of the data processing related to a specific purpose was found to be useful to a different extent by 92% of the users (see Figure 51). 20% found it extremely useful, 23% - very useful, 40% - moderately useful, 9% - slightly useful. Only 8% of the users did not see usefulness in the graph.

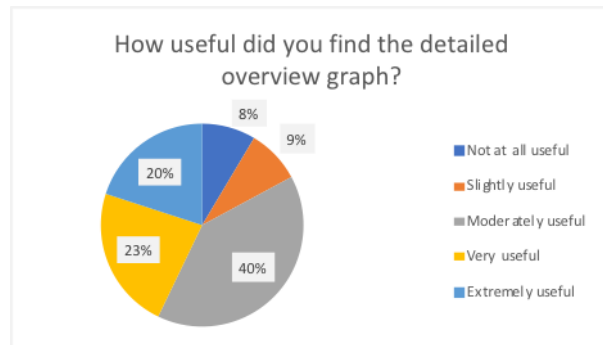


Figure 51: Usefulness of the overview graph.

The participants were asked two questions regarding the design features of the overview graph to find out if they liked the color-coding and the icons used in the graph. 26% of the participants found the color-coding to work extremely well in the graph. Another 26% reported the color-coding to be very useful. This feature was rated as moderately useful by another 26% of the participants. 14% found it to be slightly useful. The rest (8%) did not find color-coding useful. The icons helped 89% of users (37% - moderately, 34% - very, 9% extremely, 9% slightly) to understand the graph better (see Figure 52). For the 11% of the participants the icons were not useful.

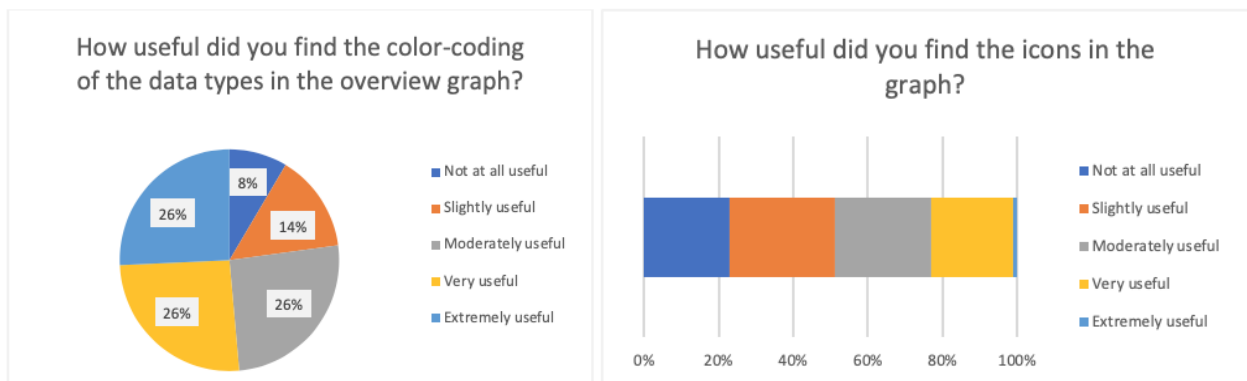


Figure 52: Usefulness of the overview graph features.

What did you like most about the consent request in comparison to a traditional consent request?

The respondents named four main points why they liked the third UI prototype better than traditional consent requests. The improved UI provides: (i) customization (e.g.: “people can specify the consent more after their wishes”, “...more opportunity to decide what happens with the data”, “...the ability to select from a variety of purposes”), (ii) detailed overview of the data processing for each purpose (e.g.: “it gives you more transparency”, “...allows you to get a better image, especially with help of the diagrams for detailed overview, about who and how collects your personal data”, “the graph gave a great overview how the data is processed and with whom it would be shared”), (iii) control over the data processing (e.g.: “...helps control the way the data is used”, “...gave a sense

of authority...”), and (iv) usability (e.g.: *“it is intuitive”, “it is very easy to use”, “it is pleasing to the eye”*).

What was the easiest and the hardest part about using the consent request?

It was very easy for the participants to use this UI (e.g.: *“...it was very clear”, “I did not face any major difficulties”, “there weren’t any specific troubles”*.) A lot of users said that slider on the left side of the UI was the easiest part about using the UI (e.g.: *“the easiest part of this consent form was definitely the slider...”, “the slider is extremely easy to navigate”*). The respondents also highly evaluated the way the UI is organized (e.g.: *“the easiest thing was to understand the logic behind how the different settings are divided”, “I liked the structure very much”*).

What could be done to improve the consent request?

Since users did not have any major problems while using the UI, most of them did not offer any improvements (e.g.: *“since I, literally, had no difficulties in navigating through the UI, I do not have much to say regarding the improvements”, “I like the UI as it is”*). One participant offered to enhance the overview graph with links to the company websites, wherever the company name is mentioned in the graph.

6 Conclusion and outlook

In this deliverable, we presented the results of our evaluations of our designed and developed interfaces, which we documented and discussed. We used Nielsen's Usability Engineering Lifecycle to structure our development process and evaluations. Until now, the privacy dashboard has been tested twice in two different stages and multiple adjustments have been made to improve the usability. However, we found severe usability issues that arose with the implementation of new functionality that needs to be addressed until the final release. The consent control interface has been tested more extensively in three stages with comprehensive questionnaires. The results have been analyzed thoroughly indicating that a good design was found with the last version of the interface.

Further user studies are planned after the submission of this deliverable with respect to the privacy dashboard and the dynamic consent approach. Results will be reported in the **D4.5 - Transparency dashboard and control panel final release**.

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8 Annexes

8.1 Second usability evaluation questionnaire

8.1.1 Demographic Data Questionnaire

1. What is your gender?

- Male
- Female

2. What is your age?

- less than 16 years old
- 16-25 years old
- 26-35 years old
- 36-45 years old
- 46-55 years old
- 55 years and over

3. What country do you come from?

Leave a comment

4. What is the highest level of education you have completed?

- Some high school, no diploma
- High school graduate, diploma or the equivalent
- Trade/technical/vocational training
- Some college, no degree
- Bachelor's degree
- Master's degree
- Doctorate degree

5. What is (or was) your field of studies?

- Natural and Physical Sciences
- Information Technology
- Engineering and Related Technologies
- Architecture and Building
- Agriculture, Environment and Related Studies
- Health
- Education
- Management and Commerce
- Society and Culture
- Creative Arts
- Food, Hospitality and Personal Services

6. On average, how many hours per day do you spend on the Internet?

- Less than 1 hour a day

- 1-3 hours
- 3-6 hours
- 6-8 hours
- More than 8 hours a day

7. How would you assess your current skills for using the Internet?

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

8. How easy is it for you to use computers?

- Very difficult
- Somewhat difficult
- Neither difficult nor easy
- Somewhat easy
- Very easy

9. What is your preferred device to browse the Internet?

- Desktop computer
- Laptop
- Tablet
- Smartphone

8.1.2 Usability evaluation questionnaire

1. What do you remember agreeing to?

- Data
- Sharing
- Storage
- Purpose
- Processing

2. Overall, how satisfied or dissatisfied are you with the consent request?

- Very satisfied
- Somewhat satisfied
- Neither satisfied nor dissatisfied
- Somewhat dissatisfied
- Very dissatisfied

3. How likely is it that you would recommend the consent request to a friend?

- Not at all likely
- Slightly likely
- Moderately likely
- Very likely
- Extremely likely

4. What was your impression of the time it took you to complete the tasks?

- Too long
- Too long but it was worth while
- About the right amount of time
- It took less time than I thought it would

5. Which of the following words would you use to describe the consent request?

- Annoying
- Appealing
- Boring
- Clear
- Compelling
- Complex
- Confusing
- Cutting edge
- Dated
- Difficult
- Disruptive

- Distracting
- Dull
- Easy to use
- Effective
- Efficient
- Effortless
- Empowering
- Engaging
- Exceptional
- Familiar
- Fast
- Flexible
- Fresh
- Friendly
- Frustrating
- Gets in the way
- Hard to Use
- Helpful
- High quality
- Impressive
- Ineffective
- Innovative
- Inspiring
- Intimidating
- Intuitive
- Inviting
- Irrelevant
- Old
- Ordinary
- Organized
- Overwhelming
- Patronizing
- Poor quality
- Powerful
- Responsive
- Rigid
- Satisfying
- Slow
- Time-consuming
- Time-Saving
- Too Technical
- Unapproachable
- Unattractive

- Uncontrollable
- Understandable
- Undesirable
- Unpredictable
- Usable
- Useful
- Valuable

6. How well the consent request does meet your needs for privacy policy representation?

- Extremely well
- Very well
- Somewhat well
- Not so well
- Not at all well

7. How understandable did you find the tree graph for each functionality?

- Not at all understandable
- Slightly understandable
- Moderately understandable
- Very understandable
- Extremely understandable

8. How useful did you find the summary tree graph?

- Not at all useful
- Slightly useful
- Moderately useful
- Very useful
- Extremely useful

9. How useful did you find the icons in the graph?

- Not at all useful
- Slightly useful
- Moderately useful
- Very useful
- Extremely useful

10. How useful did you find the color-coding of the data types?

- Not at all useful
- Slightly useful
- Moderately useful
- Very useful
- Extremely useful

11. What would you suggest to improve in the summary graph?

Leave a comment

12. What would you suggest to improve in the functionality graph?

Leave a comment

13. What did you like most about the consent request in comparison to a traditional privacy policy?

Leave a comment

14.What's the easiest part about using the consent request?

Leave a comment

15.What's the hardest part about using the consent request?

Leave a comment

16.Was there anything surprising or unexpected about the consent request?

Leave a comment

17.What could be done to improve the consent request?

Leave a comment

18.How easy is the consent request to use?

Leave a comment

19.Do you feel that you control the processing of your data?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

20.Which feature (or features) of the consent request are most important to you?

Leave a comment

21.Which feature (or features) of the consent request are least important to you?

Leave a comment

22.What might keep people from using the consent request?

Leave a comment

23.What was especially interesting, what was not entirely clear, what will you remember from the second (usability testing) session? Why?

Leave a comment

8.2 Third usability evaluation questionnaire

8.2.1 Demographic Data Questionnaire

1. What is your gender?

- Male
- Female

2. What is your age?

- less than 16 years old
- 16-25 years old
- 26-35 years old
- 36-45 years old
- 46-55 years old
- 55 years and over

3. What is your nationality?

Leave a comment

4. What is the highest level of education you have completed?

- Some high school, no diploma
- High school graduate, diploma or the equivalent
- Trade/technical/vocational training
- Some college, no degree
- Bachelor's degree
- Master's degree
- Doctorate degree

5. On average, how many hours per day do you spend on the Internet?

- Less than 1 hour a day
- 1-3 hours
- 3-6 hours
- 6-8 hours
- More than 8 hours a day

6. How would you assess your current skills for using the Internet?

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

7. How easy is it for you to use computers?

- Very difficult
- Somewhat difficult

- Neither difficult nor easy
- Somewhat easy
- Very easy

8. What is your preferred device to browse the Internet?

- Desktop computer
- Laptop
- Tablet
- Smartphone

8.2.2 Usability evaluation questionnaire

- 1. Have you agreed to the processing of your “resting heart rate” to use the functionality “Display resting heart rate”?**
 - Yes
 - No
- 2. Have you agreed to the processing of your “resting heart rate” and “activity heart rate” to use the functionality “Display all day heart rate”?**
 - Yes
 - No
- 3. Have you agreed to the processing of your data that is required to provide you with the information about how many calories you’ve burned?**
 - Yes
 - No
- 4. Have you agreed to the processing of your data that is required to provide you with your cardio fitness score?**
 - Yes
 - No
- 5. Have you agreed to the processing of your “GPS coordinates” to be able to see your route on a map?**
 - Yes
 - No
- 6. Have you agreed to the processing of your data that is required to see your pointwise velocity on a map?**
 - Yes
 - No
- 7. Have you agreed to the processing of your data that is required to have race time predictions derived for you?**
 - Yes
 - No
- 8. Have you enabled the recovery adviser?**
 - Yes
 - No
- 9. Have you agreed to the processing of your data to back them up?**
 - Yes
 - No

10. Have you agreed to the processing of your data to improve service provider's products and services?

- Yes
- No

11. Have you agreed to receive targeted fitness advertisement?

- Yes
- No

12. Overall, how satisfied or dissatisfied are you with the consent request?

- Very satisfied
- Somewhat satisfied
- Neither satisfied nor dissatisfied
- Somewhat dissatisfied
- Very dissatisfied

13. How likely is it that you would recommend the consent request to a friend?

- Not at all likely
- Slightly likely
- Moderately likely
- Very likely
- Extremely likely

14. What was your impression of the time it took you to complete the tasks?

- Too long
- Too long but it was worth while
- About the right amount of time
- It took less time than I thought it would

15. Which of the following words would you use to describe the consent request?

- Annoying
- Appealing
- Boring
- Clear
- Compelling
- Complex
- Confusing
- Cutting edge
- Dated
- Difficult
- Disruptive
- Distracting
- Dull
- Easy to use
- Effective
- Efficient
- Effortless

- Empowering
- Engaging
- Exceptional
- Familiar
- Fast
- Flexible
- Fresh
- Friendly
- Frustrating
- Gets in the way
- Hard to Use
- Helpful
- High quality
- Impressive
- Ineffective
- Innovative
- Inspiring
- Intimidating
- Intuitive
- Inviting
- Irrelevant
- Old
- Ordinary
- Organized
- Overwhelming
- Patronizing
- Poor quality
- Powerful
- Responsive
- Rigid
- Satisfying
- Slow
- Time-consuming
- Time-Saving
- Too Technical
- Unapproachable
- Unattractive
- Uncontrollable
- Understandable
- Undesirable
- Unpredictable
- Usable
- Useful
- Valuable

16. How well do you remember the overview graph?

- Not at all
- Slightly
- Somewhat
- Fairly Well
- Very Well

17.How useful did you find the detailed overview graph?

- Not at all useful
- Slightly useful
- Moderately useful
- Very useful
- Extremely useful
- Not Applicable

18.How useful did you find the icons in the overview graph?

- Not at all useful
- Slightly useful
- Moderately useful
- Very useful
- Extremely useful
- Not Applicable

19.How useful did you find the color-coding of the data types in the overview graph?

- Not at all useful
- Slightly useful
- Moderately useful
- Very useful
- Extremely useful
- Not Applicable

20.Do you feel that, with the consent like this, you control the processing of your data?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree