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Master Thesis

User Experiences on Communication Toolboxes in Governmental Agencies and Multi-government Organizations

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Title: User Experiences by Governmental Agencies and Multi-government Organizations on Communication Toolboxes

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Abstract

Customs practitioners have the need to communicate efficiently with their colleagues in an international context frequently. Numerous platforms have been developed but the overall user experience has not been studied until now. This thesis work delivers the results of the empirical study addressing the user experience of communication toolboxes, collaborative ICT tools, software, and applications that customs practitioners use in their operations and daily work. The work has been based on the request by the PEN-CP project (Pan-European Network of Customs Practitioners).

This is the first time that the overall user experience of different communication platforms has been studied in this context and the results of this work will help in the development of new communication software.

Due to the ongoing COVID19 pandemic, it was not possible to conduct the studies onsite and online interviews with the GoToMeeting program were conducted with the objective of discovering UX problems and in a later stage, through qualitative analysis, with the Atlas.Ti program, proposing solutions. Finally, considering the analyzed data a prototype was implemented with Figma. The results contain three categories of problems related to the users' experience when using their dedicated software: important features that work well and should therefore be included in the next version of communication tools, features that cause problems of different sorts and should be improved and other problems that need further analysis to propose a solution. This work has uncovered generic UX problems, that are common to these organizations but in future work it is advisable to isolate each organization to understand at a deeper level their work process by conducting contextual inquiry and task analysis, for example.

Keywords User Experience, Qualitative Analysis, User Interface Guidelines, Prototype Design, User research, Customs, Communication

Contents

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Last but evidently not least I would like to thank Andrea, for being my rock, helping me and motivating me to keep going. None of this would have made sense without her.

Otaniemi, 23 February 2022

Alejandro Esquivias Cañadas

1. Introduction

1.1. Context, Scope and Aims of the Study

According to the request and background on this master's thesis, PEN-CP practitioners "rely on efficient communications that allow customs experts from all around Europe to exchange information with one another" (Duvillier 2020). Generally available communication toolboxes include commercial software and services such as GoToMeeting[1], Webex[2], Teams[3], Zoom[4], Meet[5], Skype[6], WhatsApp[7], and others. However, the wealth of tools available does not directly mean proper alignment and fit with the tasks that the customs practitioners do. The real-life experiences have the power to reveal detailed understanding on the performance of such toolboxes in realistic work surroundings and settings. *User experience*, as defined by Hassenzahl and Tractinsky (2006) provides conceptual framing for such studies.

This thesis addresses the experiences that customs practitioners have about using current communication toolboxes. The aim is to create improved and more detailed understanding on the specific characteristics of communication and collaboration tools that should be included in future design and procurement of such services for customs operations. The empirical approach in this study aims at unveiling real-life experiences that can be seen to be evident but, at the same time, often neglected in the analysis of information and communication systems being used at the workplace.

This thesis work analyzes user experiences that government agencies and international governmental organizations have about communication platforms and tools. The research questions aim at delivering clarity to the following questions presented in the original request, which are our research questions:

1. Which features and functions are considered most useful?
2. What works technically well and what does not?
3. What/how to improve with these platforms and tools?

[1] https://www.goto.com/meeting

[2] https://www.webex.com/

[3] https://www.microsoft.com/en-us/microsoft-teams/group-chat-software

[4] https://zoom.us/

[5] https://meet.google.com/

[6] https://www.skype.com/en/

[7] https://www.whatsapp.com/

These questions are framed and surrounded by aspects that aim at creating understanding on the reasons and motivations that result as preferences on functions that the users have. However, instead of only listing what features are the preferred ones, this study aims at unveiling the reasons and rationale why such functions are considered important. In addition to presenting the question on “Which communication tools and technologies do you use today?” interesting additional aspects can be revealed by continuing the exploration and elaboration with questions such as “What are the benefits of these technologies, both for yourself and for the organization?” and “What about the limitations and shortcomings?”

In their empirical evaluation of user experience, Arhippainen and Tähti (2003) briefly explore the characteristics and qualities of questions relating to user experience. They point out that experience cannot be addressed directly but indirectly and via analysis. With such strategy in mind, addressing the reasons on the preferences of the “surface features” may be approached with the complementary “Why” question as presented in the following question: “What are your favorite functionalities and features, and why?”

Such questions and resulting analyses increase the depth of understanding on user needs and may also lead to alternative improved solutions. With such an approach we believe that the outcome will be even more beneficial with greater opportunities to apply the results in broader base of practical customs work surroundings. The detailed questions are presented in Appendix A.

Due to the nature of the *user experience* concept (“experiences that users have” or “something that users experience when using the systems”), the emphasis in this study is on empirical data from real users. The ongoing COVID-19 pandemic, however, has restricted the methods of the study to be limited to remotely conducted interviews. The pandemic prevented any visits to the sites of operation. Therefore, the interviews have been conducted using remote collaboration tools without access to the actual work surroundings. Methodologically, studies with observational elements (e.g., contextual inquiry) and opportunities in real working surroundings would have had the power to unveil even more details on the everyday use of the current collaboration tools. In the current situation, such studies and methods remain as a proposal of work to be conducted in the future. This work is limited to the recruitment and data analysis from 5 different participants, who have experience in Customs’ operations. Due to the limitation in the number of participants, the number of organizations has also been limited as a result, and the empirical findings and prototype only concern this specific field and organizations and are not generalizable. Therefore, this work contributes to the development of future communication toolboxes in the context of customs and proposes a novel process to conduct remote contextual inquiry, based on our experience during the study.

1.2. Structure of the thesis

The structure of this report is as follows. After the introduction, we present a conceptual overview of the *user experience* concept as well as methods for studying users and user experience. The concept and the methods are then combined and adjusted to fit the application domain, customs operations, and work. The application of the chosen method,

interviewing, is then described in more detail together with the definition of the target group the interviewees/informants of the study. The contents of the interview have been explored and defined in a collaborative manner with the PEN-CP project representatives.

The presentation of the methods and data provides proper framing for the analysis of the results, which forms the core of this report. The analysis is done in a qualitative manner making use of the transcripts from the recorded interviews. The actual analysis is made with the qualitative data analysis tool Atlas.Ti. The systematic categorizations created with the tool deliver reliable and transparent analysis.

Considering the analyzed data, a desktop prototype is presented. This prototype is a result of the qualitative data extracted from the interviews. In addition, to the results and recommendations this prototype could serve as the basis for future discussions, related to the design of the communication toolboxes.

Finally, the results are reflected in contrast with the aims of the study as well as in relation to results from other similar studies. The report proceeds to recommendations on features and characteristics that have been experienced as important and significant for customs practitioners to perform properly in their daily tasks. These results and recommendations can be used in future procurement of communication toolboxes for customs organizations.

1.3. Literature Review

1.3.1. Information and Communication Technology and the use of Communication Toolboxes in Customs services

According to the Revised Kyoto Convention, customs is defined as *"the Government Service which is responsible for the administration of Customs law and the collection of duties and taxes, and which also has the responsibility for the application of other laws and regulations relating to the importation, exportation, movement or storage of goods"* (World Customs Organization, 2014).

On the World's Customs Organization's (WCO) website, there is information on the different programs that have been implemented (http://www.wcoomd.org/en/topics/enforcementand-compliance/activities-and-programmes.aspx), it is possible to find the types of tasks that are carried out by Customs' practitioners. In the next paragraph, we will explain some programs that are currently in place and the types of activities carried out in them, that reflect why communication is crucial.

There are "Drugs and precursors" programs, that aim at helping Customs administrations in combating illegal trade from the cultivation to the distribution and sale of substances. For these operations to be successful Customs practitioners need to control different types of transport such as containers and air cargo. Secondly, there are programs related to the environment, where the main objective is to prevent crimes against the environment, such as endangered species trafficking, dangerous waste transportation, organic pollution or hazardous chemicals and pesticides among others. Thirdly, the WCO combats money

laundering and terrorist financing. In this category they fight crimes such as weapons/human smuggling, narcotics trafficking, intellectual property infringement. There are many other programs in place, where different types of crimes are fought but these three are representative of the activities carried out overall. It is relevant to note the WCO supports local Customs administrations in all these activities, which communicate themselves with other organizations.

Considering this definition, we must now consider what role ICT plays in the context of customs officers and what their needs are. ICT enables Customs' officers to efficiently control exported and imported goods and quickly identify illegal trafficking (Salixova, 2021).

There are different benefits of information and communication technology in this field (World Customs Organization, 2014). In the context of our work, some of these benefits are:

- More effective customs controls: ICT tools enable communication and advanced profiling of high-risk consignments.
- More efficient Customs clearance: ICT gives more time for risk assessment, due to immediate arrival of electronic paperwork. In this case, it is of central importance that this paperwork is accurately completed and perhaps automatically checked by a computer before being sent to the Customs' officers.
- More effective data analysis: Firstly, physical data takes space and is hard to analyze as opposed to digital data. Secondly, data analysis tools and methods can be applied to

  all the stored data to help Customs interpret and improve their processes. Automation produces accurate information and is an important part of current customs organizations (Holloway, 2009).

However, there are also some challenges. The main one relates to maintaining data integrity and the development of secure systems (Holloway, 2009). The revised Kyoto Convention establishes some important definitions related to ICT security, where numerous aspects must be considered (organization of IT security, access control, asset management, communications security …etc.). It should be noted that authentication methods are also addressed, and the recommendation is to use a technology based on a previously conducted risk assessment. Secondly, the challenges relate to harmonization, standardization, and data interoperability. (Holloway, 2009; van Stijn et.al., 2007)

Furthermore, one of the goals when developing enterprise architecture is to establish direct links between technology and business goals (WCO, 2014). UX can help achieve this goal, by understanding the user and their needs and how they relate to the organization's needs and goals (relationship between individual and group goals).

Finally, the ITAIDE project (Information Technology for Adoption and Intelligent Design for Egovernment) addresses how customs operations can be supported by ICT. The Danish Tax and Customs Administration implemented an e-export solution. Even though this project is not recent it can serve as a starting point when gathering requirements to understand traditional communication and ICT needs. The Danish Tax and Customs Administrations solution (van Stijn, Bjørn-Andersen, Razmerita and Henriksen, 2007) allows the exporter to report online all the necessary data, communication with other government agencies; users to request data on a specific report; the generation of reports that incorporate data mining techniques;

maintenance and update of tables; access to authorized information. This system is also integrated with other relevant systems and uses both national and international data.

We should also point out that this study is valid mainly in the European context, but we should be aware that the interviewed officers also deal with officers from other countries, where more emphasis should be put in training employees with new software. User experience can be applied in this context to facilitate the development of learnable interfaces and minimize training time.

Urciuoli, Hintsa and Ahokas (2013) conclude that in e-customs services the perceived ease of use, the ease of use, the usefulness and the perceived usefulness are drivers, when adopting such services. While their technology acceptance model is a good start it leaves out the experiential facet, which is fundamental in User Experience to understand how the system is being used by the end users. Therefore, this thesis also contributes to their work, by analyzing the Customs Officers' needs from a new perspective.

Considering all this information, communication plays a major role in Customs' daily activities. Customs officers rely on communication as their programs usually are implemented at a national or international level. Collaboration is key and thanks to modern technologies, they can communicate and act efficiently. Customs usually rely on different organizations, to successfully accomplish their goals. In this project an introductory letter explaining what was meant by "communication toolbox" was sent to all the participants before the interviews. Communication toolbox is the overarching term used to describe features of digital systems that allow customs practitioners to communicate efficiently. These features include videoconferencing, instant messaging, directory of users, thematic discussion groups, various notifications, document sharing, collaborative editing, automated transcriptions, automated translations, group calendars etc.

1.3.2. User Experience

A central concept for this work is user experience (Hassenzahl and Tractinsky, 2006; Roto at.al, 2011). In the academic community, this broad concept has been constantly under discussion and elaboration (Vermeeren et.al., 2010). Over the last 15 years, however, efforts in defining and operationalizing it have taken place resulting in specific methods for evaluating the various aspects of the concept (Tullis and Albert, 2014).

The application context introduces opportunities and boundaries for the evaluations, too. The strong emphasis on collaborative work in organizational settings with strong presence of the ICT tools points to the research direction of **computer-supported collaborative work** (Neale et.al, 2004). Fortunately, there is a strong connection between HCI and CSCW research fields making the methodological combinations relatively strong.

User experience is a term that has multiple definitions. In this work, we will consider UX according to Hassenzahl and Tractinsky's model (2006) and we will review the attributes that account for a good user experience, as defined in the UX Whitepaper (Roto et. Al, 2011).

Firstly, UX can be defined as “a consequence of a user’s internal state (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed system (e.g., complexity, purpose, usability, functionality, etc.) and the context (or the environment) within which the interaction occurs (e.g., organizational/social setting, meaningfulness of the activity, voluntariness of use, etc.)” (Hassenzahl & Tractinsky, 2006). Furthermore, Hassenzahl & Tractinsky define a model characterized by three facets, each one of them comprised by numerous attributes: the experiential facet comprised of different types of experiences (dynamic, complex, temporally bounded, etc.), the emotion and affect facet, which is a highly subjective facet where the end-goal is to elicit positive experiences by considering antecedents and consequences and the facet related to factors beyond the instrumental, which in turn comprise holistic, aesthetic and hedonic qualities. UX is defined as the intersection of these three facets. We will analyze user experience by using the model with three facets proposed by Hassenzahl and Tractinsky (2006). The first facet deals with “addressing human needs beyond the instrumental”. This facet deals with attributes such as aesthetics, which are closely related to usability. Ngo, Teo and Byrne (2003) developed formulas to measure the aesthetics attributes of an interface. Concretely they identified the following attributes and developed formulas to measure them:

1. Balance refers to how users perceive the contents that are distributed on an interface. Objects are assigned a weight depending on their size. The larger the object the more weight it has.
2. Equilibrium, refers to the degree to which a layout is centered assuming the screen has a center point (defined as the intersection of two diagonal lines, if the screen is rectangular-shaped)
3. Symmetry, measured in three dimensions (horizontal, vertical, and diagonal), refers to the degree to which elements are replicated considering the three axes of symmetry (horizontal, vertical, and diagonal)
4. Sequence refers to the positioning of objects in a layout for the user to visually scan them as optimally as possible.
5. Cohesion refers the difference in aspect ratios. Ideally, there should be minimal difference and similar aspect ratios should be preferred.
6. Unity refers to the difference in use of similar sizes and space left at the margins when compared to elements that belong together in a UI.
7. Proportion: Some shapes are found to be more aesthetically pleasing than others due to their proportions. These shapes are preferred. Examples include and are not limited to squares, double squares, golden rectangles.
8. Simplicity is achieved by having the minimal number of required elements on the screen.
9. Density is the degree of how populated the UI is with objects.
10. Regularity is the degree to which elements are arranged in a uniform manner on the screen.

11. Economy measures the different sizes used. The less sizes the more economical the UI is said to be.
12. Homogeneity measures uniformity across quadrants.
13. Rhythm is achieved by using uniform change patterns.

This proves that while aesthetics is a subjective term, aesthetically pleasing interfaces can be defined and modelled.

Attributes such as: surprise (especially unexpected positive emotions), diversion (similarly to a game, a technological system is better if the end-user is enjoying using it), influence (control over the environment), insight (users operate systems based on their own experiences acquired throughout their lives). Finally, technology should serve a purpose and not only help a user achieve their end goal. The importance of stimulation and an increase in knowledge and skill are also emphasized.

The second facet corresponds to “affective and emotional aspects of the interaction”. Unlike affective computing, whose objective is for computers to understand and process human emotions to act accordingly, UX is more concerned with the impact emotions have before, during and after using a product. The UX White paper (Roto et.al, 2011), proposes a novel definition by considering the impact of time, focusing on UX as phenomenon and as a practice. This is because, users may have had indirect experiences before they interact with the system for the first time, due to previous similar experiences or other people’s opinions. Using a similar argument, UX is not over once the interaction is finished. This inevitably raises the question of the appropriate time span to focus on UX.

At the minimum UX’s objective is to avoid user’s dissatisfaction (negative emotions in general) and should aspire to provide the best possible experience. Therefore, this facet deals with positive emotional outcomes (enjoyment, pleasure, and pride). The volume of positive and negative experiences can have an impact on this facet. Depending on the context, a single negative experience can outweigh many positive ones, making it seem from the user’s perspective that the interaction is subpar. This is another argument in favor of taking care of the whole experience. Once again, we are left with some questions relating to the modelling of emotions through the user’s journey and the time different emotions last and how they affect the interaction as a result.

Finally, the last facet contemplates the nature of the experience. An experience is defined by Tractinsky & Hassenzahl (2006) as the “unique combination of various elements, such as the product and internal states of the user (e.g., mood, expectations, active goals), which extends over time with a definitive beginning and end.” This means as well that the context of use (conditions under which the system is used in a typical day) plays a major role in experiences.

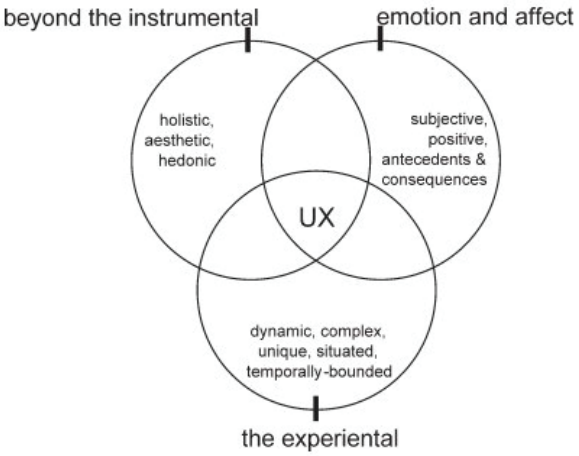


Figure 1: The 3 facets as defined by Tractinsky & Hassenzahl (2006)

To correctly analyze user experiences, we need to consider the context of use, which is a "combination of users, goals, tasks, resources, and the technical, physical and social, cultural and organizational environments in which a system, product or service is used" (ISO 924111).

Secondly, responsiveness and response times play a role in overall user experience. Waloszek and Kreichgauer propose an approach to evaluating the responsiveness of software applications from a user's perspective (Waloszek and Kreichgauer, 2009). They develop an evaluation method to evaluate the responsiveness of an application from a user-centered perspective. They observe response times and develop a time range table. However, their research is insufficient because further investigation related to the assignment of UI events to time ranges is required. For their specific purposes, their results suffice, but they are not generalizable.

Finally, Jakob Nielsen (1993) defines three important limits in response times, when designing webs and applications:

- 0.1 second is the maximum time for a user to feel the system is reacting without any lag and therefore no special feedback is needed.

- 1 second is the maximum time for the user's train of thought to stay uninterrupted. No feedback is necessary, but the user will perceive a lag when manipulating the interface.

- 10 seconds is the maximum time for the user to keep their attention on a dialogue with the interface. If the task takes more than 10 seconds, the user will generally start doing other things, while waiting for an operation to finish. Feedback during the delay is necessary for users to know what to expect.

If certain operations require more time, a percentage should be displayed. In case, a percentage cannot be displayed the system can tell the user the work it is doing in a summarized form.

User engagement

User engagement is related to user experience, as it is "the emotional, cognitive, and behavioral experience of a user with a technological resource that exists, at any point in time and over time." (Lehmann et.al., 2012). It can be measured in different manners: in a self-

reported manner, by measuring cognitive engagement (heart rate, facial expressions, vocal tone) or by using online behavior metrics These methods in general correspond to the user engagement in online sites, although some of them could adapted to measure engagement in online events, such as meetings or webinars. Considering our currently available videoconferencing tools, a heart monitor for example would be invasive and costly and therefore does not constitute a solution in our case.

In online learning environments, other methods have been proposed (Aslan et.al, 2014). These methods are classified as “automatic”, “semi-automatic” or “manual”. In the automatic category there are computer-vision based methods to detect participants’ facial expressions, their gestures and posture and their eye-movement; sensor data analyses (alertness, blood pressure, heart rate …etc.), which is a similar approach used by Lehmann et.al (2012) and leaners’ log files, that are analyzed with data mining algorithms to understand the level of engagement.

The semi-automatic category comprises methods related to “engagement-tracing”, which is a measure of timing and accuracy in learner responses to exercises and questions.

Finally, the manual category contains self-reporting methods, which are biased and do not always provide accurate information and an “observational check-list” to visually assess participants’ engagement.

Out of all these methods the most convenient accurate one is the computer vision technique. Thanks to these methods different emotions such as, but not limited to boredom, confusion, delight, frustration can be measured. Additionally, there have been attempts at using eye tracking technology to infer participants’ concentration levels (Aslan et.al., 2014) and a gaze reactive model has been developed (Williams et.al., 2012) that detects when a user is not paying attention and sends an alert for them to concentrate again.

Based on the information presented above, the following metrics could be used to track user engagement in online events:

-Percentage of users in a project that attended the session

- Distribution of emotions felt by the users over the duration of the online event, according to the computer vision algorithms

- Distribution of the users’ eye gaze over time during the online event.

User engagement is important in this project due to two fundamental reasons. Firstly, because it helps us understand how to design to increase users’ engagement and in a future work how the prototype can provide relevant metrics to improve the system. The second reason is related to the Customs’ practitioners online work setting and to develop an understanding of the level of implication from the participants’ perspective in online events.

1.3.3. Contextual inquiry

Contextual inquiry allows the researcher to uncover hidden needs and insights by observing and asking questions to the participant. Originally developed by Holtzblatt and Beyer (1999), contextual inquiry solves some disadvantages of interviews and surveys, where the method depends on the user's ability to recall a process and explain the rationale behind some decisions. On the other hand, with contextual inquiry researchers have a much deeper understanding of the user's process, motivation, reasoning, and mental model, due to the product of direct observation, taking place at the same time the user is performing a task.

Contextual inquiry is based on 3 principles:

"1-) Data gathering must take place in the context of the user's work": It is necessary to understand, see and experience the working conditions of the users. Due to the remote situation this is not possible.

"2-) The data gatherer and the user form a partnership to explore issues together.": The inquirer and the participants should be equal. Therefore, it is not the inquirer's responsibility to lead the conversation. The users must be recognized as experts in their work, which means that questions can and should flow in both directions. The inquirer should never interpret actions on their own and should ask the participant why they did certain things. It is also acceptable for participant and inquirer to brainstorm together on a problematic feature.

"3-) The inquiry is based on a focus; that is, it is based on a clearly defined set of concerns, rather than on a list of specific questions (as in a survey).": This means that contextual inquiry is based on a specific set of concerns.

Traditionally this is the workflow that a traditional contextual inquiry should follow:

Phase 1: Introduction

In this phase the inquirer should introduce themselves, indicate the session's objectives, highlighting that the participant is expected to participate and correct any misunderstandings.

Phase 2: Transition

As the inquirer, let the user know you will observe them and determine the best contextualinquiry technique (work-based, post-observation and/or artifact walkthrough).

Phase 3: Contextual interview

As the inquirer, observe the participant and initiate a discussion to understand steps in their process that are unclear to you. Some questions worth asking are related to the differences in standard steps and uncommon variations and the reasons behind them. Always validate your interpretation of their tasks.

Phase 4: Wrap-up

In this phase, the inquirer asks any final questions and explains to the participant the interpretations of their notes and observations, allowing them to comment and provide feedback.

In our work, traditional contextual inquiry was not possible, but we tried to replace with an interview question and possible follow-up questions.

1.3.4. Affinity diagrams

KJ Diagrams, a precursor

Jiro Kawakita is the inventor of the KJ Method (Kawakita, 1975), used to gather qualitative data. He developed the method during his expeditions to Nepal, where he directed reconnaissance surveys, technical research, and development projects. This method bridges the synthesis from ethnographic fieldwork and structured hypothesis-testing.

As explained by Kawakita (1975) the KJ method includes four main aspects: The W-shaped model (a problem-solving model); qualitative data formulation and analysis tools; a new type of field research concept and method and teamwork concepts for creativity. The purpose of this method is to discover facts relevant to a problem, build a better understanding of the problem by understanding its internal structure (dependance, causality …etc.). It is useful in multi-faceted and/or non-technical problems and/or problems with diverse interests and perspectives.

The W model (a problem-solving model)

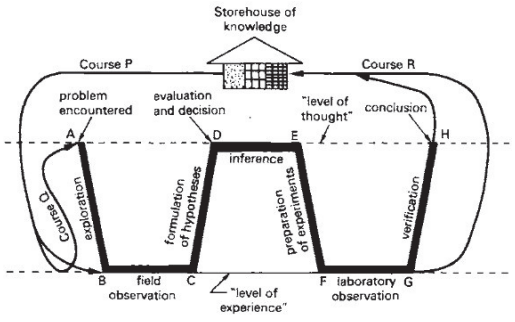


Figure 2: The W-shaped model, as introduced by Kawakita (1975)

According to Kawakita, all problem-solving involves both experiential ("level of experience" in the diagram) and cognitive ("level of thought" in the diagram) levels. This model outlines the traditional steps in scientific research. The level of thought includes or mental or cognitive activities, where reasoning is required. The level of experience refers to events or actions that can be observed.

Application of the KJ Method

a) Label making: Facts extracted from observations are written on post-its or note cards. These facts should be relevant to the research and only one fact per card is allowed.

b) Label grouping: Once all relevant facts are written on the cards, they are shuffled and categorized according to themes, and trying to avoid possible biases, when grouping cards together. It is possible for individual cards to not belong to a particular category. In that case they are left alone and are often referred to as “lone wolves”. Once categories are formed, researcher should assign a name to each individual category. It is possible to form categories of categories to reduce the number of items to analyze. When this happens, the “lone wolves” could fit in these broader categories.

c) Chart making: The families are then arranged spatially and connected with arrows to show cause and effect relationships, interdependence, contradictions. This helps researchers to better understand the data.

d) Written explanations: In this last step the chart must be explained. The data should be appropriately integrated, and interpretations should be avoided.

Drawing from the ideas of the KJ diagrams, affinity diagrams are widely used in the UX world. Both KJ and affinity diagrams have similar goals. In this section, we will explain the process to make an insightful affinity diagram, as described by the Nielsen Norman group (Pernice, 2018):

Choose a wall, where all the notes can fit and before the meeting starts stick them on the wall without any order. This step is like the shuffling in the KJ method.

Create pre-set categories to help participants and add an unknown category for notes that are understandable.

Sort the notes into categories: Take a note from the wall and look for a category where that note would make sense. In the event where a similar note is already in that category stack the notes, leaving the most descriptive one on top. In the event where the note does not fit under any categories create a new one and make sure all participants know about the new category.

Sort each of these categories into subcategories: Every participant should choose a category to sort. Inside the category look for related themes and write the names of the subcategories on a sticky note.

Summarize and present categories: The person responsible for sorting a specific category can start explaining how they did the sorting, and they can summarize the category. The other participants may ask questions or make observations related to the categorization.

Determine priorities to find out the most important notes/subcategories: Depending on the purpose of the meeting different methods may be applied. Independently of the precise method, the objective of this step is to understand how important different parts of the problem are. Usually, each participant is given a certain number of votes and the items with the most votes are deemed to be the most important ones.

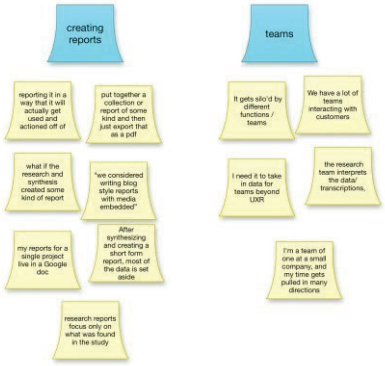


Figure 3: Example of a traditional affinity diagram

This methodology was used in our work in a virtual way by using the Atlas.Ti software, which is a computer software used to analyze data (audio, graphical and video) qualitatively.

1.3.5. Accessibility

The Web Content Accessibility Guidelines (WCAG) has the objective of providing guidelines for web content accessibility. This is important in our work to ensure the prototype's design is usable by diversely functional individuals.

WCAG defines different levels of "conformance": Level A (the minimum level of conformance), level AA and level AAA (the highest level of conformance). Satisfying one level of conformance means satisfying all the ones below as well. Even though, level AAA is the highest it is not a good practice to require it for entire sites.

WCAG created originally these guidelines for web content. However, it is possible to apply them to other content as well, as defined by the W3C team (Korn et.al., 2013). Therefore, in our work, we will focus on respecting the guidelines for accessible design in software and other non-web content, specifically the ones related to visual appearance and presentation. Concretely we will focus on principle 1, which is related to how the information is presented so that it is perceivable and principle 3, which is related to the understandability of the UI.

In the prototype section, we will detail the specific success criteria and how they are being followed in the prototype. However, even though these guidelines serve for the purpose of building our prototype, they are not an exhaustive list, and additional guidelines should be considered when developing the real application. For example, if there is audio, the guidelines related to it should be followed as well. The same applies for any other features that were not included in the prototype but are included in the real platform.

2. Method & Results

2.1. Research Method and Data: Interviews with Customs Practitioners

Interviews and observations are typical methods applied in user studies. More broadly, applicable methods for this study are implied by the research on usability and user experience. Such methods include System Usability Scale (SUS, Brooke 1986, Lewis 2018), heuristic evaluations (Nielsen and Molich 1990), usability testing (Nielsen 1993), Contextual Inquiry (Beyer and Holtzblatt 1999, Viitanen 2011), valid useful user experience method (Väänänen-Vainio-Mattila & et. al. 2008), and User Experience Questionnaire (UEQ, Schrepp & al. 2017). For this qualitative study, contextual inquiry provides the framing for the interviews: the aim is to find out about the everyday tools and practices among the respondents.

The CSCW approach brings in methods and conceptual frameworks that can capture the social surroundings and the overall analysis of the working surroundings using qualitative studies with narrative material for systematic conceptual categorizing work, analyzed with qualitative data analysis tools, such as the Atlas.Ti (the "equivalent of SPSS in qualitative research"). This variety of methods offers a good starting point for the exploration and elaboration of the supporting role that the collaborative ICT systems have in the real-life settings in different organizations.

The institutions/organizations for the in-depth interviews include participants from the following organizations. The aim in the project has been to interview at least one representative from one institution from the following categories:

- **National agencies**: Within this organizational category, the interviews have been conducted in the Institute of the Tax and Customs Administration Hungary and in the Customs service of Ireland. Agencies that belong to this group include e.g., Agencia Tributaria / Spanish Customs Administration; Guardia Civil / Spanish National Police; Direction générale des douanes et droits indirects / French Customs.
- **EU administrations and agencies**, and EU funded networks: Within this organizational category, the interview has been conducted by a representative from the European Commission Directorate-General for Taxation and Customs Union (EC DG TAXUD). Other organizations belonging to this category include European Border and Coast Guard Agency (FRONTEX), Horizon 2020: Innovation - Law Enforcement Agencies Dialogue practitioner network (H2020 iLEAD).
- **International organizations**: The interviewees for this category represented the United Nations Office for Drugs and Crime (UNODC). Other organizations of this category are e.g., World Customs Organization (WCO) and the International Criminal Police Organization (INTERPOL).

Altogether, five people were interviewed for this study and the interviewees represent this definition and aim in a balanced manner:

- 2 interviewees from the United Nations Office on Drugs and Crime (UNODC), involved in the Container Control Programme (CCP)
- 1 interviewee from Revenue, which is the Customs service of Ireland.
- 1 interviewee form the Customs Administration of Hungary
- 1 interviewee from ENLETS

According to the tasks covered in the "Information and Communication Technology and the use of Communication Toolboxes in Customs services", we believe these organizations and the tasks they perform cover the different communication needs in this type of organizations.

2.1.1. Interviews

The interviews were conducted remotely, using the GoToMeeting program. Two interviewees turned their camera on, while the rest used their microphones. The interaction was richer when we could see the interviewees, but only hearing them was sufficient for the purpose of this project, since the objective was to qualitatively analyze the user experience. The interviews were conducted in a semi-structured manner and recorded with the participant's acknowledgement. An introductory letter, explaining the purpose of this study as well as the themes to be discussed was sent to the participating organizations. The interviews lasted from 45 minutes to 1 hour. Once the interviews were over, the audio recordings were transcribed for the qualitative analysis with Atlas.Ti.

2.1.2. Construction of the interview contents

The concise presentation of the questions for the interviews are available in the annex. The rationale for the questions, based on the background material, is as follows:

1. About your role and overall communication needs and tools

This section is more general, and the objective was to find out about the interviewee's role and general communication needs.

a. Can you tell a bit about your role and typical tasks in your organization?

This is an introductory question designed to lead the interview and provide some context, so that we could better understand the interviewee's work. Furthermore, this question confirms that the person belongs to the intended group of relevant informants.

b. Do you have regular contacts & communications with law enforcement practitioners, or any experts from government agencies, businesses, research institutes,

universities, or non-government organizations? If yes, can you tell a bit how you communicate with these organizations?

This question is designed to create understanding the customs officers' communication needs and give us some more context in terms of their typical activities and tasks.

c. Which communication tools and technologies do you use today? Please list all relevant ones.

The objective of this question is to understand the tools and technologies practitioner's use. Furthermore, thanks to this question interviewees start thinking about more concrete tools and their uses and it nicely introduces the next question. From the point of view of the UX model, with this question we wanted the user to start thinking about the experiential facet, as the user would likely start describing use cases and referring to their experiences. This question has the potential to reveal some initial problems in the use of the dedicated communication toolbox or some problems related to the process followed by our interviewee when working.

d. What are the benefits of these technologies, both for yourself and for the organization?

With this question we want to start a discussion about concrete technologies and benefits. We were also looking for the reasons behind the benefits from an experiential and from an emotion and affect perspective. This is because, we would hope that during their answers, interviewees would talk more in detail about how using the technology makes them feel (are there positive or negative feelings?) and what motivates these feelings, since the objective is to understand what triggers certain experiences.

e. What about the limitations and shortcomings?

Complementing the previous question, we wanted to understand the limitations these tools have when compared to face-to-face meetings or their 'normal' work in a pre-COVID setting and the reasons for these limitations according to our interviewees. Similarly, to the previous questions, we were hoping to discover items in the "beyond the instrumental" and the "emotion and affect" facets. Interviewees could speak about their more negative feelings and follow-up questions could be asked if needed, which would in turn help uncover more limitations or the reasons behind the ones they would talk about. Potentially this question could reveal aspects related to the user's stimulation and/or increase in knowledge and skill (supposing the interviewee would have negative aspects to point out).

f. Are there any specific issues when it comes to communicating in the international context?

Customs practitioners need to communicate in the international context. This question aimed at understanding their problems related to this objective. Similarly, to the previous question, we would like to find out aspects related to the "beyond the instrumental" and "emotions and affect" facets. Due to the specificity of this question if problems exist in this type of communication, the interviewees will reveal aspects about the experiential facet, since they would likely describe a scenario and explain the main problems.

g. Do you have any particular views on the security (anti-intrusion, virus etc.) aspects of the communication tools and technologies you commonly use?

In this question we wanted to get some first impressions in terms of the security. It is a very open question, since we are asking the interviewees' opinion on this subject but could potentially reveal interesting aspects to be discussed later in section 2: "About the specific communication toolbox". This question was asked because PEN-CP was interested in this topic and could potentially lead to a scenario description, touching on the experiential aspect and contributing to the "contextual inquiry" replacement question.

2. About the specific communication toolbox

This second part is more specific and aims at finding out specific information about the communication toolbox used by the interviewee.

a. How do you typically use the dedicated communication toolbox of your organization?

With this question, we wanted the interviewee to describe typical tasks. This question is the substitute for the contextual inquiry, where we would be able to observe the users in their natural environment. Additionally, when describing their tasks interviewees might reveal functions that do not work properly and we can ask them to explain more in detail, if necessary. We wanted to uncover the process that allows users to complete a task. Therefore, we would likely address the experiential facet and if follow-up questions are asked, we could potentially uncover thoughts on emotion and affect (does the user enjoy doing this task and why?)

b. How does the communication toolbox make it easier for you to do your job?

We wanted to understand how this communication allows practitioners to efficiently do their job as well as how the pandemic affected their work. This question could reveal aspects related to the experiential facet potentially (if users described a concrete experience they had and explain why and how the tool made it easier for them to do their job). It could also reveal aspects related to emotion and affect, since the interviewee would likely describe positive experiences. **ii-/ Do you have any views on the visual design of the system?**

Although this question was not originally in the list submitted to the participants, it addresses the aesthetic aspect ("beyond the instrumental" facet) of user experience explicitly. We wanted to understand if an overall negative assessment of the user experience would be correlated with a visually unappealing design as we would expect.

c. What are your favorite functionalities and features, and why?

The objective of this question was to understand what the features that are considered useful as well as providing some arguments to support their claims. The term 'favorite' accounts for the experiential aspect described by Hassenzahl & Tractinsky. We wanted to understand if our interviewees enjoy using their respective platform and the reasons behind their enjoyment (or lack of). Potentially, if they had had any bad experiences that would account for them not enjoying their platforms, they could also bring them up here. The last option (as we later found out) is that they did not have any particularly bad experiences but simply do not enjoy using

the system. In that case, we would be dealing with a lack of stimulation. Therefore, this question would touch on the “beyond the instrumental” facet.

d. How the users of the toolbox need to consider data protection and other security aspects? Are there any specific steps and principles to take into account? Is it convenient for you follow these steps and principles?

These questions aim at finding out about the security aspects of the communication toolboxes. It is important to understand how secure processes need to be considered as a part of the interviewees’ daily work. This question is also a partial substitute for the contextual inquiry. If interviewees can answer it, they would probably describe a scenario and an experience, even if it is only from a theoretical perspective.

e. What can you say about the reliability of the communication toolbox? For example, in case the toolbox crashes, are there any backup systems or fallback plans? Are there any safeguards to avoid loss data?

This question allows us to understand whether the platforms are reliable and therefore the impact they might have on the overall user experience if they are not. Secondly, it helps us to understand the overall knowledge the interviewees have in case the platform crashes and the appropriate measures to take. Error prevention is a usability heuristic (Nielsen, 1994) and therefore contributes to the overall user experience.

f. Any other user experience related observations or comments?

In case the interviewees forgot something, they can add it here. It serves as a conclusion to the factual questions.

g. Does the communication toolbox include any functionalities and features that you are aware of, but have not yet used? Are you likely to start using them within next 12 months, and why so?

The objective of this question is to explore any under-used functionalities (or not used at all) and the reasons why they are being under-used. Secondly, we wanted to know if they would start using them if these problematic functionalities were to be fixed and the reasons for this as well. We are dealing with aspects from all three facets. The reasons an interviewee might have for not using a certain functionality (or a group of functionalities) could belong to any of the three categories.

h. What new functionalities and features would you like to see featured in the communication toolbox within the next 12/24 months, and why so?

Our interviewees have several years of experience and could potentially have ideas for new features. Once again, we wanted to understand the reasons for their claims. Rather than asking the interviewee to design a feature we wanted to understand their real needs. We expect users to elicit pragmatic answers and therefore this question deals primarily with the experiential facet, although the reasons behind a need or request could belong to any of the three categories once again.

2.1.3. Transcriptions of the Interviews

The objective of this work is to understand user experiences from a conceptual perspective. This objective motivated the following decisions, when transcribing the data to analyze it:

- Onomatopoeic sounds were removed from the transcriptions: Our objective is to categorize different experiences, and these data do not reveal relevant information and were therefore removed.
- Ellipses were used when a word could not be recognized, because of a brief cut or due to the word not being comprehensible for other reasons.
- Repetitions were removed: Sometimes when the interviewee answered a question, they repeated the same word twice. Whenever this happened, the second word was not transcribed.
- Some questions, from the interviewer's side were rephrased: Most questions were prepared in advance, but in some cases, we had follow-up questions and we asked the interviewee to clarify something whenever it was not fully clear. In some cases, our formulation was messy and for the sake of the content the question was rephrased in the transcription.

There were some technical problems during the interview. We will explain what they were and the impact they had on the transcriptions, as well as how we overcame them.

- Breaks in audio: As a result, not understanding with 100% accuracy what was being said, during the interview. If the recording also contained this break, it was impossible to fully understand what the interviewee replied. To overcome this, we simply asked the interviewee to repeat if we were not able to hear the interviewee's reply properly. In case, this was not possible, we imagined how the interviewee would formulate their response considering the context (Tilley 2003).
- Cuts in Internet Connection: During one of the interviews, there was an Internet cut, which meant the recording was missing a section. The interviewee was asked to repeat what he had said so that it was available in the recording.

Interview Script

An interview script was created, to guide us during the interviews. The script is available in the Annex section. The questions in the script are simplified and the questions containing multiple questions were divided so that a user's cognitive load is minimized. However, the questions contained in the script are the same ones (conceptually) that were sent to the organizations and are mainly thematic. This means that a question was not asked twice if the interviewee had already covered it in another answer. Sometimes, we would ask the interviewee to confirm something they had said, which touched on another point related to a different question. As a result, new information came to light and most of the times they would already answer a posterior question before it was asked.

The data was analyzed qualitatively following the guidelines by Taylor-Powell and Renner (2003):

1. Familiarization with the data: We went over the transcripts, listening to some parts from the recordings, when something was not completely clear, to understand the data. When we found an interesting observation, we noted it and sometimes asked for similar information in the next interviews.
2. Coding: The objective in this step is to identify similar concepts in the data by assigning a code to an idea.
3. Categorization: After developing different codes, we categorized them (this corresponds to a higher level of abstraction). After doing this, we also developed sub-categories.
4. Report the findings: This last step structures and communicates the main findings from the study. The next section summarizes the empirical findings.

2.1.4. System Usability Scale (SUS)

The System Usability Scale measures the usability of a system and should be used after the user has had a chance to interact with the system, but before discussions begin. This questionnaire has been proven to be robust and reliable (even with small sample sizes) (Brooke, 1996). Additionally, this questionnaire is easy and quick to administer, which is perfect for this thesis project.

Table 1- System Usability Scale

	Strongly Disagree 1	2	3	4	Strongly Agree 5
1. I think that I would like to use this system frequently.					
2. I found the system unnecessarily complex.					
3. I thought the system was easy to use.					
4. I think that I would need the support of a technical person to be able to use this system.					
5. I found the various functions in this system were well integrated.					
6. I thought there was too much inconsistency in this system.					
7. I would imagine that most people would learn to use this system very quickly.					
8. I found the system very cumbersome to use.					

9. I felt very confident using the system.					
10. I needed to learn a lot of things before I could get going with this system.					

SUS Score calculation:

1. Convert all the responses from the 1-5 range to the 0-4 range. Positive and negative questions can be found in alternating order, with positive questions in odd numbered positions (assuming the first question to be in position number 1) and negative questions in even numbered positions.

   a. For the odd numbered questions, subtract 1 from the score obtained in that question

   b. For the even numbered questions subtract their value from 5

2. Add all the scores and multiply by 2.5. The final value should be a number between 0 and 100.

When scoring the questionnaire, it is important to consider that the scores are not percentages, since 68 is the average, and therefore by definition would correspond to the 50th percentile. It is possible to obtain a percentile based on SUS scores by normalization. The graph below associates scores with adjectives (Bangor, Kortum and Miller, 2009).

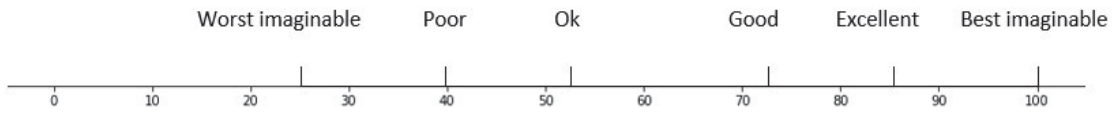


Figure 4: SUS scores with an adjective classification, as described in Bangor, Kortum and Miller, 2009.

In principle, this means that values above 68 are better than average. Values above 72 are good and values below 50 indicate poor usability and therefore suggest that the product should not progress towards a production environment. In this context "OK" does not mean acceptable usability (Bangor, Kortum and Miller, 2009), but rather the midpoint between neutral and average (and therefore below average). In conclusion, a product can be considered to have good usability when the average SUS score is above 72 and should be redesigned when the average SUS score is below 68.

2.1.5. User Experience Questionnaire (UEQ)

The User Experience Questionnaire is a questionnaire composed by 26 questions. It measures attractiveness, which is composed by pragmatic qualities such as efficiency,

perspicuity and dependability and hedonic qualities such as stimulation and novelty (Schrepp, 2019).

Attractiveness is associated to the users' overall impression of the product (is the product good, enjoyable etc.?). Perspicuity is associated to the difficulty when learning the product (is the product understandable, complicated etc.?). Efficiency, as expected measures how well tasks are solved with respect to the fastest solution (is the product practical, cluttered etc.?). Dependability measures how well users can solve tasks without relying on others and feeling in control (is the product unpredictable, obstructive, meets expectations …etc.?). Stimulation refers to the degree of motivation from users, when using the product (is the product boring, interesting etc.?). Finally, novelty refers to the degree product's degree of innovation (is the product creative, dull, conservative etc.?).

In this case, we are going to use the UEQ- S (short version), due to time constraints, since we are already planning to conduct an interview and administer the SUS. Schrepp, Hinderks and Thomaschewski (2017) showed that the UEQ-S can accurately predict the results from the traditional UEQ.

annoying	o o o o o o o	enjoyable
not understandable	o o o o o o o	understandable
creative	o o o o o o o	dull
easy to learn	o o o o o o o	difficult to learn
valuable	o o o o o o o	inferior
boring	o o o o o o o	exciting
not interesting	o o o o o o o	interesting
unpredictable	o o o o o o o	predictable
fast	o o o o o o o	slow
inventive	o o o o o o o	conventional
obstructive	o o o o o o o	supportive
good	o o o o o o o	bad
complicated	o o o o o o o	easy
unlikable	o o o o o o o	pleasing
usual	o o o o o o o	leading edge
unpleasant	o o o o o o o	pleasant
secure	o o o o o o o	not secure
motivating	o o o o o o o	demotivating
meets expectations	o o o o o o o	does not meet expectations
inefficient	o o o o o o o	efficient
clear	o o o o o o o	confusing
impractical	o o o o o o o	practical
organized	o o o o o o o	cluttered
attractive	o o o o o o o	unattractive
friendly	o o o o o o o	unfriendly
conservative	o o o o o o o	innovative

Figure 5: English version of the traditional UEQ

obstructive	o o o o o o o	supportive
complicated	o o o o o o o	easy
inefficient	o o o o o o o	efficient
clear	o o o o o o o	confusing
boring	o o o o o o o	exiting
not interesting	o o o o o o o	interesting
conventional	o o o o o o o	inventive
usual	o o o o o o o	leading edge

Figure 6: English version of the UEQ-S

UEQ Results

The results can be analyzed directly with the Excel sheet provided in https://www.ueqonline.org/. The results consist of the six qualities defined previously (attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty). These characteristics make it easier to understand what should be improved for the final users.

When analyzing the results, it is unlikely to observe values above 2 or below -2, due to the way the means are calculated. Therefore, a value of 1.5 is good but might not be perceived as such. Analogous observations hold true for negative values below -2. The next graph (Fig. 7) shows an association between adjectives and overall values for the UEQ.

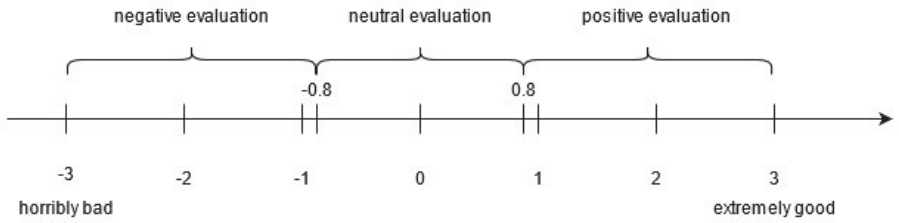


Figure 7: Association between the SUS result and negative, neutral, or positive evaluations

For individual attributes Figure 8 shows the adjectives depending on the values. For example, for "attractiveness" a value slightly above 1, would be above average but for novelty 0.75 approximately, would suffice to be in that same category (above average). This graph was retrieved from the original Data Analysis Tool (https://www.ueq-online.org/).

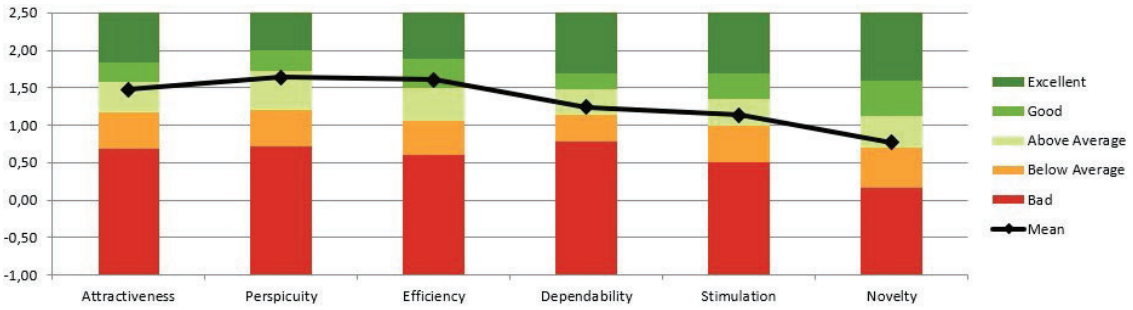


Figure 8: Illustration of the meaning behind the individual attributes, that compose the UEQ

2.2. Results: Empirical Findings on User Experience of Communication Toolboxes in Customs Organizations

This section focuses on the explanation of the results abstracted from this study. First, we will explain some general findings and then we will develop the analysis by question and

interpret the data. The users talked about technical features that they liked, disliked and in a few cases proposed new ones for the future. When talking about good existing features, users enjoyed the interactivity aspects of the communication toolboxes (forum functionality, presentation sharing, training webinars…) as well the organizational aspects (calendar). The second most important category (in terms of absolute number of sentences) referenced by interviewees was the "communication needs" category. They were able to explain in detail, the types of tools they use depending on the context. However, when describing their typical tasks, they were not so comprehensive. Due to the relatively limited number of interviewed respondents, the results are reported in a unified manner. **1) About your role and overall communication needs and tools**

a) Can you tell a bit about your role and typical tasks in your organization?

Our interviewees had distinct roles and depending on their role, their tasks and responsibilities varied. They explained how their programs were being implemented and they briefly talked about their business goals. Many of them are involved in training activities (they are usually the ones giving the training). Some use Moodle for this purpose, although the majority use Microsoft Teams or other webinar tools. For the Moodle-users, they appreciated the fact that documents can be stored and unified in one place after the webinar is over in case, they need to revisit the materials. This question was designed to lead the interview and give us some context.

b) Do you have regular contacts & communications with law enforcement practitioners, or any experts from government agencies, businesses, research institutes, universities, or non-government organizations? If yes, can you tell a bit how you communicate with these organizations?

All our interviewees had regular contacts with at least a couple of the cited organizations. Some programs need a political level communication and collaboration to be implemented worldwide. University level communication usually happens to focus on research activities. Finally, some organizations are in close contact with governmental agencies that provide knowledge in one specific domain. Our interviewees have regular contacts with many different stakeholders and use a variety of different tools as we will explain in the next question.

c) Which communication tools and technologies do you use today? Please list all relevant ones.

As explained in the question 1a, some customs officers are involved in training activities and use Moodle for training, to publish materials or in some cases attend a training in an external platform. Other frequently used technologies include: **WhatsApp** (for informal discussions or to request a brief call with a colleague), **Zoom** (for video-conferencing, although many organizations do not find it secure), **email**, **phone contact** (in smaller organizations, a phone call is bound to get a quicker reply than an e-mail or text) , **social media** (mainly Twitter or LinkedIn) to give visibility to a program, **GoToMeeting** for videoconferencing, a **dedicated secure communication platform** to discuss more private information with other colleagues, **Polycom** and Skype for business for webinar training. One interviewee mentioned that tools such as **WhatsApp** are *"perhaps overused"*, and it is easy to find too many messages to pay reasonable attention to them. He reckoned these digital tools are very flexible and are good to

set up meetings but not an effective way to continue a discussion over extended periods of time. Everyone said at some point of the interview (not necessarily in this question), that there are too many applications and the theme of integration and complementarity started to surface at this stage. In this question everyone was able to precisely explain the tools they use based on the scenario and security requirements.

d) What are the benefits of these technologies, both for yourself and for the organization?

Four of our interviewees said that meetings in person are preferred, communication is easier because there is better interaction. According to one of them: "*It is easier to build trust and confidence around a table*". Of these four interviewees one of them pointed out that meetings are cost-efficient and even though there were some challenges at the start of the pandemic, they are currently familiar with the main digital tools. Two of them mentioned that during training, they arranged the participants in the same physical space, while the trainer was online, and this helped them monitor the participants. Interviewees think a faceto-face meeting is difficult to replace. Some projects require being somewhere physically and this cannot be replaced by technology. Three interviewees believe their organization will opt for a hybrid approach combining on-site and remote work in the future.

e) What about the limitations and shortcomings?

One interviewee observed that during video-meetings it is hard to assess what each person is doing, especially when they do not have their camera on. A participant could be connected and not say anything. In face-to-face meetings it is easier to understand the level of implication of each participant and it is easier to have more fluid chats if the person is physically available. Secondly, sometimes there is a language barrier. Many officers have operations all around the world and not everyone speaks English well enough. The example we were given focused on the training, but it is possible this problem arises in other aspects as well. The interviewee told us they had simultaneous translation available and that he *"manages a few languages"* to solve this inconvenience. Finally, in some countries the quality of the internet connection is insufficient to adequately follow online training. This question makes it apparent that many external factors influence the overall communication experience.

f) Are there any specific issues when it comes to communicating in the international context?

Two interviewees mentioned cultural differences as being a problem sometimes. According to an interviewee: "*in some cultures, the best you can do is cheat your employer*", referring to some employees pretending to work and not really working. The other interviewee that mentioned "cultural differences" spoke about them in a pre-COVID era, when travelling was still allowed. Three interviewees observed some motivation issues and the fact that it is difficult to control whether trainees are really following along in a webinar. Additionally, one interviewee observed a technical problem that hindered his work. He is a member of different project groups in his organization and therefore has access to many different projects. Different projects have different users with different privileges. In this platform, users with different privileges in the same project received the same notification with a certain delay

(even some days). However, the notified document would appear if he checked for it manually. He knew about the bug and his solution was to manually inspect in case there were new documents. Finally, one interviewee explained that he knew some customs officers, that had to instruct a class after their working hours, which meant the officers were tired and it impacted the training negatively. As we can observe, many external factors influence the overall user experience, as expected because of how many different members are involved in these activities.

g) Do you have any particular views on the security (anti-intrusion, virus etc.) aspects of the communication tools and technologies you commonly use?

Most interviewees trust their organization and they claim they do not have a technical background to properly understand the security aspects. They have antivirus software installed and in one organization the laptops are connected to a docking situation and cannot be transported outside. If they have any doubts concerning the security of an application or software, they will check with their organization to ensure it is safe. One interviewee said he does not share anything sensitive by e-mail and in case he needs to communicate sensitive information urgently, he would use an encrypted radio system.

2) About the specific communication toolbox

a) How do you typically use the dedicated communication toolbox of your organization?

There are many different tasks because the organizations have different goals. Below we summarize the main tasks described by our interviewees. Unfortunately, these are not exhaustive task descriptions, and they would need to be investigated in more detail to understand the problems and the users' process. One interviewee described a typical training task, from invitation to webinar. He explained that first an invitation was sent and sometimes there were notification issues, and he did not receive it unless he checked for it manually. The resources are available after the webinar, and he thought this was a good feature. From his explanation, we can derive that the main advantage is the grouping and unification of different documents in one digital platform. Another interviewee described one type of communication with other custom officers. In their dedicated secure platform, they have a tool to send alerts to the destination country in case customs officers believe a container is suspicious and cannot inspect it. After the container has reached its destination and customs officers have inspected it, they report back and inform their colleagues whether their suspicions were correct or not through the alert system. Finally, they upload a report into the system with a predetermined format. There are some problems with the format not being followed by all the members. The format is useful for the system to automatically translate the report into another language for other unit members to consult. As explained, if the format is not followed, other members need to use google translate to understand the report. Customs officers do not follow the format *"because they are lazy"*, as stated by one of our interviewees and the system lets them upload an incorrectly formatted report. Another interviewee replied they use Skype for business for webinars (which accounts for a considerable amount of his work) but restrictions in internet access due to their own security complicate its smooth use. Finally, the last interviewee described a typical scenario of information exchange, where the application channel (like a Slack channel) is named after the case and officers can exchange documents and geo-locations to collaborate.

b) How does the communication toolbox make it easier for you do your job?

According to an interviewee being able to contact an officer, who has access to complementary information is an advantage, as there are different officers with different roles and information in the platform. A couple of interviewees said they appreciated the ability to give webinars, thanks to the video-conferencing applications. Another interviewee noted that some individual features helped him with his job. For instance, he thought the calendar functionality enabled him to organize his day properly and accurately, as he participates in many different projects and does not always remember all the meetings he has to attend. He said that the structure and design of the dedicated secure application also helped him because his platform is divided into separate individual folder for each group project. He likes this because all the necessary materials are grouped together by project. **ii) What do you think of the visual design?**

One interviewee observed that the communication toolbox he uses is "*not modern in terms of design".* He elaborated on this claim by explaining that an experienced user would probably find the information they are looking for, reasonably fast but for a new user *"it is not quite easy to find the things you are looking for"*. A couple of interviewees claimed their toolbox is well designed and they find it easy to use. One of these interviewees even claimed that inexperienced users would be able to learn it quickly.

Although most interviewees did not complain about the design, seeing the interviewees using their platforms in a professional setting could reveal even more problems. Everyone was able to use the systems well enough according to themselves, but only a few of them mentioned new users as a measure of the general usability. Just because they can correctly use the system, as experienced users, this does not equate to a good overall usability.

c) What are your favorite functionalities and features, and why?

In general, most users said they did not have a favorite functionality, but one interviewee talked about how the toolbox gives him the feeling he is talking to the right person, because he can see in the system where his colleagues are based, and he can therefore contact them directly. Since there is a strong emphasis on security, he can be sure he is talking to the right person. Another interviewee, said that although he did not have any favorite features, he appreciated the application being multiplatform, which means he can use it on any device (phone, tablet, computer). Additionally, he said that he thought the gallery is useful although he complained that searching for a particular picture is hard, because the system only provides a list.

d) How do the users of the toolbox need to consider data protection and other security aspects? Are there any specific steps and principles to take into account? Is it convenient for you follow these steps and principles?

Most users stated again they trust their organization in security matters. One interviewee explained that a new user would not be able to register in a system, as manual confirmation is required. Another interviewee explained his organization had a secure chat app with dedicated channels to communicate (like Slack) and before joining a channel the new user had to sign a GDPR consent. Another user explained that he was not allowed to connect any laptops that did not belong to his organization to their internal intranet. Furthermore, he

could not plug in USB sticks to give a simple PowerPoint presentation. He complained about the software being *"walled-off"* and explained that due to it he had had to purchase new laptops to install a program he needed for his job and training, as it was easier than asking the IT Team to install the desired program. Another interviewee explained he had *"two layers"* in his phone. One is for his personal use and the other is for professional use. In this question, interviewees did not provide a structured and clear process. Rather, they listed single rules they had to follow. This leads us to believe that a better understanding of the tasks is necessary.

e) What can you say about the reliability of the communication toolbox? For example, in case the toolbox crashes, are there any backup systems or fallback plans? Are there any safeguards to avoid loss data?

No users have reported any crashes. All our interviewees mentioned that a technical support team was available in case they needed something, but they had not had any significant issues and when they had a problem the support team was able quickly help them. Only one user stated convincingly that a backup is available on the cloud, and he knew how to access it. The other interviewees imagined that a backup was available but did not know precisely if it existed and how to retrieve the information. In this question, we can observe that the users are not aware what to do if a crash were to happen. Once again, we can observe how minimal cognitive resources are invested, as users consider that a crash is not likely to happen (in one case, in seven years no crashes had occurred) and do not learn the appropriate procedure.

f) Any other user experience related observations or comments?

Only one interviewee said there exists a chat inside platform, but it is underused because double authentication is necessary, and it is easier to access to the normal e-mail. The other interviewees said they did not have anything else to add.

g) Does the communication toolbox include any functionalities and features that you are aware of, but have not yet used? Are you likely to start using them within next 12 months, and why so?

Everyone answered they had used everything except for one interviewee. He said that if the integration between different calendars were better, he would use the calendar within the system. The problem resides in the lack of syncing between different calendars on his dedicated platform. The answers are not surprising considering that our interviewees had worked for the same organization with the same tools for several years and had therefore used all the features.

h) What new functionalities and features would you like to see featured in the communication toolbox within the next 12/24 months, and why so?

Four interviewees said they could not think of a new functionality, or they did not need anything else. One interviewee said that a webinar tool inside the dedicated secure communication platform would be nice, so that he only had to work with one platform. However, there was a contradiction with this interviewee's answers. At an earlier stage of the interview, he had complained how there should be more separation more separation

between different systems and suggested making a dedicated system per goal/organization. This confirms that it would be necessary to explore the organizations' individual tasks by conducting a contextual inquiry. Interestingly, even though everyone revealed flaws in their respective platforms, only of them suggested a new functionality. This is worth exploring to find out the real user's needs. Considering these answers and the answers to question 2c, where users revealed they do not have any favorite features, we can derive that most of them do not enjoy using their dedicated communication toolbox.

2.3. Categorization

In the following section we will present the different categories extracted from the interviews. Table 1 presents in a summarized manner that categories and subcategories that were found in the analysis and support the results.

Table 2 with the names of the categories and their definitions

Category	Definition	Sub-categories
1. Technical features	Technical features in the system that users like/hate or proposed for the future.	Good existing functionality
		Problematic feature
		Possible future feature
		New feature request
		No new features
2.System structure	All the factors that affect the experience based on structure of the information.	Learnability
		Clear structure
3.Human experiences (where interaction with other humans plays a major role)	All the factors where personal preferences or/and interaction with others influence the overall experience	Face to face meetings
		Personal trust
		Dislikes extra work
		Training
		Forced usage
4.Security	All the factors and opinions that make the system secure to use	Security
		Reliability
5.External factors that affect the XR	Factors that are external to the organizations. These include technical and organizational problems.	Technical
		Constraints
		External factors

6.User's knowledge	Represents what the user knows and some solutions they adopt to technical problems.	User's technical knowledge on the platform
		Trust in their own organization
		Solution or workaround to technical problems
7.Complementarity and Integration	Represents all the quotes referring to complementarity and integration between different platforms	Complementarity
		Integration
8.Needs	Communication needs where the interviewee details how different tools are used	Communication needs based on current existing software
9.Tasks	Describes a typical task in their job	

The categories were constructed by noticing the themes in the interviews. If an interviewee repeated or said something was important the sentence was underlined for it to be considered in the analysis. Some of these themes appeared due to the interview questions, while others emerged from related discussions or follow up questions. The categories were constructed, considering the research questions, the customs practitioners current needs and other factors that can affect the overall user experience. To correctly analyze and understand user experience it is important to understand the reasons behind a feature being liked or disliked. That is precisely the reason why a category with technical features (liked or disliked) by users was created. In this category is where most of the more easily modifiable features are. Related to this, is how information is presented on screen, which is why the second category (system structure) is there. Thirdly, many experiences related to the use of technology in conjunction with other humans, were mentioned. These experiences were described positively due to other people interacting in some way, which makes this kind of interaction the main enriching aspect. Related to the security of the different systems, interviewees expressed why they think their systems are secure.

There are some factors that are unrelated to the software but affect the overall experience. These were important enough to be considered a distinct category by themselves. The user's knowledge is something that affects the overall experience, as well. Generally worse experiences can sometimes be attributed to less knowledge about the platform. In this category, the problems there are with a platform and their own solutions is also included. The last two categories of tasks and needs are related, since to accomplish an intricate task, customs officers must be aware of their specific needs.

3. Analysis and Discussion

This section is divided into four main parts. The first part concerns: features that work well and are therefore worth keeping, improvement requests, and components that need to be explored in more detail to have a better understanding. In the second part, we explain some remarks concerning the research process. Thirdly, we propose partial solution to conduct remote contextual inquiry and finally, we present our prototype. Finally, we will discuss the findings and propose conceptual solutions.

3.1. Important Features, Improvement Requests

This section is divided into three parts: features that work well and are therefore worth keeping, improvement requests, and components that need to be explored in more detail to have a better understanding.

3.1.1. Important features that work well

This category consists of features and functionalities that our interviewees liked, or thought were useful. We explain what they are and the reasons they consider them useful. Below, the list of useful features is explained more in depth.

o Ability to show presentations: Like any modern communication platform, most users appreciate this feature and claimed it was one of the most useful, especially when delivering training, as it is the substitute for on-site presentations.

o Calendar functionality displaying the meetings, events, and other important deadlines. Users like to use the calendar to organize their day. However, one user complained when an integration with different calendars was missing. In this case, his solution was to use a tool where different accounts could be synchronized automatically. The solution to this problem is technical and could be solved relatively easily.

o Video-conference functionality: Videoconferences are preferred in many cases over a simple phone call to have a more in-depth discussions but face to face meetings are everyone's preference when possible. This attribute can be justified from two perspectives. The first one being that it is easier to perceive emotion and overall engagement with the discussed topic when the cameras are turned on. Therefore, in terms of user experience, this appeals to the users' emotional facet. Secondly, as mentioned by some interviewees, better results are obtained during physical meetings, perhaps because of the last argument. Therefore, the second perspective corresponds to the "experiential" facet, derived from the emotional facet in Hassenzahl & Tractinsky's model (Hassenzahl & Tractinsky, 2006)

o Platform interactivity: Customs officers find interactivity important. Many of them are delivering training or they need to communicate extensively with their colleagues from other

countries. For example, in one of the tools, forums were used to interact with colleagues on a specific topic. However, they were underused, and the reasons did not seem to be clear. Considering the UX model introduced in the literature survey, this belongs to the emotional and affect facet of UX, because interviewees enjoy interacting with their colleagues and think this enhances the overall interest in a topic.

o Simultaneous translation when delivering training: This feature is successfully implemented by one organization and the interviewee claims it helps when delivering training. Even though, this feature was only referenced by one organization, we can hypothesize it being useful. Coupling verbal and non-verbal communication enhances the trainee's comprehension. Therefore, one could argue there exists emotion and affect that is better perceived, when these two ways of communicating are combined.

o Showing a history of recent activities or documents that were accessed previously: A history of recently accessed folders helps the user when looking for information, since it saves the user, time when looking for information. We have no information on how this browsing history works but sorting by frequency could also be a solution for users that are involved in many projects at the same time. In this case, users relate to their own experiences when using the platform. They are busy, and this feature helps them, when using the platforms. Therefore, this is related to the "experiential" facet.

o Store previous training materials in a unified way for future reference if needed: The theme of "unification and complementarity" has appeared recurringly in the interviews. This desire stems from the users' desire to use as little resources as possible and therefore not have to look for information in various platforms. Additionally, many users have spoken about the limited integration and communication between different platforms. On the other hand, some users have explained their organization uses a unified approach to information storage, when conducting training using a MOOC and all of them have agreed this is beneficial. This part also accounts for the "experiential" facet. It is thanks to the users' own experiences (both positive and negative), that they can explain this requirement.

3.1.2. Improvement requests

This category consists of problematic features pointed out by the interviewees and other features they know are currently being developed or suggestions they had for a future platform. Below is a list containing some recommendations:

o Security: Understand precisely what the organization needs are and what type of software is needed. It is unreasonable to block all third-party software and limit communications without understanding that software's use. As reported during the interviews, this practice negatively impacts the work and ultimately makes the business incur in economic losses.

o Using pre-formats and making a certain format compulsory. Whenever users need to adhere to a certain format for whatever reason (business-related, technically related …etc.), ensure the system dynamically requests the desired user's input in the correct order. The

system should not allow incorrect user input and should always guide them to correctly fill out all the required data, with precise error-messages.

o Notification problems: Users receive some notifications late. They depend to a certain extent on these notifications to correctly do their job. This is a technical problem and impacts the overall user experience and should therefore be solved.

o Avoid unnecessary cognitive load: Some users complained that a relation between parts in the system that should be related in principle was not shown. If various parts of a system are related, the system should show it. This is especially beneficial in case of more complex relations. A better design could also help speed up day to day operations, as well as improving learnability.

o Improve learnability: Learnability is the degree of ease with which first time users accomplish a task in a specific system **(Joyce, 2019)**. According to one of the interviewees, a new user would find it difficult to find some features in one of the Customs' systems. Whenever it is possible, learnability should be improved, so that it takes less time for a nonexperienced user to find the information they need, and time is minimized when learning the interface. Conventions for icons and contents should be respected, so that items are correctly identified.

o Ensure platform complementarity and integration: There have been numerous complaints about wasting time finding information or documents, because of the number of different systems customs practitioners use within their organization. Furthermore, the integration between different platforms is virtually non-existent in most cases. This should be improved, so that users need to invest less time when looking for a document. While interviewees understand the necessity for double-factor authentication, they wonder about another solution that would be as secure and less time consuming. This would need to be explored further and if it is feasible from a security perspective it could be implemented. A simple solution would be to allow the user to browse around the service until they access more private data and then require them to use double-factor authentication. Another alternative would be to implement a similar solution to Slack's magic link where the user enters their email, and the system allows the user to login through their email. The main advantage of this strategy would be in the fact that it helps users that have different passwords across may systems. Therefore, this solves partially one of the problems of password platform integration.

Although the following does not constitute an improvement request, it is important to point it out. One user did not really understand what was meant by "communication toolbox". As a result, the interview had fewer tangible results, due to it being less focused. In future work, it is important to ensure before starting the interview phase that the interviewee has read the introductory documents and correctly understands the definitions.

3.1.3. Components that need to be explored further to gain a better understanding.

This category comprises all the elements that were not completely understood in this study and need a more in-depth analysis. The following list should be considered in future studies.

o Task analysis and understanding of the business processes. Task analysis is about learning the tasks users do to achieve their goals. It is necessary to isolate each organization's process to better understand them. To summarize the information a hierarchical task analysis diagram could be produced. Once tasks are understood more precisely, systems can be designed, based on each individual organization's need or goal. We believe this is necessary to gain a better understanding because of slight contradictions and non-exhaustive descriptions of tasks, which likely means some problems were not uncovered.

o Some functionalities, such as the forums, are under-used (in one organization). It could be beneficial understanding the reasons behind it and whether more under-used functionalities exist. One of the reasons, might be that the notifications are not working correctly, and users do not receive on time the appropriate notification. However, some motivation issues were addressed as well. It would be interesting exploring these to better understand the user and their reasons for not interacting with their colleagues.

o External factors: These comprise all the factors that affect the user experience. Some examples include motivation issues, high-volume of work, which may impact the trainees' attention when attending a training session, general motivation issues, organizations' own internal processes and cultural differences. It is not trivial to find a solution for all these issues at once. Technology plays a larger role when participants are using it alone in positive experiences. People tend to have more positive responses when they interact with other people in their professional environment (Zeiner et. al., 2018). This collaborative use could help combat motivation issues. Many factors belonging to this category cannot be directly solved using technology and require the organizations' help.

3.2. Remarks on the Method and Research Process

Empirical studies with highly occupied informants pose a challenge for research. This was experienced also in this study. The main challenge in this study was to find and recruit the interviewees to participate, which took considerably longer that originally planned. The outcome of the interviews, however, includes representatives from the three categories of organizations illustrating the uses and needs in the different surroundings. Additional informants would improve the reliability of the results even though the interviews in this study started to show saturation in the answers. Secondly, although the SUS and UEQ were going to be administered, no participant answered, and we therefore have no data for that part of the study. In future work, finding more time to administer these tests will likely benefit the results.

The ability to observe activities in the natural surroundings (no contextual inquiries) has been limited due to COVID-19. As a result, as researchers we had limited information of the users' context, comprised by their tasks, their technical and physical environment, and their resources.

This research was very cost-effective. We were able to interview different users from different countries, without travelling. Since we were not interrupting their daily tasks, users had more

time and patience to explain some aspects. However, as we discussed previously this meant we could not directly observe their tasks and, as researchers, we only have the users' opinions to analyze.

The number of interviewees in this study is sufficient to find about 85% of usability problems. (Nielsen & Landauer, 1993). Therefore, we can claim reliability. However, it should be noted that for most organizations we only had access to one interviewee, so considering different organizations have different tasks, we were only able to have one opinion. Nonetheless, many interviewees that belonged to different organizations made similar observations and the last interviewee repeated most of what had already been said so for the purpose of this study, the number of interviewees is sufficient.

In terms of the transcribed data, our transcriptions are biased to a certain extent, due to our decisions when transcribing. Body language is hard to perceive through videoconferences (and not at all possible in audio meetings) and therefore was not analyzed but in further studies could be something to consider.

Finally, we must consider that our interviewees had access to the questions beforehand. While this allowed them to discuss and prepare more in depth, there is also the chance that they only discussed limited information and prepared more artificial answers. However, considering our qualitative analysis and given that the main objective of the report was to conceptually analyze user experiences, we believe the expected results have been achieved.

3.3. Prototype

Based on our findings and the context of use studied in the literature survey, we developed a desktop prototype with the help of Figma. In this next part we show our UIs and justify the design. The designs can be improved but we have tried to introduce useful features and could serve as inspiration for future communication toolboxes. In general, the interfaces are designed to be simple without many items on them for better legibility. The navigation levels are quite shallow, the user does not need to go through many different pages to accomplish a task and the route is always visible at the top. Many different interfaces have been described during the interviews and not all of them have been addressed. The screens that were designed correspond to solutions to the problems introduced in the "Discussion" section. These problems had to be complex enough and require more than a simple "programmatic" solution. For example, problems with the validation of reports were pointed out during the interviews, but this problem only requires form validation, which could be implemented by using AngularJS, for example, in a web prototype. Secondly, due to the prototype's limited interactivity, error messages could not be implemented but should be descriptive enough in the real platform. As mentioned in the literature survey, we have respected the time limits when simulating the interactivity. For the purposes of the prototype, all tasks are instantaneous, and the time limits are inferior to 0.1 seconds and therefore do not require feedback, but in the real implementation these time limits and the necessary feedback should be considered. Finally, to design aesthetically pleasing UIs, we have considered the attributes defined by Ngo, Teo and Byrne (2003), which were introduced in the literature survey.

3.3.1. UI Construction Guidelines

We need to consider User Interface construction guidelines, to ensure that our information is correctly structured, because that was an issue in the existing platforms. Secondly, these guidelines have been developed to enforce a consistent experience by respecting the user's mental model and not having unpredictable designs. To build the prototype, we have considered the UI guidelines as described by Smith & Mosier (1986), the design heuristics defined by Nielsen (1994) and the accessibility standards defined by WCAG (Korn et.al, 2013). The table below summarizes the guidelines for designing user interface software that have been followed and some examples in the prototype. They specifically address "Data Display" guidelines, since the prototype is mainly visual but when implemented as an application, guidelines from other categories should be considered as well.

Table 3 Utilization of UI construction guidelines in the prototype. The first two columns are a citation from the guidelines developed by Smith & Mosier (1986) and the last column explains how the guideline is addressed in the prototype.

Guideline Number &Title	Guideline Explanation	Guideline Example in the prototype
2.0/3 Data Displayed in Usable Form	Display data to users in directly usable form; do not make users convert displayed data.	The data tries to be clear and concise. This can be seen especially in the text hints when the user needs to enter data.
2.0/4 Data Display Consistent with User Conventions	Display data consistently with standards and conventions familiar to users.	For example, the format of the calendar is the European version, because this is a European project, but this should be adapted to other versions. The content is aligned to the left of the screen.
2.0/6 Consistent Display Format	For any data display, maintain consistent format from one display to another.	The forums are an example of consistent display. The homepage contains all the posts, there is a filter at the top and finally a button at the bottom that allows for extra actions. The project homepage and structure are another example of this guideline.

2.0/8 User Control of Data Display	Allow users to control the amount, format, and complexity of displayed data as necessary to meet task requirements.	The filters are an example of this guideline. The users can add them, filter according to their preferences and sort results based on filter importance from left to right.
2.0/10 + Protection of Displayed Data	When protection of displayed data is essential, maintain computer control over the display and do not permit a user to change controlled items.	In the forums, users cannot change the posts or replies created by other users. Also, when creating a post, users have limited power when creating a title so that it is kept consistent.
2.0/14 + Consistent Wording Across Displays	Ensure that wording is consistent from one display to another.	The title at the top of each page is the same as in the hamburger menu or the route at the top of the page. The text hints are worded similarly.
2.1/6 + Conventional Use of Mixed Case	Display continuous text conventionally in mixed upper and lower case.	The text hints are another example of this guideline.
2.1/8 + Consistent Word Spacing	Maintain consistent spacing between the words of displayed text,	To make reading easier consistent spacing is used throughout the prototype.

	with left justification of lines and ragged right margins if that is the result.	
2.1/10 + Conventional Punctuation	Use conventional punctuation in textual display; sentences should end with a period or other special punctuation.	The text hints when creating a post make use of conventional punctuation.
2.1/16 + Affirmative Sentences	Use affirmative statements rather than negative statements.	The text hints to create a post or search for content use affirmative sentences.
2.2/2 Visually Distinctive Data Fields	Provide clear visual definition of data fields, so that the data are distinct from labels and other display features.	When displaying a forum discussion, the title of the post is different than the content. Secondly, clickable

		contents appear underlined in blue.
2.2/3 + Data Field Labeling	Identify each data field with a displayed label.	When the user needs to input data (creating a post, searching for tags …etc.) the data fields have distinct labels showing their purpose.
2.3/2 Logical Organization	Organize tabular data in some recognizable order to facilitate scanning and assimilation.	Tabular data is organized by date.
2.3/8 + Distinctive Labeling	Ensure that row and column labels are distinguishable from the data displayed within tables, and from the labels of displayed lists such as menu options or instructions to users.	The tables are formatted so that the title appears in black and therefore as a distinct element.
2.3/12 Consistent Column Spacing	Maintain consistent column spacing within a table, and from one table to another.	Columns are spaced consistently, facilitating legibility.
2.3/13 + Column Scanning Cues	Separate the columns in a table by enough blank spaces, or by some other distinctive feature, to ensure separation of entries within a row.	The tables in the prototype follow this guideline.

2.3/14 + Row Scanning Cues	In dense tables with many rows, insert a blank line (or some other distinctive feature to aid horizontal scanning) after a group of rows at regular intervals.	Rows in tables have alternating colors and elements are separated by a blank space to make horizontal scanning easier.

2.4/5 Only Necessary Information Displayed	Tailor graphic displays to user needs and provide only those data necessary for user tasks.	In general, the prototype tries to follow this guideline and not overcomplicate the interfaces. However, this would need additional confirmation from real users to ensure that nothing is forgotten.
2.4/12 Standard Symbols	Establish standard meanings for graphic symbols and use them consistently within a system and among systems with the same users.	The same icons are used when an external resource needs to be accessed or the down arrow in the filters, or the icons in the hamburger menu.
2.5/1 Consistent Format	Adopt a consistent organization for the location of various display features from one display to another.	The project pages have the overall same structure, although they should be customizable depending on the project. The forums are kept consistent, as well.
2.5/2 Distinctive Display Elements	Make the different elements of a display format distinctive from one another.	This guideline is present throughout the prototype. The title of each page is presented in the same font at the top, the filters are distinguishable because of their background, the chat has a contacts section and a chat section clearly separated… etc.
2.5/3 + Spacing to Structure Displays	Use blank space to structure a display.	This is done throughout the prototype, but the most obvious examples would be the sections' separation in the project pages.
2.5/4 Paging Crowded Displays	When a display contains too much data for presentation in a single frame, partition the data	Since, minimalism was a great concern, data is available in different pages instead of having it in the
	into separately displayable pages.	same, so that the interface is not congested.

2.5/5 + Related Data on Same Page	When partitioning displays into multiple pages, consider the type of data, and display functionally related data items together on one page.	Even though data is available in multiple pages, each page has its own purpose, and the data is specific to that page.
2.6/26 Color Coding for Data Categories	When a user must distinguish rapidly among several discrete categories of data, particularly when data items are dispersed on a display, consider using a unique color to display the data in each category.	The post titles and responses have different colors. The chat messages have different colors. The buttons to join or discard a forum have different colors (red to discard or green to join).
2.6/27 + Easily Discriminable Colors	When selecting colors for coding discrete categories of data, ensure that those colors are easily discriminable.	For someone without visual disability these colors should be easy to differentiate. However, for someone with deuteranopia distinguishing red from green is non-trivial. Precisely the reason why the accessibility switch can always be accessed easily from the hamburger menu.
2.7.1/1 User Selection of Data for Display	For general data processing systems, allow users to specify the data for displayed output; for specific information handling applications, allow users to select data for display as needed to meet task requirements.	Users have the flexibility of filters to select the data they desire.
2.7.1/5 Selectable Data Categories	If the data categories required at different stages in a user's job cannot be exactly predicted, allow the user to select the categories needed for any information handling task.	Once again, the filters allow users to follow this guideline easily.

3.3.2. Accessibility guidelines

Similarly, it is important to follow the accessibility guidelines, defined by WCAG. In the literature survey, we introduced the principles to consider and now we will detail the success criteria and their application in the prototype. The first two columns are a citation from WCAG and the respective success criterion.

Table 4 showing how WCAG's success criteria are being followed in the prototype

Success Criterion Number &Title	Success Criterion Explanation	Success Criterion Example in the prototype
1.3.3: Sensory Characteristics (Level A)	"Instructions provided for understanding and operating content do not rely solely on sensory characteristics of components such as shape, size, visual location, orientation, or sound."	In the prototype the buttons have icons and text, which means the users would not only rely on shapes to perceive the button and understand its use.
1.4.1: Use of color (Level A)	"Color is not used as the only visual means of conveying information, indicating an action, prompting a response, or distinguishing a visual element."	Similarly, to the previous requirement, text is always present. For hyperlinks, the text is blue and underlined and therefore color is not the only means of conveying information.
1.4.3: Contrast (Level AA)	"The visual presentation of text and images of text has a contrast ratio of at least 4.5:1"	The background in the prototype is mostly white with black text in the foreground. Table 5 presents all contrast verifications
1.4.4: Resizing text	"Except for captions and images of text, text can be resized without assistive technology up to 200 percent without loss of content or functionality."	The zoom bar available in all UIs makes this possible.
3.2.3: Consistent Navigation (Level AA)	"Navigational mechanisms that are repeated on multiple Web pages within a set of Web pages occur in the same relative order each time they are repeated, unless a change is initiated by the user."	The absolute route a user followed to get to a page is always available in the same location at the top of the page.

3.2.4: Consistent Identification	"Components that have the same functionality within a set of software programs are identified consistently."	A set of icons for buttons are used consistently, the filter design is kept consistent as well.
3.3.2: Labels or Instructions (Level A)	"Labels or instructions are provided when content requires user input."	In the post creation UI instructions are available for each section.

The table below illustrates how different components in the interfaces have appropriate contrast. Since, many interfaces share components, manually checking each interface is not necessary. For better understanding, pictures corresponding to the component's name are available in the annex. To measure color contrast, we used the Dopely online tool (https://colors.dopely.top/color-mixer) to get the resulting color from mixing different colors with varying intensity and then we measured the contrast using the WebAim tool (https://webaim.org/resources/contrastchecker/) to get the results. For example, in the homepage screen, the folders were the result of using a white image (hexadecimal code of #FFFFFF) with an opacity of 31% on top of a blue image (hexadecimal code: #1883FF). The resulting color is #60a9ff. Therefore, we measured the contrast between #60a9ff and the black text. This gives us a contrast ratio of **8.61**:1 and passes both WCAG criteria (AA and AAA).

Table 5 showing the contrast between different elements from the interfaces

Components to be tested	Background color in HEX	Foreground color in HEX	WCAG success criteria that are met
Text in the navigational route	#DFDFDF	#033BFF	AA and AAA, due to the size of the text (large)
Filter text against filter background	#C4C4C4	#000000	AA and AAA
Homepage folders and text	#1883FF	#000000	AA and AAA due to the size of the text (large and bold)
Black text on the right-side contextual information	#E5E5E5	#000000	AA and AAA
Blue text on the rightside contextual information	#E5E5E5	#033BFF	AA
Table's column title	#FFFFFF	#000000	AA and AAA
Post title and background	#C4C4C4	#000000	AA and AAA
Post content and background	#BADAFF	#000000	AA and AAA

Join Button	#0ACF83	#000000	AA and AAA
Discard Button	#FB3E3E	#000000	AA
Other in-platform buttons	#C4C4C4	#000000	AA and AAA
Buttons leading to external platforms	#C4C4C4	#033BFF	AA due to the size of the text (large)
Selected forum tab	#782CE8	#FFFFFF	AA

This table illustrates how this prototype follows at the minimum the AA success criteria for contrast.

3.3.3. Prototype User Interfaces

In this section, we show the interfaces and justify our design decision and explain the added value for customs practitioners based on the extracted data. As explained in the introductory paragraph, the attributes for designing aesthetically pleasing interfaces have been considered. Specifically, the UIs have been built in such a way that their components have equilibrium, because the interface has a center point; symmetry in at least one dimension; simplicity and low density, because the interface is kept as simple as possible, without many items on the screen. In some UIs, additional attributes have been considered. For example, tables help the users efficiently scan items optimally, and therefore it has been considered for those screens.

Finally, according to the results of the interviews, the following table has been elaborated, to show the requirements that were mentioned during the interviews.

Table 6 showing the requirements discovered in the interview phase and how it has been implemented in the prototype.

Requirement number	Requirement	Quote from the interviews	How the required is implemented in the prototype
1	Integration between different platforms	"A website that has connection with different platforms […] integration maybe is the word"	In the forums, even though the thread is not available, the system shows where it can be accessed. Secondly, the external resources in a project's homepage are another example of this.

2	Screensharing functionality	[referring to favorite functionality] "I would say the ability to show your presentations as you go along"	This is not explicitly shown in the prototype because such features already exist, and our design had no added-value.
3	Videoconference functionality	[referring to favorite functionality] "and in this Polycom system there is also videoconferencing"	This is not explicitly shown in the prototype because such features already exist, and our design had no added-value. However, there is a webinar section in the hamburger menu.
4	Calendar functionality	"[about a feature that needs improvement] I am using different calendar accounts"	There is a dedicated calendar section where filtering by projects (or accounts) is possible.
5	Interactivity between different users	"These forums are really useful if you would like to share your experiences"	The forums allow users to interact with one another and are an example of this requirement.
6	Simultaneous translation	"[talking about solving problems derived from communication in the international context] The people we work with do not always manage the English language […] and that's why we work with simultaneous translation with our trainers"	This is not explicitly shown in the prototype because this is a feature that should be implemented in the training and was difficult to prototype.

7	History of recently accessed documents	“Maybe the most useful is that in my homepage, I can see all my recent activities”	The projects are arranged in folders and there is a menu to the right showing the files accessed in the project.
8	Unification of different materials after training	“Yes, it can be said because every document is there”	The training projects have dedicated pages with all the necessary information.
9	Disable submission of forms until all fields have been properly completed	“They upload their reports, their own reports, and they do not use the preformatted documents or templates”	This is not explicitly shown in the prototype because such features already exist, and our design had no added-value.
10	Improving learnability	“I am a regular user, so it is not difficult for me but if you are visiting this for the	The prototype uses conventional icons and makes use of the space to show
		first time, I'm not sure that is quite easy for you that you can find things with which you want to find”	the sections that are related.
11	Improve the experience related to the security	“The interaction possibilities are not that friendly […] I am saying this because of the security”	This is not explicitly shown in the prototype because this would require prototyping a whole authentication process and this is out of the scope.

We will reference these requirements throughout the prototype to justify our design decisions.

Homepage

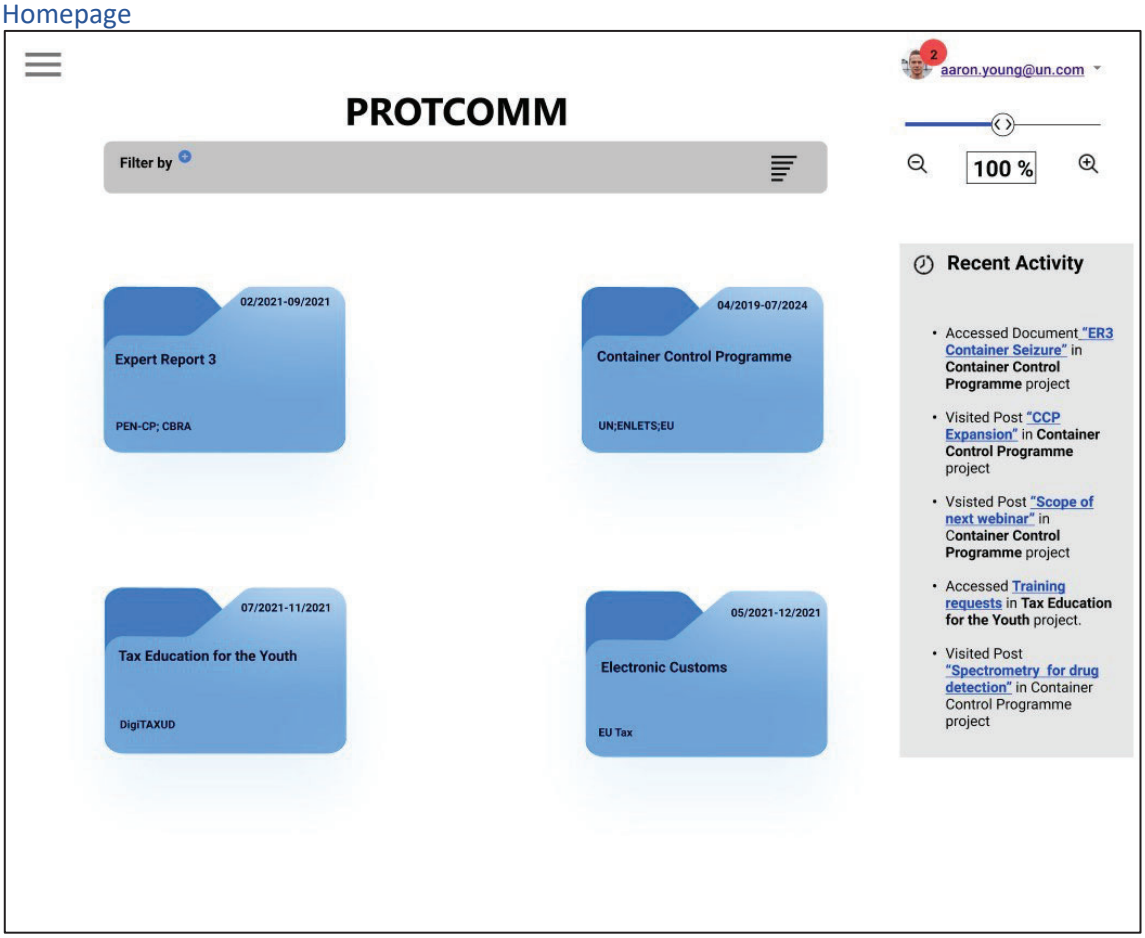


Figure 9: The prototype's homepage

In the homepage the user can see all the projects they are participating in, with their corporate email on the top-right of the screen and a zoom bar underneath, in case they need to adjust the size of the text, as stated in the WCAG guidelines. Each project is represented by a folder, with its title in the middle, a start and end date and the participating organizations at the bottom. Ideally, the interface should already be adapted to the specific user, also taking into consideration their disabilities. Therefore, the software should save the user's text size preference, as well as any other accessibility preference. Finally, the filter is kept consistent throughout the prototype. The user adds a tag to filter by with the 'plus' icon. The tag is then added, and they can filter according to that tag with the down arrow. For example, to add the 'date' filter, the user would click on the plus icon, select date from the list. The date tag would be added to the pool and with the down arrow a specific interval could be selected. Finally, once the results are displayed users can sort the results with the icon on the right side of the filter bar. The design is simple and respects conventions. Therefore, this UI considers requirements 10 and 7 (due to the filtering by date possibility).

Project Page

Tax Education for the Youth Page

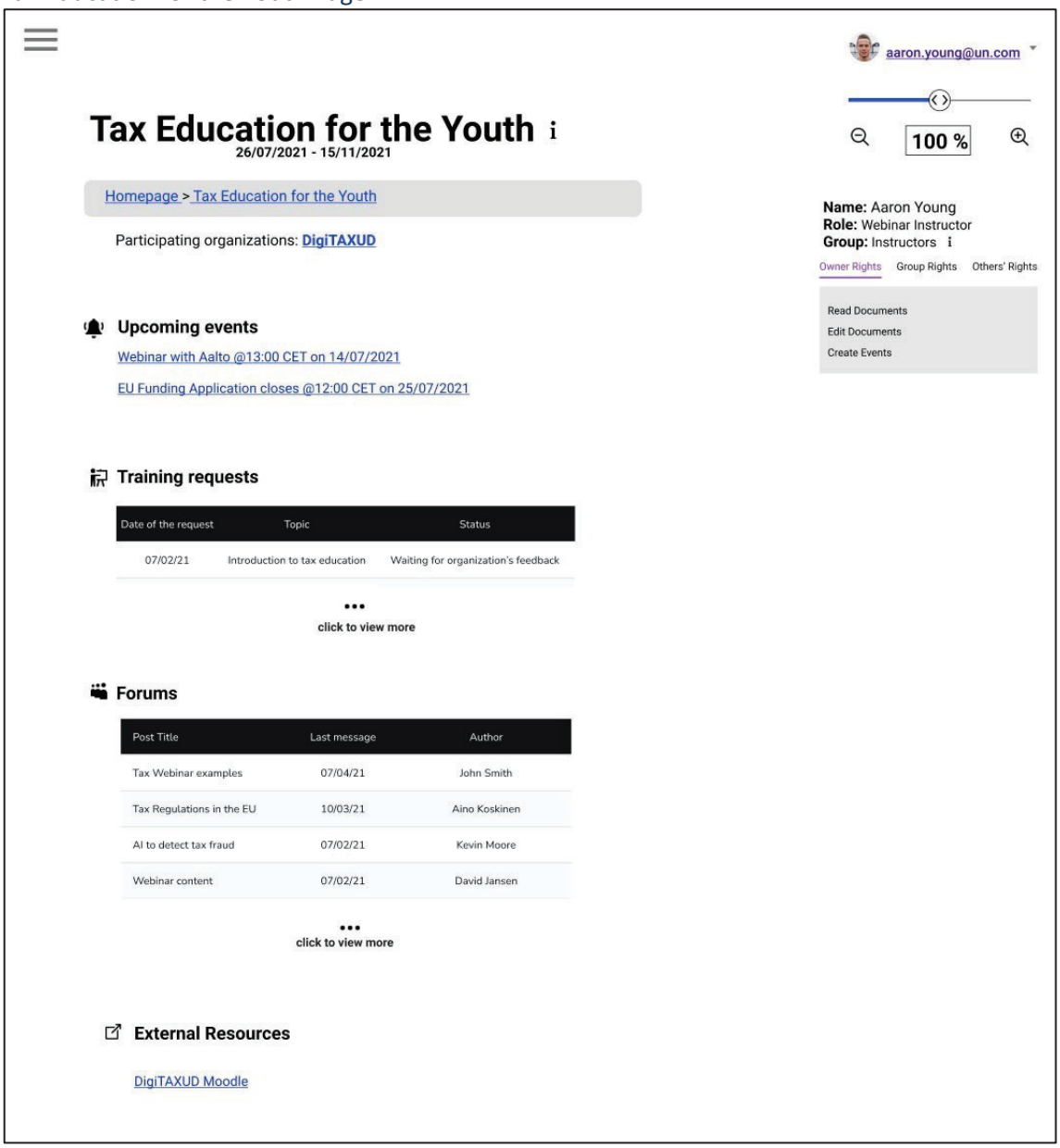


Figure 10: One type of project page, where the main content is not stored on the platform

There are two different designs for the project pages. This is an example of a project that is mainly run on the Moodle LMS platform but is integrated with the Communication Toolbox. A generic project page would have the title of the project at the top and its start and end date underneath. The information icon could provide a brief overview on the project. Then the participating organizations are present underneath. In the middle of the page different customizable sections are available. These sections contain a summary of the most recent events or a summary of upcoming events, but this information can be expanded when clicked (as we will see in the next UI). On the top right, the role of the user and their rights are visible. Taking a similar approach as UNIX, we have imagined different rights could be defined. In this

way, the owner rights define the rights the owner (user Aaron Young) has on his own documents. Group rights define the rights the group has (in this case, the instructors' group). These should be defined by a group administrator or coordinator. Finally, 'others' rights' define the rights that other users have. They can be set to administer private information, for example to be used in the spectator forums (which will be defined later). In terms of the presented requirements, this UI should follow requirement 8 and is conventional enough to consider requirement 10 as satisfied.

Container Control Programme Page

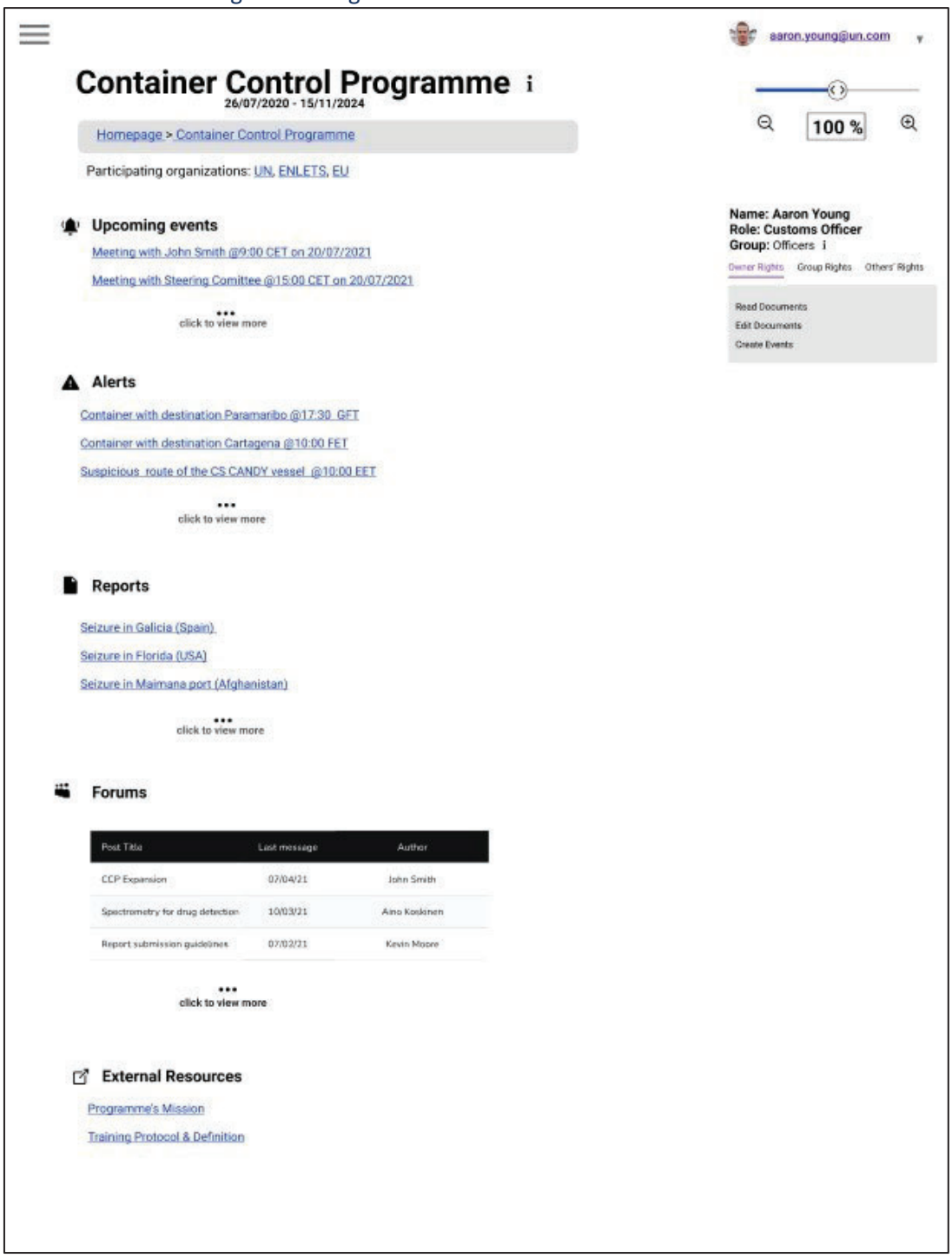


Figure 11: The second type of project page, where the main information is stored in the platform

This is an example of a project that resides mainly in the platform. Similarly, to the previous UI the overall structure is kept consistent. In this project more sections are available, as the communication toolbox is where all the materials are stored. Notice that throughout the prototype, the route is available at the top. In this way the user can go back to a page they visited in that route directly by clicking on it.

Container Control Programme Page 2

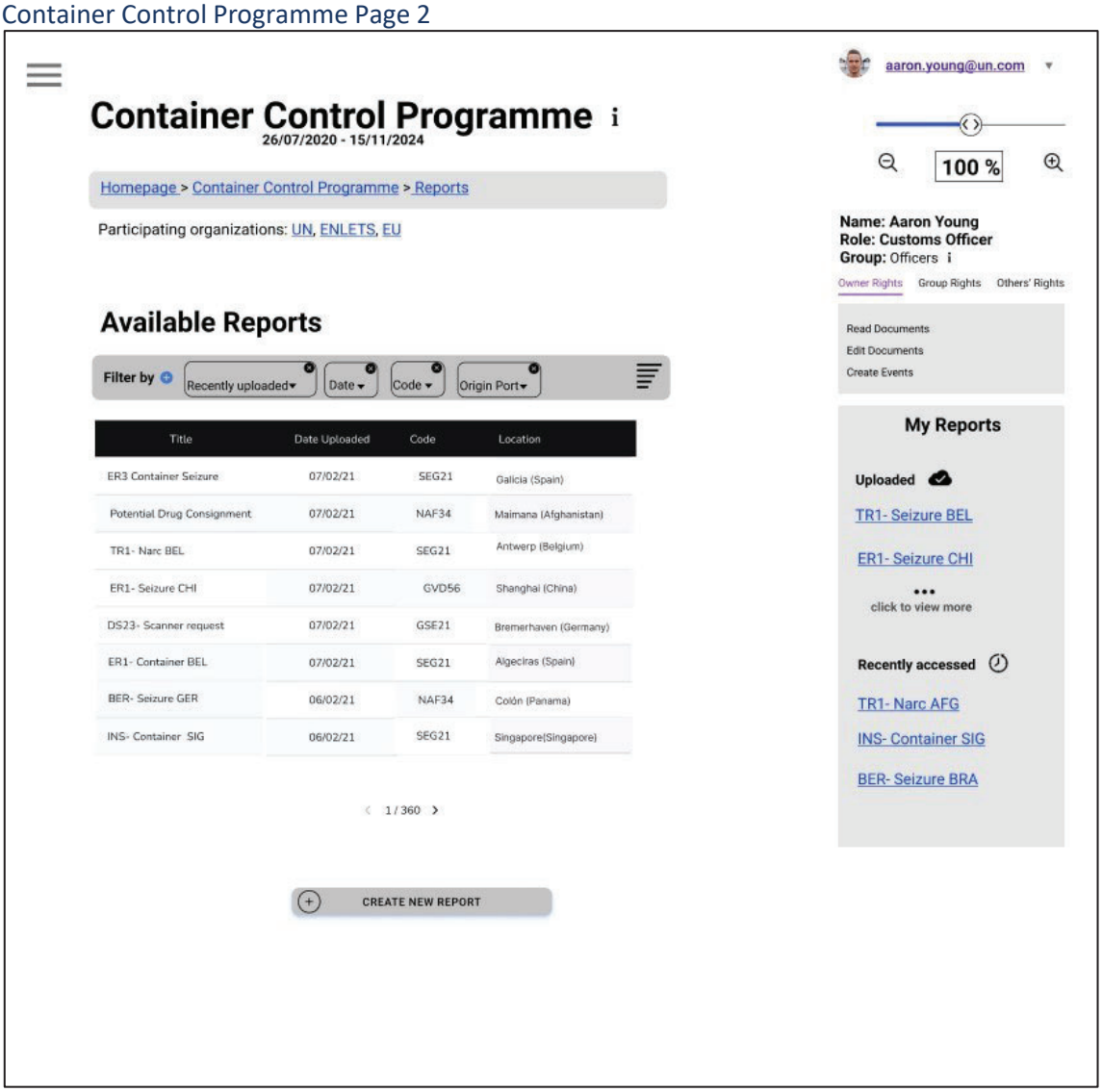


Figure 12: The second page of the CCP project, where the user can check and filter the reports

This is the view where a user can see an overview of the report (as described in the interviews). We could imagine that based on their rights, the button to create a new report might be disabled if they are not currently part of a team that inspects containers. The same overall structure can be observed, and the filter tool has been designed in the same manner as before.

Calendar

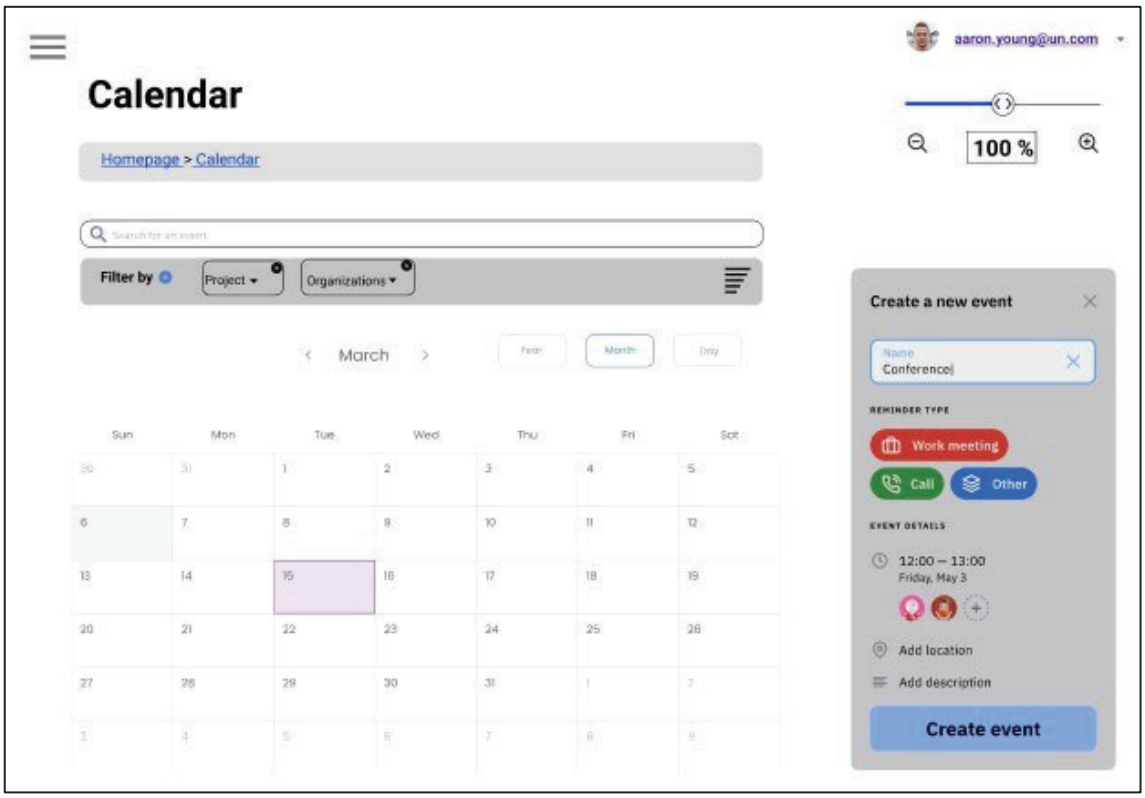


Figure 13: Calendar page, where the user can filter events based on project/organization and create new events

This is the calendar UI. By right-clicking on a specific day, a contextual menu, which is typical UI element, could appear to create a new event. The main problem reported by our users was syncing calendars from different accounts. This is a difficult requirement to implement on a prototype, but the filter could allow to view events from different accounts and projects and combine them. This UI was deemed important by one of our interviewees and therefore follows requirement 4.

Online forums

Forums main page

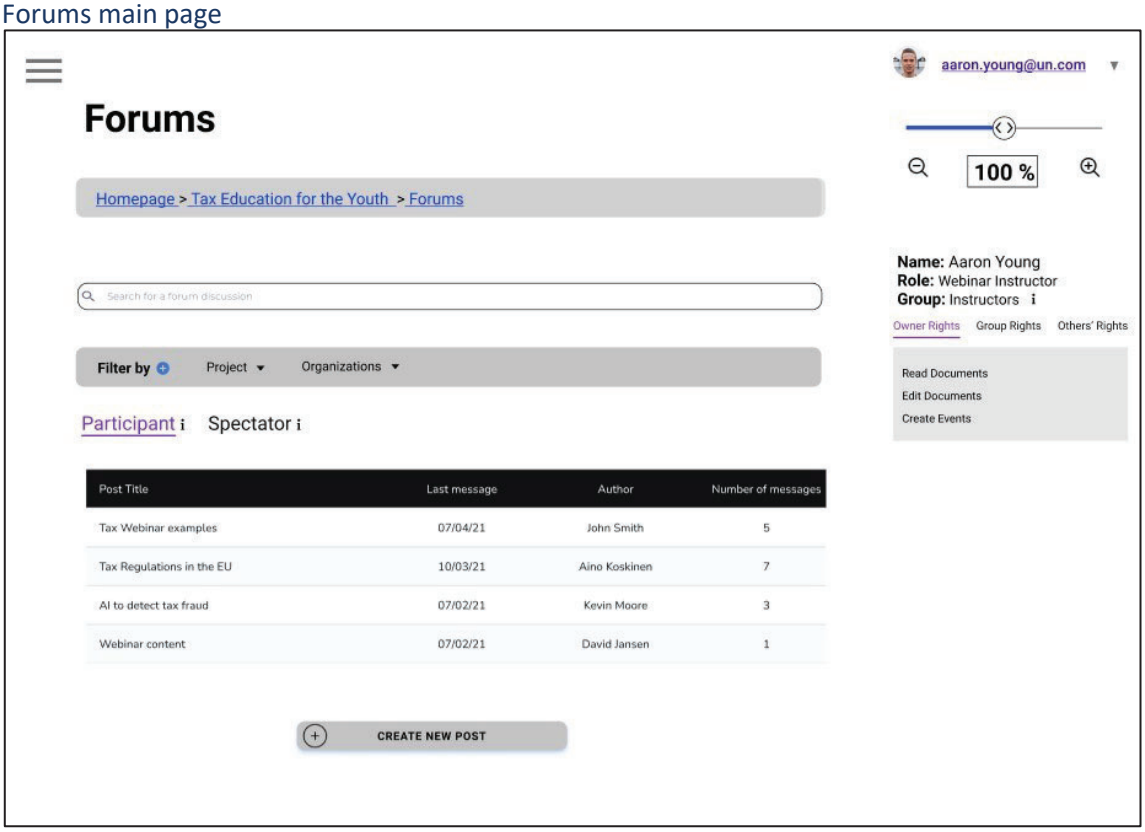


Figure 14: Forums' main page with participant and spectator roles

This is the main page where all the posts from a specific project (in this case "Tax Education for the youth") can be seen. During the interviews, motivation issues were mentioned frequently. These issues stemmed from different causes and are not trivial to solve. To try and solve these motivation problems we have imagined that users could join a forum as a participant or a spectator. We have imagined that a user has 'participant' rights in all their projects and 'spectator' rights in the projects they choose to join because they are interested in the topic. The spectators join projects and have no obligations to actively participate in them. Their motivation for joining relates to their own interest in a topic. For this idea to work, there should also be an agreement from the business side to allow employees a certain amount of development time. This is the solution to requirement 5.

Post in the platform

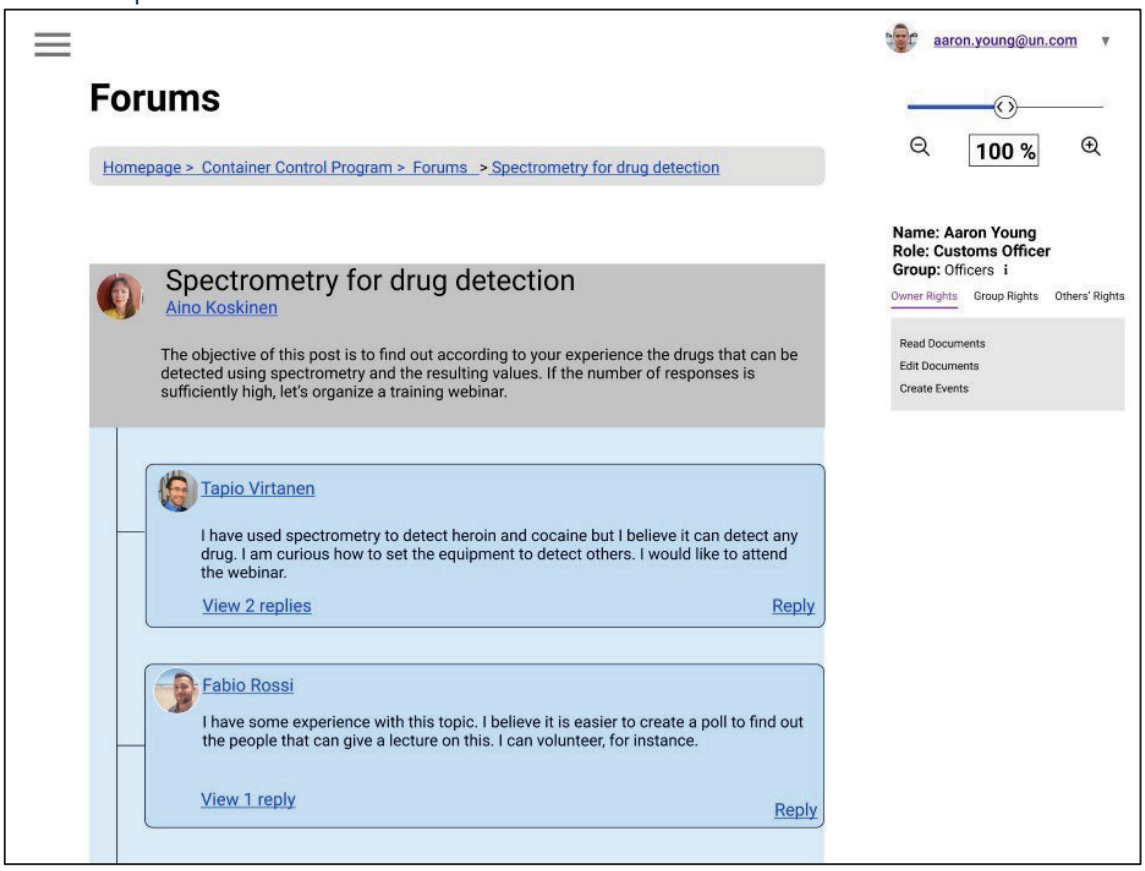


Figure 15: Example of a post that resides in the platform

Once a user clicks on a post, they have access to the conversation. The lines are designed to help guide the user in reading the post by using a tree-like structure. The title is of a different color to distinguish it. Perhaps in the implementation it could stay fixed so that when a user is scrolling down and reading replies, they have in mind the scope of the original post.

Post in an external platform

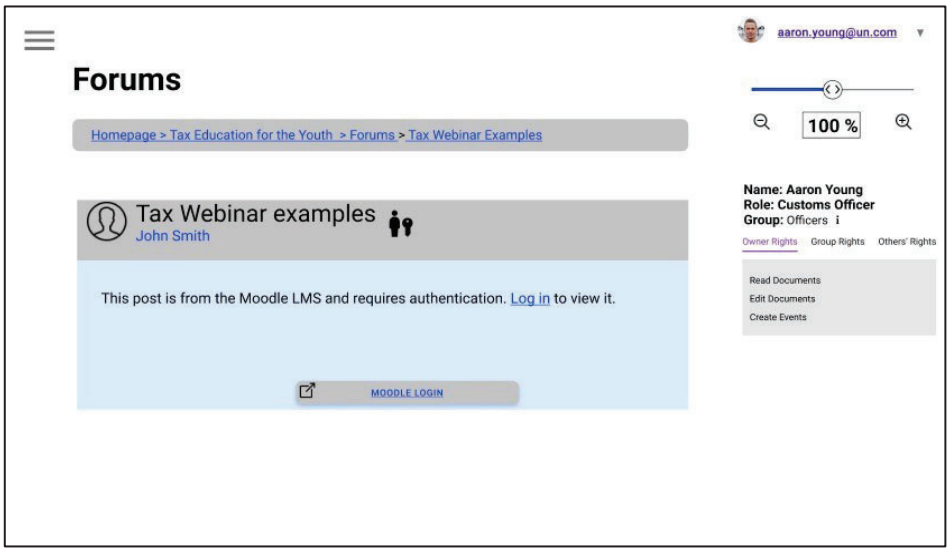


Figure 16: Example of a post that does not reside in the platform

A major part of this work revolved around integration. We have imagined posts from different platforms to be available on the main communication platform to some extent. This is what the user would see if they tried to access a post that originated from an external platform. By providing this information, the user knows where to find all the information they need, and the communication toolbox serves as an 'unifying' software, by directing the user to the specific external resource. If this cannot be done, then all the external resources should be added to the project page, so that the user has a comprehensive list of all of them. This UI is the solution to requirement 5 and 1.

Post creation

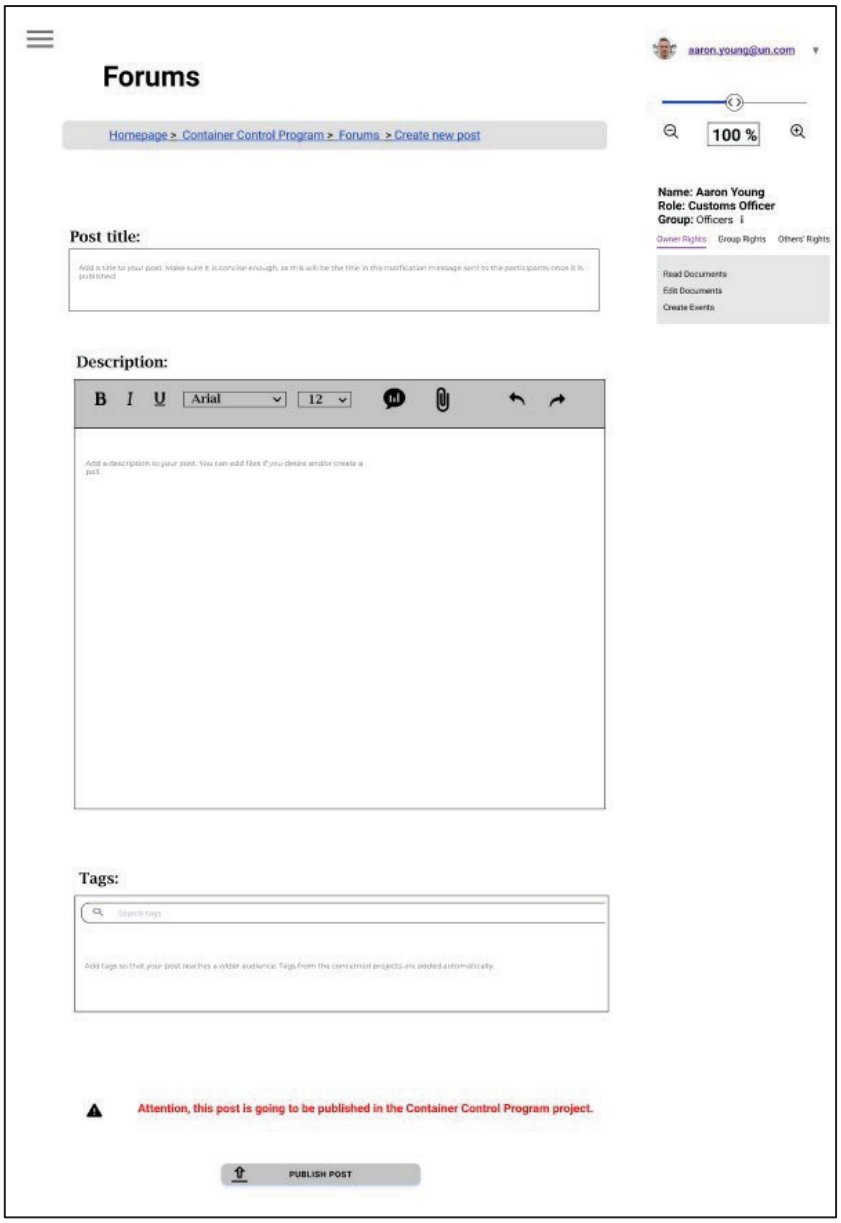


Figure 17: Post creation interface

This is the UI to create a forum post. The title cannot be styled so that it is kept consistent with other post titles and users are not influenced to click one over another, but the description can be. There is a poll functionality available in the forums. Moodle also has a poll functionality, but it is available only as a separate feature. For minimalist design, we have decided to put it here. In this way, it offers the flexibility of creating a poll directly or creating a post and including a poll, but other answers are also a possibility.

Spectator forums homepage

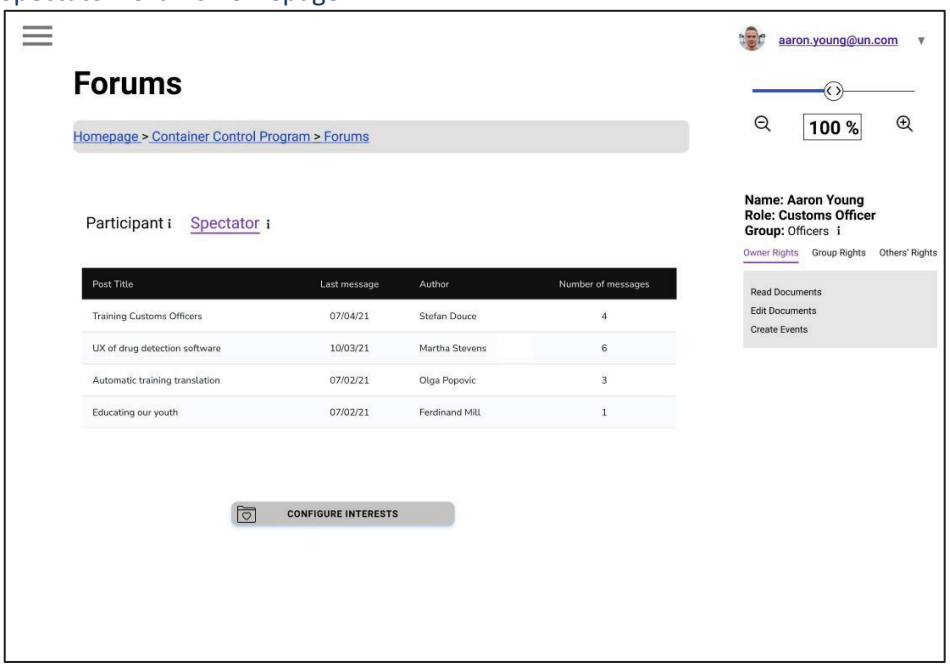


Figure 18: Forums' homepage from the spectator role

Similarly, to the participant forums, this is the tab for the spectators. The users can configure their own interest by clicking on the button, as we will see in the next UI.

Configuring new spectator forums

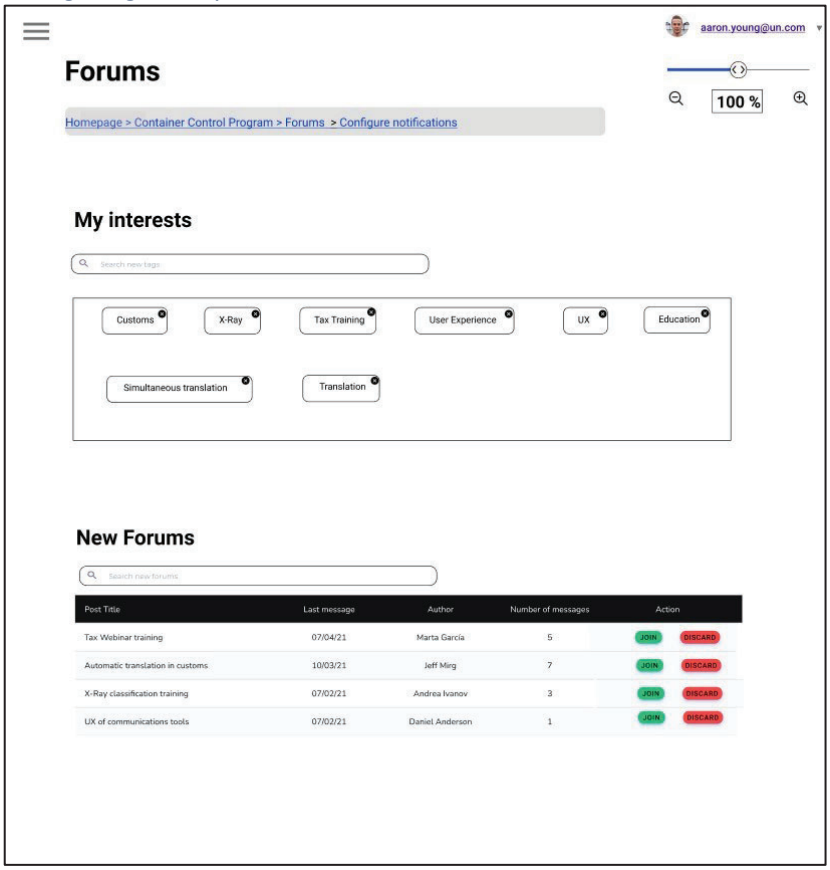


Figure 19: Configuration of interests for the spectator forums

This is the page where new interests can be configured, and new posts based on tags introduced by the user are displayed. The tags can be searched and added by using the search bar in the same manner as the forums. The search bar in this case might not be necessary depending on the number of posts created per day. The user also has the option to join or discard new posts that appear on their results based on their interests.

Chat Page

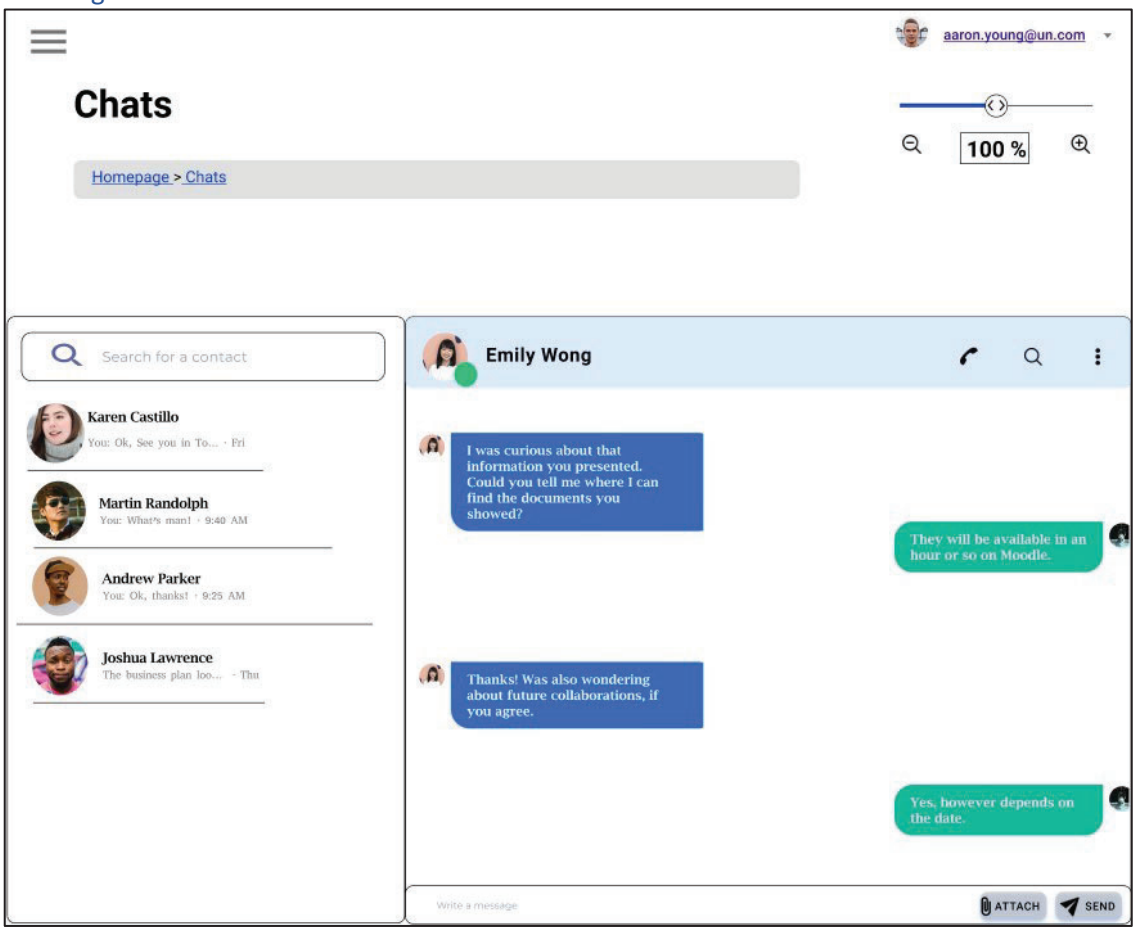


Figure 20: Chat interface

This is a normal chat UI, that resembles mainstream desktop chat apps, which is important so that the user's mental model is not broken. Since this is a work chat some functionalities are limited. A file could be added by dragging it to the chat directly but there is also a dedicated button, to give the user more freedom when trying to accomplish a task. In a similar manner, a message could be sent by pressing the 'Enter' key but there is also a dedicated button for it. Finally, contacts can be searched directly even if the user has never spoken to them previously (similarly to Microsoft Teams). This is done due to simplicity reasons and to avoid creating a different functionality.

Hamburger menu

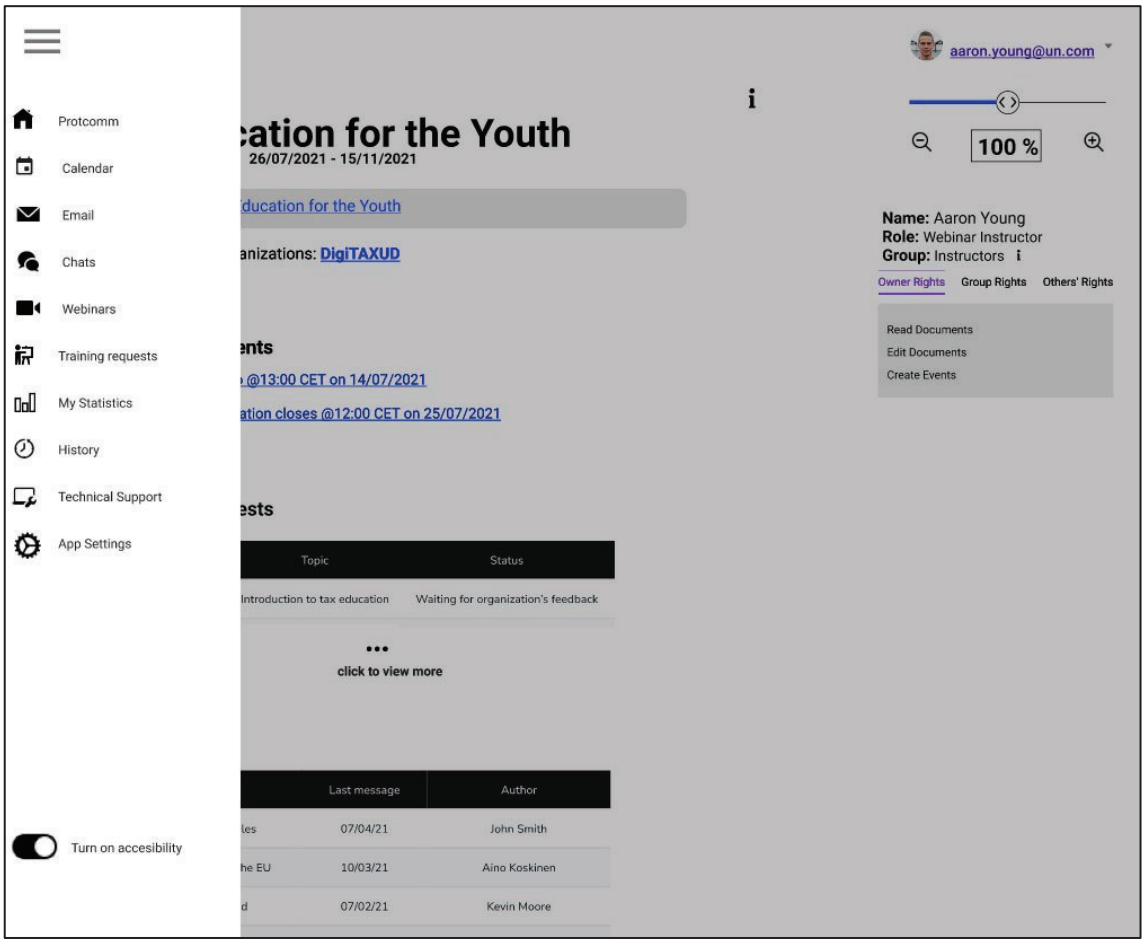


Figure 21: Hamburger menu interface

The hamburger menu can be accessed at any point by clicking on it. The user can directly access a specific page without having to navigate to it. When displayed, the background is darkened to place the emphasis on the menu. At the bottom there is an accessibility mode that can turn any page the user is on accessible. This can be configured in the app settings according to a specific disability. While the app should be adapted for a specific user this button helps when communicating information to a diversely functional colleague directly.

Statistics Page

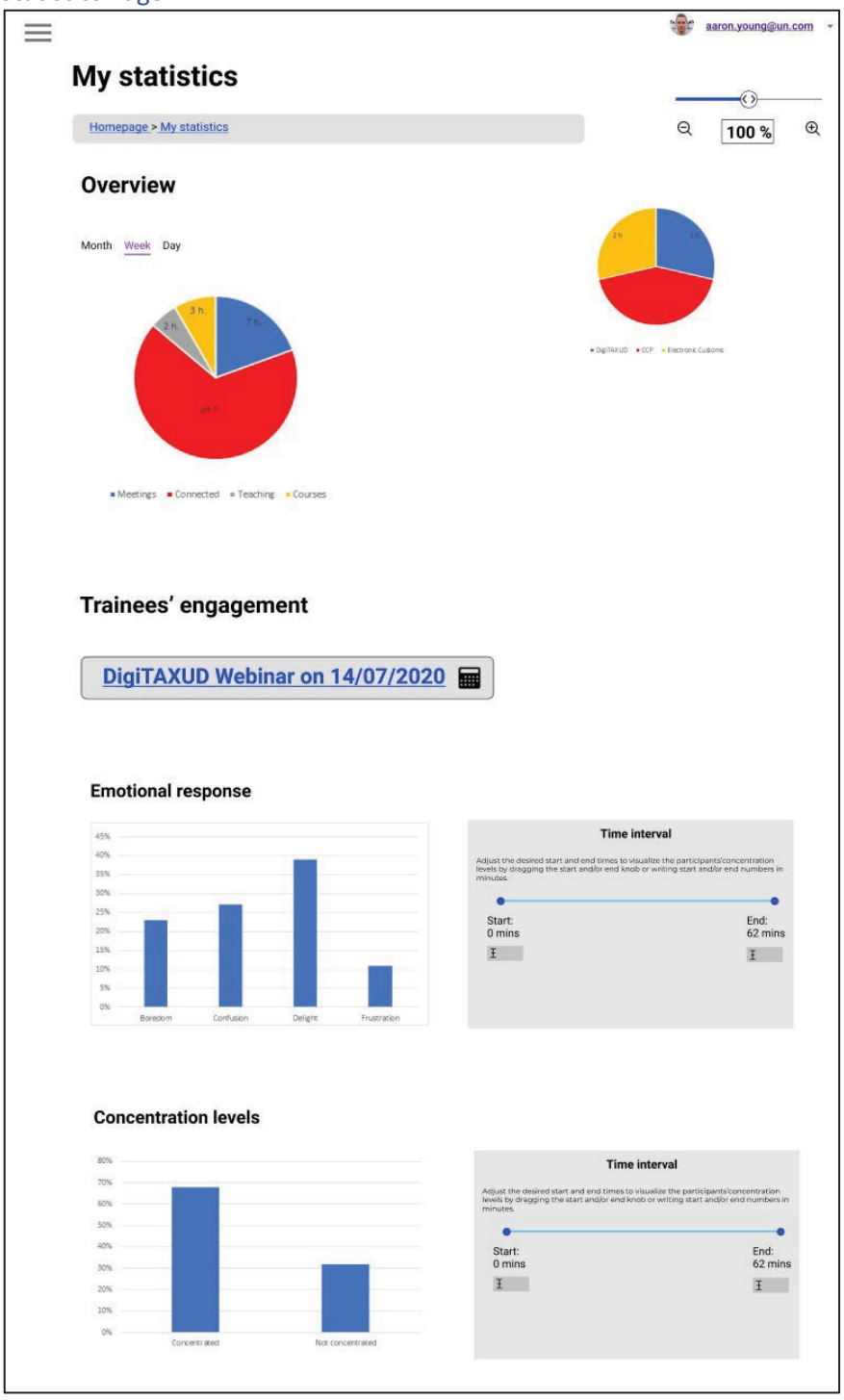


Figure 22: Statistics' interface related to user engagement in online meetings

According to what was introduced in the "User Engagement" section in the literature survey and the motivation issues explained by some participants, it would be possible to implement computer vision algorithms to detect participants' emotions and track their eye gaze to determine concentration levels. This page displays those statistics to the person in charge of

the webinar. The webinars could be selected thanks to a calendar that would open with all the webinars instructed by that user. In general, thanks to this page users would have tools to better manage their time. The overview section at the top has a blank space to the right so that a further division of the meetings, connected, teaching and course time, can be displayed (this UI shows where one of the subsequent graphs would be positioned if the user would have clicked on “meetings”). In general, the idea is for the user to click on a section in the pie chart and on the right different categories could appear. Users could also select the time frame, for which they want to see this information by manually writing the start and end times or by dragging the spheres that correspond to start and end. This allows the exploration to be done in two different ways depending on their needs.

3.3.4. Navigation map

This section details the navigation map of our prototype. The blue boxes represent variable content, which means that the sections on the page can be configured based on the project. For example, in the prototype we have assumed that a project is being mainly run in the “Protcomm” platform (the Container Control Program), while the other one is being mainly run-on Moodle (the “Tax Education for the Youth” project). As a result, their pages are different. The orange boxes accounts for the shared resources (the “Spectator Forums”). Based on this level of navigation, logically the next one is automatically determined. This navigation map corresponds to our prototype and specifically to the two projects we introduced.

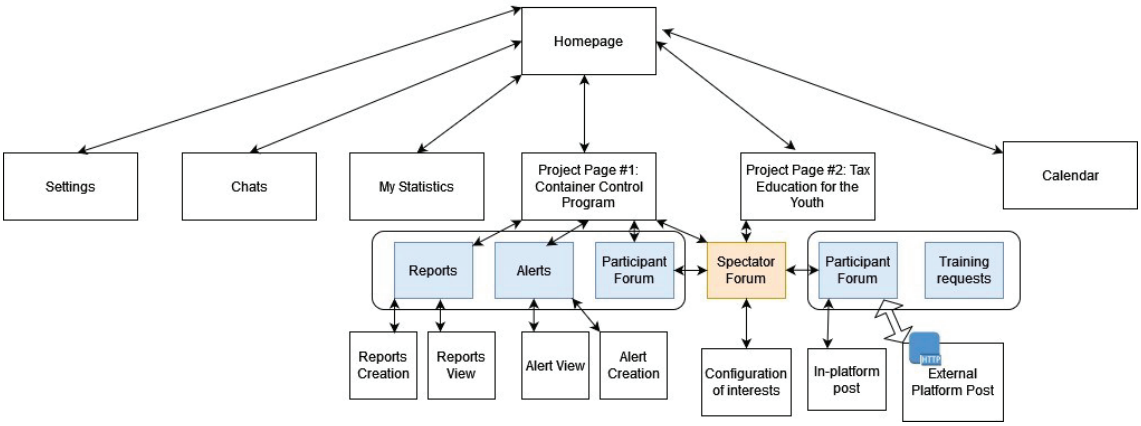


Figure 23: Prototype’s Navigation Map

3.4. Discussion

3.4.1. About the results of the interviews

Combining the results from the interviews, the papers from the Customs officers' needs and the conceptual modelling done by Hassenzahl & Tractinsky (2006), we will attempt to extract the components that account for a good user experience in the context of this project.

In the features that work well our interviewees mentioned they enjoyed the screensharing, calendar and videoconferencing functionalities. Furthermore, they thought the platform interactivity; the simultaneous translation; a history of recently accessed files and storing previous materials in a unified manner were useful features.

In terms of improvement requests, participants mentioned excessive security restrictions from their organization that negatively impact their work. Secondly, although some parts in the software were relate, the design failed to visually demonstrate this relationship. Thirdly, there were some technical problems related to notifications not arriving on time or the system allowing the submission of a report with incorrect format. Finally, the participants complained about the use of different platforms that had little added value when compared with each other and felt that they were repeating the work in different platforms due to the lack of communication between platforms.

From these findings, we can conclude that participants like to use technology with other people, and this brings more enjoyment to their work (due to the screensharing and videoconferencing functionality). This belongs to the experiential and the emotional and affect facet defined by Hassenzahl & Tractinsky (2006). During times, where face-to-face meetings have been limited due to the ongoing epidemic this is the substitute for human-contact. Therefore, exploring this facet in detail in future work is also relevant. Concretely, in future research we would need to find a way to bring participants closer together to build the "trust" (as referred by one interviewee), similarly to them being a physical space. Once again, this must not only be done using software. Human protocols can be established and followed. Some measures that could be taken include frequent breaks and going over the previously covered concepts, frequent discussions in breakout rooms and overall striving for greater active participation during meetings. Secondly, they like being organized (because they referred to the calendar functionality), which means that they have an interest in what they do, and they care about their work. The simultaneous translation proves they have a desire to communicate their knowledge to other people and understand their problems, which again is an indication they care about doing their work to a high standard. The technical problems in some platforms, contributed negatively to the overall experience, even if our participants found workarounds. Thirdly, our participants tend to invest minimal resources when doing a frequent task (they dislike the need for different platforms that display similar data or the format when submitting a report is not adequately considered). Finally, in some cases there seems to be a disparity in terms of a task's objective understanding, where the organization does not fully trust admittedly non-technical officers with potentially security-endangering tasks.

Now, that we have extracted the real human reasons that account for the user experience, let's propose solutions.
When working remotely as a team, ensuring collaborative work is interactive and not limited to just a presentation from one person is fundamental. At this stage, it is beneficial to understand the specific type of work participants are doing to assess if more collaboration is possible.
From the perspective of the organization, establishing a protocol, to make meetings more engaging is another complementary solution. This protocol could include a short 5minute survey done in the meeting, at the end asking participants open-ended questions about the meeting. In terms of forum interactivity, there could be various problems that explain poor interaction between participants, such as: technical problems resulting in notifications not arriving on time, a vast difference in knowledge between participants (making the discussion difficult), a lack of time to participate in a non-mandatory activity or perhaps a low interest in the discussed topic. Since, the exact problem could not be extracted in this phase, it should be explored further. However, some solutions to enhance forum interactivity include updating the interface of the forum to resemble social media (considering the trade-off that exists between minimalist design due to the target group and aesthetically pleasing social media-like design) and linking resources in the forum discussion, for example.
To solve the security concerns coming from the organization's side, a possible solution could be to setup a virtual machine to run potentially harmful software. The second solution could be to purchase one computer (not connected to the main network) for this type of tasks. The main problem seems to be the time constraints and busy schedules of the employees. By reducing their workload, they would be able to better prepare for meetings and everyone would likely benefit from a better interaction and more dynamic meetings in general. This issue is addressed in the prototype by displaying some metrics related to the total work hours. However, it should be explored further, as it is possible that because participants care and enjoy their work, they overload themselves with meetings and take on more than the day allows. Therefore, it could be a problem created by themselves because of their commitment.
Finally, to show the relationship between different parts of a system, conventional icons and spacing should be used. This is related to the perceived ease of use and usefulness (lack of in this case) mentioned by Urciuoli, Hintsa and Ahokas (2013) and would greatly enhance the learnability. Furthermore, the software should clearly show its usefulness to the users (perceived usefulness). From these interviews, we can conclude that usefulness is sometimes not understood. A redesign of the interfaces (to resemble more conventional designs) and better integration between different platforms would likely improve the four attributes analyzed by the authors (ease of use, perceived ease of use, usefulness, and perceived usefulness).

3.4.2. Prototype challenges and limitations

The main challenge in this phase was building the prototype without real knowledge of the information that is relevant to customs' practitioners and therefore having nearly no reference regarding the current available software. The UIs that have been prototyped correspond to potentially improvable features as they were described during the interviews. However, this lack of information was also an advantage when building a minimalist prototype. Finally, it is necessary to conduct usability testing with real users to correctly understand what is missing and how to improve it.

3.4.3. Proposing a new methodology for remote contextual inquiry

After having reviewed the traditional contextual inquiry methodology; drawing ideas from English and Rampoldi-Hnilo (2004) and after our own experience with this study we propose some corrections to successfully conduct remote contextual inquiries.

The first guideline states that data must take place in the context of the user's work. Due the remote nature of the contextual inquiry, the conditions related to the physical context cannot be explored or understood. Instead, a virtual walkthrough of the environment could take place. However, this approach has some drawbacks: As, researchers we are completely dependent on the participant's camera and video quality to fully capture what their workplace is like. Assuming their video and camera quality is acceptable, we would only have a limited view on their workspace, as videoconferencing cannot capture the full essence of being in the same physical space. Another solution would involve having an additional session with the participant, exclusively focused on their physical work environment. However, as the inquirer, we need to be aware of the participant's bias. When they are talking about their work environment, they might describe their personal perceptions rather than objective facts. A solution, if to ask the participant for evidence (audio, video …etc.) and to talk with someone else working at the same place to have more balanced opinions.

The second guidelines that need to be modified are the ones referring to the contextual interview phase. If the participant works mainly with their laptops, we could ask them to share their screens, while they perform their typical tasks. Additionally, having their cameras on would enhance our analysis. However, while we will be able to see their process, it might be harder to correctly assess the meaning behind some facial expressions. The solution is to ask more questions to validate pain points.

4. Conclusions: Recommendations for Customs Practitioners & Future Work

The aim of this thesis was to analyze user experiences in communication platforms used by government and international agencies to create improved and more complete understanding on the specific characteristics of future communication toolboxes that should be developed in the future. To adequately analyze and understand these topics we formulated three research questions. Firstly, we wanted to understand the features and functions that are considered the most useful by customs practitioners. Secondly, we wanted to understand what works technically well and what does not in current platforms. Finally, we wanted to find out how to improve these platforms and tools and what to improve.

The most useful features pointed out by the interviewees were: screen-sharing and videoconferencing, especially when giving a presentation during training, as it provides more interaction than a simple phone call; a forum functionality to discuss a specific topic with their colleagues; simultaneous translation when delivering training. They thought a history of recently accessed documents, an agenda to structure their day and the possibility to store different training materials in an organized and unified way were useful features as well. These features are working well in current existing platforms.

To improve these platforms, it is important to precisely understand the organization's needs and not impose excessive security measures. Secondly, technical problems should be investigated and solved (like the notifications not arriving on time). Thirdly a modern and intuitive design conforming to already existing guidelines should be followed. Finally, better integration between platforms is needed.

The main themes from an experiential perspective addressed by our interviewees revolved around the use of minimal resources to accomplish a task, the integration and complementarity of different platforms and the possibility to interact with other colleagues to discuss a specific topic. Considering Hassenzahl & Tractinsky's definition, the main problems present in the communication toolboxes are related to aesthetic and hedonic qualities, which belong to the "beyond the instrumental" facet and to emotional experiences. Users do not feel they are stimulated and use the tools to simply accomplish their tasks.

Overall, most of them have no favorite features and have shown they do not enjoy using their respective toolbox. Secondly, users need to identify with the toolbox. Users enjoy more personalized products, instead of having to deal with static content and follow pre-formats. Customs officers care and enjoy their work. If possible, this should be enhanced with the use of collaborative technologies, due to them allowing users to interact and bring a greater sense of accomplishment. It is vital to understand that our participants care about their work and therefore organizational tools should be central in further software development.

Considering the research questions and the work that has been developed, we have reached our goal at uncovering the problems in the existing communication platforms. This work has

uncovered general problems related to user experience in communication toolboxes in the context of Customs practitioners. However, there are still items that need further exploration to properly understand the reasons for them being under-used, as defined in the section "Components that need to be explored further to gain a better understanding". To better understand how each individual organization works, conducting a contextual inquiry would be beneficial. In addition, to uncovering more information related to user experience, it would also serve to clearly distinguish between the organizations' different goals and specific problems (since this report only contemplates general problems and does not focus on specific issues).

Thirdly, to properly develop the prototype, more specific requirements would need to be generated to ensure all the necessary information is present. If this feature were something important a new webinar tool with these algorithms would need to be developed. These requirements would allow the designers/ developers to understand the level of importance of some features (for example the computer-vision algorithms used to track attendees' concentration levels might not be crucial). The prototype should then be modified and tested with real users, observing the problems, and employing the UEQ and SUS questionnaires, to objectively assess their performance. In case participants do not have time, the UEQ-short version can be used. This questionnaire predicts with high-quality the results of its longer version counterpart (Schrepp et.al. 2017).

References

Arhippainen, L., & Tähti, M. (2003). Empirical Evaluation of User Experience in two Adaptive Mobile Application Prototypes. Proceedings of the 2nd International Conference on Mobile and Ubiquitous Multimedia.

Aslan, S., Cataltepe, Z., Diner, I., Dundar, O., Esme, A., Ferens, R. Yener. (2014). Learner Engagement Measurement and Classification in 1:1 Learning. 2014 13th International Conference on Machine Learning and Applications. doi:10.1109/icmla.2014.111

Bangor, A., Kortum, P.T., & Miller, J.T. (2009). Determining what individual SUS scores mean: adding an adjective rating scale. Journal of Usability Studies archive, 4, 114-123.

Beyer, H., & Holtzblatt, K. (1999). Contextual design. Interactions, 6(1), 32-42. doi:10.1145/291224.291229

Brooke, J. (1996). SUS: A Quick and Dirty Usability Scale. Usability Evaluation In Industry, 207212. doi:10.1201/9781498710411-35

Duvillier, T. (n.d.). Expert Report: User Experiences by Governmental Agencies and Multigovernment Organizations on Communication Toolboxes (PEN-CP-2020-ER3). Retrieved from https://cmt.sym.place/news/view/302792/expert-report-user-experiences-by-governmentalagencies-and-multi-government-organizations-on-communication-toolboxes-pen-cp-2020-er3

D'Mello, S., Olney, A., Williams, C., & Hays, P. (2012). Gaze tutor: A gaze-reactive intelligent tutoring system. International Journal of Human-Computer Studies, 70(5), 377-398. doi:10.1016/j.ijhcs.2012.01.004

English, J., & Rampoldi-Hnilo, L. (2004). Remote Contextual Inquiry: A Technique to Improve Enterprise Software. Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 48(13), 1483-1487. doi:10.1177/154193120404801303

Hassenzahl, M., & Tractinsky, N. (2006). User experience - a research agenda. Behaviour & Information Technology, 25(2), 91-97. doi:10.1080/01449290500330331

Holloway, S. (2009). The transition from e-customs to e-border management. World Customs Journal, Volume 3, Number 1.

Joyce, A. (2019). How to Measure Learnability of a User Interface. Retrieved from https://www.nngroup.com/articles/measure-learnability/

Kawakita J. (1975). KJ Method- A scientific approach to problem solving, Kawakita Research Institute.

Korn, P., Martínez Normand, L., Pluke, M., Snow-Weaver A., Vanderheiden G. (2013). Guidance on Applying WCAG 2.0 to Non-Web Information (2013). W3C. Retrieved from https://www.w3.org/WAI/GL/wcag2ict/

Lehmann J., Lalmas, M., Yom-Tov, E., and Dupret, G., Models of User Engagement User Modeling, Adaptation, and Personalization, Berlin, Heidelberg: Springer Berlin Heidelberg, 2012, pp. 164–175.

Lewis, J. R. (2018). The System Usability Scale: Past, Present, and Future. International Journal of Human–Computer Interaction, 34(7), 577-590. doi:10.1080/10447318.2018.1455307

Microsoft Team (2021). Design and code for Windows apps - Windows apps. Retrieved from https://docs.microsoft.com/en-us/windows/apps/design

Neale, D. C., Carroll, J. M., & Rosson, M. B. (2004). Evaluating computer-supported cooperative work. Proceedings of the 2004 ACM Conference on Computer Supported Cooperative Work - CSCW 04. doi:10.1145/1031607.1031626

Ngo, D. C., Teo, L. S., & Byrne, J. G. (2003). Modelling interface aesthetics. Information Sciences, 152, 25-46. doi:10.1016/s0020-0255(02)00404-8

Nielsen, J. (1993). Response Time Limits: Article by Jakob Nielsen. Retrieved from https://www.nngroup.com/articles/response-times-3-important-limits/

Nielsen, J. (1994). 10 Usability Heuristics for User Interface Design. Retrieved from https://www.nngroup.com/articles/ten-usability-heuristics/

Nielsen, J., & Landauer, T. K. (1993). A mathematical model of the finding of usability problems. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems - CHI 93. doi:10.1145/169059.169166

Nielsen, J., & Molich, R. (1990). Heuristic evaluation of user interfaces. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems Empowering People - CHI 90. doi:10.1145/97243.97281

Oyedeji, A. (2018). Usage of information and communication technology among Nigeria Customs Service Personnel. Afro Asian Journal of Social Sciences.

Peres, S. Pham, T. Phillips, R. (2013). Validation of the System Usability Scale (SUS). Proceedings of the Human Factors and Ergonomics Society Annual Meeting. 57. 192-196. doi: 10.1177/1541931213571043.

Pernice, K. (2018). Affinity Diagramming: Collaboratively Sort UX Findings & Design Ideas. Retrieved from https://www.nngroup.com/articles/affinity-diagram/

Roto, V., Law, E.L., Vermeeren, A., & Hoonhout, J. (2011). User Experience White Paper – Bringing clarity to the concept of user experience.

Salixova, F. (2021). The role of information and communication technologies in customs. International Scientific and Current Research Conferences, 1(01), 118–123. Retrieved from https://www.orientalpublication.com/index.php/iscrc/article/view/165

Schrepp, M. (2019). User Experience Questionnaire handbook: All you need to know to apply the UEQ successfully in your projects (Version 8). Retrieved from https://www.ueqonline.org/Material/Handbook.pdf

Schrepp, M., Hinderks, A., & Thomaschewski, J. (2017). Design and Evaluation of a Short

Version of the User Experience Questionnaire (UEQ-S). International Journal of Interactive Multimedia and Artificial Intelligence, 4(6), 103. doi:10.9781/ijimai.2017.09.001

Slack. Sign in to Slack. Retrieved from https://slack.com/intl/en-gb/help/articles/212681477Sign-in-to-Slack

Smith, S.L. and Mosier, J.N. (1986). Guidelines for designing user interface software. Retrieved from https://www.hcibib.org/sam/

Taylor-Powell, E., & Renner, M. University of Wisconsin - Extension, Program Development and Evaluation. (2003). Analyzing qualitative data.

Tilley, S. A. (2003). "Challenging" Research Practices: Turning a Critical Lens on the Work of Transcription. Qualitative Inquiry, 9(5), 750-773. doi:10.1177/1077800403255296

Tractinsky, N. (1997). Aesthetics and apparent usability. Proceedings of the ACM SIGCHI Conference on Human Factors in Computing Systems. doi: 10.1145/258549.258626

Tullis, T., & Albert, B. (2013). Measuring the user experience: Collecting, analyzing, and presenting usability metrics. Amsterdam: Elsevier/Morgan Kaufmann.

Urciuoli L., Hintsa J., Ahokas J. Drivers, and barriers affecting usage of e-Customs — A global survey with customs administrations using multivariate analysis techniques. Elsevier. Government Information Quarterly, Volume 30, Issue 4, 2013.

Stijn, E. V., Bjørn-Andersen, N., Razmerita, L., & Zinner Henriksen, H. (2007). Improving international e-Customs: The European ITAIDE initiative. In *First International Conference on the Digital Society (ICDS 2007)* IEEE. doi: 10.1109/ICDS.2007.24

Vermeeren, A. P., Law, E. L., Roto, V., Obrist, M., Hoonhout, J., & Väänänen-Vainio-Mattila, K. (2010). User experience evaluation methods. Proceedings of the 6th Nordic Conference on Human-Computer Interaction Extending Boundaries - NordiCHI 10. doi:10.1145/1868914.1868973

Viitanen J. (2011). Contextual inquiry method for user-centred clinical IT system design. Studies in health technology and informatics, 169, 965–969

Väänänen-Vainio-Mattila, Roto, V., Obrist, M., & Väänänen-Vainio-Mattila, K. (2009). User experience evaluation methods in academic and industrial contexts. In Interact 2009 conference, User Experience Evaluation Methods in Product Development (UXEM'09), Workshop in Interact'09 conference.

Waloszek, G., & Kreichgauer, U. (2009). User-Centered Evaluation of the Responsiveness of Applications. Human-Computer Interaction – INTERACT 2009 Lecture Notes in Computer Science, 239-242. Springer. doi:10.1007/978-3-642-03655-2_29

Zeiner, K. M., Burmester, M., Haasler, K., Henschel, J., Laib, M., & Schippert, K. (2018). Designing for Positive User Experience in Work Contexts: Experience Categories and their Applications. Human Technology, 14(2), 140-175.

Appendices

Appendix A: Interview questions

1) About your role and overall communication needs and tools

a) Can you tell a bit about your role and typical tasks in your organization?

b) Do you have regular contacts & communications with law enforcement practitioners, or any experts from government agencies, businesses, research institutes, universities, or nongovernment organizations? If yes, can you tell a bit how you communicate with these organizations?

c) Which communication tools and technologies do you use today? Please list all relevant ones.

d) What are the benefits of these technologies, both for yourself and for the organization?

e) What about the limitations and shortcomings?

f) Are there any specific issues when it comes to communicating in the international context?

g) Do you have any particular views on the security (anti-intrusion, virus etc.) aspects of the communication tools and technologies you commonly use?

2) About the specific communication toolbox

a) How do you typically use the dedicated communication toolbox of your organization?

b) How does the communication toolbox make it easier for you do your job?

c) What are your favorite functionalities and features, and why?

d) How the users of the toolbox need to consider data protection and other security aspects? Are there any specific steps and principles to take into account? Is it convenient for you follow these steps and principles?

e) What can you say about the reliability of the communication toolbox? For example, in case the toolbox crashes, are there any backup systems or fallback plans? Are there any safeguards to avoid loss data?

f) Any other user experience related observations or comments?

g) Does the communication toolbox include any functionalities and features that you are aware of, but have not yet used? Are you likely to start using them within next 12 months, and why so?

h) What new functionalities and features would you like to see featured in the communication toolbox within the next 12/24 months, and why so?

Appendix B- Script used during the interviews

Introduction

Hello, I am Alejandro. I am a master's student, majoring in Human-Computer Interaction. I am currently writing my master's thesis on User Experiences by Governmental Agencies on Communication Toolboxes, which is why we are having this interview. The interview consists of two parts. One, which is more general and the other one, more specific, focused on the specific communication toolbox. At the end of the interview, I would like to ask you to fill out two small questionnaires, which will complement our qualitative analysis. If you do not mind, we are recording this session. Is that, ok?

Interview Questions

1) <u>About your role and overall communication needs and tools [15 minutes]</u>

a) Can you tell a bit about your role and typical tasks in your organization?

b) Do you have regular contacts & communications with law enforcement practitioners, or any experts from government agencies, businesses, research institutes, universities, or nongovernment organizations? If yes, can you tell a bit how you communicate with these organizations?

c) Which communication tools and technologies do you use today? Please list all relevant ones.

d) What are the benefits of these technologies, both for yourself and for the organization?

e) What about the limitations and shortcomings?

f) Are there any specific issues when it comes to communicating in the international context?

g) Do you have any particular views on the security (anti-intrusion, virus etc.) aspects of the communication tools and technologies you commonly use?

Do you have a dedicated communication system that you use? This next part is about the specific communication toolbox (a set of different technologies, that allow you to communicate within your organization. Useful tools and features include videoconferencing, instant messaging, directory of users, thematic discussion groups, various notifications, document sharing, collaborative editing, automated transcriptions, automated translations, group calendars etc. In this expert report, "Communication toolbox" is used as the overarching term for all such features.)

2) <u>About the specific communication toolbox [35 minutes]</u>

a) How do you typically use the dedicated communication toolbox of your organization?

b) How does the communication toolbox make it easier for you do your job?

b-ii/ Do you have any particular views on the visual design of the system?

c) What are your favorite functionalities and features, and why?

d) How do the users of the toolbox need to consider data protection and other security aspects? Are there any specific steps and principles to consider? d-ii/ Is it convenient for you follow these steps and principles?

e) What can you say about the reliability of the communication toolbox? For example, in case the toolbox crashes, are there any backup systems or fallback plans? Are there any safeguards to avoid loss data?

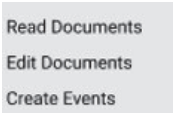
f) Any other user experience related observations or comments?

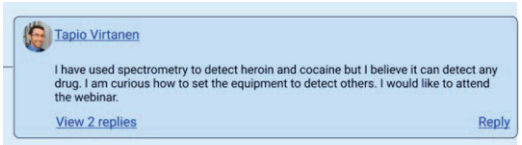
g) Does the communication toolbox include any functionalities and features that you are aware of, but have not yet used? Are you likely to start using them within next 12 months, and why so?

h) What new functionalities and features would you like to see featured in the communication toolbox within next 1224 months, and why so? SUS- https://forms.gle/tuwDkZqe8C5ed8wYA

UEQ- https://forms.gle/RzWCpXpWUFPfo2Bs5

Appendix C- Table describing different components of the prototype

Name of the component	Picture showing an example of that component
Text in the navigational route	
Filter text against filter background	
Homepage folders and text	
Black text on the right-side contextual information	

Blue text on the right-side contextual information	
Table's column title	
Post title and background	
Post content and background	
Join button	
Discard Button	
In-platform buttons	
Buttons leading to external platforms	
Selected forum tab	

Appendix D- Introductory letter sent to participating organizations

PEN-CP Pan-European Network of Customs Practitioners

PEN-CP Expert Report: User Experiences by Governmental Agencies and Multi-government Organizations on Communication Toolboxes

Expert interview briefing document

The Pan-European Network of Customs Practitioners (PEN-CP, www.pen-cp.net) is a 5-year EU Horizon 2020 funded security practitioner network-project, with 13 European customs administrations as core partners. PEN-CP's endeavor is to establish a customs practitioner network which facilitates translating customs security research and innovation ideas and requirements into scalable, viable solutions, technologies, and process improvements that would help European customs administrations to overcome the challenges of the contemporary customs and border management security.

A Custom innovation network, like PEN-CP, relies on efficient communications that allow officers from various Customs administrations to contact each other and exchange information, in an effective and efficient manner. Useful tools and features include video-conferencing, instant messaging, directory of users, thematic discussion groups, various notifications, document sharing, collaborative editing, automated transcriptions, automated translations, group calendars etc. In this expert report, "Communication toolbox" is used as the overarching term for all such features.

The objective of this research is to analyze user experiences in different Communication toolboxes used by governmental actors, in European or global context. The outcomes of this research will help Customs and other governmental agencies to make more informed and better selections regarding future Communication toolboxes. We welcome warmly experts from UNODC CCP-program; H2020 iLEAD -project, and Customs2020 CDTPG & CLEN initiatives to participate in this research, thanking in advance for all contributions.

In Helsinki, Madrid and Thun, on 1 May 2021

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement No 786773.

INTERVIEW QUESTIONS

1) About your role and overall communication needs and tools

a) Can you tell a bit about your role and typical tasks in your organisation?

b) Do you have regular contacts & communications with law enforcement practitioners, or any experts from government agencies, businesses, research institutes, universities or non-government organizations? If yes, can you tell a bit how you communicate with these organizations?

c) Which communication tools and technologies do you use today? Please list all relevant ones.

d) What are the benefits of these technologies, both for yourself and for the organization?

e) What about the limitations and shortcomings?

f) Are there any specific issues when it comes to communicating in the international context?

g) Do you have any particular views on the security (anti-intrusion, virus etc.) aspects of the communication tools and technologies you commonly use?

2) About the specific communication toolbox

a) How do you typically use the dedicated communication toolbox of your organization?

b) How does the communication toolbox make it easier for you do your job?

c) What are your favourite functionalities and features, and why?

d) How the users of the toolbox need to consider data protection and other security aspects? Are there any specific steps and principles to take into account? Is it convenient for you follow these steps and principles?

e) What can you say about the reliability of the communication toolbox? For example, in case the toolbox crashes, are there any backup systems or fallback plans? Are there any safeguards to avoid loss data?

f) Any other user experience related observations or comments?

g) Does the communication toolbox include any functionalities and features that you are aware of, but have not yet used? Are you likely to start using them within next 12 months, and why so?

h) What new functionalities and features would you like to see featured in the communication toolbox within next 1224 months, and why so?

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement No 786773.

CONSENT FORM FOR THE INTERVIEWS

Title of the research

PEN-CP Expert Report: User Experiences by Governmental Agencies and Multi-government Organizations on Communication Toolboxes (PEN-CP-2020-ER3).

Voluntary participation

Participation in this interview is voluntary. You have the right to refuse to take part in the interview with no professional or other consequences. You are free to decline to answer any particular question you do not wish to answer for any reason. Once you have started with the interview, you can stop or withdraw at any time without any consequences.

Data protection

PEN-CP complies with national and EU legislation on procedures for data collection, storage, protection, and retention.

Confirmed by the interviewee

- I agree to participate in the interview organized by the PEN-CP project and carried out by contracted expert(s) from Aalto University.
- I recognize that I can stop or withdraw at any time without any consequences.
- I recognize that any reference to me (name etc.) can be made only if pre-approved by myself
- I recognize that I have an opportunity to give feedback on quotes that the interviewer wishes to include in final the report or other research products.

Date: _____

Print Name: _____

Signature: _____

Name and contact details of PEN-CP Coordinator

If you have any complaints or reservations about the ethical conduct of this interview, you may contact the PEN-CP Coordinator, Cross-border Research Association, juha@cross-border.org .

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement No 786773.