



Usability Requirements Analysis

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Abstract

The usability requirements document states the scope and understanding of usability and user experience within the FutureID project, lists relevant research done in the area, and states a list of elaborated individual requirements of the developed FutureID client.

Cross references between research guidelines and the individual requirements are being given, and initial guidance towards the later assessment (within planned user tests) is being provided. The structure and organization of the requirements is in accordance to established standards, as it is intended to be easily applicable to user tests. The appendix contains some sample material of relevant questionnaires to measure the degree of fulfillment for the individual stated requirements.

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1. Introduction

The usability requirements analysis document is being structured in three major parts. The first, Section 2, will illustrate the overall objectives for usability within the FutureID client, as well as describe the scope and boundary for the stated requirements here. Section 3 briefly describes the terms of usability and user experience in this context and provides an overview of relevant research regarding user interface guidelines and heuristics used for privacy and security related tools. Section 4 lists the actual usability requirements together with related instructions towards the assessment of the required characteristics. The requirements themselves are organized in subsections based on core usability characteristics, the dialogue principles and trust and knowledge. The appendix contains some questionnaire sample material, which can be directly used in later usability tests. The satisfaction criteria mentioned in the requirements also provides rough guidance on which questionnaire can be employed to measure which usability aspect.

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2. Usability and User Experience Objectives

Usability and user experience of a product can play a major role in determining its market success. The following sections will illustrate some of the overall objectives, scope and concrete tasks associated with the usability of the FutureID client in regards to the usability requirements.

2.1 General Objectives

For the user interface and a product, usability can be seen as an overall enabling factor, allowing for acceptance and potential market success. While an aesthetic and usable user interface can serve as a unique selling point, distinguishing a product from competitors, it can also help to communicate a greater strategy or message. Ease of use factors, such as efficient navigation and interaction, and clear and precise wording and visual language, can contribute to a comprehensive understanding of a system by the user.

Each of these points is also valid for the development of the FutureID client. For a successful privacy and security related system, it is essential to establish the users' trust towards the usage. One prior condition to that is the correct functioning of the system and the behavior of the individual UI subcomponents according to the users' expectations. The stated requirements in this document will help to meet and achieve these higher level objectives and contribute to the successful adoption of the FutureID client.

2.2 Scope and Assumptions of the Usability Requirements

Since for the real usage of the system, the user interface cannot be seen as separated from the underlying functionality, the following assumptions and considerations have been made:

- The addressed requirements are focused on the FutureID clients.
- Textual or graphical content and information is provided in a structured format by services and identity providers or other third parties (e.g. descriptive texts, logos, contact and feedback means). Further, the information is correct and sufficient.
- Additional technical equipment needed to fulfill tasks by the user that is not directly part of a FutureID client, is being set up correctly and works with assumed functionality (e.g. a card reader or hardware pin-pad set up and working correctly).
- The functionality being offered in the user interfaces is technically working correctly (e.g. no software bugs or malfunctions due to programming errors).
- It is known which attributes are provided through which identity provider (e.g. that the birthdate is contained in the German identity card). Trust levels are being known for all authentication credentials.

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- Help text contents and descriptive texts are provided by the project partners with relevant expertise.
- The user interface of services making use of FutureID will be not within the scope for the usability requirements discussed here. However, general guidelines about the interplay between services and FutureID client might be addressed in individual requirements.

2.3 User Tasks related to the Measurement of Requirements

The essential use cases, scenario of use and user goals have been adapted from deliverable D21.5 (Business and Use Case Analysis) and D34.1 (Requirements Analysis). See also D34.1 for a list of relevant personas and user types also referenced in individual requirements within this document.

Each task is being distinguished as system task (ST) or interaction task (IT). System tasks are performed by the system itself, such as offering a filtered set of possible authentication methods to the user. Interaction tasks are user actions that may trigger a system feedback such as entering a password or pin code. Essential key tasks, based on 34.1, are marked with an exclamation mark. These tasks shall be the basis for the subsequent measurement of whether the stated requirements have been fulfilled or not. These stated tasks are fundamental to the tasks that users will have to conduct during the planned usability tests.

Credentials:

- ! ST: Show list of credentials
- ! IT: Select credential for identification or authentication

Authentication:

- ST: Request authentication in service
- ! IT: Authenticate (Log in with eID-card + PIN or other combination)
- ! IT: Choose way of authentication from multiple options

Signing:

- IT: Signing a document
- ST: Inform individual about correctness and success of signed information (e.g. display original document again)

Attributes:

- ! ST: Show required attributes for service (affirmations/declarations)

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- ! ST: Show optional attributes for service (affirmations/declarations)
- IT: Support selective release of attribute from one or several credentials
- IT: Support proof over selected attributes (age verification)
- ! ST: Show status of anonymity. Show which attributes are released to the other party. Where available and indicated, show attributes the Service Provider declared to be necessary and place them vis-à-vis.
- ! IT: Confirm sending prior to releasing attributes

Errors / warning / information / user intervention:

- ST: Show error message (KYC)
- ST: TBD Show warning message or info / guidance
- IT: TBD: Where applicable: Abort action, undo, recover from error
- ST: Display additional information or help towards usage of the system
- IT: Get into contact with FutureID Team or other responsible parties (e.g. Service Providers)
- ST: Display legally necessary and other relevant information in easily accessible and understandable way (data protection, consumer protection etc.)

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3. Relevant Research Guidelines and Standards

The following section shall provide a short summary of the essential terms of usability and user experience and how they are understood within the context of this document. Furthermore, Section 3.3 lists several relevant guidelines and heuristics from current research. These guidelines are particularly important in connection to, and in addition to, the later stated requirements. Therefore, cross-references are included in both sections.

3.1 Usability and ISO9241-11 and ISO-9241-110

Usability is the extent in which a product can be used by specific users in a specific context of use to reach specific goals effectively, efficiently and satisfactorily. Usability is a key indicator of product quality and in the design process plays an important role in ensuring that a product is easy and pleasant to use. Nielsen (2012) defines five quality components of usability:

1. **Learnability:** The ease of performing basic tasks for the first time
2. **Efficiency:** The speed of performing tasks once a user has experience using the system
3. **Memorability:** The ability to remember the interface's components
4. **Errors:** The regularity and severity of, and recovery from, error
5. **Satisfaction:** The overall pleasantness of the product

Adhering to these quality components helps to prevent the following problems that may be experienced when using a product:

1. Additional, unnecessary steps, which are not required in a work task.
2. Misleading information.
3. Insufficient or too brief information regarding the human-computer interaction.
4. Unexpected reaction of the interactive system.
5. Constraints of the navigation when using the system.
6. Inefficient removal of errors.

3.2 User Experience Model

User Experience (UX) as described by Hassenzahl (2008) is a momentary, evaluative feeling (positive or negative) when using technical products and services. It is a process of innovation that includes considering emotional and aesthetic aspects of the product. A positive UX occurs by satisfying basic human needs. These needs are self-esteem, competence, competition,

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physicalness, security, stimulation, relatedness and popularity. Designing a good user experience is important as it engages and delights the user and builds trust.

3.3 Research Guidelines

The following sections (3.3.1 to 3.3.5) provide an overview of established guidelines and heuristics for the usability of security and privacy related tools. One of the FutureID project's goals is to provide a usable and well-designed client; therefore, the stated guidelines should be closely considered within the usability requirements.

To establish a connection between the guidelines and the usability requirements stated in Section 44, each of the stated guidelines contains a colored number block of the related requirement. For an overview of the overall structure of the requirements and their referenced number, see the beginning of Section 4. The related requirement resembles the individual requirement that covers the thematic area as stated in the section guideline.

3.3.1 Usability Requirements for Security Tools (Whitten and Tygar, 1999)

1. *Unmotivated user property*: As a secondary goal, security is not the main task. The user is unlikely to invest a lot of time and effort. This assumption explained by Whitten and Tygar likely holds for a majority of users, and also concerns privacy aspects.

1.2 Efficiency

2. *Lack of feedback property*: The user needs precise feedback to make well-informed decisions, but security (and additionally privacy) configurations tend to be complex and are difficult to communicate to the user efficiently (Fischer-Hübner, 2011).

2.5 Self-descriptiveness

3. *Abstraction property*: Security and privacy concepts often use sets of abstract rules: this makes them difficult to understand for laypeople.

3.2 Knowledge and understanding

4. *Barn door property*: "The futility of locking the barn door after the horse is gone" (Whitten und Tygar, 1999, p.3): Once committed, a privacy or security critical user error cannot be undone. Implying, once unprotected, a secret is gone.

2.7 Error tolerance

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5. *Weakest link property*: The security of a system is only as strong as its weakest link. Therefore, the user must be guided through all relevant parts of their privacy and security configuration.

1.3 Satisfaction

2.5 Self-descriptiveness

3.3.2 Freiburg usability guidelines (Gerd tom Markotten, 2004)

1. *Error prevention*: This central guideline complements ISO's error tolerance: Errors have to be prevented as far as possible and the user is warned when an action is potentially security critical. This has to be ensured to take the 'barn-door' property of security into account.

2.7 Error tolerance

2. *Ease of use for first-time users*: As security is only a secondary goal, it cannot be assumed that users are willing to spend time learning the interface. Therefore, learnability is replaced with the demand to make the first use of the application as easy to learn and understandable as possible.

1.2 Efficiency

2.2 Suitability for learning

3. *Task-suitability for laypeople*: In a similar vein, task-suitability should be explicitly focused on laypeople: no expertise in security issues can be expected from the user.

1.1 Effectiveness

2.1 Suitability for the task

4. *User guidance*: Controllability and suitability for individualization are two problematic guidelines when talking about privacy and security tools. If the user can freely move through the interface and deactivate warning messages at will, it is likely that a weakness in the privacy and security configuration is not brought to their attention. As the weakest-link-property states, this lowers the privacy and security level of the whole system and is, for this reason, unacceptable for privacy-aware and secure usability. Instead, the user should be guided step-by-step through important interactions.

2.3 Suitability for individualization

2.6 Controllability

5. *Conformity with user's expectations and Self-descriptiveness*: These are both kept as they are fully applicable to secure usability.

2.4 Conformity with user expectations

2.5 Self-descriptiveness

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6. *Trust*: This newly added guideline is necessary because of the mostly invisible results of security tools. The user cannot possibly determine if, for example, the antivirus software stays quiet because there are no viruses or because it is just not detecting them. To achieve a subjective feeling of security, it is for this reason important to achieve trust. This may be supported by constant and precise feedback about the actual level of security (Lederer et al., 2004; Fischer-Hübner et al., 2010).

Note additionally that this is, however, not valid for privacy levels as these cannot be assessed effectively throughout operation as for this much information on the linkability of personal data stored with other entities would be necessary which reside with data controllers and are not available on the user client.

The defaults in system design and configurations also can influence the users' trust. In particular if it turns out that the default setting of a system puts assets important to the users at risk, this may massively decrease the level of trust. So system designers should take the principles of "security by default" and "privacy by default" seriously (Hansen, 2013).

1.3 Satisfaction

3.1 Trust

3.3.3 Guidelines for Secure Interaction Design (Yee, 2004)

General principles

1. *Path of least resistance*. By default, the easiest and most intuitive way to complete a task should also be the safest.

1.3 Satisfaction

2.5 Self-descriptiveness

2. *Appropriate boundaries*. The interface should simplify tasks by making them relevant to the goals of the user. Distinctions should be made between affected and unaffected objects, and between, desired and undesired actions.

2.5 Self-descriptiveness

Maintaining the actor-ability state

3. *Explicit authorization*. For a user to grant authority to another, the user action should make it explicitly clear what authorization they are permitting.

2.6 Controllability

4. *Visibility*. Active authority relationships, that may affect security decisions, should be clearly visible on the interface for the user's review.

2.5 Self-descriptiveness

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5. *Revocability*. Where possible, authority which a user has granted to another should be easily revocable through the interface.

2.6 Controllability

2.7 Error tolerance

6. *Expected ability*. The interface presented to a user should be tailored to their authority and therefore not imply the user has additional authority which they do not.

2.4 Conformity with user expectations

Communicating with the user

7. *Trusted path*. The user should be protected against corrupted communication channels that may illegitimately manipulate authority on the user's behalf.

1.3 Satisfaction

8. *Identifiability*. Within the interface, identical elements and actions should appear identical, while differing elements and actions should appear distinct.

2.4 Conformity with user expectations

9. *Expressiveness*. Customizable privacy and security controls should be available through the interface in order let users specify policies that fit their goals (see also [Ackerman and Mainwaring, 2005]).

2.6 Controllability

10. *Clarity*. Before an authority-manipulating action is executed, the effects of the action should be displayed to the user.

2.7 Error tolerance

3.3.4 Principles and Patterns to Align Usability and Security (Garfinkel, 2005)

1. *Least surprise / Least astonishment*: The system should act according to the user's expectations.

1.1 Effectiveness

2.4 Conformity with user expectations

2.7 Error tolerance

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2. *Good security now (Don't wait for it to be perfect):* The system should ensure that security features are deployed as they become available, rather than waiting for the perfect system.

3. *Use consistent and meaningful vocabulary:* The user should not be confused with expert vocabulary they do not know. Expressions should be used consistently in the same contexts in order to provide consistency.

2.5 Self-descriptiveness

3.2 Knowledge and understanding

4. *Consistent placement:* Systems should be designed in a manner that similar security functionalities are consistently placed in the same positions and have the same or similar appearance.

1.2 Efficiency

2.4 Conformity with user expectations

5. *No external burden:* The system should have minimal or no negative impact on other users of the technology in order to avoid pushing back of the users.

2.2 Suitability for learning

2.4 Conformity with user expectations

3.3.5 Idea for Heuristic Evaluation for IT Security Management Tools (Jaferian et al., 2011)

In reference to the proposed FutureID system, the guidelines and heuristics for security management tools, as proposed by Jaferian et al. (2011), appear only partially applicable to the system. FutureID is intended more for end-user purposes, rather than direct security management (e.g. corporate identity management tools, maintaining different roles, etc.). However, in order to provide overview of related guidelines, they have been included here as well.

1. *Visibility of activity status:* limit the awareness to only what the user needs to know to complete their tasks. Provide users with awareness of the status of the activity distributed over time and space.

2.5 Self-descriptiveness

2. *History of actions and changes on artifacts:* consider the recording of changes on things like policies, logs and user's communication. There should be means for searching and making further analysis of this data.

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3. *Flexible representation of information:* The presentation of the shown content should be changeable by the intended target audiences. These means should be adjustable and flexible, as to play well along other tools or standards.
 4. *Rules and constraints:* IT security management tools should allow users to employ rules and constraints which meet their needs. Different ways of using rules and constraints should be offered.
 5. *Planning and dividing work between users:* The division of work between different users participating together in a task should be made easy by the system.
 6. *Capturing, sharing, and discovery of knowledge:* It should be possible for users to store their knowledge and capture their experiences. This could be made explicit by creating documents or notes or by providing log data access.
 7. *Verification of knowledge:* For critical tasks, the system should validate the user's knowledge before taking action. Another support would be allowing the users to test their actions in a sandbox environment before applying them to a live system.
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4. Usability Requirements and Measurements

The usability requirements are structured in three main categories: usability core requirements, dialogue principles and trust & knowledge.

The usability core requirements are based on the usability definition as stated by ISO 9241-11, containing the aspects effectiveness, efficiency and the users' satisfaction. The dialogue principles are based on the ISO 9241-110, that contain the seven aspects of these general ergonomic principles. Additionally the third section contains requirements concerning trust and knowledge, since this resembles important aspects not directly covered by the dialogue principles.

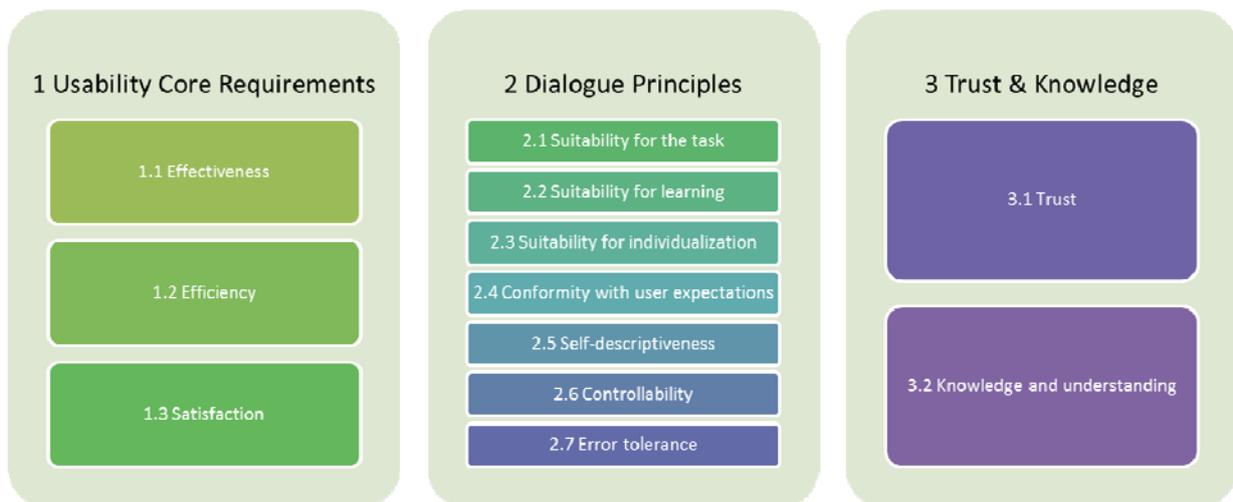


Figure 1: Structural hierarchy of the usability requirements

4.1 Requirement Structure

No.	UR-0X – Descriptive Text
Description	The keywords "MUST", "MUST NOT", "REQUIRED", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document MUST be interpreted as described in RFC 2119 [1].
Relevant Guidelines	Related guidelines from Section 2: E.g. ISO 9241-110, Freiburg usability guidelines.
Context of Use	Intended users, their goals and tasks, associated equipment, and the physical and social environment in which the product will be used, and examples of scenarios of use. The six user groups mentioned here (Digital Outsiders, Casual Users, Professional Users, Trend Users, Digital Professionals, Digital Avantgarde) are in reference to Deliverable D34.1 Requirements Report, pp. 5 ff.

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Methodology	Method suitable for measuring the requirement, e.g. questionnaire ISOMetrics, SUS, TAM (measures the ease of use of a system).
Satisfaction Criteria	Exact measure of requirement. Relative importance of criteria & types of performance criteria (e.g. completion rate, time).

4.2 Core Usability Requirements (ISO9241-11)

4.2.1 Effectiveness

No.	UR-01.1 – Effectiveness of the FutureID client
Description	<p>The user MUST be able to use the interface effectively. This means that the user must be able to fulfill their designated goals towards the FutureID client. All key tasks (see Section 2.32.3) MUST be able to be fulfilled by all target user groups, having no prior training or being laypersons.</p> <p>The default settings SHOULD be chosen in a way to minimize additional risks for users, e.g. for their security, privacy and self-determination (Hansen, 2013).</p> <p>All additional tasks, not identified as key tasks, SHOULD be able to be fulfilled by all target user groups.</p>
Relevant Guidelines	ISO 9241-110, Task-suitability for laypeople (Gerd tom Markotten, 2004) Least surprise/Least astonishment (Garfinkel, 2005)
Context of Use	Relevant for all users and all client types. In regards to tasks as defined by Section 2.32.3.
Methodology	Usability tests, questionnaire: ISOMetrics, SUS; TAM.
Satisfaction Criteria	Completion rate in regard to key tasks. Overall number of assists used to complete all key tasks.

4.2.2 Efficiency

No.	UR-01.2 – Efficiency of the FutureID client
Description	<p>Users SHOULD be able to accomplish their goals related to the FutureID client quickly. Especially when it comes to repeated functionality (e.g. authorizing at a system every day), users MUST be able to fulfill their goals in what they would consider reasonable time (as e.g. can be measured by perceived ease of use).</p> <p>Security technologies like encryption might slow down response times significantly. Even if computation of a function takes time, the user interface of the clients SHOULD stay responsive at all times.</p>
Relevant Guidelines	ISO 9241-110, Unmotivated user property (Whitten and Tygar, 1999) Ease of use for first-time users (Gerd tom Markotten, 2004)

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	Consistent placement (Garfinkel, 2005)
Context of Use	Relevant for all users and all client types. In regards to key tasks as defined by Section 5.4.
Methodology	Usability tests, questionnaire: ISOMetrics, SUS, TAM.
Satisfaction Criteria	Overall time taken to complete all key tasks, mean time on task. Overall numbers of user mistakes/number of times undo or abort functionality is used while completing all key tasks.

No.	UR-01.2.1 – Consistency, feedback and shortcuts of the FutureID client
Description	<p>The user interface SHOULD provide consistent naming and placement of related functions and options in order for users to fulfill their tasks efficiently.</p> <p>Naming and navigation SHOULD provide efficient feedback in order for users to orient themselves quickly. This also applies for first time users of the system.</p> <p>The system SHOULD provide shortcuts to provide experienced users with more efficient and less cumbersome use of the system.</p>
Relevant Guidelines	ISO 9241-110, Unmotivated user property (Whitten and Tygar, 1999) Ease of use for first-time users (Gerd tom Markotten, 2004) Consistent placement (Garfinkel, 2005)
Context of Use	Relevant for all users and all client types. User interface naming, placement and navigation will be targeted at Digital Outsiders, Casual Users, Job Related Users, and Trend Users; while shortcuts are targeted at Digital Professionals and Digital Avantgardes. In regards to key tasks as defined by Section 2.3.
Methodology	Usability tests, questionnaire: ISOMetrics, SUS, TAM.
Satisfaction Criteria	Overall time taken to complete all key tasks, mean time on task. Overall numbers of user mistakes/number of times undo or abort functionality is used while completing all key tasks.

4.2.3 Satisfaction

No.	UR-01.3 – User satisfaction towards the FutureID client
Description	The user SHOULD have a sense of satisfaction when using the system and accomplishing tasks. This implies a system that MUST provide a reasonable effort for fulfilling a certain task (i.e. simple functions should be simple to use) and MAY be fun to use.
Relevant Guidelines	ISO 9241-110, Trust and credibility factors (Gerd tom Markotten, 2004) Weakest link property (Whitten and Tygar, 1999) Path of least resistance (Yee, 2004)

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	Trusted path (Yee, 2004)
Context of Use	This requirement is particularly relevant to Digital Outsiders, Casual Users and Job Related Users whom may require more incentive to reuse the system. In regards to key tasks as defined by Section 2.3.
Methodology	Usability tests, questionnaire: ISOMetrics, SUS, TAM, AttrakDiff, UEQ
Satisfaction Criteria	Perceived joy of use, aesthetic quality, attractiveness Willingness to reuse the system

4.3 Dialogue Principle Requirements (ISO9241-110)

4.3.1 Suitability for the task

No.	UR-02.1 – Suitability for the task of the FutureID client
Description	All users MUST be able to fulfill the key tasks as defined by Section 2.3. All additional tasks not identified as key tasks SHOULD be able to be fulfilled by all target user groups. The task-suitability SHOULD be more focused on the average user than on security experts.
Relevant Guidelines	ISO 9241-110, Task-suitability for laypeople (Gerd tom Markotten, 2004)
Context of Use	Relevant for all users and all client types. In regards to key tasks as defined by Section 2.3.
Methodology	Usability tests, questionnaire: ISOMetrics, SUS, TAM
Satisfaction Criteria	Perceived joy of use, aesthetic quality, attractiveness

4.3.2 Suitability for learning

No.	UR-02.2 – Suitability for the learning in the FutureID client
Description	The interface SHOULD be designed in a way that first-time users should be able to use the system and don't have to rely on external explanations. First use of the dialogue SHOULD be as easy to learn and understandable as possible. Furthermore, the system MUST provide certain means of learning support (e.g. through context sensitive help or overlay explanations on the underlying data processing, available options etc., see e.g. (Fischer-Hübner, 2011; Angulo et al., 2012)) for more interested users, but it cannot be assumed that all users will consider taking advantage of this information.
Relevant Guidelines	ISO 9241-110, Ease of use for first-time users (Gerd tom Markotten, 2004) No external burden (Garfinkel, 2005)
Context of Use	Relevant especially for Digital Outsiders, Casual Users, Job Related Users, Trend Users and all client types. In regards to key tasks as defined by Section 2.3.

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Methodology	Usability tests, questionnaire: ISOMetrics, SUS, TAM.
Satisfaction Criteria	Low overall number of assists used to complete all key tasks. Improvement in efficiency (see Section 7.7.2) performing key tasks with experience using the system

4.3.3 Suitability for individualization

No.	UR-02.3 – Suitability for the learning in the FutureID client
Description	While the FutureID client aims for a design that ideally suits the needs of all user groups, users SHOULD also be able to individualize their system to a certain extent. This MAY include remembering of certain settings for future reference and also the UI-settings in terms of used colors or font size. Further requirements towards colors, contrasts, font types and sizes are given in the Accessibility Requirements Deliverable (D22.7).
Relevant Guidelines	ISO 9241-110, User guidance (negative impacts) (Gerd tom Markotten, 2004)
Context of Use	Relevant for all users and all client types. In regards to key tasks as defined by Section 2.3.
Methodology	Usability tests, questionnaire: ISOMetrics, SUS.
Satisfaction Criteria	Perceived joy of use, usability, aesthetic quality, attractiveness

4.3.4 Conformity with user expectations

No.	UR-02.4 – Conformance to user expectations of the FutureID client
Description	The client system SHOULD act according to the users' expectations and their experiences with other systems or tools. Same functionalities SHOULD be placed consistently in the same position. The same applies to actions, naming, icons and central terms used in the interface.
Relevant Guidelines	ISO 9241-110, Least surprise / Least astonishment (Garfinkel, 2005) Consistent placement (Garfinkel, 2005) No external burden (Garfinkel, 2005) Conformity with user's expectations (Gerd tom Markotten, 2004) Expected ability (Yee, 2004) Identifiability (Yee, 2004)
Context of Use	Relevant for all users and all client types. Particularly relevant to Digital Outsiders, Job Related Users, and Trend Users who may be less able to adapt to unfamiliarity within applications. In regards to key tasks as defined by Section 5.4.
Methodology	Usability tests, questionnaire: ISOMetrics, SUS.
Satisfaction Criteria	Perceived joy of use, usability Efficiency performing tasks for the first time

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4.3.5 Self-descriptiveness

No.	UR-02.5 – Self-descriptive FutureID client
Description	<p>The vocabulary of the interface and of the privacy and security configurations, as well as additional explaining text, SHOULD be formulated in a way that the user is able to easily understand it. The user SHOULD be aware of what the user needs to know to complete an action.</p> <p>Furthermore, the interface SHOULD be self-descriptive. It SHOULD draw distinctions among objects and actions along boundaries that matter to the user. The user SHOULD be able to review any active authority relationships that could affect security decisions. This especially includes descriptions of which services or parties will receive potentially private user data or authentication information.</p> <p>Remark: Underlying descriptions that are being displayed in the UI SHOULD provide a certain structure in order to be displayed and rendered correctly in the user interface.</p>
Relevant Guidelines	<p>ISO 9241-110, Use consistent and meaningful vocabulary (Garfinkel, 2005) Self-descriptiveness (Gerd tom Markotten, 2004) Visibility of activity status (Jaferian et al., 2011) Lack of feedback property (Whitten and Tygar, 1999) Weakest link property (Whitten and Tygar, 1999) Path of least resistance (Yee, 2004) Visibility (Yee, 2004) Appropriate boundaries (Yee, 2004)</p>
Context of Use	Relevant especially for Digital Outsiders, Job Related Users, Trend Users, and all client types. In regards to key tasks as defined by Section 5.4.
Methodology	Usability tests, questionnaire: ISOMetrics, SUS
Satisfaction Criteria	<p>Overall number of assists used to complete all key tasks. Overall number of user mistakes/number of times “undo” functionality is used while completing all key tasks.</p>

4.3.6 Controllability

No.	UR-02.6 – Controllability of the FutureID client
Description	<p>The user SHOULD be able to customize the interface to their requirements. The user SHOULD be able to specify and express privacy and security policies that fit their goal.</p> <p>Also the authority to act on behalf of the user or accessing the user’s personal data MUST only be granted to another actor through an explicit user action understood to imply granting.</p> <p>The user SHOULD be able to choose the credential provider (means of authentication).</p>

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Relevant Guidelines	ISO 9241-110, User guidance (Gerd tom Markotten, 2004) Explicit authorization (Yee, 2004) Revocability (Yee, 2004) Expressiveness (Yee, 2004)
Context of Use	Relevant for all users and all client types. Specification of privacy and security policies is particularly relevant to Digital Professionals and Digital Avantgardes, as they are more concerned about privacy and security. In regards to key tasks as defined by Section 5.4.
Methodology	Usability tests, questionnaire: ISOMetrics, SUS.
Satisfaction Criteria	Low overall number of assists used to complete all key tasks.

4.3.7 Error tolerance

No.	UR-02.7 – Error tolerance of the FutureID client
Description	The user SHOULD be kept from faulty entries that can cause critical privacy or security issues. Errors SHOULD be prevented as far as possible and the user SHOULD be warned when an action is potentially critical for privacy or security. Language used within error and warning messages SHOULD be easily understandable by non-technical users and SHOULD provide a clear means to abort the action or SHOULD contain undo functionality after the action has been followed through. Functionality for cancelling or providing an undo is based on the precondition that the functionalities are technically viable. Messages MAY be expanded for further details, which may include technical or legal language (see also Article 29 Data Protection Working Party, 2004. “On More Harmonized Information Provisions”).
Relevant Guidelines	ISO 9241-110, Barn door property (Whitten and Tygar, 1999) Clarity (Yee, 2004) Error prevention (Gerd tom Markotten, 2004) Use Consistent and Meaningful Vocabulary (Garfinkel, 2005) Revocability (Yee, 2004)
Context of Use	Relevant for all users and all client types. Error and warning messages will be targeted at Digital Outsiders, Job related Users, and Trend Users. While the messages’ extra details, will be targeted at Digital Professional Users, and Digital Avantgarde Users. In regards to key tasks as defined by Section 2.3.
Methodology	Usability tests, questionnaire: ISOMetrics, SUS, System testing in regards to technical error tolerance (see also FutureID deliverable D22.2 Security Requirements Analysis).
Satisfaction	Minimal overall number of errors made while completing tasks

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Criteria | Possibility and low average time taken to recover from errors

4.4 Trust and Knowledge Requirements

4.4.1 Trust

No.	UR-03.1 – User interface pre-conditions for trustworthiness of the FutureID client
Description	<p>To use the FutureID system effectively, it is necessary that users to a certain extent trust the FutureID client. As the perceived trust of users towards a system is based on many different factors, only user interface and usability relevant factors shall be considered here, other relevant factors will be assumed as being fulfilled within their own domain (e.g. technical compliance of the developed prototype).</p> <p>To allow for the trustworthiness of the FutureID client, it SHOULD be designed in a way that conveys professionalism and a thoroughly functional system. This strongly applies to the key tasks (see Section 2.3). It SHOULD try to convey the expertise of the FutureID consortium and the system creators. On the other hand, any UI-elements conveying trustworthiness to the user (e.g. through seals (Fischer-Hübner et al., 2008)) SHOULD be based on the expertise, accumulated knowledge and clarified intentions of the consortium partners.</p>
Relevant Guidelines	Trust (Garfinkel, 2005) Fogg (2003)
Context of Use	Relevant for all users and all client types. In regards to key tasks as defined by Section 2.3.
Methodology	Usability tests, questionnaire
Satisfaction Criteria	Perceived feeling of trust Willingness to reuse the system

4.4.2 Knowledge and understanding

No.	UR-03.2 – User’s knowledge and understanding of the FutureID client functionality
Description	<p>To reach a more common usage of privacy and security related functionalities in general, and especially for the usage of the FutureID client, users SHOULD be able to understand some key terms and concepts related to their privacy and security and the offered functionalities. For this the FutureID client SHOULD inform the user or visualize the processing of user data, the entities involved in the transactions and how the data flows take place (Fischer-Hübner et al., 2011; Graf et al., 2011).</p> <p>Also, the user SHOULD understand, whether some attributes are compromising their anonymity status or not, i.e. if a clear reference to the name of the person in being given (Wästlund and Fischer-Hübner, 2011).</p>
Relevant Guidelines	Abstraction property (Whitten and Tygar, 1999) Use consistent and meaningful vocabulary (Garfinkel, 2005)

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Context of Use	Relevant for all users and all client types. In regards to key tasks as defined by Section 2.3.
Methodology	Usability tests, post-test interview, questionnaire on key concepts
Satisfaction Criteria	Number of key concepts understood by the user.

4.4.3 Support of different languages

No.	UR-03.3 – Language support
Description	The FutureID client SHOULD support multiple languages. These languages SHOULD be configurable either through the overall operating system's settings of the user or through the client itself.
Relevant Guidelines	Abstraction property (Whitten and Tygar, 1999) Use consistent and meaningful vocabulary (Garfinkel, 2005) No external burden (Garfinkel, 2005) Conformity with user's expectations (Gerd tom Markotten, 2004) Ease of use for first-time users (Gerd tom Markotten, 2004)
Context of Use	Relevant for all users and all client types.
Methodology	-
Satisfaction Criteria	Support of different languages.

4.5 Conclusion

All requirements that have been presented here were created in close accordance to the established usability standards. The cross references between the requirements and the research guidelines has shown that for a security and privacy related tool, such as the FutureID client, conformity with user expectations, self-descriptiveness and controllability are of very high importance and considered to be basic needs. Some other requirements or UI aspects, even if they were not rated as important by the guidelines in Section 6, might turn out as delighting factors for the users, but this will have to be determined during user tests.

Measuring whether an individual requirement has been met (and to which degree) will be only possible through the use of appropriate tools, and the involvement of users. Within each requirement some satisfaction criteria has been identified, but these can only be used as a guide for future usability tests, since the overall performance of the client (as a baseline), and the exact expectations of the users can be only estimated at this point. Important for the design of an effective UI are also some of the requirements stated in the other thematic deliverables, such as the accessibility requirements and privacy requirements, which might have also serious implications for the look and feel of the FutureID client.

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Appendix

Testing Materials

ISOMetrics Questionnaire

The ISOMetrics Questionnaire is based upon the ISO 9241-110 (formerly ISO-9241-10) standard and is used to evaluate software usability through a user-oriented approach. Two versions of the questionnaire exist; a short version which is suited summative evaluations and a long version, suited to formative evaluations.

More information on ISOMetrics can be found within The ISOMetrics Manual:
<http://www.dcs.ed.ac.uk/teaching/cs4/www/hci/questionnaires/manu115e.pdf>

Sample Questionnaires

Short version sample questionnaire:

<http://www.dcs.ed.ac.uk/teaching/cs4/www/hci/questionnaires/isoes201.pdf>

Long version sample questionnaire:

<http://www.dcs.ed.ac.uk/teaching/cs4/www/hci/questionnaires/isoel201.pdf>

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Technology Acceptance Model (TAM) Questionnaire

The Technology Acceptance Model (TAM) theorises how user perception and acceptance of an information system influences usage. The TAM questionnaire measures this through collecting data on the perceived usefulness and ease of use of information systems.

Chutter's (2009) paper, "Overview of the Technology Acceptance Model: Origins, Developments and Future Directions," provides more information on TAM as well as samples of TAM questionnaires.

<http://sprouts.aisnet.org/785/1/TAMReview.pdf>

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AttrakDiff Questionnaire

The AttrakDiff questionnaire is used to evaluate user experience through the scaled grading of pragmatic and hedonic quality attributes. Such attributes influence the attractiveness and likeability of information systems, consequently impacting the behavior and emotion of users such as regularity of use and enjoyment, respectively.

More information on AttrakDiff can be found on its website:
<http://www.attrakdiff.de/sience-en.html#arbeitsmodell>

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The User Experience (UEQ) Questionnaire

The User Experience Questionnaire (UEQ) is used to assess the user experience of information systems. The questionnaire implements scales which allow users to express their feelings, impressions and attitudes when using a system. Data collected provides a comprehensive view of a user's experience, covering the areas of: attractiveness, efficiency, perspicuity, dependability, stimulation and novelty.

More information and samples of the UEQ can be found on its website:
<http://www.ueq-online.org/>

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System Usability Scale (SUS)

The System Usability Scale (SUS) is a simple tool for evaluating the usability of a system. The scale consists of ten questions with five response options, ranging from “Strongly agree” to “Strongly disagree.” SUS results are converted into numbers from 0 to 100; these provide an indication on the acceptability of the system’s usability.

More information on SUS, sample questions and how to interpret SUS results can be found at the link below:

<http://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html>

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