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Collaborative editing systems for large scale online citizen participation

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Abstract. Modern online participatory platforms are a key tool for large-scale citizen participation, both concerning the number of citizens participating and their geographical distance. However, existing platforms implement little if any collaborative system in order to help people contribute. Consequently, my doctoral research questions the relevance of different types of collaborative editing systems as supports for citizen participation. Apart from that, I also propose an analysis of users' behavior in a past online consultation in order to identify flaws and to draw recommendations concerning the design of participatory platforms.

Introduction

Citizen participation, as defined by Baum (2001), is the involvement of citizens in public decision making. During the past decades, citizen participation in the political life of their city, province or country has become more and more applied, especially at the local scale with initiatives like those studied by Lupia (1994) or de SOUSA SANTOS (1998). Citizen participation can be applied in various circumstances, from participatory budgeting, like in Holston et al. (2016), to public consultation, like in Aragón et al. (2017). In the recent years, these diverse

applications have been massively implemented in an online context. A survey on 40 major cities (more than 200,000 inhabitants) from the United Nations (2018) shows that 85% of them propose online feedback submission systems. Nevertheless, participatory systems granting more power to citizens are far less implemented in the surveyed cities, with only 23% of them proposing online participatory budgeting.

Digital alternatives to in-person citizen participation have the main advantage of enabling massive participation at the national and international scale. However, they imply computer-specific problems, from technical issues (e.g., bugs, security breaches, etc.) to the need for a certain degree of computer literacy through the necessity of making many contributors collaborate. To achieve viable participatory democracy systems, these problems have first to be identified and addressed. Toward this objective, the computer-based collaborative editing research field can be an inspiration, since it has already treated similar questions and proposed functional systems for both the general public and certain specific communities.

Collaborative editing systems, as well as other CSCW applications, have been classified by Johansen (1988) in four categories depending on their temporal and location dimensions, i.e., whether or not contributors collaborate respectively at the same time and at the same place. These categories do not offer the same possibilities for online citizen participation and a focus of my Ph.D. has been to assess which category was the most appropriate for the different types of citizen participation. Moreover, my analysis of modern citizen participation platforms has highlighted the fact that these platforms implement little means to enable large scale collaboration among contributors. Consequently, we have chosen to focus on the following research questions:

- How can we build an online CSCW platform for citizen participation which is able to handle the contributions of a large number of users (of the order of the population of a city or a country) while remaining usable and without exposing them to an information overload?
- What are the biases induced by a platform for participatory democracy and how can we detect and prevent them?

Methodological approach

As a first step, we have performed an analysis of a citizen consultation platform set up during the elaboration of the République Numérique French law[1]. This platform allows the users to contribute to the law project by either proposing new articles or amending, discussing and voting existing ones in a manner similar to the one described by Parra et al. (2017). The determining factor in our platform choice was the high number of active contributors, here 21464 different citizens, organizations and institutions. Other factors, such as the existence of a dataset detailing all the

[1] https://www.republique-numerique.fr

contributions and the fact that it was held in French, which is fluently understood by my supervisors and myself, have also impacted our choice.

The objective of our analysis was to identify flaws in the design of citizen participation platforms and to propose recommendations to solve them. In order to validate our recommendations, we will develop a prototype of platform for participatory democracy focused on ideation, elaboration and approval Parra et al. (2017) of propositions and to submit it to empirical validation through the organization of an online consultation. We plan to use the Decidim open source project as a starting point for its development. The criteria of evaluation will be its technical viability, its capability to solve the issues that we have identified on preexisting participatory platforms and to allow contributors to collaborate in order to express and discuss propositions.

First results

Our analysis of the existing collaborative editing systems has led us to question the viability of the categorization proposed by Johansen (1988) in the case of citizen participation. Indeed, the location differentiation between the "same place" and the "different places" systems seems to be irrelevant since, until now, online platforms are primarily used for citizen participation in order to increase the amount of possible contributors and to reduce the impact of geographical position of citizens on their capability to contribute. Consequently, we decided to revisit the location differentiation and to base it on the technical architecture of the platforms to distinguish centralized and distributed systems. This categorization allows us to differentiate the forms of citizen participation where a conceptual central node with decisive power can be identified, generally an institution, from those where decision-making power power is distributed more evenly, as described by Arnstein (1969). Concerning the temporal differentiation between synchronous and asynchronous platforms, we consider that these two types of platforms offer completely different possibilities for citizen participation, both in terms of applicability depending on the amount of users and of appropriate use cases.

Moreover, our analysis of the République Numérique online citizen consultation has allowed us to identify flaws in the design of the dedicated platform and to measure their impact on the participation. These flaws can create centralization of contributions around a small set of initial propositions, reduce the number of propositions related to a specific topic or unbalance the amount of replies of different types to a single proposition. In this latter case, we can see for example propositions receiving many votes – symbolizing their (dis)approbation by the contributors – but very little comments or arguments – which would be helpful to help new contributors form an opinion. Finally, through this analysis, we also highlight the fact that the République Numérique platform, as well as most other participatory platforms we have reviewed, contains very little collaborative tools. Consequently, we consider that such platforms are not collaborative and that new specific tools for citizen participation should be implemented. These tools

should support the ideation, elaboration and discussion phases of the participatory process.

Next Steps

During the next months, I expect to develop a participatory platform based on the Decidim framework in order to implement the recommendations drawn by our analysis of the République Numérique online consultation. I also plan to integrate new means of collaboration among contributors according to our analysis of the existing collaborative editing systems. We expect to subject the elements implemented in this platform to empirical validation through the organization of an online consultation.

I also plan to analyze other use cases of collaborative editing which are more mature, such as Open Source software development. We expect that the means implemented to enable large-scale collaboration in different contexts can be used to widen the scope of means to improve online citizen participation. We also plan to question the viability of the different means proposed to manage high amounts of contributions without exposing contributors to information overload.

Finally, I plan to investigate the relevance of Natural Language Processing (NLP) as a mean to enable large-scale citizen collaboration. So far, we have identified two different use cases for NLP in a participatory platform. The first one is to identify irrelevant, duplicate or malicious contributions, which has already been done for other types of platforms such as StackOverflow – by Correa and Sureka (2013) or Tóth et al. (2020). The second use case is to filter the propositions highlighted for a contributor depending on their areas of interest and expertise and on their prefered means of contribution.

Biography

William Aboucaya is a second year Ph.D. student in the MiMove team of INRIA. His doctoral research focuses on the use of CSCW for online citizen participation and is funded by Sorbonne Université. William obtained his computer engineer degree (equivalent to master's degree) in 2019 at the ISEP engineering school, with an elective in software engineering. His Ph.D. is directed by Valérie Issarny (MiMove@INRIA) and supervised by Rafael Angarita (LISITE@ISEP).

During his master's degree, William has obtained a software and distributed systems-oriented background. The first months of his Ph.D. have provided him a better knowledge of participatory systems and collaborative editing. William has also taught a web development class at ISEP during the first semester of the academic year 2020/2021.

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I would like to thank my director Valérie Issarny and supervisor Rafael Angarita for their support and guidance. I would also like to thank my other colleagues at the MiMove team and all the researchers who have been willing to answer my questions for their help and advices.

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Gender and Discussion in Innovation Design

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Abstract. When it comes to gender and design there seems to be a gap in the literature focusing on the effect gender has on discussions which influences the design decisions being made. This research aims to uncover if there is any effect, and then how this can be mitigated or used to the advantage of the users. So far, this research has looked at the conversations which has taken place, and the aim going forward is to look at the products being designed and to uncover how gender may have played a part in their creation.

Background and Motivation

Gender Diversity in Computer Science

In 2018, women made up just 22% of the STEM workforce (WISE, 2019b), with just 16% of the workforce of IT professionals being female. Furthermore, women in STEM apprenticeships are slowly increasing in numbers, but completion is continuing to drop (WISE, 2019a). The proportion of gender in the workplace is significantly different from the audience they are building for.

The effect that the team creating designs and products have on users cannot be overstated. Furthermore, a lack of diversity has shown again and again the major impact that this can have on products and technology released to consumers. For example in 2015, an article was published by the BBC after the launch of the Apple Watch voicing concerns of consumers with tattoos that features such as heart rate censor did not function correctly, labelled as "TattooGate' (BBC, 2015). The BBC also stated that "it can also happen to people with dark pigmentation or black skin". How a product as highly anticipated as the Apple Watch made it to market with such discrimination built into it is highly suggestive of a lack of diversity in its design.

Often when gender and design are discussed, the problems raised concern a lack of women as designers or developers (Rode, 2011), but there is little on ensuring full gender representation when it comes to users. This issue is critical to consider; as it is not just women who make up around half the design or development team, but the users themselves. The possibility that the women's contribution to design and innovation should be regarded as important if not fundamental, seems indicative of bias continuing into design processes. Women are, and should be given, equal opportunity to be designers and users, and contributions should be encouraged and supported. As such, this research aims to outline and consider how gender roles play a part in innovation and design with regard to users, as well as designers, by examining any gender differences in design innovation workshops. There are other studies considering Conversation Analysis (CA) and gender e.g. Stokoe and Weatherall (2002), but a much more limited number on how this ties in to innovation and ideation. Consequently, this research has focused on how gender, as an example of diversity, can effect design decisions being made, particularly when it comes to group conversations during the ideation stage of a project.

Research Questions

Throughout the research so far, these questions have adapted and fluctuated between more broad and very specific. At the time of writing, the current research questions are:

- How does gender influence group design discussions?
- In a group setting, how does the gender diversity of the group effect the product that is created?

Methodological Approach

Participatory Design (PD) as an innovation workshop, is the act of involving stakeholders in the design process to ensure that all requirements are thought out and well designed and implemented. As a methodology, PD has been used to format workshops (Hansen et al., 2019), which is how it was used in this study. Hansen et al. (Hansen et al., 2019) state, their claim "is not that PD is superior to other approaches" but that an increased interest in HCI should be matched by an increased interest in PD. However, their paper holds a variety of reasons as to why PD is the only way to achieve a design which both users and designers would be able to work with, and other literature supports this. Hansen et al. also state that PD is "not merely a collection of participatory methods or about having an ethical standpoint in design, but an approach to generate effects related to democracy, empowerment, and quality of process and product" (Hansen et al., 2019) which supports any interest in diversity and design through PD. This research aims to uncover to what extent gender is a factor within conversation with group or co-design being used as a framework, as well as the effect that this has on its suitability in organisations. PD in this study was used more as a methodology than as an ideology, therefore the main focus will be on the design groups and innovation.

Innovation has been defined as the creation and adoption of an idea, a product, a technology, or a program that is new to the group using it (Gupta et al., 2007). In line with this, (Fagan, 2004) describes innovation as being able to be focused on one of three areas: person, process or product. Ideation in the context of this study, will focus upon innovation in products. Generating ideas, which could be linked to people or process, with the understanding that the act of creating the idea itself will often, but not exclusively, lead to a product.

Workshops

Since design is often staged through workshops supported by collaboration and cooperation, it is important to consider the effect that gender has on research method. Balka (1997) extended the "analysis of gender as a factor in participatory design initiatives", and achieved this by focusing on "the challenges of implementing PD in the context of non-profit feminist and women's organisations" (Balka, 1997). The main challenge encountered in using PD as a framework for design in these organisations was how this process fitted into the organisational structure at large (Balka, 1997). This is particularly relevant to this research within a University setting, as if only a subsection of diverse groups are surveyed and given opportunity to be involved in the process of design, then the products and services made available to students may not be suitable for all. Moreover, overall Balka (1997) supports the argument that PD is "likely to fail unless the gendered nature of expertise is recognised".

The methodology of PD, has a set structure given that it is a research methodology (Spinuzzi, 2005). This three-stage method includes; "initial exploration of work", "discovery process" and "prototyping" (Spinuzzi, 2005). In this study of design, the method of "initial exploration" was in the form of an innovation workshop. Innovation Workshops are a style of focus group, where participants are encouraged to adopt an innovative and creative thinking style. In this particular case this included; independent ideation around problem areas, followed by collaborative grouping. The "discovery process" was done through independent ideation of solutions around those problem areas, with the "prototyping" being carried out by the group at large. Ideation, in this instance, refers to the process of noting ideas around a topic on a sticky note. Many innovation workshops are based around this method of ideation; the differences lie in the topics of ideation and how these are derived (Silverstein et al., 2013).

Online Workshops

Due to the COVID-19 pandemic, workshops are no longer able to be run in person, so these will now be happening online and therefore each stage of the workshops must be redesigned to work online. Below is an outline of how this will happen in the first instance, with an understanding that this may need to be adapted after the first workshop is run.

The first stage is problem ideation, which involves generating problems around a specific area. When the workshops ran in person, participants are asked to write down, individually, on sticky notes as many problems or issues as they can which relate to the workshop theme. Participants are then asked to present their problems to the group, as they would have done had the workshop taken place in person. Once all the problems have been shared, participants are then asked to categorise their problems. When in person, this normally involved asking participants to come up with problem areas/categories as a team and then to sort all their problems under these categories, physically with the sticky notes. Now this is happening remotely, these categories will be achieved through discussion, and then shared to the call's chat for reference. In the past workshops that have been run, individual ideation took place using sticky notes and placing these under the list of categorised problems as prompts. When running these workshops remotely, participants are asked to individually ideate using the categories as prompts. They are then be asked to present these.

The next stage, involves consolidating ideas and then ranking them between "really helpful" and "would be nice". When in person, this took place by rearranging a lot of sticky notes. However, instead of this being a physical activity, the focus is more on the discussion and participants are asked to discuss each idea and then to select their top three.

When participants have selected their top three ideas, they are then asked to design these. This would normally be on a large sheet of combined paper, where they all have a pen and start designing. Whilst an online group design tool is being

selected and passed through ethics approval, individual design is be carried out. Participants are each given five minutes for each of the three ideas to draw how they think this idea would work. Once the design has taken place, the participants present their ideas to the group.

Analysis

Building upon the research and literature surveys of Stokoe and Weatherall (2002) and Sidnell (2010), CA as a means of evaluation is well rehearsed. "CA provides the tools to explore in fine detail how issues around gender are occasioned in talk" (Stokoe and Smithson, 2001). However, this practice focuses on how things are said, and the interactions between participants. This study aimed was to find the role gender played in a group setting with regards to innovation and PD. Therefore, as well as understanding how interactions took place, there also needed to be a focus on what was being said. In looking at the way participants interact with one another, it is important to understand the more subtle differences in language. Stokoe and Smithson (2001) state that CA is a "fruitful way of exploring links between gender and discourse", because "rather than imposing the analyst's assumptions on to the data in which gender may be relevant, CA focuses on what participants themselves focus to talk on".

Thematic analysis is used to extract themes from a text, or "thematic analyses move beyond counting explicit words or phrases and focus on identifying and describing both implicit and explicit ideas within the data, that is, themes" (Guest et al., 2012). A combination of Thematic Analysis and CA has been used throughout this research to help understand what is being said in a group context, as well as how it is being said.

Findings to Date

Hedging

Hedging is the term referring to the linguistic style of 'hedging' your bets with phrases such as "I think", "you know" and "sort of" (Holmes, 1986, 1990; Murphy, 2010). Murphy (2010) states that "the use of hedges among females before a key word" is used "to avoid the appearance of playing the expert". Holmes (1990) recognises as well that the context used around hedging also plays a large part in it's practise. For example, Holmes (1986) also states that hedging has two purposes, either to express speaker confidence e.g. "you know" or "reflecting uncertainty" e.g. "I think". Hedging is recognised as a "significant communicative resource for academics" (Hyland, 1996) although Hyland (1996) also recognises that is used by academics. They classify "scientific hedges" into various categories as a means of analysis, and conclude with the statement that hedges "constitute an essential element of argumentation in presenting new claims". This may be especially important to consider when asking groups to present their ideas to one

another and to reflect on how these are used as either a tool to show certainty or uncertainty, as stated by Holmes (1986). More recently, Gribanova and Gaidukova (2019) also suggested that the style of hedging carried out can be used as a tool and is quite often done so politically.

Dixon and Foster (1997), found that hedging was used the same number of times by both genders, contradicting what was found by Holmes (1986). They did however find that the results based on the gender of the audience of the speaker had a significant influence on "their use of epistemic sort of and confident you know." A study conducted as part of this PhD research found that hedging was used differently by men and women, but due to the sample size, no statistically significant differences were able to be concluded (Ashcroft, 2020b).

Group Dynamics

Other workshops have found gender differences displayed with regards to problem raising, apologetic language, asking for help, hedging and group practices such as writing and turn-taking are all indicative of gender differences in group design processes (Ashcroft, 2020a). This ties back into the discussion around hedging made above where it is important to recognise the position of the talk and to understand the context (Holmes, 1990). To deconstruct the effect gender has on this process, each of these areas must be taken and investigated in further detail. Due to the small sample size, it is important to test if these issues would still hold when applied to a large proportion of the population. This study does however stand as a strong foundation for this research and gives direction in where thought should be applied. For example, would apologetic language still be used in single-gendered groups? Would turn-taking still happen by simply going around the table but without a leader, or would a woman step forwards and lead the design? And then depending on the outcome of this, what can be done to allow equality or equity in a group setting? It is vital that these questions are looked into in further detail in more extensive research to ensure that design workshops are carried out in a way that is sensitive to all genders.

Next Steps

The next steps for this research is to focus more on the designs being done by participants in the workshops, and look at the potential physical differences in the designs are changed based on the gender diversity and interactions which take place in the design groups.

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Exploring Possible Futures With Computational Media

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Abstract. When thinking about software, we often think about applications with a fixed set of functionality that are tied to particular devices. While applications provide functionality for their use cases, e.g., a word processor for writing text, they are usually inflexible in providing functionality beyond their often narrow use case. An alternative model considers software as a medium — Kay and Goldberg think of it as expressive and malleable as paper or clay. My research explores computational media and possible futures of software built with computational media by following an explorative and qualitative research approach using high-fidelity prototypes. I present preliminary results of properties of computational media, the potentials and limits of them, and use cases where software built with computational media excels. With my research, I aim to contribute to rethinking applications as the predominant model of software, shifting software towards a more malleable foundation, overcoming the boundaries of applications and devices.

1 Background and Motivation

We often think about software as monolithic applications on particular devices: We use our laptop to write text in Microsoft Word or edit photos in Adobe Photoshop, and use our tablet with pen input to read and annotate documents in Adobe Acrobat Reader. By doing so, applications compartmentalize functionality into fixed silos — applications are good at doing what they do, but going beyond that, they are often highly inflexible. The notion of computational media looks at software from a different angle: instead of seeing it as tool for a specific task, it considers software as a malleable medium, that users can form and mold to their needs and easily share with others. Kay and Goldberg (1977) compare computational media with paper or clay, allowing for many different ways of using it. While computational media has a long history with early platforms such as the Dynabook (Kay and Goldberg, 1977) and Boxer (diSessa and Abelson, 1986), and experienced a recent resurgence in new platforms like Webstrates (Klokmose et al., 2015), its potentials and limitations are mostly unexplored.

My notion of computational media builds on the idea of *shareable dynamic media* by Klokmose et al. (2015): a medium that is characterized by the three properties *shareability* (being shareable with other users and allowing for collaboration), *distributability* (being distributable across heterogeneous devices), and *malleability* (being extendable and reprogrammable). Building on Webstrates, Rädle et al. (2017) created Codestrates, which added an authoring environment that "blurs the distinction between use and development of applications" (Rädle et al., 2017). It inherits the properties of Webstrates and implicitly adds the forth property *computability* (being able to edit and execute custom computations within the document). These four properties are the foundation for my proposed properties of computational media.

2 Research Goals

My PhD project aims to explore the use of computational media as malleable software in different scenarios. The aims are threefold and interrelated:

RG1 — Defining Properties of Computational Media. First, my project aims to define properties of computational media in more detail. It will build on existing work (Klokmose et al., 2015; Rädle et al., 2017) and discuss properties in the process of different cases.

RG2 — Exploring Potentials and Limits of Computational Media. Next, my project will explore and uncover potentials and limits of computational media. These potentials and limits will be related to the defined properties to understand how they influence computational media.

RG3 — Identifying Domains and Use Cases for Computational Media. Lastly, my project aims to identify domains and uses cases in which computational media is well suited to be used. This aim, again, is related to the preceding aims and allows for a better assessment of the capabilities of computational media.

3 Research Approach

My project aims are rooted in exploratory research, therefore, my research approach focuses on qualitative methods and exploration rather than comparative lab studies. Computational media as software is radically different from the established model of turn-key applications found in most commercial software products. Thus, my project aims to explore and uncover *possible futures* (Salovaara et al., 2017) of software built with computational media. To operationalize this aim, the project utilizes high-fidelity prototypes and participatory design (Bødker et al., 1995). The prototypes act as *computational alternatives*: "manifestations of research and design ideas as well as demonstrations of possible ways to move ahead" (Korsgaard et al., 2016). Using high-fidelity prototypes allows users to imagine in more detail how software built with computational media is different from classic applications. The development of these prototypes is supported by participatory design and co-design methods (Bødker et al., 1995; Sanders and Stappers, 2008). Letting users participate in the design process allows them to shape software to their needs while reflecting on how computational media, rather than applications, contributes to achieving these goals. Working closely with participants in such a design process, further, provides insights into their understanding of software as a computational medium.

4 Preliminary Results

So far, I worked on two projects: (1) Deploying a computational medium in a nanoscience lab (Nouwens et al., 2020) and (2) using computational media in a co-design study about collaborative writing (Larsen-Ledet and Borowski, 2020; Borowski and Larsen-Ledet, 2021). I will briefly introduce these projects and then summarize the results of these two projects in relation to my research goals.

Computational Media in a Nanoscience Lab. My first project involved deploying a computational media prototype, the *computational labbook*, in a study with biomolecular nanoscientists. The work of these scientists relies on computational tools for designing RNA structures in the field of RNA origami. The prototype was developed iteratively together with the scientists in a participatory design process. The labbook acted as a computational alternative (Korsgaard et al., 2016) to co-create possible futures (Salovaara et al., 2017) of a computational laboratory notebook (Nouwens et al., 2020). This project provided insights to deepen the properties of computational media and their facets, and how they relate to the case of computational nanoscience.

Computational Media in Co-design Workshops. My second project focused on using a computational media prototype in a co-design workshop to facilitate cooperative prototyping (Bødker and Grønbæk, 1992). The prototype was malleable and allowed participants to extend and reprogram it during the workshop. This work provided insights into the difficulty of making use of malleability and reprogrammability as an end-user. It, further, showed the benefits of employing computational media in prototyping workshops during a co-designs study and limitations of current platforms like Codestrates (Rädle et al., 2017).

4.1 RG1 — Properties of Computational Media

The first three properties are defined by Klokmose et al. (2015), while the fourth property was derived from Rädle et al. (2017) during my first project (Nouwens et al., 2020). The facets of the properties below are based on my two projects if not cited otherwise.

Distributability. Computational media is distributable in three ways: documents, functionality, and computation. *Documents* of computational media are distributable beyond device and operating system borders. *Functionality* of a document, e.g., parts of the user interface, can be distributed across multiple devices, allowing for cross-device interaction and a fluid rearrangement of parts of a document or the user interface on multiple devices. Lastly, *computation* can be distributed across devices and servers, providing means to offload computation to more powerful client devices, e.g., from a phone to a desktop computer (Badam et al., 2018), or to a more powerful server (Klokmose et al., 2019; Nouwens et al., 2020).

Shareability. Computational media is shareable, allows for collaboration, and enables users to more easily receive help from peers. Documents are *shareable* with other users, they are held in common and can be accessed by multiple users simultaneously. In Webstrates, for example, documents are shareable using links. Documents are also synchronized and automatically updated, enabling real-time *collaboration*. Finally, shareability enables users not only to collaborate together to solve a task, but also to *receive or give support* to others. This was employed by nanoscientists in the first case to receive help from remote programmers (Nouwens et al., 2020).

Malleability. Computational media is malleable and supports multiple levels of tailoring: extensibility, configurability, and reprogrammability.[1] *Extensibility* allows users to extend and reduce the functionality of a document, e.g., by using plug-ins that can be added or removed. *Configurability* enables users to customize existing functionality, e.g., by editing parameters without needing to change the underlying code. *Reprogrammability*, lastly, provides tools to view, edit and re-run

[1] These levels are inspired by the levels of end-user tailoring by Mørch (1997).

the underlying code of functionality from within the document, i.e., documents are self-contained and inhabit the code of their functionality.

Computability. Computational media is computable, allows custom code execution, and contains the computational environment within itself. *Code execution* of arbitrary code is possible from within documents and outputs of computations can be stored and presented directly within the document. Ideally, computation should not be restricted to one programming language but support polyglot language interoperability, allowing to combine multiple programming languages in the same document. The *computational environment* is part of the document and independent from devices, i.e., code executions behave the same on all devices.

4.2 RG2 — Potentials and Limits of Computational Media

Distributability. Unsurprisingly, distributability of documents is beneficial when users use multiple devices at multiple locations. Systems like Google Docs employ such a way of distribution already. While cloud storage like Dropbox synchronizes files each device still needs to be able to open these files, requiring to install particular applications. A limitation of this is the need to be connected with a server while working on documents. While the possibility of cross-device interaction is beneficial, there are limitations like a *legacy bias* (Plank et al., 2017) towards using only one device at a time — like in my first project (Nouwens et al., 2020).

Shareability. With documents being held in common, shareability provides means for both synchronous and asynchronous collaboration. As a computational platform, this is not restricted to, e.g., text as in Google Docs but also enables for collaborative programming practices. This can, for instance, be useful when working on programming assignments together (Borowski et al., 2020), when requiring help from a more capable peer (Nouwens et al., 2020), and when prototyping (Borowski and Larsen-Ledet, 2021). While documents held in common are useful in these cases, it also poses potential risks regarding security and privacy.

Malleability. Malleability is beneficial, as it allows users to customize software on a visual *and* functional level. This can be useful in scenarios like prototyping (Borowski and Larsen-Ledet, 2021) and allows users to mix and match functionality (Borowski et al., 2018). Being a self-contained system with easy access to code is needed in such a case. Often, however, this still requires programming skills on the side of the user, which can provoke new problems, as users might feel disempowered by their software (Nouwens et al., 2020). Too much choice in what tools one wants to use can overwhelm users (Larsen-Ledet and Borowski, 2020).

Computability. Computability provides the foundation for leveraging computation in more areas of software. It allows to “opportunistically use scripts

from different sources, written in multiple languages" (Nouwens et al., 2020). Bundling the computational environment with the document and not relying on specific devices or dependencies, such as local Python distributions, allows sharing documents without worrying about how a document looks or behaves on different devices. But this bundling can also confuse as it removes the familiar separation of functionality in applications and content in files (Borowski and Larsen-Ledet, 2021).

4.3 RG3 — Use cases for Computational Media

Frontiers of Science. The first domain to apply computational media are "frontiers of science," i.e., fields where there are no established applications available — either because it is not profitable for companies to develop them or because the field is just emerging. Computational media can provide users "with the flexibility of scripts together with the accessibility of applications" (Nouwens et al., 2020), placing itself in between the two. This is mainly supported by the properties malleability and computability.

Prototyping and Co-Design. As shown in my second project (Borowski and Larsen-Ledet, 2021), another domain that can be supported by computational media is cooperative prototyping (Bødker and Grønbæk, 1992) in participatory design and co-design processes. Being self-contained and malleable, documents in computational media can quickly be changed and iterated. In addition, it allows also participants to join in the design process, being able to modify the functionality of documents without the need for additional development environments, which are otherwise often required to modify software.

Collaboration. The distributable and shareable nature of computational media makes it a good foundation for collaborative use cases. For example, collaborative data exploration (Badam et al., 2018), video editing (Klokmose et al., 2019), programming (Borowski et al., 2020), prototyping (Borowski and Larsen-Ledet, 2021). Malleability can, further, help to support idiosyncratic needs (Larsen-Ledet and Borowski, 2020) by letting users tailor their functionality.

5 Next Steps

In the second half of my PhD, I focus on the property malleability: A common problem in both projects was the difficulty of users to make use of malleability. Although the prototypes in both studies were self-contained and entirely reprogrammable, it was difficult for participants to make use of it. This was both due to a lack of programming skills and the difficulty to understand existing code in the system. To support users without or with little programming skills to make use of malleability, I plan to build a new prototype that follows a declarative programming model to define interaction, making it easier to understand the existing

code/functionality and to extend and reprogram it. With this prototype, I then plan to conduct another co-design workshop or hackathon — possibly again in the domain of collaborative writing — to deepen the initial insights into using computational media in prototyping workshops and provide answers about how a declarative programming model can support the accessibility of malleability.

6 Expected Contribution

The project's outcome will be related to the project goals: (1) a definition of properties of computational media, (2) potentials and limits of these properties and computational media overall, and (3) domains and use cases for computational media. Furthermore, the project will produce several high-fidelity prototypes demonstrating possible futures of software building on computational media and open new possibilities for future research by providing a technical foundation as well as guidelines for the design of computational media platforms and how they can complement current turn-key applications. These new insights and technical foundations are intended to shift the focus of software towards a common, shareable, and malleable foundation, in order to overcome the boundaries of applications and devices.

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Confronting Asylum Decision-making through Prototyping Sensemaking of Data and Participation

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Abstract. Despite decades of legal harmonization, the chance of receiving asylum varies significantly across Europe among people from the same country of origin. The research outlined in this paper is part of an interdisciplinary research project focused on understanding asylum decision-making and outcome variations across the Nordic countries (Sweden, Norway, and Denmark). The project will eventually cover over 100,000 asylum decisions. The research outlined in this paper aims to push agendas on data science in Computer-Supported Cooperative Work (CSCW) through prototyping context and participation as part of raising questions to the data and promoting data literacy. Combining the application of Machine Learning (ML) and Natural Language Processing (NLP) with participatory methods (e.g. critically designed artefacts) enable us to 1) move beyond "obvious" ML-application areas, 2) through sensemaking of data with stakeholders, and 3) co-develop approaches to data science from a CSCW-perspective.

Introduction

In Computer-Supported Cooperative Work (CSCW) and related areas of research scholars are starting to investigate how to respond to and create a shared research agenda for the refugee crisis (Talhouk et al. 2016, 2019). Increasing interest in data-driven technologies for decision-support has led to scholars asking new questions

about the role of technology in relation to large-scale political issues (Dombrowski et al. 2016, Molnar 2019). As such, scholars begin to discuss the entrenched inequities of data science tools among the already marginalized and how they locate wealth and power largely in Western societies (Taylor et al. 2021). Acknowledging these deep issues of inequity "data are part of the problem, to be sure. But they are also part of the solution" (D'Ignazio et al. 2020).

The PhD research outlined in this paper is part of the interdisciplinary research project Data Science for Asylum Legal Landscaping (DATA4ALL) focused on understanding asylum decision-making and outcome variations across the Nordic countries (Sweden, Norway, and Denmark). This project will use Natural Language Processing (NLP) and machine learning (ML) together with participatory design methods to understand outcome variations in asylum decisions across Nordic countries. Despite decades of legal harmonization, the chance of receiving asylum for displaced people from the same country varies significantly across Europe (Goodwin-Gill et al.; Guild 2016).

According to the 1951 Refugee Convention Article 1A, a refugee is defined as a person:

> "who is outside his or her country of nationality or habitual residence; has a well-founded fear of being persecuted because of his or her race, religion, nationality, membership of a particular social group or political opinion; and is unable or unwilling to avail him – or herself of the protection of that country, or to return there, for fear of persecution" (The UN Refugee Agency).

The 1951 Refugee Convention does not define how states should determine refugee status. Asylum proceedings and status determinations are left to each state. Refugee status is declaratory, which means that a person becomes a refugee when they meet the criteria of the Convention, not only when a state recognizes a person as such. An asylum seeker (in this paper, described as a person seeking asylum), on the other hand, is an individual whose request for protection has not yet been processed (The UN Refugee Agency).

In this context, asylum claims are left for adjudicators to decide on the basis of testimonies and the disclosed material, which become adjudications dataset available for data science.

The research outlined in this paper contributes an approach and initial points for discussion of how a CSCW-perspective can help raise questions about large-scale data. Data from asylum decisions stems from a complex and cooperative decision-making practice, which is only opaquely described as they are extracted and made available for data-driven technologies. Contextual factors may affect the data production, including imprecise language interpretation, lacking trust in authorities – but also implicit bias of adjudicators can shape interpretations of asylum claims.

This PhD project will leverage methods for prototyping sensemaking of data and participation such as speculative and critical design (SCD) methodologies to 1) engage with different types of stakeholders, connect data to the world it came from,

and promote data literacy and ethics, and 2) advance the work of unpacking and better understanding the different systemic issues influencing variations in asylum outcomes.

Machine Learning of Asylum Decision-Making

ML is increasingly being promoted to fulfill different purposes. The DATA4ALL project will use data science techniques such as ML and NLP for the purpose of explanatory research. In other countries ML is increasingly being endorsed to support decision-making in adjudications involving foreign citizens' applications for asylum (Chen et al. 2017) in order to avoid variations in decision outcome (Ramji-Nogales et al. 2007), improve impartiality, and decrease unfair decisions made by human judges (Heyes et al. 2019; Chen et al. 2017).

Large-scale datasets are not yet being applied to asylum-decision making in Denmark, though ML has been increasingly applied in sensitive settings (e.g. social welfare) fueling debates on its use. The Danish government introduced a new National strategy in 2019 with the aim of becoming a frontrunner in AI through an ethical and responsible perspective on ML use in public casework: "The public sector should take advantage of AI to provide a world-class service" (Ministry of Industry, Business and Financial Affairs 2019).

Meanwhile, large-scale data are gaining attention in the asylum domain. In 2020 it became public that decisions of recognition rates of one judge of the Danish Refugees Appeals Board varied significantly from the decisions of other judges between 2012-2019 (Flygtningenævnet 2020). Prior CSCW-research have forcefully documented the importance of unpacking the situated and cooperative aspects of decision-making in practice. Careful investigation of the social organization of work is critical for giving context to such data (Randall et al. 2007, Møller et al. 2020).

As large-scale datasets become available, and with these a growing anticipation that they can be transformed into knowledge and informed decisions, algorithmic authority increases (Lustig et al. 2016). Legal decision-making more broadly has seen an increase in algorithmic systems for decision-support (Olsen et al. 2020). In the area of asylum decision-making, data and algorithms are increasingly considered for streamlining and adding transparency into practices around decision-making (Molnar 2019; Pakzad 2019).

If data science methods are to be applied to advance asylum law, critical questions must be raised to the data in order to ensure social and ethical aspects and legal liability related to this project. This means engaging with various stakeholders to certify that context is considered appropriately (Neff et al. 2017).

Prototyping Sensemaking of Data and Participation

This PhD project will be approached by opening a conversation between CSCW, critical data studies (Neff et al. 2017), and principles from "Data Feminism" (D'Ignazio et al. 2020). To contextualize and ground the findings from applying e.g., ML to asylum cases, I intend to use participatory methods as an approach, for example, prototyping as a strategy for enabling sensemaking of data and participation (Neff et al. 2017).

Prototyping as a method covers a spectrum from product development (Andersen et al. 2017) to mere speculative research artefacts that can form a tool for inquiry (Auger 2013; Baumer 2017; Baumer et al. 2018). Prototyping is especially useful to 1) engage stakeholders and connect large-scale data to the situated context they are produced in while promoting data literacy of stakeholders. Further, prototyping allows me to 2) unpack the different political struggles influencing variations in asylum outcomes that cannot be ascribed to the situated practices of asylum decision-making (*following* Cakici et al. 2020). 3) Data are transformative of future practices and prototyping enables stakeholders who are not trained in data sciences to co-develop methods and take part in the discussion- and design of the databased services (Seidelin et al. 2020).

To unpack asylum decision-making and understanding outcome variations from a CSCW and critical data perspective, this PhD project revolves around four research questions as described below including further elaboration of the methodological approach, descriptions of the work/findings to date, next steps and expected contributions.

RQ1: How can perspectives from the people applying for asylum be taken into consideration throughout the project?

To answer this research question, I must unpack and understand *who* the people seeking asylum are and *how* and by *whom* the people seeking asylum become categorized into "asylum seekers".

Feminist theory encourages us to seek and hear the voices of the persons who are being described or discussed. Designing data-driven technologies responsibly involves that we include the people that are eventually influenced (D'Ignazio et al. 2020). Thus, I plan to examine what a responsible approach to knowledge production looks like from the perspectives of the people seeking asylum to rebalance the perspective of government stakeholders, which produced the decisions analyzed in the project. I intend to set up inclusive practices that allows the perspectives of the people seeking asylum to be represented.

RQ2: How are asylum decisions made in Denmark today?

In order to get a deep understanding of the Danish asylum decision-making process, an overview of the current Danish asylum procedure was created (Figure 1) as a starting point for prototyping a critically designed artefact.

This overview will be further developed to engage stakeholders in a discussion of the work practices of asylum decision-making, such as the subtle categorization of cases (Møller et al. 2012).

I will use prototypes as tools for collaboration with stakeholders such as NGO's, the Danish Immigration Service, the Refugee Appeals Board, and the people applying for asylum to understand the situated context and to study the classification systems, the categories, and standards in use.

Prototyping critically designed artefacts serves two purposes in this project: 1) gaining a shared understanding and common vocabulary in regard to Danish refugee terms and processes, and 2) mutual learning (Kensing et al. 2013) through participation of all stakeholders to establish a platform for sensemaking of data and discussions of the work practices of asylum decision-making, such as the subtle categorization of cases (Møller et al. 2011; Møller et al. 2020).

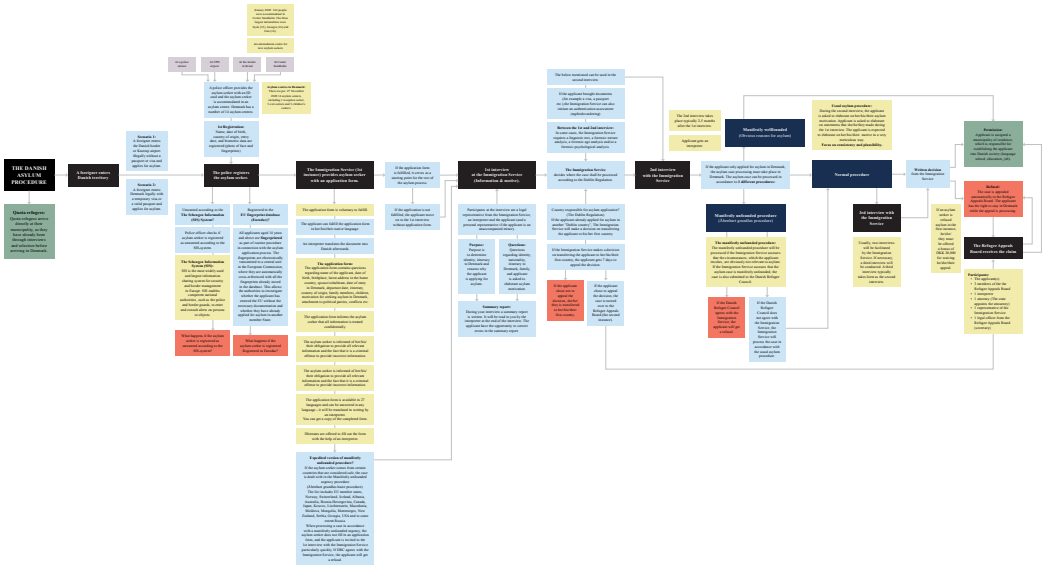

Figure 1. An overview of the current Danish asylum procedure

RQ3: What counter data can be constructed that can help nuance our insights and learnings about the Danish asylum procedure?

As a preliminary exercise in the DATA4ALL project, data from decision summaries of asylum cases treated by the Refugee Appeals Board have been extracted and analyzed. These datasets contain publicly available summaries for decision-making on asylum cases (The Refugee Appeals Board) that have been rejected by the Danish Immigration Service and therefore turned over to the Refugee Appeals Board.

The data that has informed the analysis in the preliminary exercise are - as any other data, neither neutral nor objective, but constructed and products of unequal social and political relations. When working with data, I must actively prevent

numbers from speaking for themselves and therefor situating data in context is necessary for making any real sense of correlation (Randall et al. 2007, Møller et al. 2020). It is essential to address the complexity of what the data actually represent and contextualize and evaluate the findings of this study to ensure that its "situatedness" (Haraway 1980) is taken into account.

The variations identified in the preliminary exercise will be used as a starting point for developing a second speculative research artefact. Through applying a SCD approach, it becomes possible to research "counter data" (D'Ignazion et al. 2020) through amplifying these stakeholders' ground-up understanding of asylum-decision-making and what may cause the kinds of variations in asylum cases.

Counter data is missing data or data that are currently not being collected because of e.g., bias, lack of social and political will, or structural oppression. "Data Feminism" seeks to use data and computation to counter this kind of oppression (D'Ignazio et al. 2020). Possible questions to explore through speculative design to research counter data: What happens with data about a person seeking asylum first registered in, for example, Greece and afterwards seeking asylum in Denmark? What happens with the data when an asylum case is rejected by the Danish Immigration Service and turned over to the Refugee Appeals Board? What kind of important details could possibly get lost during these processes?

RQ4: How can values encoded and reproduced in the asylum classification system be challenged through speculative research artefacts?
Acknowledging that asylum decision-making is a highly political domain, I plan to challenge the values encoded and reproduced in the Danish asylum classification system through speculative design.

Speculative research artefacts and scenarios are not meant to be implemented or used in everyday context, rather they can act as a catalyst for both sense-making and as thinking tools to question and discuss the broader impacts and consequences of technological infrastructures and the ethical implications of data science techniques (Auger 2013; Dunne et al. 2013).

Possible questions to ask through speculative research artefacts: Who are made visible and who are made invisible in the asylum classification system in Denmark? What and whose values are encoded and reproduced in Danish asylum decision-making through the classification systems, categories, and standards in use? What do these values say about the Danish asylum system?

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Appropriation process of activity-based work environments. Towards a situated approach

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Abstract. Our research focuses on activity-based workplaces which offer a diversity of workplace configurations which, instead of being attributed to users, are shared according to the needs of their activities. Indeed, we question the way these activity-based workplaces configure the ways in which individuals and collectives carry out their activity. Our proposal consists on a exploratory study carried out within an energetic French organization. We have established a two-phase methodology. Three days of observation amid three different units evolving in activity-based workplaces have helped us to identify the uses that emerged from these spatial typologies. Then, a set of two interviews with 8 participants have been conducted based on the four dimensions of the situated acceptance model (Bobillier Chaumon, 2013) and on picture elicitation. Our results provide an overview of the social and psychological consequences of activity-based workspaces on workers, their work collective, and their activity. Our conclusions can be mobilized in activity-based real estate projects, for example during the design stage. This research conducted with a situated approach based upon the study of the development of the activity proposes a change from the usual managerial approach about these activity-based workplaces, which prescribe an ideal way of working within the workplaces.

Introduction

The development and massive spread in the use of information and communication technologies (ICT) in companies, the phenomenon of despatialisation (Taskin, 2012) and the emergence of telework (Vacherand-Revel, 2016) are driving companies to adopt more flexible organisational forms (Jemine, 2016). Their reorganisation is driven by these demands for flexibility, reactivity and mobility (Ianeva & Adam, 2017).

These flexible models are concretised in their spatial form by the relocation or reorganisation of working spaces into activity-based working environments (Ianeva, M., Ciobanu, R., Lai, C., 2021; Ianeva, Ciobanu, Vacherand-Revel, 2017). This type of environment is based on different open-plan platform designs that offer a diversity of typologies and configurations of workplaces which, instead of being attributed to users, are shared according to the needs of their activities. Several rules determine how these workspaces need to function: the clean-desk rule, which imposes the obligation of freeing up the workspace when one has finished using it to allow others to move in; or the paperless rule, which imposes electronic document management in an environment where it is difficult to store paper documents.

The use of the term “activity” to qualify these spatial devices does not fail to challenge ergonomists and psychologists whose work is anchored in the French tradition of work analysis. Indeed, these projects carry the promise of a work environment which will foster the realization and the development of the professionals’ activity.

Indeed, these activity-based work environments convey a normative vision of work and of how it should be done. Through the promotion of "good ways of working", they represent a privileged tool for the implementation of managerial practices (Pillon, 2016) that are marked by a managerial discourse on flexibility and on worker empowerment. Indeed, the designers and decision-makers of these workspaces anticipate their functionalities and prescribe how they should be used, trying to outline the range of their main possible uses. And this without questioning the way in which these forms of design reconfigure the situation with which workers interact to carry out their activities. But these types of environment integrate a certain vision or definition of the activity, which participates in reconfiguring both psychologically and psychosocially work relationships (Ianeva, Ciobanu, Vacherand Revel, 2017).

Challenges of the thesis

The literature in management science has embraced the subject of these emerging workspace typologies in order to question their effects on aspects such as

performance, collaboration and job satisfaction (Maclouf, 2011). Certain managerial approaches praise the positive effects of these flexible work environments, on work efficiency, satisfaction or on the collaboration. Other authors describe these projects as "managerial fables", which are used as an argument to reduce space requirements thus reducing real estate costs and to facilitate the reorganisation and densification of the workspace (Taskin, 2012). In these studies, workspace is disembodied from the situation and is not considered as a tool or an artefact (Rabardel, 1995) which can be shaped and reshaped by the user's actions. We therefore make the hypothesis that the workspace is not only a framework or a neutral container that shelters productive activity, but an essential component of the developmental process of the subjects and of the collectives.

Any situation of change of space is thus presented as a setting in motion of the activity, revealing the arbitrations and choices made by the professionals and as such, generating psychological activity on the part of the subjects and negotiations in the work collectives. This idea is built in the continuity of certain recent works (Vasquez and Cooren, 2013; Yaneva and Guy, 2008; Mengis, Nicolini and Gorli, 2016) but also in coherence with the approaches stemming from the historical-cultural psychology of activity (Engeström, 1987; Lave, 1988). Thus, we are more particularly interested in these movements of reinterpretation of which the functional characteristics of the spaces constitute one of the main resources.

We thus articulate the situated cognition approach (Lave, 1988) with the model of situated acceptance (Bobillier Chaumon, 2013), in order to understand how the functional characteristics of these work environments are mobilised and reinterpreted by their users and how these spatial configurations affect their activity.

Indeed, situated cognition theories introduce the context in our understanding of the lived experience. Action is guided and embedded in its local circumstances, whose are constructed throughout action (Suchman, 1987, Lave, 1988). This distinction and relation between the "given" and the "created" situation is at stake in Lave approach (1988), in her distinction of the *arena* and the *setting*. Situation as a condition and as a constitutive element of the action is relevant in the analysis of the psychological and practical dynamics involved in the use of activity-based workplaces.

Rather than focusing on the intrinsic characteristic of the spatial layout in terms of the physical environment or the comfort of the occupant, the model of situated acceptance highlights how workers deal with these spatial configurations in practice. It makes it possible to question the way users collectively "re-design" the operating rules of these workplaces through their ongoing activity. This comprehensive approach of human activity-in-context makes it possible to concretely evaluate the contributions and limitations of a device around four dimensions :

- The individual dimension relating to the employee's own activity, in a cognitive and emotional sense
- The organisational dimension involving the relationship between employees and the way their work is organised, their actions and initiatives
- The relational dimension involving collective and collaborative activity, the way work collectives function and articulate themselves
- The dimensions of professionalism and identity, which express the ability for individuals to have their skills recognized, and the ability for them to conduct their activity and maintain their power of action.

The analysis of the spatial appropriation experience throughout the four dimensions of the situated acceptance model allows us to see not only what individuals feel in their use of these artefacts, but also what they actually do with them, what they seek to do, or what they cannot/no longer do with them (Bobillier Chaumon, 2016). Thus, without reducing the action to the situation, this model addresses the subject's psychological and collective activity. The functioning of activity-based workspaces relies on the users' ability to make choices, to arbitrate between different available options and thereby to control his or her activity. These choices are made within the articulation between the spatial configuration and the internal individuals' resources and have consequences upon their activity. This understanding of the dynamics underlying the process of appropriation of these activity-based work environments will be mobilized in order to design workspaces that will offer the most suitable conditions for their final acceptance by their users. Thus, our thesis work aims at understanding how the functional characteristics of these activity-based work environments are appropriated by their users. We focus on the social process of incorporating these workspace typologies into one's activity.

Context of the study

For this proposal, we will introduce an exploratory study which has been conducted in a French industrial energy groupe. Committed to a quality-of-life-at-work process since December 2017, this subsidiary had taken the commitment to evaluate and promote health and safety at work and to improve working conditions to improve the company's performance. At the time of the study, its workspaces had an occupancy rate of 0.8. There were therefore 1,094 employees who shared 728 workspaces spread over two and a half floors.

The building is composed of three floors of activity-based layouts. Each floor has different spaces and workstations with associated rules governing their use (Figure 1 : Presentation of the different types of workspaces).

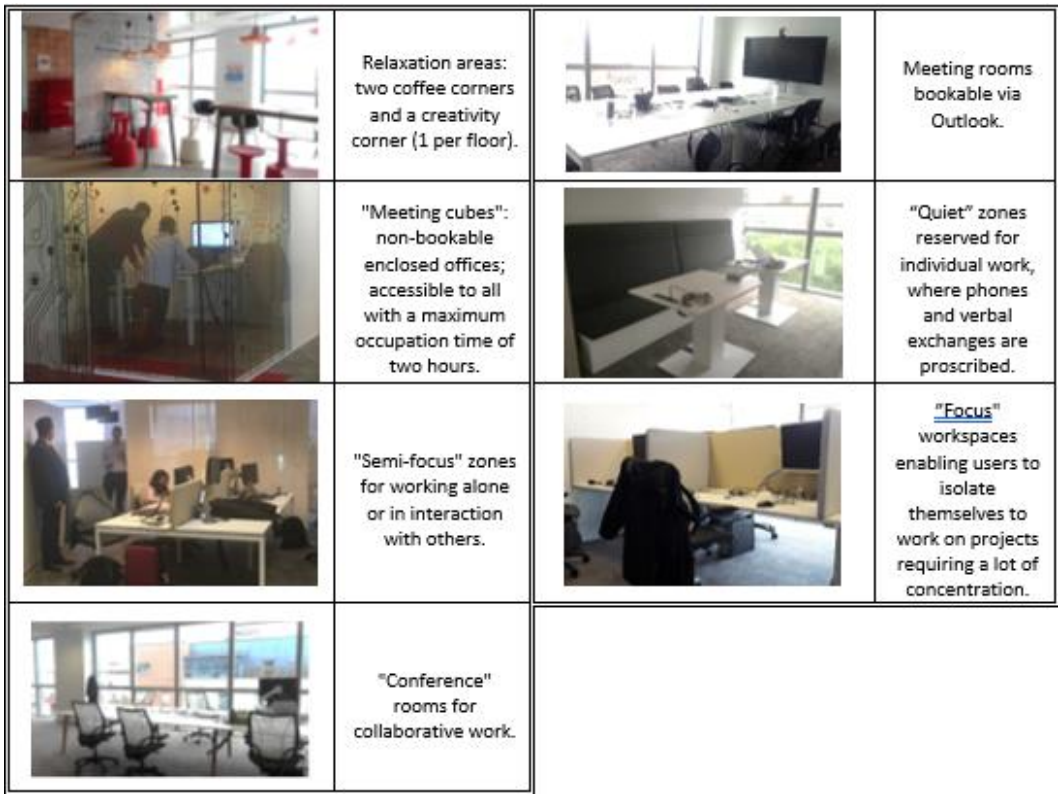

Figure 1: Presentation of the different types of workspaces and workstations

Methodological approach

For three days, we were able to observe three different teams selected following their responses to a mailing campaign conducted by the officer in charge of quality of life at work. There was a Support Team of four people, a Wi-Fi team of five people, and an Applications Team of eighteen people. An initial telephone interview with each team manager allowed us to define the scope of our observation and design our observation table.

The next stage involved two procedures and five people. The first procedure was aimed at a more in-depth questioning of the participants about their activity and their activity-based work environment experience. For this purpose, we conducted an interview inspired by Vermersch's (2000) method of "explicitation". We wanted to motivate our subjects to consider the impact of their workspace on their activity, their emotions and the different ways in which they functioned. Our interview guide (Table 1 : Synthesis of the main subjects adressed in the semi-directive interviews) was directly inspired by Bobillier Chaumon's four dimensions of situated acceptance and his work on ICTs and their impact on the activity of managers which he carried out for the Association for managers' employment (in French, *Association Pour l'Emploi des Cadres*) (2011).

Table 1: Synthesis of the main subjects adressed in the semi-directive interviews

Status and function	Use of activity-based workspaces	Dimensions of situated acceptance	Conclusion
- Manager/employee - Description of the team - Description of a typical day pf work	- Discovery of activity based workspaces - Choice of work position - Time management	- Individual dimension - Organisational dimension - Relational dimension - Dimension of identity	- Future projection into these workspaces - General challenges and issues of these workspaces

Finally, we proposed a second interview to our respondents the purpose of which was to explain in further detail the dimensions of situated acceptance through personal photos relevant for them. We asked each person to take pictures of their work environment. The aim was to elicit deeper-seated feelings in our subjects and encourage them to provide complementary and more in-depth information than that obtained during the first interview. In order to encourage them to talk about these images, we drafted an interview guide with questions inspired by Vermersch's (2000) “explicitation” interview. The aim of this methodology was to enable the interviewees to be proactive in the process by encouraging them use their own words (Figure 5).

The transcription of the verbal and visual data obtained with our methodology enabled us to constitute a body of data and images that we then analysed thematically (Bardin, 2007), with an analysis grid constructed on the basis of the four dimensions of the situated acceptance approach (Bobillier Chaumon, 2013).

Results

Our objective was to understand how activity-based environments configure the ways in which individuals and groups carry out their activity by using an approach centered on real situations.

We first showed that dynamic environments, with the decompartmentalization of spaces and the proximity of complementary services, favour the emergence of collaborative phenomena. Communication is made more fluid and faster, which allows the emergence of group dynamics fostering mutual assistance and the pooling of knowledge and skills. However, such dynamics are subject to the density of occupancy.

The users of activity-based workspaces appropriate their spaces in a manner which enables them to collectively assign new uses to them. Thanks to the openness of spaces and the visibility of others and of their activities, people can extract from their environment relevant information for their work or for that of their colleagues. In this sense, the dynamics of these spaces foster the emergence of new ways of working and new ways of organising activities collectively. It is this strengthening of the collective dimension that makes it possible to correct the prescribed uses of

spaces when they prevent activities from being carried out. In this sense, activity-based workspaces organised according to the actual activities instead of being organised according to different workspace typologies rely on the fabric of affects and relationships that they help generate.

The space also intervenes at the individual level and on the internal processes of space management. Activity-based workspaces encourage individuals to develop their own rules for managing their activity according to the spatial configurations available to them. They can also, through internal dynamics, divert the prescribed uses of space to address their needs. In this sense, space enables the field of action of individuals to be more easily developed and appropriated. But these new work environments are rarely created by the individuals themselves; they are imposed and embody values set forth by the organisation which may conflict with the users' personal values. Individuals then find it difficult to give meaning to their activity and become resigned to the uses prescribed for the workspaces.

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Kira Oberschmidt (2021): Facilitating active stakeholder involvement in eHealth projects. In: Proceedings of the 19th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.18420/ecscw2021_dc004

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Biography

My name is Kira Oberschmidt and I am in the second year of my PhD research. I have a background in Psychology, starting with a BSc at the University of Twente 2017). After my bachelor, I stayed at the University of Twente (UT) to obtain two master's degrees; one in Health Sciences, with the specialisation Personalized Monitoring and Coaching; the other in Psychology, with the specialisation Health Psychology and Technology. I completed both master's degrees with a combined colloquium in 2019. For me, these studies nicely complemented each other. Where psychology often focusses more on developing eHealth in a way that engages users and persuades them to become more healthy, the health science perspective also includes the implementation and continued use of technology.

In January 2020 I started my doctoral research at Roessingh Research and Development (RRD) in Enschede, The Netherlands. My lead supervisor is Dr. Christiane Grünloh (RRD, UT) and my promotor is Prof. Hermie Hermens (UT, RRD). RRD is a research and development SME in the area of rehabilitation technology and telemedicine with strong formalized links to one of the largest rehabilitation centres in the Netherlands (Roessingh Rehabilitation Centre) and the University of Twente.

Doctoral Research

Background
My PhD research is situated within the Pharaon project (Pilots for Healthy and Active Ageing, see also https://www.pharaon.eu/), which is funded under the Horizon 2020 research and innovation programme. Pharaon aims to address challenges of our ageing society and respond to the need for tools that improve quality of life, independence and overall health of older adults. The goal is to integrate existing digital services, devices and tools into open platforms that can be readily deployed. The platform will be validated in large-scale pilots in six different pilot sites across Europe, with the main aim to improve healthy and active ageing. This is done in close collaboration between research, industry and healthcare partners. Roessingh Research and Development is one of the partners in the Dutch pilot.

All pilots in the project will use the action research framework and RRD is responsible for the development of guidelines for action research in future projects. To do so, we will investigate the action research that is conducted in each pilot from a meta-perspective. The collection of appropriate information as input for such action research guidelines is part of my thesis.

We follow the definition of action research as described by Reason and Bradbury (2013), according to which action research contains different cycles of planning, action and evaluation of this action. Stakeholders are involved as co-researcher in action research projects. This active role of the stakeholders is the main focus of my thesis. Another key aspect of action research is that it takes place within the community, so changes are made and evaluated directly. Even though it is still mainly used in educational research, action research fits well within the domain of human-computer interaction (HCI) research (Hayes, 2011).

Research question and methods
Since starting my research a year ago, I planned and conducted several studies, which will be explained in more detail below. The main research question that I want to answer in my thesis is

"How can we facilitate the active involvement of stakeholders in eHealth action research projects?"

The underlying research questions supporting my aim to answer the main question are

1. What is the state of the art of multi-stakeholder action research?
2. Which different interests play a role in a multi-stakeholder project?
3. What are researchers' attitudes and expectations towards action research projects?
4. How do relationships and networks develop in a multi-stakeholder project?
5. Which role do cultural differences play in multi-stakeholder action research?
6. What can we learn from a large scale, long term action research project?

All questions, the relationships between them, and the corresponding methods can be found in Figure 1.

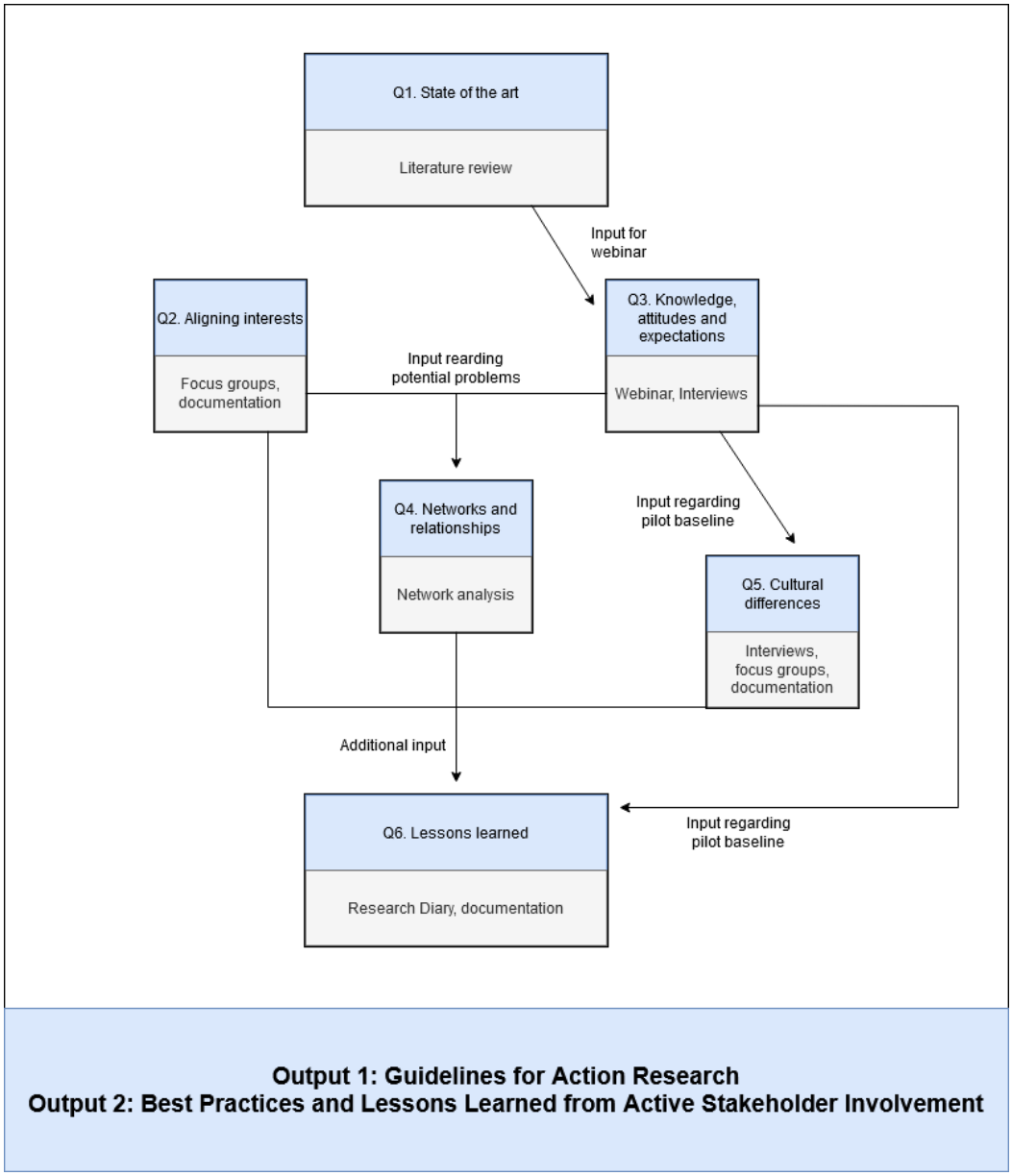

Figure 1. Overview of research questions and methods.

We will answer the overarching question regarding active stakeholder involvement both from a stakeholder and from a project perspective. Our first study on the alignment of stakeholder interests has been accepted for publication and will be explained in more detail below. From the project perspective, we started by gathering knowledge from the literature about the state of the art of eHealth action research (more information below). This gave us input for a second study that we are currently conducting, looking at the knowledge, attitudes and expectation regarding action research within our consortium. Identifying existing action research knowledge and expertise, expectations and attitudes of project partners in the early phase of the action research cycle can serve as a pilot specific baseline. This information is important when the overall experiences made in the specific pilot is analysed and interpreted in later stages of the project. In the future, we plan to supplement interviews and focus groups with less traditional methods like network analysis or the analysis of a research diary. Involving the other project partners in such methods goes beyond the traditional role that participants have in interviews or focus groups and can hopefully help us and others learn from what we did in our project. However, those methods are of course still valid and useful for other parts of the research. Meeting and project documentation, like minutes or deliverables also play a big role and can help to understand the different stakeholders and their positions better. Therefore, such documentation is also included in my research.

Work to date

My first study was about the alignment of interests that the various stakeholders and parties brought into the Dutch pilot. This study aimed to answer the second research question, "Which different interests play a role in a multi-stakeholder project?". Focus groups were conducted with older adults and with the technology providers in the group. Additionally, information from meetings and project documentation was taken into account. Based on these findings we mapped the interests of different parties within the project. We concluded that such explicit mapping and the formal and informal discussion of stakeholder interests can be very valuable for a project, because partners are aware of each others expectations and the project leader can cater better to individual needs. Additionally, we became critically self-aware of ageist assumptions that might still be present despite our aim to avoid those stereotypes and bias. Therefore, we also made the recommendation that other researchers should also try to be more aware of such underlying assumptions, for example through external reviews. I presented this paper at the OzCHI conference in December 2020.

The second study was a literature review on action research in eHealth studies, addressing Q1: "What is the state of the art of multi-stakeholder action research?". We describe the setting of 40 different eHealth action research projects, described in 40 papers. Part of the analysis included what kind of action research model was used. We found that such descriptions were often lacking and should be improved in future studies. Additionally, we looked at the best practices and lessons learned from using action research. Recommendations from our findings relate to the role of the researcher in such projects, as they need to share their tasks with the stakeholder co-researchers, but have some other action research specific roles to fulfil as well. Other recommendations are made regarding the documentation and dissemination of research outcomes, so that they are understandable and accessible for the different stakeholders, both within and outside of the academic community. I am currently in the process of submitting this paper, which will be the second article to be included in my PhD thesis.

The literature review is currently followed up by an investigation for the third research question, "What are researchers' attitudes and expectations towards action research projects?". These researchers had no previous experience with action research, so we hosted a webinar to inform them about it. This way, they can plan their pilots with the principles of action research in mind. Later on, the different pilots can be compared more easily if everybody is on the same page regarding action research. During this webinar, we presented the results from our literature review and participants discussed their ideas on several questions related to action research in breakout sessions. To see how the webinar participants and their co-researchers feel about doing action research, interviews will be conducted. In these interviews, their expertise, attitude towards, and expectations of action research are going to be discussed. This will serve both as input for additional activies and as a baseline measure to be used in later parts of the project. The outcomes of the webinar and the interviews will also be combined in a paper about getting novice action researchers started with the framework. Depending on the results this might include their struggles, need for information or guidance or concrete suggestions for how to initiate action research. At the time of

writing this application, the interview study is ongoing and interviews are expected to be conducted until the end of January.

Potential next steps

After rounding off this third study, the next steps will likely include a network analysis of the relationships between the partners in one of the pilots, meant to answer the fourth research question "How do relationships and networks develop in a multi-stakeholder project?". By looking at the networks that have developed between the partners both on the national and international level, we hope to learn more about how different stakeholders position themselves within research projects. Potential outcomes could for example include differences in how the various types of partners (researchers, technology providers, health care professionals etc.) see their role and position in the project, and whether their description of each others role and position is congruent. The results might show pitfalls for multi-stakeholder projects, for example if partners feel inferior to the researchers, instead of being equals in the project. Additionally, while project documents might show the intended hierarchy and structure of a project, this might look differently in practice. It would therefore be interesting to investigate how and why this structure changes once the project actually starts. Lastly, comparing a stakeholder's self-described role and position does not necessarily align with how others described them. Analysing this mismatch might also present interesting results.

Another interesting opportunity is to focus on cultural differences regarding stakeholder involvement, as the project's pilots are situated in five different European countries. The question we want to address here is Q5, "Which role do cultural differences play in multi-stakeholder action research?". It is possible that in different cultures non-academic stakeholders like technology providers or health care professionals have more or less knowledge about, or are more or less willing to participate in, academic research. Even if no differences were found this would be interesting, as it would mean that recommendations can be generalized to different cultures more easily.

Lastly, to evaluate and learn from the overall process, a reflective study will be conducted, answering the final research question "What can we learn from a large scale, long term action research project?". This will include reflections on at least the Dutch pilot, but hopefully others as well. We will of course include our researcher perspective, but hope to also involve the other stakeholders in some way. An idea would be to compare the different perceptions of the stakeholder groups in the project. However, this also depends on the further developments within the project.

Contribution

The final thesis will contribute to the growing literature on stakeholder involvement in eHealth studies. So far, while more and more studies are including stakeholders at some point(s) in the project, they rarely reflect on this process. This makes it difficult for others in a similar situation to learn from their mistakes, or to copy what worked well. In my thesis, I hope to offer some guidance for stakeholder involvement. Researchers looking to actively engage various stakeholders in their project will find points of attention and recommendations for how best to include different parties. We plan to come up with concrete suggestions or guidelines for eHealth action research in general, and active involvement of multiple stakeholders specifically.

With this thesis I hope to generate more attention for active stakeholder involvement, as well as more guidance for those trying to actively involve their stakeholders. Hopefully, this will help to convince researchers and other eHealth partners to include stakeholders more actively in the future and give them the tools they need to do so. Projects can benefit greatly from more engaged stakeholders, for example, because outcomes align better with stakeholder needs and are more embedded in the community.

During the doctoral colloquium, I hope to sharpen the focus of my research, which is currently very broad. To plan the next steps of my research a more concretized research question is needed. There are several related issues that I would like to discuss during the colloquium:

- My current topic, "Active involvement of stakeholders" is very broad. I would like to hear suggestions for narrowing this down, while still keeping the results useful for researchers and AR projects.
- There are some aspects of active stakeholder involvement that I plan to investigate. But it would be helpful to hear if others have suggestions for additional topics or aspects of stakeholder involvement I am overlooking in my current plan.
- Another problem we are struggling within our project (and I expect many others do too) is the impact of the pandemic. It has been difficult for us to get in direct contact with some target stakeholders (e.g. older adults that are more isolated now, but also care personnel as they are very busy). I would like to hear from others how they tackle this problem, and together discuss some strategies for reaching those target groups even in the current situation.

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Enhancing Collaborative Science Learning through Multiplayer Online Videogames

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Abstract. We designed and implemented SAIR – A multiplayer online RPG with educational content in the context of this PhD research, concerning the application of educational content in a multiplayer game, in order to determine and explore factors such as cooperation, and the general framework considering Serious Games. We tested SAIR with a team of professional educators and we keep improving it. Further research will elaborate on the game's design document as it could provide useful guidelines in the design and development of educational MRPGs. Another interesting parameter is the assessment with students of the collaborative gameplay with students in science learning.

SAIR – Designing, implementing and testing a multiplayer serious game as a research tool.

Multiplayer games additionally offer the element of collaboration or competition with real people (classmates or teachers in our case) as shown in the civilization experiment by Squire in 2003 which have a positive effect on the player's/student's performance, which in turn leads to better educational results, and enhances immersion. A central element in multiplayer games is that the interaction enables players to communicate and collaborate in the game sessions (Manninen, 2003). It seems that multiplayer games have obvious learning potential, and studies have focused on which types of learning these games support (Herz, 2001; Steinkuehler, 2004). Basic design principles e.g. scenario, immersion, interactivity, constructive trial and error process, or collaboration could make a successful educational videogame (Chorianopoulos, Giannakos, 2014). Especially, collaboration could improve the pupils' ability to learn since they learn from interaction with other group members and by reaching consensus. Since group members depend on each other, they help one another and assume responsibility for common success or failure (Jong et all 2006). Following the plan proposed in the PhD proposal, we started by making an extensive bibliographic research in the field of serious games. This led to participating in a doctoral consortium of FDG 2018 with the article https://www.researchgate.net/publication/327112337_Enhancing_Collaborative_STEM_Learning_through_Multiplayer_Online_Videogames.

Following that, we started research on the field of game engines, in order to find the appropriate tool to realize our game. The research started with the use of Unreal Engine, and while the results seemed promising at the start, the design of the game we had decided to implement, drew us to the RPG Maker MV, of the RPG Maker Series. Due to this particular game designing environment having Javascript as its language, it was much easier to include the multiplayer parameter, as well as keep the inclusion of the educational content to a high degree.

SAIR – MasterS of AIR, was designed and implemented in the course of the following months, featuring three chapters of the chemistry book, for the fifth grade, and the possibility for up to three players simultaneously. At the same time, and after finishing the design and implementation of the game an article was published titled: Game mechanics of a Character Progression Multiplayer Role-Playing Game with Science Content. - https://www.researchgate.net/publication/347304131_Game_Mechanics_of_a_Character_Progression_Multiplayer_Role-Playing_Game_with_Science_Content

Current game-based learning designs incorporate the multiplayer component as delegation of tasks, with the meaning that individuals accept the game rules, interact with each other, but they do not necessarily share the same goals. We employed gameplay mechanics of the Multiplayer Role-Playing Games (MRPGs), such as character's progression and a turn-based battle system to encapsulate multiple aspects of science learning and to provide students with a tighter collaborative learning experience. SAIR is a chemistry MRPG that can be played with up to 3 people. Further research should evaluate with students the influence of collaborative gameplay in science learning. Therefore what I would like to see is if there would to be possible to move to some evaluation regarding alternative implementations – or should I move to mapping the theoretical framework, including SAIR as well?

Statement

As I would like to join the academic community by posting results of my work in scientific magazines in order to have a fruitful dialogue with the community I would like to attain some quality feedback from outside reviewers before submitting my own articles.

Biography

Konstantinos Patiniotis, has a BSc in Libraries and Archive Science, and an MSc in informatics. He has worked in various Academic Institutions in Greece, as a librarian. He is currently working on getting his PhD from Ionian University, department of Informatics working on intergrating educational content on digital games, where he assists in the teaching of the subject of Human-Computer Interaction.

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Digital Twin, support for collaborative practice: application to the railway system

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Abstract. The digital twin is one of the promising technological concepts of the Industry 4.0. However, few research deals with the cooperative use of the digital twin. Through this PhD project, I aim to study how the digital twin of the French railway infrastructure can improve the coordination between the stakeholders of its maintenance . In order to study this, I am conducting a multisited ethnography to identify the coordination mechanisms that are involved in the work scheduling activity. I am planning to study more in depth how the digital twin can support cooperative practices by using technological probes. PhD Research context

This PhD takes place as part of a collaboration between SNCF Réseau and Troyes University of Technology. SNCF Réseau is the French railway infrastructure manager; it manages the maintenance, exploitation, and development of 30 000 km of railway infrastructure. As other infrastructure managers, SNCF Réseau has started to develop a national asset management strategy. This strategy seeks to coordinate the maintenance, exploitation and development of the railway infrastructure at a national scale to meet performance requirements. To do so, one of the pillars of this strategy is the digitalization of work practices.

In this context, SNCF Réseau is developing a technological concept: the railway digital twin. In the literature, the digital twin concept can be summed up as a digital replica of a physical system that is connected to it (Grieves, 2015). It could also be seen as a real-time reflection of the physical asset, that interacts with the physical asset (Tao et al., 2018).

Despite the fact that the digital twin concept has been built in order to offer a real-time, integrated and collaborative representation of the infrastructure (Tao et al., 2018, 2019), few researches address the use of digital twin whether as a means of communication, coordination, or cooperation (Lamb, 2019; Tao et al., 2019)

We envision the digital twin as a new technological opportunity to support coordination practices among railway infrastructure stakeholders. More precisely, we think that the digital twin can help us revisit some issues of the technological support for awareness.

Indeed, awareness has been intensively studied by CSCW scholars (Bentley et al., 1992; Heath & Luff, 1991) and has been characterized by a set of practice that workers have developed in order to coordinate their actions with the actions of others in a seamless way (Schmidt, 2002).
Tenenberg et al. (2016) proposed to revisit the concept of awareness by no longer emphasizing on how an individual perceives the activity of another but rather emphasizing on how an individual in a group perceives something, what they have called “we-awareness”. This work puts forward the shared intentionality and the recursive social inference under awareness practice. Nonetheless, Tenenberg et al. did not answer the question of the technical support of we-awareness.(Greenberg & Gutwin, 2016).

Research questions

In this research context, the PhD is looking at the following questions:

- How can the digital twin support a daily maintenance management practice locally while ensuring a cooperation between SNCF Réseau work entities?
- Which representation of the digital twin can be appropriated by the different actors of the maintenance management?
- How flexible the digital twin should be to be embedded into a local practice and at the same time ensuring cooperation with other units?
- And to which extent the flexibility of the digital twin could support a standardized process?

To study those questions, a preliminary field study has been conducted. Its goal was to identify a work situation in which coordination takes place among SNCF entities. This preliminary study has allowed to identify the work scheduling activity as an interesting field to focus on regarding the research questions.

The case study: The work scheduling activity

Most of works on the railway infrastructure imply traffic interruptions. In order to minimize the impact on train traffic, these interruptions generally take place during the night, for a few hours (approximately 4 to 6 hours). The challenge when scheduling works on the infrastructure resides in maximizing the traffic while ensuring that all the works can be done and also ensuring the safety of people on the work site. For that, no train can cross the work site : elementary protection zones (ZEP in French) are put in place; ZEP are track sections that either divert trains, or turn the signals to red.

The work schedule is co-designed by three SCNF Réseau establishments:

- The infrapole, which is responsible of the maintenance of a railway sector.
- The infralog which is responsible of the renewal or development work.
- The traffic establishment, which is responsible of the traffic management on a sector.

The PhD focuses on the pre-operational work scheduling phase which starts with a coordination meeting six weeks before the works on the infrastructure take place. During this meeting, the requesters (the ones who are requesting some work to be done) (from infrapoles or infralogs) are gathered by a coordinator from a traffic establishment. During the meeting, scheduling “clashes” (e.g. two works planned at the same place at the same moment) are discussed. At the end of the meeting, a first schedule is ready. Then, this scheduling is instantiated on the train timetable in order to produce a daily work notice that is sent to the switchman of the traffic establishment the day before the works should take place. But between the coordination meeting and the daily work notice issue, the schedule may encounter some changes.

Data collection

To study the diversity of practice, we were engaged in a multi-sited ethnography (Marcus, 1995) involving two sectors around Paris. We have combined semi-directive interviews and observations on both sectors. In the sector 1, we interviewed one requester (in infrapole) and the two managers in charge of the

coordination center (in a traffic establishment) and we have observed one coordination meeting. In the second sector, we observed three coordination meetings and interviewed three requesters (in infrapole). These coordination meetings took place during the COVID-19 pandemic, and therefore were conducted online. Interviews and observations were conduct by the PhD student, and discussed with supervisors. The aim of the interviews and observations was to collect the experience of work scheduling stakeholders.

First Findings

In order to describe the coordination practices that underline the work scheduling activity, we have analyzed our data through the coordinative mechanisms concept (Schmidt & Simone, 1996). We have therefore identified the coordinative protocol, and the coordination artifacts which we have described in a manuscript submitted to the CSCW Journal.

Our analysis highlights strong differences between the two sectors. First, stakeholders of the work scheduling activity are different. Then, the schedules between them are different (e.g. in one sector, the coordination meeting deals with works that take place in six weeks, and in the other one, the coordination meeting deals with works that take place in six, three, and the following week). Finally, the artifacts used are either different or are used in a different way.

Despite those differences, we have identified three coordination mechanism that are common to the two sectors:

- The common understanding of the sector (e.g. ZEP name, tracks name …)
- The construction of a common understanding of the work scheduling (what is done, when, where and by who).
- The articulation around scheduling clash that is composed of an identification of clash by the coordinator, followed by a negotiation between requesters and coordinator, that can lead to arbitrage if no arrangement is found.

The digital twin to support cooperation during the work scheduling activity

To study more deeply how the digital twin can support cooperation through an representation of the infrastructure, we are willing to use technology probes (Hutchinson et al., 2003). Through probes, we seek to learn more about how

coordination takes place in the work scheduling activity, and to test different digital twin designs and features, and finally to ground the reflection on the digital twin design and how it could better support the work scheduling process.

Currently, we have designed two probes; the first one aims to plot work sites on a geographical information system and to highlight scheduling clash. The second one aims to provide an awareness of existing requests.

Expected contribution

This PhD seeks to contribute to three research communities. First, we would like to envision how the digital twin technological concept can be a new way to support cooperative practices.

Secondly, in order to address cooperative use, the digital twin concept must be designed in that way. Thus, this research aims to bring attention to cooperative use and practice-centered design to the digital twin community.

Finally, this research takes place at SCNF Réseau. Therefore, we seek to bring to SCNF Réseau a collaborative digital twin basis for the work scheduling activity and methodologies to extend this basis to other activities.

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Design Considerations for Trust in situated Human-Robot Interaction

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1 Problem Statement

Active and Assisted Living (AAL) technologies like robots are increasingly promoted for the care of older people at home. However, using these technologies in private spaces may come with issues of trust. Research also suggests that older adults use a language of distrust to refer to digitalization in a Western society as a whole (e.g. Knowles and Hanson, 2018), and this may be also responsible for a limited uptake of technology by people (Haslwanter and Fitzpatrick, 2017).

In Human-Robobt Interaction (HRI) however, multiple perspectives can be taken for trust (e.g. Mayer et al., 1995; Lewis and Weigert, 1985). Empirical work has predominantly taken a reductionist approach, targeting trust as a variable in controlled experiments (Zafari et al., 2019; Rossi et al., 2017). To complement previous research and to design for real-world settings, we see an opportunity in gaining a better understanding of people's needs in their everyday lives. Research in Computer-Supported Cooperative Work (CSCW) has been at the forefront of studying collaborative care engagements (Fitzpatrick and Ellingsen, 2013), also taking into account a more situated understanding of people's practices (Kuutti and Bannon, 2014). While CSCW does not focus on robots, it will be potentially useful to learn from current approaches to studying trust in collaborative ensembles.

While several studies on trust have been conducted with younger participants and robots in controlled settings, these have focused on dyadic human-robot

interactions. We see an opportunity in complementing this research with a bottom-up understanding of trust in relation to HRI and also taking into account perspectives of multiple stakeholders and their practices. Practice-oriented work explores "*[...] historical processes [..], longer-term actions which persist over time, and which must be studied along the full length of their temporal trajectory[,][...], situated in time and space*" (p. 3534 Kuutti and Bannon, 2014). A practice lens also requires us to look at interaction sites and usage of current technologies (Wulf et al., 2011).

Exploring methods to capture factors that influence trust in relation to HRI will also provide an opportunity to gain a better understanding of day-to-day practices, where recent work has also called for methods to design and evaluate robots (Werner et al., 2015). Given robots are complex to develop and changing them later will be costly, recent work has suggested participatory design for robots (Lee et al., 2017). This approach however involves stakeholders from multiple disciplines (Lan Hing Ting et al., 2018) (e.g., gerontologists, social scientists, engineers). To make collaboration in these teams more effective, we see an opportunity in considering the challenges for method exploration, e.g., concerning knowledge transfer (Vincze et al., 2014).

2 Research Questions

The aim of this thesis is to answer the question,

RQ: *How to design for trust in situated human-robot interaction in older adults' living spaces?*

To answer this main question, several sub-questions need attention:

RQ1: What can HRI learn from studying trust in related research areas, i.e., from CSCW taking into account practice-based research, and what are the limitations of typical experimental HRI studies?

RQ2: What can we learn about trust from older adults' current practices and their use of AAL technologies for designing robots?

RQ3: How can we capture trust methodologically, both taking into account interdisciplinary teams in participatory design and older people's social practices in real-world settings?

3 Methodological Approach

The overall aim of this thesis is to develop and present design considerations for trust in situated human-robot interaction. RQ1-RQ3 will be answered taking a constructivist worldview and using predominantly qualitative methods in several case studies.

RQ1. On a theoretical level, a critical literature overview is needed on trust in HRI and in related areas, i.e., CSCW, where the situatedness of interactions has been taken into account for some time (Kuutti and Bannon, 2014; Wulf et al., 2011; Fitzpatrick et al., 2015). The aim of this narrative review is to explore what CSCW can contribute to an understanding of trust in situated HRI. To illustrate how trust has been worked on in HRI, we will also conduct a pilot study with 27 participants on how robot-related design cues (i.e., relationship strategies) can affect people's trust. This will be followed by a methodological discussion.

RQ2. A nuanced understanding of older adults' current practices and long-term usage of current technologies is needed to understand older adults' values and to provide lessons-learned for designing robots in this context. Therefore, we will on one hand provide findings on trust from using our novel method using elicitation cards (also used to answer RQ3). This will yield an understanding of older adults' current practices and topics related to trust that are particularly relevant in the context of envisioning robots in people's living spaces.

As a next step, we will conduct a long-term study with older adults using current AAL technologies. This will be useful to understand how technology is currently embedded in complex relationships in people's everyday spaces, where an understanding of qualities of these relationships will be useful to provide lessons-learned for a better understanding of situated trust taking a more holistic unit of analysis. In our study, several devices tailored to older adults (including tablets, fall detection sensors, safety watches) will be deployed to over 80 households for over 18 months. We will conduct 20 qualitative interviews with 15 older adults in two phases. The study will be also useful to unpack factors that influence trust in relation to robots that are not yet commonly in use.

RQ3. Because we lack an understanding of factors that affect trust, we also lack methods to study these. To gain an initial understanding of current challenges of participatory design with older adults and robots, we will conduct workshops with 17 older adults and commercially available robots. While these workshops will complement previous participatory design research in HRI (Lee et al., 2017), we will also reflect on challenges related to interdisciplinary collaboration. As a next step, we will iteratively develop a deck of elicitation cards to be used in qualitative interviews on trust in situated HRI. As part of this study, 10 people with little experience in qualitative research will be involved in designing and testing the method, and it will be used with additional 10 older adults.

4 Findings to Date

4.1 RQ1: Trust in HRI and HCI/CSCW

Our critical literature review shows how trust has been worked on differently across the fields of HRI and HCI/CSCW and present gaps (Schwaninger et al., 2019). Most HRI studies on trust focus on dyadic interactions between one person and one robot (Martelaro et al., 2016; van Straten et al., 2018). In contrast, trust in HCI/CSCW

has been studied mainly between people (Robert, 2016; Lampinen et al., 2016) and in institutions (Corbett and Le Dantec, 2018). Further, technology is often seen as interwoven with broader social contexts of people's everyday lives in HCI/CSCW, which has not been the case in HRI. Looking at people's practices may be however fruitful for trust, as interactions with robots will be interwoven with those practices.

To illustrate how trust has been predominantly worked on in HRI using social robots, we also performed a pilot study on how a robot's language cues can affect people's trust in a controlled setting. We conducted a user study, where we evaluated the effect of different interaction styles on people's trust (Zafari et al., 2019). The findings of our pilot study suggest that a robot's verbal cues and relationship strategies can potentially have an effect on trust.

4.2 RQ2: Learning from People's current Practices

We conducted a study using our deck of elicitation cards as described in the next subsection. Salient trust-related themes that were identified from the analysis of card usage were the desire for control, companionship, privacy, understandability, and location-specific requirements with regards to trust. Further, older adults had different privacy preferences throughout their homes, and different acceptance of a robot's capabilities, which they realized throughout the conversations.

A second study was conducted as part of a large-scale AAL project with older adults using current AAL technologies. Drawing on 20 qualitative interviews with older adults, we identified different forms of relatedness (Ryan and Deci, 2017) in these complex ecosystems, such as between older adults and people, technology, places, and institutions (Schwaninger et al., 2020).

4.3 RQ3: Methodological Insights and Method-Development

To gain an initial understanding of methodological challenges of participatory design with older adults and robots, we conducted three participatory design workshops with older adults and three prototypes of voice assistants. In the workshop itself, the voice assistants were perceived not useful by participants as they were presented to interact with verbally. Our reflection on the workshop points to challenges when organizing workshops with older adults as interdisciplinary teams, i.e., in relation to researchers roles, participant recruitment - in particular terminology and expectations -, and robot design. Using the term 'robot' when recruiting participants yielded specific expectations, and we found that using this term with caution would be beneficial in the future.

To offer a methodological contribution related to trust, we developed and tested a deck of elicitation cards to facilitate conversations about trust at early stages of participatory design. The deck of cards was designed together with 10 Informatics students as exemplars of engineers working in interdisciplinary research teams, which yielded several card categories to be used in qualitative interviews. Because trust is an abstract topic, the cards also use elicitation techniques. When using the

cards in 10 interviews with older adults, they acted as ice-breakers and helped to establish trust. The findings have been written up as an article and were accepted for a Special Issue in the International Journal of Social Robotics.

5 Next Steps

To develop and present design considerations, it will be necessary to further specify the contribution of this thesis. It will be also important to synthesize across all findings and to develop and present perspectives for design from across theoretical work and empirical studies.

Concerning design, several points may be considered for discussion. Methodological reflections will be presented to engage with older adults and robots, e.g., in relation to expectation management and terminology. An understanding of older people's practices and values will also be helpful to develop design considerations based on factors that influence trust in these real-world settings. This will concern aspects like a holistic unit of analysis, older adults' values and individual differences, and topics related to trust to consider specifically when designing for older adults. Potentially, concrete use case scenarios with robots can be presented as well. While several publications have been associated with this thesis, we are also in the process of writing and planning further publications. We are currently in the process of writing a journal article in a collaboration based on the data on a long-term AAL project. Further, we have been collecting data at a care home in a collaboration, which will feed into publications and which we may draw on to outline future work in this thesis.

6 Expected Contributions

The aim of this thesis is to present design considerations for trust in situated human-robot interaction, being the main contribution. Building blocks include findings from the literature, an understanding of older people's values and topics that affect trust from the field, methodological findings, and perspectives for design. The theoretical part will be pull together findings on how to approach trust from the literature across HRI and CSCW. Drawing on several case studies with older adults, we will present topics that affect trust and a nuanced understanding of relational qualities in (care) ecosystems. Methodological findings will be based on exploring participatory design approaches for robots with older adults in multidisciplinary teams. A broad set of design considerations will be presented based on findings from the literature, investigations in the field, and methodological lessons-learned.

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