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c/o Prof. Dr. Volker Wulf
Fakultät III
Universität Siegen
57068 Siegen
E-Mail: volker.wulf@uni-siegen.de

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Do Hand-Held Devices have a future in Augmented Reality real-life remote tasks? Reflections on impact/acceptance versus Head-Mounted Displays

Bernardo Marques, Samuel Silva, Paulo Dias, Beatriz Sousa Santos
IEETA, DETI, University of Aveiro, Aveiro, Portugal
Contact Author: bernardo.marques@ua.pt

Abstract. Augmented Reality (AR) is a powerful tool for supporting remote scenarios. Despite the broad adoption of Hand-Held Devices (HHDs), one common assumption is that Head-Mounted Displays (HMDs) may revolutionize such activities, since collaborators can visualize situated instructions given by remote experts, while in a 'hands-free' setting. This claim is typically based on toy problem user studies with rather low complexity (Lego Blocks/Tangram puzzles), but what works best for real-life scenarios is not clear. This shows a need for understanding the use/adoption of such devices in real scenarios. In this work, motivated by a partnership with the Industry sector, we discuss how HMDs and HHDs are viewed by different audiences (user study participants, domain experts and target users) for supporting on-site workers during remote maintenance tasks. After all, most stakeholders defend HHDs are still the way to go to address real-life scenarios.

Introduction

Scenarios of remote collaboration force distributed team-members to establish a joint effort in aligning and integrating their activities in a seamless manner. It has the potential to support challenging problems in industrial, medical, and educational domains, among others (Johnson et al., 2015; Kim et al., 2020).

One major issue of remote scenarios is the fact that collaborators do not share a common space/world, reason for the interest in using Augmented Reality (AR) (Madeira et al., 2021; Marques et al., 2021d, 2019; Martins et al., 2021). Remote AR-based solutions ensure collaborators establish a shared understanding, analogous to their understanding of the physical space i.e., serve as a basis for situation mapping, allowing identification of issues, and making assumptions and beliefs visible (Lee et al., 2020; Barroso et al., 2020; Marques et al., 2021c,a,b). By creating a common ground environment, it can enhance alertness, awareness, and understanding of the situation, allowing interactions between geographically dispersed collaborators (Johnson et al., 2015; Belen et al., 2019).

Although various visualisation technologies are available for AR use-cases, namely Hand-Held Devices (HHDs), Head-Mounted Displays (HMDs), static screens, and projectors (Egger and Masood, 2020; Alves et al., 2021), in scenarios of remote collaboration supported by AR, the most prominently approach is the use of HHDs and HMDs for the on-site collaborator, and computers for remote experts. While HHDs like smartphones and tablets are attractive due to their price, availability, and familiarity, HMDs like the Microsoft HoloLens are prominently considered given their 'hands-free' characteristics, i.e., easily supports observing augmented content on top of world environment, leaving the on-site collaborator able to conduct physical tasks (Palmarini et al., 2018; Souza Cardoso et al., 2020; Thomas and Holmquist, 2021). In fact, a potential shift in the preferred device may occur. This last is thought to revolutionize real-life scenarios where HHDs are currently the dominant approach (Belen et al., 2019). Some literature corroborates the previous claim based on the results of preliminary user studies. Nevertheless, it must be highlighted that these focused almost exclusively on tasks requiring low levels of collaboration and rather low complexity like toy problems, e.g., assembly of Lego Blocks or Tangram puzzles (Marques et al., 2021e).

Hence, the question arises: *'Do HHDs have a future in real-life AR-remote tasks? Or will HMDs proliferation occur in the next years?'*

To address this, there is a need for understanding the use and possible adoption of such devices in real-life scenarios. Also, consider the perspective of domain experts and target-users. To explore this opportunity, in this work, motivated by a partnership with the Industry sector, we discuss how HMDs and HHDs are viewed for supporting on-site workers during real-life remote tasks according to different audiences: user study participants, domain experts and target users.

Methodology

A Human-Centered Design (HCD) methodology was established through participatory design, i.e., involving stakeholders in the design process. It was motivated by a partnership with the Industry sector (Figure 1), considering different audiences: *user study participants, domain experts and target users*. Step 1 focused on identification of industrial needs. Step 2 implied the creation of an AR-based collaborative prototype based on the requirements defined, including support for HHDs and HMDs (Figure 2). Step 3 enabled iterative refinement of the prototype through various real-life studies. Results from this process will be reported in the Discussion Section later on.

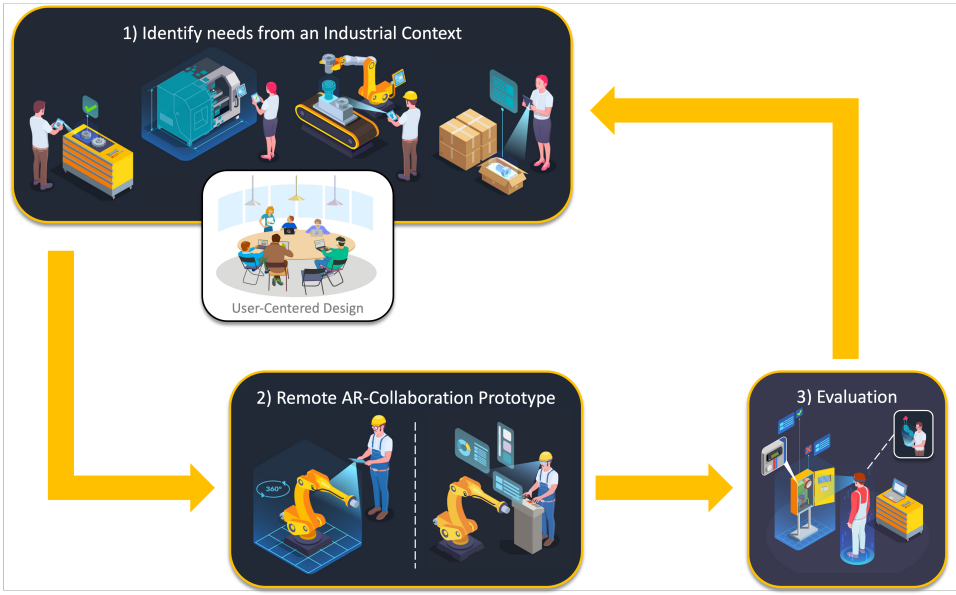

Figure 1. Methodology adopted for understanding how collaborative work is accomplished in an Industry context and how AR may assist in remote scenarios: a) focus group to identify user needs; b) definition of requirements; c) AR-based prototype creation; d) evaluation following a set of real-life tasks identified as relevant in maintenance contexts. Adapted from: (Marques et al., 2022).
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Focus group with domain experts and target-users

Eight individuals from multi-disciplinary areas (e.g., technicians, project managers, remote support supervisors, designers, software engineers, and a Faculty member) participated in an initial focus group session, that lasted 2 hours. The collaborative realities of each participant were explored and the subject of AR in different devices was progressively addressed. Qualitative data was collected, i.e., using a mobile device to record audio and notes from the participants, who provided their informed consent. Later, the insights from the collected data were analyzed to determine common themes and shared understandings.

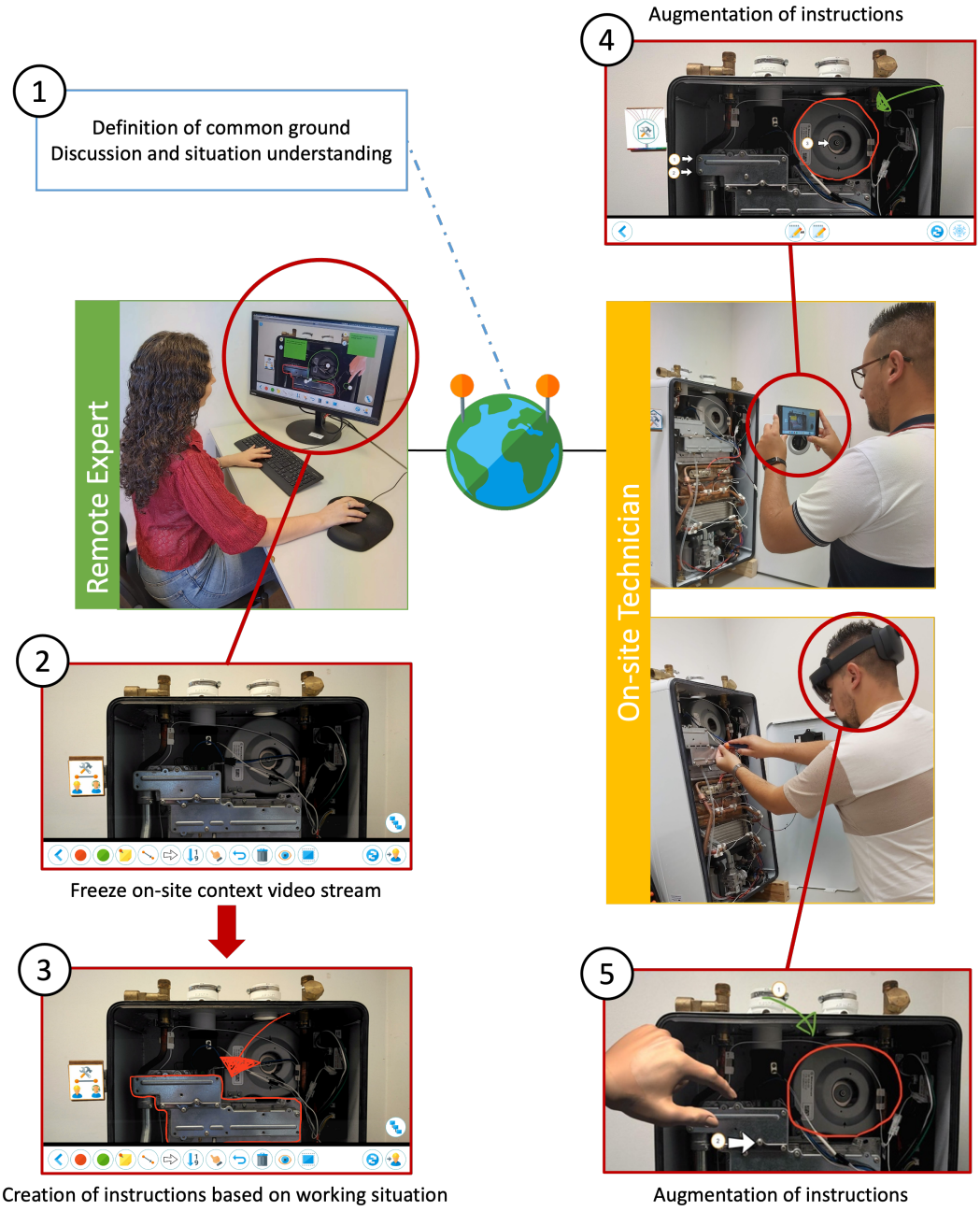

Figure 2. **Overview:** When facing unfamiliar tasks, on-site technicians can point a HHD or a HMD to the situation context and share it using video with the remote expert. After a discussion for situation understanding (1), the expert freezes the live stream (2) and using different annotation features enhances the pictures captured to identify specific areas of interest or indicate actions to be performed (3). Afterwards, the technician receives the instructions and performs an augmentation on top of the real world (4 & 5). **Development:** Unity game engine - C# scripts. Vuforia library to place augmented content. Communication over Wi-Fi through calls to a PHP server. .

Real-life studies with user study participants

Within the scope of the industry collaboration, several studies were carried out, highlighted below, which allowed us to more clearly perceive the advantages, constraints and challenges of the devices considered.

An initial formal user study with 9 participants (20 to 63 years old) was conducted to **evaluate if the instructions could be used during real-life tasks, and identify usability constrains**. Participants had various occupations, e.g., Master and PhD Students, Researchers and Faculty members from different fields. They had no experience with the case study, but had experience with AR and remote tools. Participants would act as on-site technicians using a HHD, while a researcher was the counterpart. The goal was to conduct remote maintenance procedures, defined with the assistance of our industry partners, including 1- replace interconnected components, 2- plug/unplug energy modules, 3- remove sensors, 4- integrate new components. On average, each evaluation session lasted for 70 min (tasks took 40 min to complete).

Later, an informal user study was conducted with 8 participants (25 to 63 years old) from the previous study to **identify usability constrains, and asses their satisfaction towards the HMD version of the prototype**. Participants would act as on-site technicians using the HMD. The goal was to reproduce similar procedures as the ones considered in the previous study, i.e., with a different scope, yet with identical complexity and resources. On average, each evaluation session lasted for 70 min (tasks took 35 min to complete).

For both studies, the procedures consisted in: First, participants were instructed on the experimental setup, the tasks, and gave their informed consent. Then, they were introduced to the prototype and a time for adaptation was provided, i.e., a training period to freely interact. Afterwards, the tasks were performed, while being observed by a researcher, who provided assistance if necessary. In the end, participants answered a post-task questionnaire and a small interview occurred to understand participants' opinions, preferences and suggestions towards: perceived helpfulness and satisfaction; visualization and movement; ergonomics and safety; learning opportunities and training.

Discussion of HHDs vs HMDs in real-life tasks

This section describes the main insights, comments and preferences of domain experts, target-users and user study participants based on the focus group and studies conducted. Based on this information, we delve deeper into the question raised in the introduction.

Perceived Helpfulness and Satisfaction

Regarding hardware characteristics, during the focus group session, it was emphasized by the audience that the workforce is constantly moving, which means smaller, lighter, easy-to-carry devices are more convenient. Also, headphones integration could be needed for louder environments, as well as the existence of internal/external lamps for darker situations, i.e., areas with low light levels that require artificial illumination. It was also unanimous that existing HMDs and HHDs fit this description, or can be adapted to such needs.

Some domain experts and user study participants considered HMDs 'hands-free' capability as important for operational deployment, being less intrusive, so that technicians use their hands to accomplish the tasks, while visualizing additional information. Besides, additional comments were made towards the advantages some companies advertise, namely improved immersiveness during collaboration and enhanced performance, decrease in errors and task duration, as well as cognitive load. Nevertheless, the workforce needs in real-life scenarios, as well as their computer literacy are not considered, which may lead to technology rejection.

Although HHDs require technicians to place the device on a surface to perform the intended tasks, many target-users reported this feels more natural, when compared to HMDs, due to the lack of familiarity and acceptance of such devices. Using HHDs appears as the next step to replace existing video conference solutions, which they already explore in the workplace. In fact, the industrial partners stated that in the past, they had surveyed their workforce on such topic, reporting that most technicians (who had an informed opinion, having understanding of its features and prior contact with some demos before said survey) preferred using traditional HHDs, despite the lack of a 'hands-free' approach. There was also concern associated with the HMDs shared view, given that it is dependent on head orientation, which may not always represent the task context, i.e., relevant areas of interest to the remote expert. This may happen when an action is performed too close to the worker body, leading to reduced situation perception. Another important factor is the significant investment in hardware, including not only the HMDs, but also computers with specific characteristics for the development/authoring process associated with such devices.

Visualization and Movement

As for resolution, field of view and content distortion, HHDs appear as the best alternative. Especially, in scenarios of one-to-many, where there is more than one expert providing assistance or high amounts of visual cues being shared. These restrictions of HMDs may have some effects on the human body after a prolonged period of usage (see below). There was also some apprehension as to technicians walking while processing visual information presented via HMDs, because it may cause usage issues, e.g., spatial disorientation and tracking losses. Additionally, some user study participants commented they did not see their surrounding physical space, stating this could be distracting and cause disorientation sometimes. In industrial environments with human and robot movement constantly present, this may lead to severe safety problems (as illustrated next). Thus, this may lead to a more cautiously (slower) approach to task resolution.

Ergonomics and Safety

Scenarios of remote collaboration may occur for longer periods of time. This topic was subject of concern by all stakeholders involved. Although HHDs force on-site

technicians to divide their attention between the instructions received and the tasks, possibly generating some fatigue, this option was considered comfortable and safe in general. In contrast, it was agreed that long-term usage of HMDs (i.e., worn over a complete working shift) may cause discomfort, headaches, dizziness nausea, problems to focus on the instructions received, as well as higher levels of stress. There is also the risk of injuries and safety issues caused by fatigue, by having on-site workers in uncomfortable positions to provide the task context to remote experts (e.g., approach their heads closer to working machines with hot parts or rotating elements), or even by dividing their attention between the AR-content and the real-world environment (e.g., fail to notice they are in traffic areas). There was also caution towards being able to wear glasses with HMDs, e.g., experience increase discomfort and pain regarding pressure points (e.g., nose, head, ears, etc.), as well as if the headset fits properly over the glasses.

Learning Opportunities and Training

Another important topic is the HMDs set-up process, which may take longer, including hand/head/eye calibration, while traditional HHDs require almost no set-up. Since some technicians may not be familiar with such processes, there is a need to consider training sessions, allowing the workforce to know where to start. Not only that, but also to learn how HMDs work, in particular, interaction possibilities, which are somehow limited for most existing options in the market. This must be addressed to improve acceptance and content manipulation. Regardless, participants believe that although an adaptation period is necessary to learn how to use HMDs, training can improve user performance, leading to higher acceptance of such devices.

Concluding Remarks and Future Work

Collaboration using AR has high potential in problem-solving scenarios among distributed team-members facing complex tasks. Regarding HHDs vs HMDs, research has been mostly devoted to user studies with rather simpler tasks, limiting the amount of collaboration required. A more in-depth consideration is paramount since little research on comparing these devices for real-life remote tasks exist.

As a contribution, a discussion regarding these devices usage and accepted during real-life remote tasks was presented, focusing on the opinion of different audiences. Although HMDs appear as a step forward, at this time, many stakeholders still believe they are not robust/reliable enough, still requiring further improvement, e.g., miniaturization and weight loss, higher processing speed. Existing drawbacks make them unsuitable for some, if not most industrial applications, e.g., manipulating large/heavy parts, working in small spaces. Therefore, the research community must be careful to derive insights on the general use of HMDs for assistance during scenarios of remote collaboration.

Overall, we argue that HHDs still prevail, being cheaper and more accessible for larger adoption by companies with different sizes and workforce expertise, despite the obvious drawback of having to hold the device during task resolution. This also represents an opportunity, as HHDs may function as a probe to stimulate discussion, boosting user confidence/engagement in AR-technology, leading to a better adoption/acceptance of more industry-ready headsets moving forward.

This study is being expanded by conducting a formal long-term user study to compare task resolution and collaborative process of distributed team-members while using such devices, which was not possible due to the pandemic constraints.

Acknowledgments

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Explanation Preferences in XAI Fact-Checkers

Gionnieve Lim and Simon T. Perrault
Singapore University of Technology and Design
gionnievelim@gmail.com, perrault.simon@gmail.com

Abstract. As misinformation grows rampantly, fact-checking has become an inordinate task that calls for automation. While there has been much advancement in the identification of misinformation using artificial intelligence (AI), these systems tend to be opaque, fulfilling little of what fact-checking does to convince users of its evaluation. A proposition for this is the use of explainable AI (XAI) to reveal the decision-making processes of the AI. As research on XAI fact-checkers accumulate, investigating user attitudes on the use of AI in fact-checking and towards different styles of explanations will contribute to an understanding of explanation preferences in XAI fact-checkers. We present the preliminary results of a perception study with 22 participants, finding a clear preference towards explanations mimicking organic fact-checking practices and towards explanations that use texts or that contain more details. These early findings may guide the design of XAI to enhance the performance of the human-AI system.

Introduction

Misinformation has become one of the greatest challenges of the twenty-first century. With the ease of creation and spread of information online, malicious actors have weaponized the digital ecosystem to spread misbeliefs intending to socially engineer behavior. From individual issues to international threats, misinformation has caused financial, political, and social harm in all scales (Spring, 2020). To address misinformation, particularly on social media where

user participation and information exchange is most substantial, one countermeasure is the use of AI to identify misinformation and to either remove or label the false content. Such AI systems tend to be sophisticated, their opaque decision-making process being uninterpretable to humans (Castelvecchi, 2016). This has led to research exploring the use of XAI to explain the decision-making process. With growing interest in the application of XAI in automated fact-checking, we seek to make an initial investigation on user preferences towards XAI fact-checkers to understand the illustrations and details that users appreciate in explanations. This is done through a perception study that examines various dimensions of XAI fact-checkers. We present the results of participants' assessments of XAI fact-checkers, discussing early findings on user preferences in explanations that developers may take into account during the process of design.

Related Work

Automated Misinformation Detection

The spread of misinformation on popular social media apps like Facebook and Twitter has become a global concern. Due to the sheer quantity of information generated every instance, social media companies have taken to using AI to identify misinformation (Facebook, 2020; Twitter, 2021b). Automated misinformation detection has also been used to assist in the jobs of human fact-checkers in media firms and fact-checking organizations by identifying check-worthy claims from the mass of online information (Funke, 2018). This problem is also popular in academia with many researchers working on building AI systems with ever higher misinformation detection accuracy (Zhou and Zafarani, 2021). While automated misinformation detection has become advanced, parallel meta-discussions on AI have called for greater transparency and collaboration with human input in these systems (Shneiderman, 2020). A response to this is the adoption of XAI. With the variety of explanations that have been developed, having an understanding of how users feel towards different explanations may serve to illuminate the future design directions of XAI fact-checkers.

XAI Fact-Checkers

Social media companies have committed to more ethical AI practices through the use of XAI (Facebook, 2021; Twitter, 2021a). There has also been several research works on fact-checking with XAI. Two of the more popular techniques are LIME (Ali et al., 2021) and SHAP (Reis et al., 2019). These techniques build a linear model that is easier to understand above the more complicated underlying

AI model. The attention mechanism (Aloshban, 2020) is an interpretable machine learning technique with extended applications such as evaluating news using other sources like news articles (Popat et al., 2018) and social media comments (Tian et al., 2020). This technique uses a model that is fundamentally understandable. We modeled the set of XAI fact-checkers used for the study after the outputs of these techniques. From the literature, these techniques were more widely applied in explainable misinformation detection with a diversity of illustrations and details. As such, we identified five types of explanations for the XAI fact-checkers in the perception study (Figure 1).

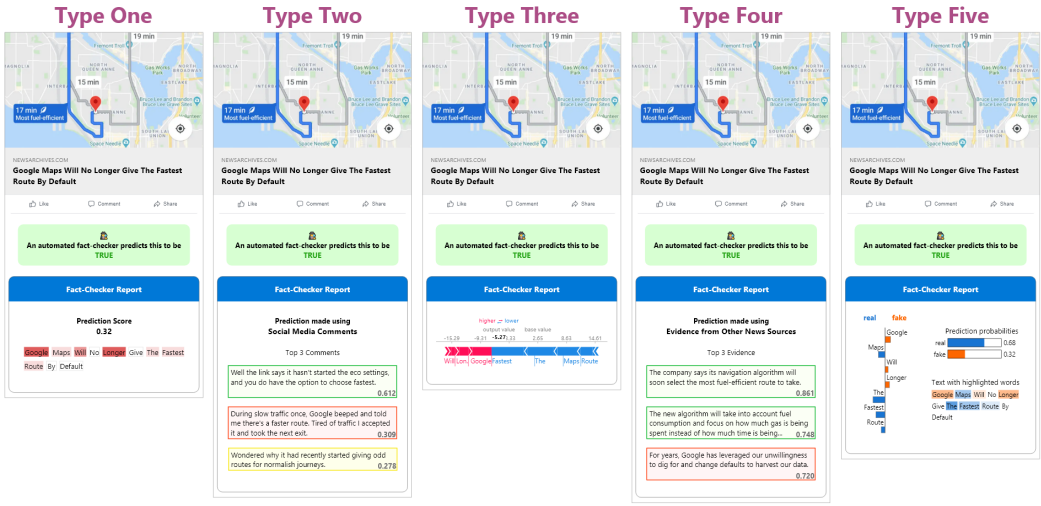

Figure 1. XAI fact-checkers with five types of explanations.

Method

Study

An online form was used to administer the study. We employed convenience sampling where the study link was sent to a university mailing list and to personal contacts. Further sharing of the study by participants was encouraged. The study was voluntary and uncompensated. Collected data was kept confidential and no identifiable information was gathered. The research was approved by the University's Institutional Review Board.

The form contained 31 items. There were 3 items on participant demographics, 25 on the assessment of XAI explanations, and 3 on XAI fact-checking reflections. The questions included single-choice and 5-point Likert items.

Participants

Twenty-two responses were gathered. Most participants were in their 20s (*M = 24.6, SD = 5.58, Min = 20, Max = 46*). On gender, 7 were female and 15 were male. On current or highest attained education, 7 had polytechnic diplomas or GCE A-Levels, 11 had bachelor's degrees, and 4 had postgraduate degrees.

On the level of knowledge of AI based on a 5-point scale (1: None, 5: Expert), where 'Expert' was described as 'having the ability to program AI algorithms', the AI knowledge of participants averaged 3.91 (*SD = 0.97, Min = 2, Max = 5*). None of the participants were unaware of AI.

Preliminary Results

Participants were asked to assess five types of explanations (Figure 1) by the following parameters: Visually Appealing (*Vis*), Easy to Understand (*Und*), Useful (*Use*), Informative (*Inf*), and Convincing (*Con*). The scoring was conducted on a 5-point scale (-2: Strongly Disagree, +2: Strongly Agree). For each parameter, an accompanying description was provided (Table I). These parameters were chosen to comprehensively cover various aspects of an XAI explanation. While each parameter could be broken down into smaller components, for example, for Visually Appealing, we could have assessed 'color' and 'layout' independently, we did not do so as that level of specificity was unnecessary for obtaining an overall user perception and would have been more appropriate in, say, a study on user experience and usability.

Table I. Assessment parameters of an XAI explanation.

Parameter	Description
Visually Appealing	I like the design/color/layout of the fact-checker.
Easy to Understand	I can understand the details of the fact-checker.
Useful	The details given by the fact-checker are meaningful to me.
Informative	The amount of details given by the fact-checker is acceptable to me.
Convincing	The details given by the fact-checker persuade me to believe in its veracity prediction result.

An overview of the assessment results of the five types of explanations is given in Figure 2. Type Four consistently achieved the highest means across all parameters (*Vis: M = 0.50, SD = 0.80; Und: M = 0.77, SD = 0.43; Use: M =*

0.73, SD = 0.77; Inf: M = 0.73, SD = 0.88; Con: M = 0.73, SD = 0.98). Types Two and Five had second and third position means for *Vis*, *Und*, and *Use* which swapped for *Inf* and *Con*. Types One and Three had fourth and fifth position means for *Vis*, *Und*, and *Use* which swapped for *Inf* and *Con*.

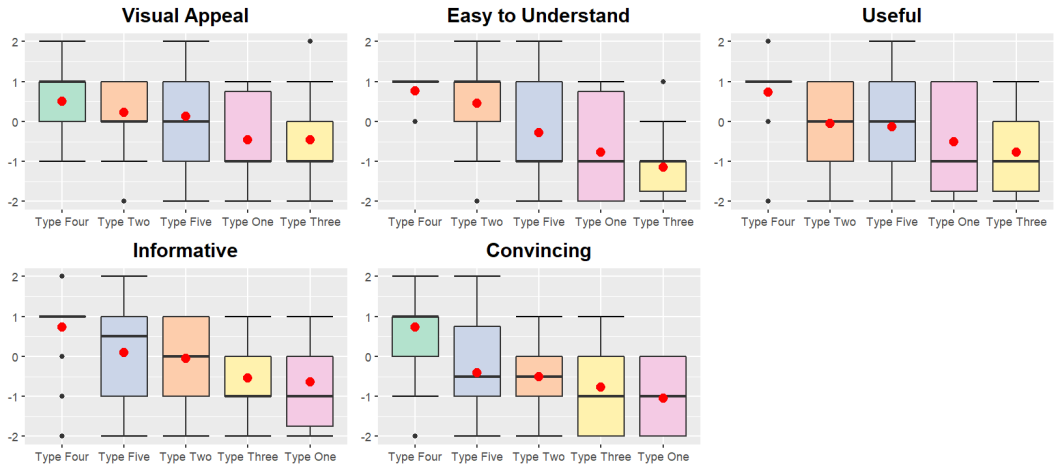

Figure 2. Assessment results by each parameter where red dots indicate the mean. Box plots are arranged by descending mean.

For all the parameters, only Type Four had positive mean scores throughout while Types One and Three had negative mean scores throughout. Type Two had positive mean scores only for *Vis* and *Und*. Type Five had positive mean scores only for *Vis* and *Inf*.

By averaging the scores across each parameter, Type Four achieved the best overall score (*M = 0.69, SD = 0.79*), followed by Two (*M = 0.18, SD = 1.06)*, Five (*M = 0.12, SD = 1.23*), One (*M = 0.68, SD = 1.12*), and Three (*M = 0.74, SD = 1.01*). This order is similarly reflected in the ranking of XAI explanations that participants gave. We showed all five explanations and asked participants to rank them according to their overall preference. We then coded the best rank as 5, the worst rank as 1, and the like, to obtain descriptive statistics. The top-ranked explanation is Type Four (*M = 3.64, SD = 0.58*), followed by Two (*M = 3.14, SD = 1.42*), Five (*M = 3.14, SD = 1.36*), Three (*M = 2.82, SD = 1.59*), and One (*M = 2.27, SD = 1.64*). The order of the last two positions were reversed in the latter case.

Before participants assessed the XAI explanations, we showed them an image of an AI fact-checker prediction without any explanation and asked them, on a 5-point scale (1: Not at All, 5: Very Much), how curious they were about how the AI fact-checker came up with its prediction result. Most participants indicated a high level of curiosity (*M = 4.36, SD = 0.66*). After the assessment, we asked

them to compare the AI fact-checker without explanation to a Type One AI fact-checker with explanation (as it was the simplest) and asked them which version they preferred. Nine participants selected the one without explanation while 13 selected the one with it.

Discussion

There is a clear preference towards Type Four out of all the explanations. Type Four uses weighted information from other news articles to predict the veracity of the news. Considering that this method is very similar to what one might naturally do when fact-checking, that is to find other news articles and cross-reference the information, it is not surprising that this organic style of explaining is most preferred by users. In a similar fashion, Type Two, which uses weighted comments on the news as an explanation, is also more preferred.

Interestingly, there is contestation among Types Two and Five which are vastly different types of explanations. Type Two uses comments to explain while Type Five uses weighted words of the news headline, showing the magnitude and directional effect of each word and their overall contribution to the veracity prediction. In Figure 2, both types had similar scores for most parameters, with an observable disparity only in *Und*. From a usability standpoint, text is easier to understand but might take longer to peruse. In contrast, diagrams are more concise but require a certain level of data literacy. Since all our participants are highly educated, they likely have no issue with interpreting the diagrams, but if a greater diversity of participants who may be less educated are involved, we might observe a lower preference of Type Five to Type Two.

There is also contestation among Types One and Three. Both use weighted words of the news headline and show the magnitude of contribution to the veracity prediction. Type Three further makes explicit the directional contribution of the words through the diagram. From Figure 2, there are observable disparities in *Und*, *Use*, and *Con*. The result for *Und* is not surprising as Type One is much simpler than Type Three. More interesting is the result for *Use* and *Con*. Ironically, while more users found Type One to be more meaningful, more are persuaded to believe in the veracity prediction by Type Three. While our results are not sufficient to explain this contradiction, a plausible reason for the latter observation may be because the diagram in Type Three is more informative and has greater visual impact, leaving a stronger impression on participants.

Summarizing, there is a general preference towards texts than to diagrams, and to having more than less content in XAI explanations. Participants are generally curious about how an AI fact-checker makes its decision and would appreciate having explanations provided. In the context of fact-checking, providing text-like explanations may be better for users, but may not be feasible as many industry AI fact-checkers use metadata for identifying misinformation. If diagram-like

explanations like LIME and SHAP are the practical option, explanations should be redesigned to support the human understanding and control of XAI more strongly (Wolf, 2021; Zagalsky et al., 2021).

Limitations

This preliminary study is limited in its scope and scale. First, while we sought to understand users' preferences towards explanations in the context of fact-checking, our study did not investigate, in the first place, users' attitudes towards fact-checking. In a study conducted in the United States, fact-checking was found to have varying reception by people across different political ideologies and topics (Rich et al., 2020). This study might thus have been better established by differentiating between participants who were receptive to automated fact-checking and those who were not as the level of attention they would pay to XAI fact-checkers in a real setting would differ greatly.

Second, the parameters that are used to capture explanation preferences lack nuance. For the purposes of this study, we defined and examined broader parameters. Yet, in doing so, we also missed capturing specific and precise preferences in finer aspects. For this, a future line of work includes defining and conducting an extensive assessment of XAI explanations using parameters with detailed breakdowns coupled with the solicitation of qualitative feedback.

Last, the sample of participants is not representative. The sample size of the study is small, and the participants are largely highly educated young adults, with a greater proportion of males. Future recruitment of participants will aim to be of a greater magnitude and diversity to better emulate the public demographic.

Conclusion

With advances in research on automated fact-checking using XAI, an understanding of how users perceive and take to the explanations is fundamental to future developments. With that aim, we conducted an XAI fact-checkers perception study with 22 participants. We found an obvious preference to a type of explanation that follows the organic fact-checking process of cross-referencing with other news articles. There was also a general preference towards explanations using texts or that are heavier on details. Developers may consider these aspects when designing for higher synergy between humans and AI fact-checkers.

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Gabriela Molina León, Gabriella Skitalinskaya, Nils Düpont, Jonas Klaff, Anton Schlegel, Hendrik Heuer, Andreas Breiter (2022): Co-Creating a Research Data Infrastructure with Social Policy Researchers. In: Proceedings of the 20th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies - Posters and Demos, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.48340/ecscw2022_p03

Co-Creating a Research Data Infrastructure with Social Policy Researchers

Gabriela Molina León, Gabriella Skitalinskaya, Nils Düpont, Jonas Klaff, Anton Schlegel, Hendrik Heuer, Andreas Breiter
University of Bremen, Germany
Contact Author: molina@uni-bremen.de

Abstract. We present a case study on co-creating a research data infrastructure together with social policy researchers. Over three years, we investigated how the social scientists worked with data, and designed a collaborative system to support them in the harmonization, validation, exploration, and sharing of research data. We conducted several co-creation workshops, interviews, surveys, and user studies not only to co-design the system but also to assess the benefits and limitations of our participatory approach for this interdisciplinary collaboration. The evaluation uncovered that the researchers were satisfied with the processes and tools that we developed, and that the system was successfully adopted. We found that when working in a large interdisciplinary project, especially in the context of social policy research, it is critical to assess the status of the data early on, and to discuss how the group and individual goals connect with each other, to ensure long-term engagement and commitment.

Introduction

In the last decade, we have witnessed a rapid increase in the quantity of data available in science. Accordingly, CSCW researchers have been studying how experts work with data in diverse domains to find out how technology can support cooperative scientific work (Velden et al., 2014). Vertesi and Dourish (2011) studied how the way planetary scientists produce data is a key factor in how they share data. Neang et al. (2021) investigated the social and organizational concerns surrounding data integration in oceanography. Overall, the scientific culture and practices of the disciplines play a critical role in how computer-support systems can facilitate scientific work (Jirotka et al., 2013). This is what Lee et al. (2006) call the *human infrastructure* of cyberinfrastructure.

Tenopir et al. (2015) found that the norms of data sharing vary highly between disciplines. While astronomy and biodiversity researchers have a culture of data sharing, medicine and social sciences researchers are less likely to share. According to Savage and Vickers (2009), researchers rarely create appropriate metadata early enough, which later leads to not releasing the data because of the associated workload.

Given the need for more efforts to support sharing in the social sciences, we sought to co-design a research data infrastructure together with social science researchers. Over three years, we collaborated with social policy experts in a multidisciplinary project aimed at analyzing and explaining social policy dynamics worldwide. We supported them on the harmonization, validation, exploration, and sharing of their datasets. Accordingly, we present a case study tackling the following research question:

RQ What to consider when applying co-creation as a design methodology to create a data infrastructure system for social policy researchers?

We present our insights on how social policy researchers organize their data work, and how we co-designed a data infrastructure to support them. According to the evaluation, the system was successfully adopted. We share our recommendations for data infrastructure projects based on our co-creation study.

Motivation and methods

Our case study is based on a multidisciplinary research project on global social policy involving 29 researchers from political science, sociology, geography, and computer science (CRC 1342: Global Dynamics of Social Policy, 2022). We report our insights from the first three years of our on-going collaboration.

The main goal of the project is to collect data on social policies worldwide. The data involves not only social policy indicators (i.e. variables) created by the researchers, but also indicators collected by institutions such as the World Bank. We designed an information system to harmonize, share, and explore said data.

We applied co-creation as a design methodology (co-design). Co-creation is based on conducting regular workshops with the stakeholders to not only design a solution *for* them, but also *with* them (Sanders, 2008). In the workshops, we used well-known methods for creative work such as wishful thinking (Kerzner et al., 2019), paper prototyping (Snyder, 2003), and reflective discussions (Molina León and Breiter, 2020).

To learn more about their work, we conducted contextualized interviews with researchers of different project roles, and collected artifacts such as data files, papers, and data analysis scripts. All the interviews and discussions were recorded and analyzed through open coding according to grounded theory. To evaluate the collaboration and the system, we conducted a survey and two user studies whose results we present in the Evaluation section.

The Information System

Through the workshops and interviews, we elicited and iteratively refined the following design requirements for the system:

R1 Support data harmonization. The researchers collected time series data from various sources in different formats (e.g. books, CSV files). They required support on combining the datasets together and preparing them for analysis.

R2 Support data validation. The data standards agreed on needed to be validated systematically. The researchers wished for support on checking the data, e.g. verifying country names.

R3 Enable interactive data exploration. Once the data was in the system, the social scientists wished for tools to search and filter the indicators according to their research interests.

R4 Allow flexible sharing of data and resources. Sharing was a priority to collaborate with other researchers. Sharing tools would help ensure transparency, reproducibility, and reuse of their research and data.

To support data harmonization (**R1**), we established *Data and metadata standards* as guidelines for the data collection and merging processes. We created a dedicated wiki to document the standards and the data itself, ensuring a high level of documentation quality and transparency. Furthermore, we co-developed a universal dataset template. The template covered all necessary attributes for each data point and metadata. We also harmonized existing practices in data coding and established coding rules. These rules described the requirements for each template item, such as country codes, naming guidelines, etc.

For the data validation (**R2**), we implemented a validation pipeline, which thoroughly checked if the uploaded data fulfilled the standards and gave detailed feedback otherwise. For data exploration (**R3**), we designed three interfaces that present the data in different ways:

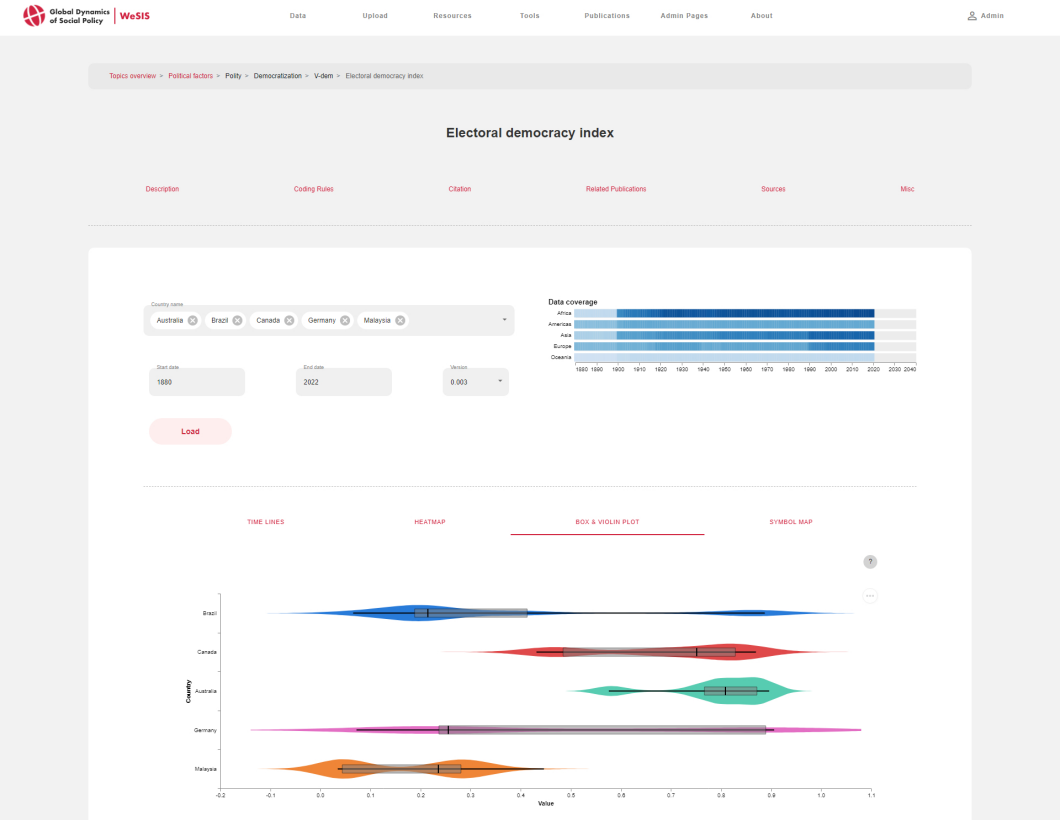

Figure 1. The *Electoral democracy index* indicator page (upper part of the interface).

1. **Indicator page**. This page presents all the information about a particular indicator, covering its coding rules, sources, and more. Since the researchers wished to discover and analyze spatio-temporal data patterns, the page supports exploration through a coverage visualization, interactive search and filtering options, and a wide range of visualizations tailored for each data type (see Figure 1).

2. **Country profile**. Many theories and explanations in social policy research focus on countries as the focal unit of analysis. Thus, we co-designed profiles that zoom in on a specific country and shift the focus to the development *within* it. As such, the profile is a valuable tool to inform area studies, providing easy access to a set of key indicators.

3. **Data Explorer**. Here, we focus on supporting the analysis of multiple indicators simultaneously by providing basic correlation insights and visualizations tailored to different combinations of indicator types. While correlation is not causation, it helps uncovering possible relationships that can be further inspected and may inform inductive reasoning.

To support data sharing (**R4**), all pages provide various exporting options with version control and all visualizations are downloadable. While the system is still

being prepared for general public access, registered users can compile indicators into so-called "datasets" and share them with non-registered users via token-based urls. For script sharing, we created the Community Notebooks page, where researchers can upload computational notebooks to reproduce and replicate results.

Evaluation

After the first five workshops, we conducted a survey to investigate how the researchers perceived the collaboration so far. Eight researchers participated. Despite the small sample, the results provided relevant insights. Paper prototyping and group discussions were the most preferred activities as they allowed the experts to concretize their ideas and refine them by discussing them with their peers. While researchers with high attendance were more positive about how their participation influenced the outcome, half of the participants did not find such regular meetings helpful for their work but noted that the workshops were the place where they learned most about the research of their colleagues.

A few months later, the first version of the system was almost ready to be released within the project. Before doing so, we conducted a small user study to evaluate the interface design and to further assess the benefits and limitations of our participatory approach. The researchers performed three navigation tasks focused on the data visualizations, and participated in an interview. We had six participants. That was the first time they could interact with the system, and four participants reported to be impressed because it offered more options than other systems they knew. This led to more positive answers about our collaboration being helpful for their work. In the interviews, the most mentioned issue was that not everyone was attending the workshops. Initially, we invited all researchers to encourage openness and diversity, but only a few attended regularly.

Shortly after releasing the system, we conducted a second study with 12 researchers to evaluate the validation and exploration features. The study consisted of five tasks. The first and second tasks required uploading a dataset, with and without errors. The other tasks involved searching and exploring a given indicator, interacting with a *Country profile*, and exploring indicator relationships in the *Data Explorer*. After each task, participants rated its difficulty, and shared any problems they had. Figure 2 presents the difficulty answer rates.

All but one participant completed the validation tasks successfully and everyone finished the exploration tasks successfully. Overall, the outcome was positive because most participants found all tasks easy to perform. The researchers found the validation tests especially helpful for verifying the data. However, this required additional work to adjust the data according to the established standards — in contrast to their previous manual approach. They especially appreciated the option to combine indicators in the Data Explorer, missing in other systems.

Regarding the co-creation process, the evaluation showed that the system fulfilled the requirements and that the participants felt that their ideas were included. However, the diversity of goals among the researchers, combined with

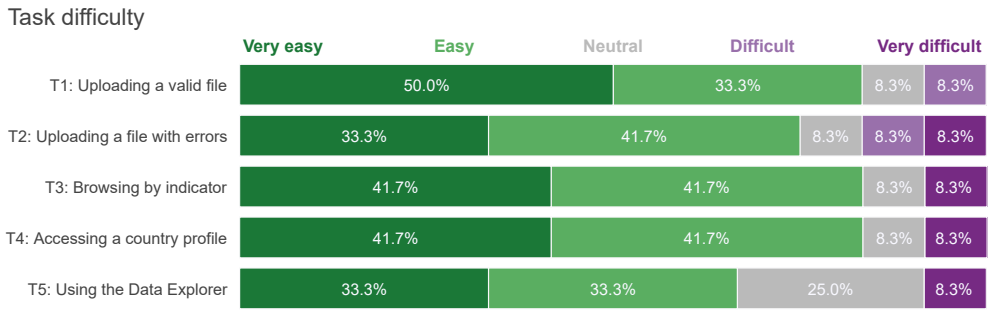

Figure 2. Difficulty rank per task in the second user study, evaluating the data validation and exploration features.

the inconsistent attendance, made it challenging to design custom features. Moreover, the researchers saw the benefit of a systematized workflow for future colleagues but considered that co-creating increased their workload.

Recommendations for data infrastructure projects

Based on our case study, we propose the following recommendations for researchers and practitioners who plan to co-create a data infrastructure:

1. *Ensure a limited yet representative group of participants actively involved in the process*. Initially, we invited all researchers. We noticed that too many people were involved, some attended rarely, and power structures influenced who voiced their opinion (e.g. doctoral students hesitated before disagreeing with their supervisors). Overtime, we decided to invite only two persons per research group and to organize teams mixing different groups and roles.

2. *Assess the status and amount of data available early on*. We planned to use example datasets for designing the system early on, yet such datasets were not ready. Thus, the design and development had to happen in parallel to the data collection, which is not rare for research data management systems.

3. *Connect individual and group goals, working in short iterations*. Long-term projects struggle with keeping participants engaged. Discuss the individual goals of every participant and how they connect to the project goal, prioritizing a balance between both. Short work iterations lead to less repetition and facilitate including the input of the participants in every step.

4. *Define the roles and tasks of the participants early on*. The expectations of the social scientists about the computer scientists, and viceversa, were different because each group overestimated the work speed of the other. This illustrates how misconceptions can easily occur in multidisciplinary projects. Although participatory methods are favored to get everyone's voice heard, it

is also important to clearly define the tasks and commitment needed for the collaboration to succeed.

Discussion and conclusions

Tenopir et al. (2015) suggest that creating a sound data infrastructure is a solution to impulse data sharing among researchers. However, designing for reproducibility has multiple constraints and challenges (Feger et al., 2020). Our study shows that designing such a system is a long-term process that requires a close and exhaustive collaboration. In the workshops, we found that some researchers did not identify themselves as users because it would take a long time for the system to reach a state where it could provide immediate benefits. This reflects one of the challenges of developing groupware applications reported by Grudin (1994): the disparity between work and (immediate) benefit.

Promoting collaboration among the researchers was another positive outcome beyond the system adoption. Participants developed a shared understanding of their collaborative research in the workshops. This confirms the findings of Neang et al. (2021) with oceanographers. Overall, our case study presents insights on how to co-create a data infrastructure for social policy research. Accordingly, we provide our recommendations for similar endeavors. Our work contributes to the open science efforts within the scientific community.

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Designing ground truth for Machine Learning - conceptualisation of a collaborative design process between medical professionals and data scientists

Hubert Dariusz Zając
University of Copenhagen
hdz@di.ku.dk

Abstract. The development of Machine Learning (ML) models is a complex process consisting of several iterative steps like problem definition, data collection and processing, feature engineering, model training, and evaluation. While the amount of research on ML model development is growing, little is known about the design process of *ground truth* in datasets that serve as the backbone of many ML-based systems. Design choices made before the labelling process often become invisible, and the *ground truth* becomes an infrastructural part of the data, which prevents it from being inspected in the event of problems at the later stages of the data science cycle. I conducted observations of the collaborative work of radiologists and data scientists on *ground truth* design. I report on the adopted process divided into three stages: Stage 1 - assessment of data requirements and labelling practices; Stage 2 - design and evaluation of label structure; and Stage 3 - design and evaluation of labelling tool. Moreover, I introduce two activities of Stage 2: *ideation* and *stress test* to design high-quality labels. At last, I pose outstanding questions to unpack the tensions and motivations observed during the ethnographic work.

Introduction

The development of Machine Learning (ML) models is a long and complex process with many interdependent activities. Amershi et al. (2019) proposed an iterative process that outlines nine distinct stages. The three early phases of that process focus primarily on data collection, data cleaning, and data labelling. These three stages constitute *data wrangling* - an activity so complex and laborious that it accounts for up to 80% of time and effort required by some data science projects (Guo et al. (2011); Hellerstein et al. (2017); Kandel et al. (2011)). Sutton et al. (2018) described extensive data-processing activities as "death by a thousand wranglings." However, at the same time, the activities, decisions, and conducted work shift into invisibility (Star and Strauss (2004)), once, the dataset is sent further down the process (Mueller and Salathé (2019)). Labels become an infrastructural part of the data and gain authority as the objective representation of reality (Green (2020); Gitelman (2013)), thus serve as the *ground truth* in the later stages of ML development and are not considered a human contribution of a situated and emergent process (Mueller and Salathé (2019); Feinberg (2017)). Similarly, Seidelin et al. (2018) suggested that in an organisational context, data is a *design material*, and as such can be moulded and acted on through a collaborative design process.

There are many reasons as to why *data wrangling* and its outcomes disappear into the infrastructure (Feinberg (2017)). Star and Ruhleder (1996) suggested that data scientists focus on datasets as entities that can be used to achieve other high-level goals e.g., creating a model, rather on individual components with a complex origin that constitutes them. Additionally, the articulation work (in the context of ML development) - a type of work necessary to make other work possible (Schmidt (2002)) - is often considered by data scientists banal and obvious (Feinberg (2017)), thus not worth recording. The effect of this assumption may be further enhanced by the lack of documentation tradition in data science (Pine and Liboiron (2015); Rule et al. (2018); Zhang et al. (2020)), which allows for the disappearance of the complex, collaborative, and social work put into data preparation.

Given the current practices, accounts of documented label design work in the medical area are lacking, which can be observed in the articles introducing medical datasets used in many data science projects[1]. Many of these datasets did not report on any in-depth considerations when designing the labels, providing only superficial reasoning. E.g. Nguyen et al. (2020) attributed the origin of the labels to "a committee of most experienced radiologists from the two hospitals." CheXpert authors selected 14 radiological observations and a single differential diagnosis based on their prevalence in a sample of radiological reports and their

[1] I completed a preliminary analysis of seven open access chest x-ray datasets (Shiraishi et al. (2000); Johnson et al. (2019); Bustos et al. (2020); Demner-Fushman et al. (2016); Nguyen et al. (2020); Wang et al. (2019); Irvin et al. (2019)) that collectively were cited as part of a method section more than 1 000 times

clinical relevance (Irvin et al. (2019)). Wang et al. (2019) described briefly that eight available labels in their dataset were selected "based on radiologists' feedback." These datasets are often used as-is, and so Li et al. (2019) wrote "[t]hese [available in ChestX-ray8 (Wang et al. (2019))] labels are obtained by analyzing the associated radiology reports. The disease labels are expected to have accuracy of above 90%. We take the provided labels as ground-truth for training and evaluation in this work." It is possible that the design work to select the eight labels of ChestX-ray8 was considered obvious and that the labels themselves were an objective part of the dataset. However, in doing so, as pointed out by Mueller and Salathé (2019), the decisions taken during that design work became impossible to inspect in the event of problems at the later stages of the data science cycle.
Some work has been conducted on unpacking the intricacies of data labelling. Fort (2016) proposed a three-stage process to ensure reliable labelling. Especially relevant, in the context of this poster, is its first stage - the pre-campaign, during which a team of domain experts, managers, administrators, and other relevant stakeholders creates an annotation guide. Such a guide, following Fort's definition, includes categories (labels), their definitions, a vision, and goals. In this poster, I split the guide into the guidelines on how to annotate and the label structure, to focus on the origin of the *ground truth*. Moreover, I report on a three-stage process conducted during the pre-campaign and introduce two activities for the design of the label structure. The labelled data in question were chest x-rays and the label structure defined all the possible labels that can be applied to a dataset to serve as the *ground truth* for an ML model. Upon completion, the label structure comprised: (1) a tree structure of possible labels, (2) label definitions and examples, (3) definitions of auxiliary metrics collected per study. Several other boundary negotiating artefacts (Lee (2007)) were used to support the collaborative work and develop mutual understanding e.g. spreadsheets for early label comparison. Their description, however, lies outside of the scope of this poster. Finally, I pose outstanding questions about the motivation and tensions between the team members during the collaborative design work.

Methodology

To conceptualise the design work required to design *ground truth*. I participated in the AI4XRAY project[2] funded by Innovation Fund Denmark[3] - an interdisciplinary project established to design, develop, and roll out an AI-based chest x-ray prioritisation tool in Denmark, Kenya, and Thailand. One of the project's objectives was to create a high-quality dataset of labelled chest x-rays for ML training purposes. The collaborative design work that took place before the labelling of the data happened between February and September 2021 and

[2] https://di.ku.dk/english/news/2020/new-ai-system-will-detect-critical-heart-and-lung-diseases-faster/

[3] https://innovationsfonden.dk/en Grant number: 0176-00013B

consisted of a series of 16 meetings. The design team comprised three specialised radiologists and four data scientists.
I conducted participative observations of the collaboration during ten meetings between radiologists and data scientists. Additionally, I designed a prototype of a labelling tool, based on the data collected during the meetings, and evaluated it with one of the participating radiologists accompanied by one of the data scientists. The evaluation was audio-recorded and transcribed. Throughout the collaboration process, I collected the following types of data: digital notes, audio recordings, emails, and intermediate artefacts.
I started the analysis using abductive grounded theory (Rahmani and Leifels (2018)), which in opposition to traditional grounded theory encourages the use of existing theories to explain grounded concepts. I openly coded the collected materials to gain an understanding of the reoccurring themes and discourses. Subsequently, I revisited the codes and the source material. I looked at data as design medium (Seidelin et al. (2018)) and at the observed collaborative design work as articulation work (Schmidt (2002)) in an ML development process and as a part of the labelling process described by Fort (2016).

Results and contributions

The primary contribution of this poster is the preliminary description of the *ground truth* design work that makes it possible to label chest x-rays. The secondary contribution is outstanding questions that stem from the preliminary analysis of collected data, and that will be addressed in a follow-up study.

Preliminary ground truth design process

The entirety of the process is contained within the pre-campaign stage of the process proposed by Fort (2016) and can be divided into three stages based on the topics they concerned, Figure 1.

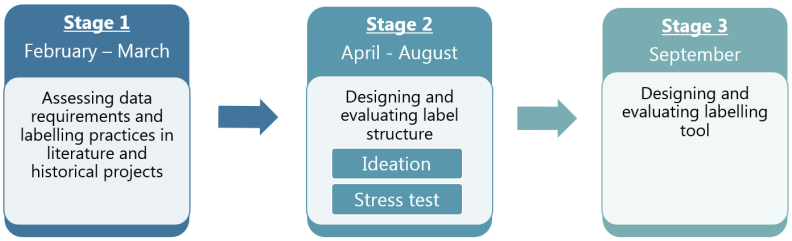

Figure 1. A collaboration timeline and the main focus of each of the stages of the pre-campaign.

Stage 1 - during the first stage of the collaboration, the team focused on assessing data requirements and researching labelling practices. In the meetings participated not only team members that ended up constituting the core of the *ground truth* design team but also leaders from each of the domains involved in the project -

radiology, radiography, and computer science.
Stage 2 - once the approach was clarified, goals set, and tasks distributed, only the core radiologists and data scientists continued collaboration. The focus of that stage was designing and evaluating the label structure, which was achieved through two activities - *ideation* and *stress test* - described in the later sections.
Stage 3 - the final stage of the collaboration focused on designing and evaluating a custom IT solution to label data. During that period we completed two iterations of design and evaluation with one of the radiologists and data scientists from the project. The outcomes - a high-fidelity mock-up of the labelling tool and a list of requirements - were shared with the development team.

Label structure and additional metrics

The label structure is a tree-like data structure that contains all the possible labels that can be assigned to radiological findings observed on a chest x-ray. Importantly, the labels were designed not to include clinical diagnoses like e.g., pneumonia. Both leaves and nodes can be assigned as labels to specific findings. All the labels included relevant examples and were defined in Danish and English per Fleishner Society (Hansell et al. (2008)). A part of an intermediate label structure can be seen in Figure 2.

The collected data was extended with four additional metrics. Each of them was defined with relevant examples in Danish. The metrics were as follow:

- acuteness - a metric applied on a study level that represents the overall state of a patient comprising three levels;
- severity - a metric applied per finding that represents its severity comprising four levels;
- uncertainty - used to indicate uncertainty about the existence of a single finding;
- bad image quality - used to indicate bad quality of a single x-ray.

Design of the label structure and additional metrics

During the first stage of the *ground truth* design process, consistency and specificity were the core qualities sought after. The label structure was introduced to support the same level of quality across all the labellers. Its design was the central point of the second stage of the collaboration between radiologists and data scientists and was achieved through two activities - *ideation* and a *stress test*. They can be seen in Figure 3.
Ideation - the goal of this activity was to create a testable version of the label structure. Initially, collaborating radiologists, based on their professional experience and a set of 15 radiological reports of chest x-rays from Rigshospital, introduced the first version of the label structure comprising 12 nodes. The improvement process was facilitated by data scientists. Using a current version of

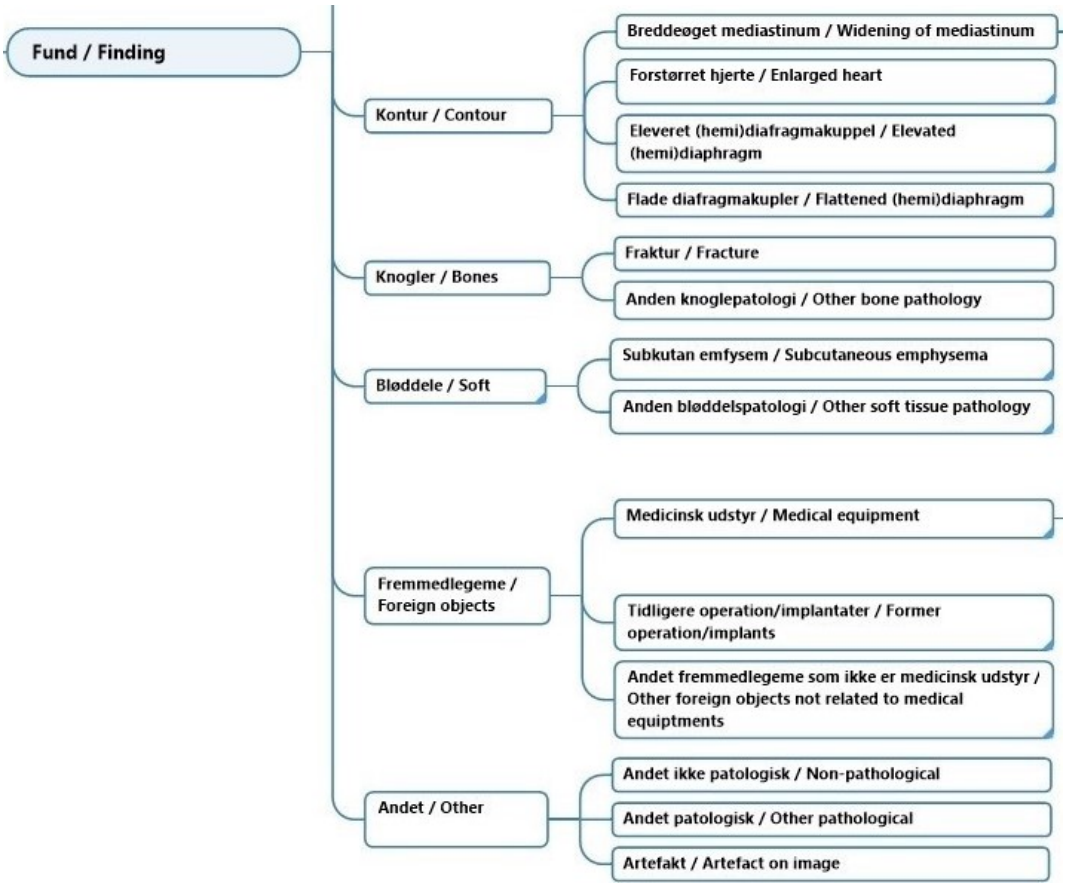

Figure 2. A part of a structure of applicable chest x-ray findings in Danish and English. An artefact from the collaboration on ground truth design in the AI4XRAY project..

the label structure radiologists independently labelled 15 chest x-rays to assess its quality. The key goals behind this test were to ensure that the label structure is:

- not too intricate - preferred use of the leaf nodes over parent nodes;
- precise enough - assignment of the same labels or closely related labels (a child or parent node) to the same findings;
- extensive enough - assignment the majority of the findings to semantically rich nodes, avoiding the "other" category.

Throughout the evaluation process, the team designed three versions of label structures, altering the number and organisation of the nodes.

Stress test - once a semi-stable version of the label structure was obtained, using local chest x-rays, the team designed a *stress test* to evaluate structure's robustness and further its design. This activity was based on 40 chest x-ray images with the highest concentration of findings from the PadChest dataset (Bustos et al. (2020)). The test was divided into two iterations of 20 images each. Radiologists used a current label structure to label all the radiological findings. Subsequently, data scientists compared their responses against each other and labels supplied with the PadChest dataset. After each iteration, the design group met, discussed the results

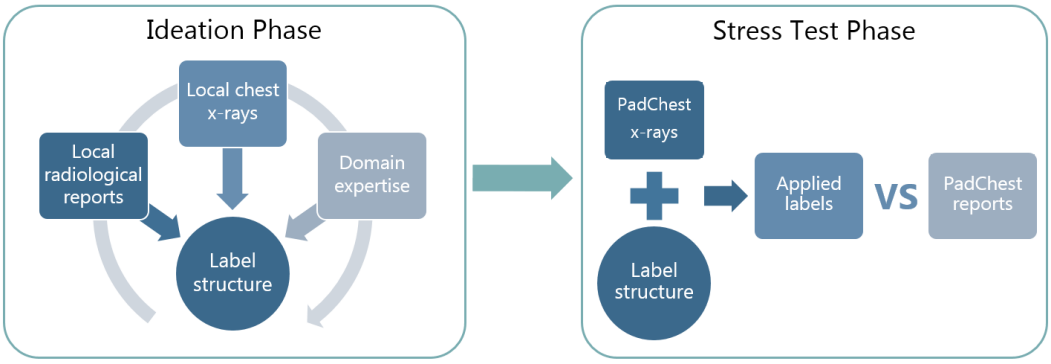

Figure 3. A preliminary description of two activities to design label structure.

and the use of the label structure, focusing on the three quality goals.
On top of the labels' assessment, during the stress test, radiologists tried to assign *acuteness* and *severity*. The granularity of these metrics, as well as definitions, and intended use was negotiated with data scientists.

Outstanding questions

Although the situated observations of the collaborative work between radiologists and data scientists on ground truth design helped uncover new sites of collaboration and highlight their complexity, several outstanding questions need further elaboration. It is imperative to understand the goals and motivations of the different participants to understand the influence of the collaborative work on the labels and thus on the future dataset. Moreover, analysing tensions, and unpacking the collaboration using sensemaking theory (Weick and Sutcliffe (2005)), can further our understanding of the articulation work before creating medical datasets for ML use.

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Andreea Sistrunk, Subhodip Biswas,* Nathan Self,* Kurt Luther and Naren Ramakrishnan (2022): Redistricting Practices in Public Schools: Social Progress or Necessity?. In: Proceedings of the 20th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies - Posters and Demos, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.48340/ecscw2022_p05*

Redistricting Practices in Public Schools: Social Progress or Necessity?

Andreea Sistrunk[†], Subhodip Biswas,[†] Nathan Self,[†] Kurt Luther and Naren Ramakrishnan
Virginia Tech, VA, USA
Contact Author: sistrunk@vt.edu

Abstract. Redistrict, a fully integrated web interface, proposes a new platform for proximity-based public schools boundary deliberations. It has been pilot-tested on one school system in the US and aims to shift, educate, and bring visibility to policy and geographical constraints. It extends current deliberations' state of practice, held in person or over video conference using static pdf/printed maps. This research draws knowledge from computer science, educational policy, social sciences, and geographic information systems (GIS) to allow public school officials, parents, and community at large to compute "what if " scenarios towards a better understanding, discovery learning, and optimization when redesigning school attendance zones. We explore possible areas of improvement for the broader community to cast an informed, unique vote, while maintaining privacy, supporting ingenuity, and transparency. This speculative research prototype creates space to support a concrete path of much needed advancement in complex social deliberation using interdisciplinary research.

[*] Equally contributing authors
[†] Equally contributing authors

Public School Rezoning in United States of America

Public schools are the main educational system in the US, with an enrollment of over 90% of school-aged children to account for 55.3 million students as of 2006, 56.2 million in 2017, and projected to be 58.2 million in 2027, as per the National Center for Education Statistics [1]. Given this steady increase, public school districts are engaged in a revolving decision-making process to best allocate limited building space for a growing student population. Because in the US, residences are paired up to neighborhood schools based on a complex proximity/cluster assignment, school attendance plays a deciding role when choosing a home in many families. Figure 1 shows GIS visualization corresponding to a school district in Virginia. In proximity-based assignments, each neighborhood is designated to attend a specific elementary, middle, and high school. Population fluctuations require change in neighborhood assignments from one school to another over the years, in an attempt to optimize building capacity, neighborhood composition, and accessibility, and so on. This re-assignment of neighborhoods from one school attendance area to another is decided through public hearings, where community participation is sought. These public school boundary deliberations are traditionally held in person and often controversial (Kelly, 2019).

— To prepare for traditional deliberations, before COVID-19 pandemic, public school officials (often a handful of people from the school planning department) produced printed maps and presentations aiming to illustrate land computation, geographical constraints, and educational policy directives. School officials made suggestions to move school boundaries based on complex and customized constraints discernment using advanced GIS software and best-practices-education policies for equitable distribution of students. However, each of these tools used independently requires the aggregation to be computed manually. Additionally, often changes in the school board's leadership shifts policy interpretation. This calls for customized solutions to fit each rezoning effort, becoming a cyclic strain on the public school officials. More so, lack of standardization raises concerns of equity, making room for (intended or un-intended) bias.

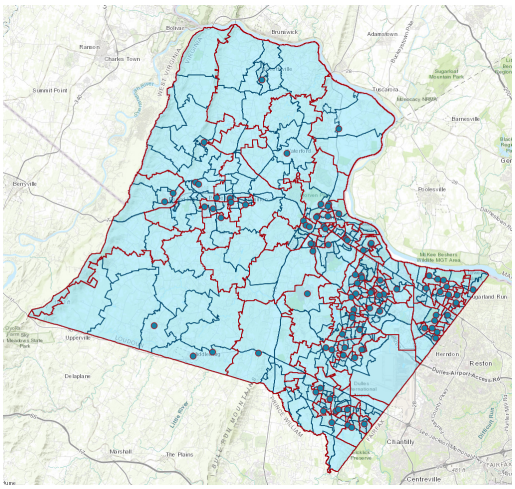

Figure 1. A GIS visualiation showing the school district corresponding to Loudoun County Public schools.

[1] https://nces.ed.gov/fastfacts/display.asp?id=84

This setup is difficult for community members too. Some have multiple jobs and children of various age groups in the public school, trying to participate in decisions over their children's education can be a real time and organizational challenge. During 2017-2020 our researchers witnessed evening gatherings in school cafeterias, pushing capacity limits. Some came, after a full day at work, with small children-crying picked up from school, or daycare. All just to participate in an 2.5 hour open discussion on school boundaries. These decisions dictated if the children would have the same classmates next year or not, if they will need to go to another school, if children travel sometimes over an hour to school, if they will study in a trailer or a crowded classroom, and so on. In these meetings, parents lining up to speak, but only for 2-3 minutes due to time limitations. The public sessions were normally information fire-hoses and more often than not, the community was left more divided and confused than when they came, easily envisioned in this setup. Especially in the state of Virginia, some schools are rezoned every 2-3 years, meaning some children need to change schools this often (Svrluga, 2013). This reverberates in families core values, neighbors, and home real estate value as some schools are perceived as better than others. Rightfully so parents are frustrated, children feel displaced. It is a strain on the community's well being, communication, and trust. If we factor the size of public school systems, needing to accommodate 50+ million children and constant population growth, it is not surprising to come across tensed neighborhoods, adversity, litigations, and newspaper articles siding with one area or another (Kelly, 2019). Traditional setup of public school boundary deliberation was impossible during COVID-19 pandemic, and consequently many public school systems suspended boundary decision-making sessions or moved to video conference for concerns of participants' well-being and impossibility of public social distancing. While this allowed to elevate the concerns on time commitment, the participants' understanding and input remained highly limiting.

The Redistrict Interface

Our initiative sprang from participatory observation of more than ten public school boundary rezoning efforts as parents, educators, and researchers. (Dantec and DiSalvo, 2013) Additionally to the field work, community-based research involved collaboration with school planners, (Meng et al., 2019) educators, and subject matter experts to design, test, and deploy a pilot software through an iterative improvement process (Mahyar et al., 2018). Initially the GIS shape files were imported to transform a static map in a-drag-and-drop interface, allowing the user to change neighborhoods assignment from one school attendance zone to another (Yoon and Lubienski, 2018) (Dow et al., 2018).

With each assignment the planners wanted to see the impact on school capacity. A subsequent improvement was the approximation of school population growth based on projected urban increase. Previously, this computation was highly manual in the traditional boundary allocation methodology (Lubienski and Lee, 2017). A

subsequent concern was raised about prioritization of community feedback (Saxena and Guha, 2020) (Holten Møller et al., 2020).

During the public meetings, anyone can express opinions, and it becomes almost impossible to discern between affected residents' and other community members unaffected by the school boundary change. To overcome this limitation, the application landing screen informs and authenticates the user. The home address provided is used for attendance validation and enforced by IP address as shown in Figure 2. As well, it casts only one vote per residence. Once authenticated, the user is shown a map of the public school district reactive to hovering and clicks. It informs the community of proposed boundary changes and allows the user to submit a different configuration.

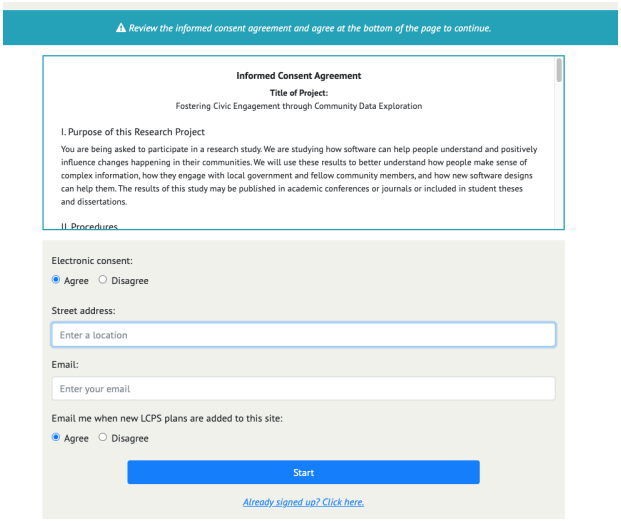

Figure 2. The landing screen with unique IP identification.

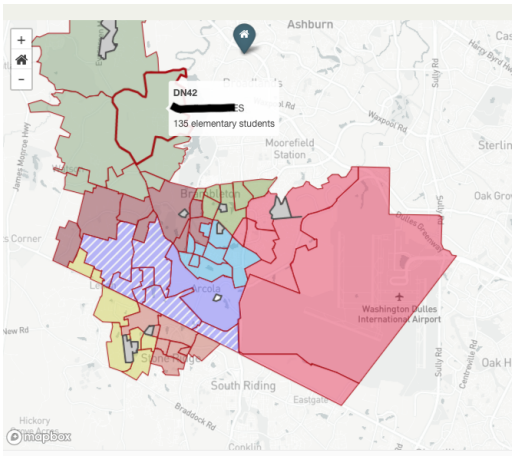

Figure 3. The map of a public school district.

The tiles represent the smallest planning zone parcels. Their color visually refers to a certain school, as each school attendance area has a different color as shown in Figure 3. This color coordination was adopted from current state of practice, utilized in paper printed maps. Each tile represents a neighborhood and are collectively called basic school planning areas (SPAs). They remain indivisible during any rezoning. This is due to the need to keep small communities together. Solid colored tiles are not proposed to be moved. The hashed SPAs are proposed to change planning zones. In the process of trying to find a better than proposed parcel allocation the user can review and understand the impact changes have on student projection and building capacity.

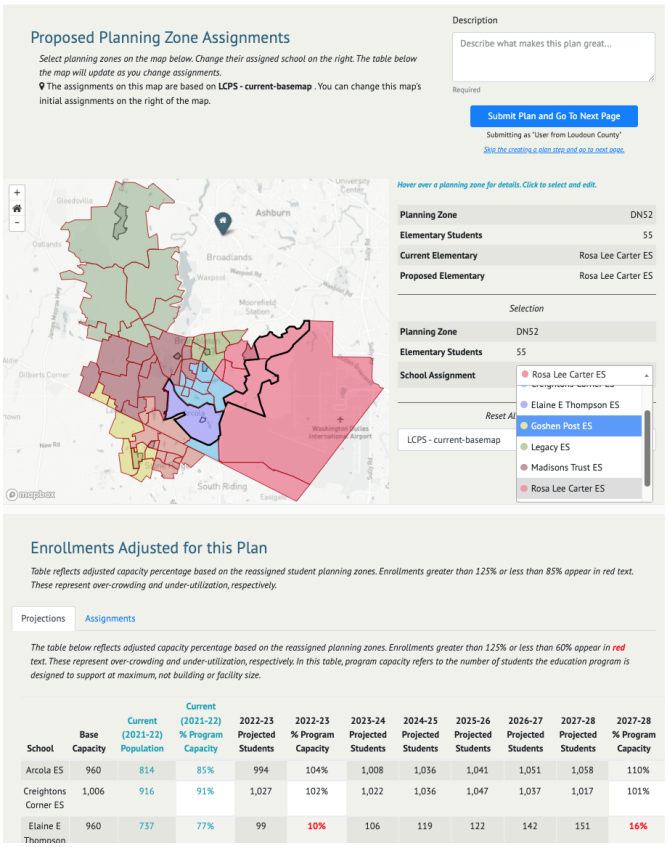

Figure 4. The map of a public school district.

When the user hovers their cursor over the SPA, it highlights and a text appears with more details (School Name, Number of Students). Otherwise, the web interface hides details of the parcels until the user hovers over - both to not deter attention or overwhelm with abundant details. For the parcel reassignment, the user is shown an estimation of the school building utilization for the current and the upcoming years. In the process of computing the "what if " scenarios the users can possibly test and understand true physical building constraints and very low margins for a "perfect" solution. A screenshot of the interface is shown in Figure 4.

Interactive GIS and spatial optimization

Biswas et al. (2019, 2020b,a) developed a series of optimization algorithms to calculate the best distribution of the parcels given many education policy and geographic constraints. It uses the geographic shape files to identify the school planning areas (SPA) that contain the actual school buildings. Adjacent SPAs are incorporated based on a shared boundary. This assignment continues until every SPA is assigned to a base school. Traditional boundary allocation was highly manual involving individual calculations for every SPA, our algorithm proposes a consistent optimization across all schools in a standardized and automated manner.

Conclusion

Using the Redistrict interface, school planners are able to quickly and efficiently compute and propose school boundary changes calculated on consistent allocation criteria across the entire public school district. This takes subjectivity out and allows

for a uniform data-based decision-making, while decreasing planners' workload. Using the interface they are able to inform the community members and request real-time input. Changes can be implemented and disseminated instantaneously, allowing users time and flexibility to participate in boundary change. In turn, the community members are able to understand the proposed boundary changes and new school allocations, with estimated impact. The community members are able to try out their ideas attempting a better school allocation, and submit these proposals to the planning department for further review, with comments. Each vote is unique and valid only for affected residents / neighborhoods. The interactive design allows for highly-complex data and constraints to become just a drag-and-drop exercise.

Our exploratory prototype expands on the status quo of participatory design (Kozubaev and DiSalvo, 2021) through full immersion of the user in both the entire process of boundary realignment and optimization of the difficult constraints this process entails. By participating in the action of rezoning the user not only can fully understand immediate and long-term impact of the decisions (or lack-thereof) on schools' capacities, but can become intimately knowledgeable of constraints public school officials need to account for when making decisions. The ability to efficiently compute complex data and interdisciplinary priorities can better equip authorities to face the continuous challenges this process entails. It gives fast answers to community members, and creates the opportunity to raise awareness and rebuild trust (Corbett and Le Dantec, 2019). Participation in the process itself educates the community and holds public school systems accountable, transparent, and equitable in the assignment of every single SPA in their jurisdiction. More so, because every SPA is assigned to a public school, using the same criteria, it promotes standardization, and eliminates fluctuation in decision-making from one school board to the next, which can finally introduce bias in assignments. Since the interface not only promotes personal well-being in a socially distant community, but in the context of COVID-19 pandemic becomes a necessity in the evolution of complex decision making of participatory design, it is fully supported by interdisciplinary research and best HCI practices. It enables informed, active, participatory decisions towards a transparent design of public schools boundaries. This reverberates in well-being for the community to learn who we are and choose who we want to become.

Acknowledgments

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David Unbehaun, Aydin Coskun, Jule Jensen, Konstantin Aal, Sarah Rüller and Volker Wulf (2022): Designing Multimodal Augmented-Reality Approaches in Sports: Collaborative and Competitive Scenarios for Individual and Group-based Outdoor Interaction. In: Proceedings of the 20th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies - Posters and Demos, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.48340/ecscw2022_p06

Designing Multimodal Augmented-Reality Approaches in Sports: Collaborative and Competitive Scenarios for Individual and Group-based Outdoor Interaction

David Unbehaun, Aydin Coskun, Jule Jensen, Konstantin Aal, Sarah Rüller, Volker Wulf
University of Siegen
{firstname.lastname}@uni-siegen.de

Abstract. This work presents a prototype for a multimodal and augmented (AR) based System designed for individual and joint activities in outdoor sports. Based on the need for social interaction and computer-supported collaborative sports and the decreasing physical activity across all ages, game scenarios for the context of outdoor sports were formulated and implemented with a head-worn multimodal AR interface. The System's innovation, flexibility, and multimodality found the basis for multiple use cases, such as professional and leisure, individual and group contexts. The technical infrastructure allows multimodal experiences while tracking and monitoring data such as movement speed, location, and heart rate. Within several game scenarios, players can cooperatively and competitively challenge themselves and other players to improve their physical activity playfully. This work is an inspiration and orientation for future research, development, and design of gamified AR exercising technologies.

Introduction

Physical activity (PA) has multiplicative health, social, and economic benefits [23], can create connections in many ways, and plays an essential role in many people's everyday life: physical activities have a positive impact on physical and mental health (e.g., [4,6]) and make a valuable contribution to social interaction, participation and individual mobility (e.g., [18,19]).

The use of health-related information and communication technology (ICT) such as exergames [11–15], health applications and wearables [16], as well as digital games and training programs [17] in different domains, has shown to improve activity levels and offer valuable potentials. Recently, virtual and augmented realities (VR and AR) are becoming increasingly visible in the field of health-related ICT and Human-Computer-Interaction (HCI) [3,7,22].

Tying in with new hybrid forms of exercise, as seen in the genre of Exergames and the example of Pokémon Go [1], the field of Computer-supported collaborative sports tries to make use of new technologies by expanding sports experiences through Visual Augmentations [20].

Users of sports games, for example, can receive additional information in real-time and in real-life environments during gameplay and experience a range of innovative forms of activity through augmented reality and mixed reality technologies (MR). AR glasses are already available in cycling, in areas such as movement training and rehabilitation [2] in billiard and table tennis [21], or sport climbing [8].

Prospective research directions refer to the opportunity to use AR more commonly on a recreational level, such as making sports more challenging by designing visual obstacles [21] or enabling the users to manually set their training, as is already the case in Augmented Climbing [8]. The related research stresses the importance of motivational, social, and acceptance factors to support individual and social sports activity [20].

The concepts of immersion and flow have been shown to increase use time and enjoyment and are essential for providing the perfect Sports AR experience [5,9,10]. Similarly, social collaboration and competition prove to have a significant effect on motivation as well as acceptance and desirability of the device [9].

Our work presents an AR-based system to foster physical activity, facilitate social interaction as well as create an innovative interface to access and promote sports and active participation across all ages and abilities. In this paper, we present an ICT-based System aiming to adapt sports activities and combine them with AR approaches and multi-user applications to create new multimodal scenarios in collaborative and competitive individual and social outdoor interactions.

System Overview

The designed and developed System's technical infrastructure consists of several interconnected elements: AR glasses, a smartwatch, and a smartphone allowing different multimodal input and output options (gesture and voice control). Depending on the area of application, the System can be used as a navigation and orientation system (near-real-time positioning) and synchronize movements of multiple players between the real and virtual worlds to support, for instance, the search of geocaches or Bluetooth beacons with audiovisual signals. The System offers more than one output channel (e.g., visual and acoustic) in terms of multimodal interaction. It provides the possibility to use different input modalities, e.g., speech input and touch control. Compared to existing AR interfaces in gaming contexts, the input modalities allow more embedded gameplay. Instead of using additional technical infrastructure such as a phone (e.g., in Pokémon Go), the interface is present in the user's vision and thus directly connected to the natural environment. Similarly, the wearable interface enables the user to move more freely and naturally without holding other technology.

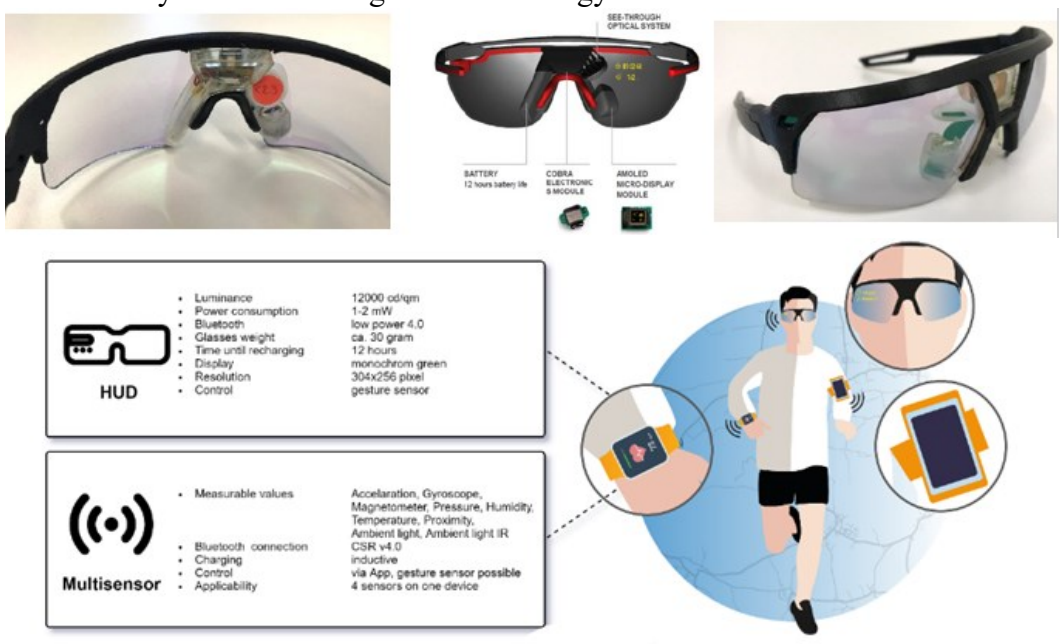

Figure 1: AR glasses with a monochromatic field of view (above) and System components (below)

The System consists of AR glasses and a smartphone application to command the System and store and analyze data (see Figure 1). The System supports multimodal input and interaction options (gesture and voice control in Figure 1) and offers multi-user applications in cooperative AR environments. The smartwatch can share fitness and health information to the application, displayed by the AR glasses, and stored within a cloud-based platform. The data can analyze

and present individual results, share achievements within a group and derive long-term activity trends from strengthening health awareness. The System can consider multimodal input mechanisms and enable two or more (inclusive) user input methods such as speech and gestures.

Multimodal Interaction, Interactive Prototype, and Game Scenarios

The multimodal systems will adapt to the user needs in a context-specific way, allowing them to be used meaningfully. We designed the System to ensure that the user is provided with the best possible combination of available modalities (gesture or interface interaction) to process a specific task before and during the training activities without needing to stop. For this purpose, the development of multimodal interaction fosters accessibility and increases the efficiency and ease of use, and the flexibility of human-technology interfaces. Depending on user skills or preferences and the usage context, different input and output formats are developed, which offer different advantages such as voice or textual chat for communication with other users.

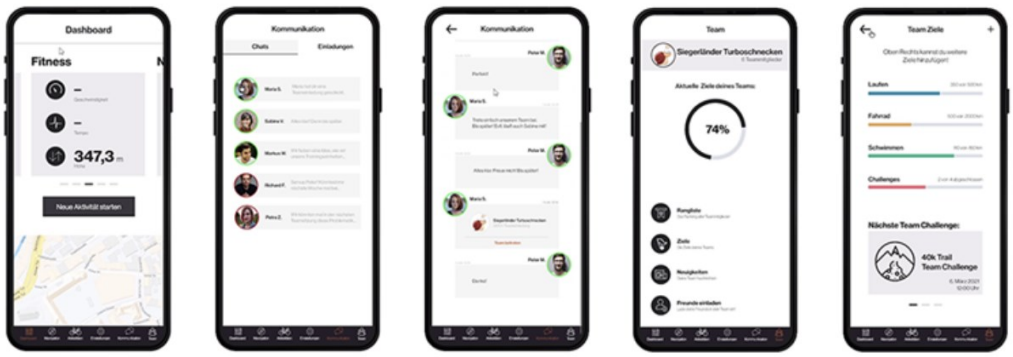

Figure 2: Interactive Prototype of the System Application

The application itself (see Figure 2) is structured like most popular apps many people use daily (such as Instagram and YouTube). The user always sees the current navigation menu at the top. At the bottom, the permanently visible main navigations bar is always accessible, regardless of where the user is and is designed with icons and texts aligned in a row. These elements are the main elements (dashboard, navigation, activities, settings, communication, team) of the application and should be easily accessible for the user to operate through different functions quickly. The control elements were placed where the users would expect them to be for user-friendly operation. Thus, the return arrow is always at the top left. The control elements are displayed uniformly to achieve consistency. The user can communicate with team members and other users in the general chat. The user can invite friends to an existing team or meet for a workout session or challenge.

In the "Team" section, the user can navigate other sub-menu items like rankings, goals, news, and inviting friends. The ranking functionality shows all team members, their rankings, and their points through workouts, challenges, and exercises. Every exercise generates points for the user based on the length and intensity of the workout. In addition, the user can set goals and challenges for the team so that each team member can review and participate in the challenge. The user can also promote different events and share the news with the team in the news section.

The technical infrastructure of the AR interface and app enables a multiplicity of possible game scenarios. The first scenario is called Ghost Run (see Figure 3). When the player can choose between different local routes to record a new time, the System will countdown from five to zero, and the System will track their activity. After completing the run, the player and other players on their team or friends list can see their route's time, pace, distance, and height meters. Suppose a player chooses to race against another player's best time. In that case, the AR interface will show continuous feedback in icons and timings on how the user performs compared to their competitor. After completing the run, the player will get an overview of timings and distances to evaluate how his performance varied in different parts of the route.

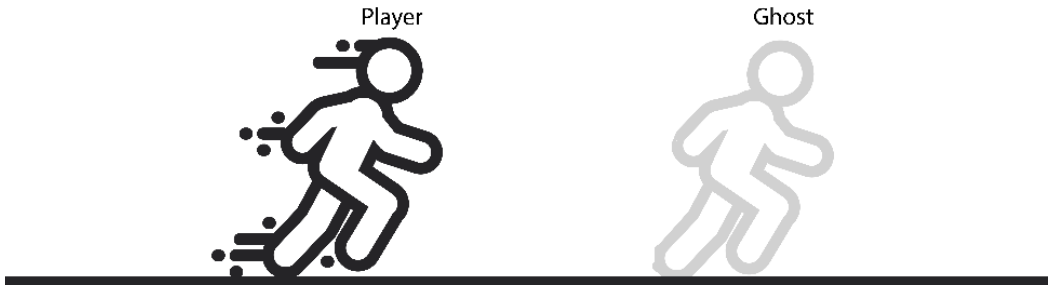

Figure 3: Ghost Run Scenario

The Knockout scenario (see Figure 4) lets players compete against each other synchronously in different regions on classified and comparable routes. The route is split into several segments. The slowest runner of each segment will be kicked out until only one player is left. The AR interface shows the player's current placement compared to the other players. If a player gets eliminated, they get a sound and icon notification. The other players also get notified that they survived the segment.

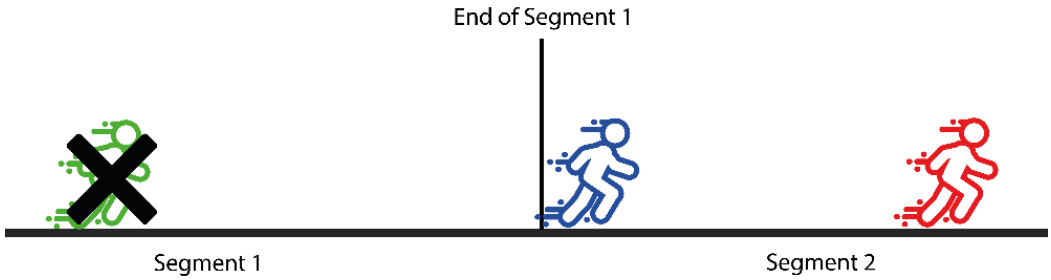

Figure 4: Knockout Scenario

In the Segments scenario (see Figure 5), players compete by running a route separately. The route is split into segments. The player who completes a segment the fastest time wins said segment. When the route is finished, the player that won the most segments wins the challenge. The AR interface shows in which segment the players are in. Every player's segment's time and win will be shown in the post-game lobby.

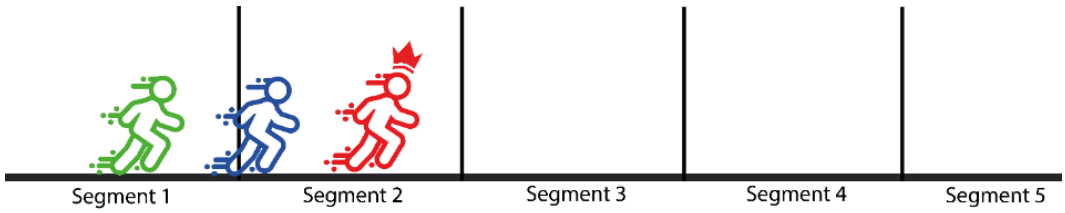

Figure 5: Segments Scenario

The Live Competition scenario (see Figure 6) enables players or teams to compete against other teams. Each player's performance on a route will be tracked and added up to a team score. The AR interface will show the player's and team's ranking compared to the other team. The fastest team wins, and the fastest player on each team gets an additional trophy.

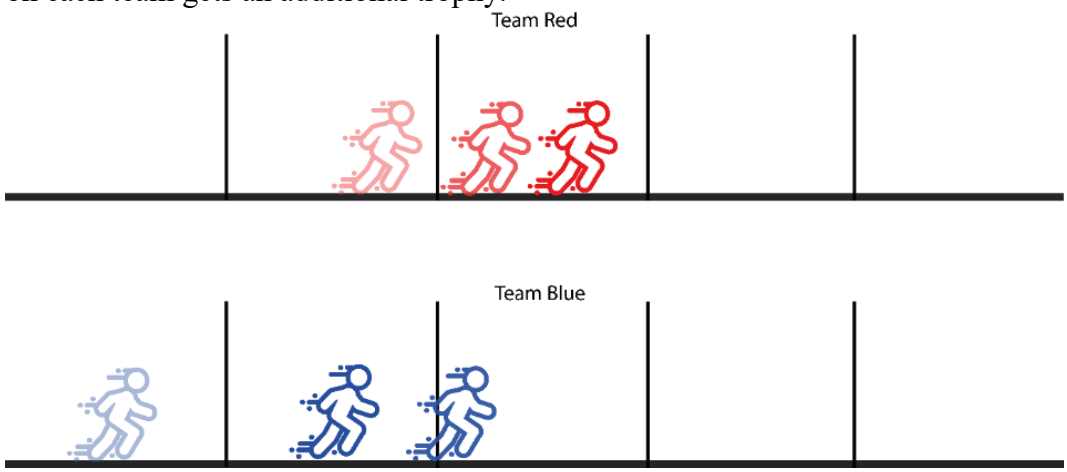

Figure 5: Competition Scenario

Conclusion and Outlook

Our work presents a multi-user and multi-device AR technology intending to make PA more enjoyable. Hence, based on an immersive and multi-user capable AR technology, an innovative, individualizable opportunity of movement training for health promotion is created. These multi-user sports- and exercise-related applications to be developed will be researched concerning their suitability for everyday use and user acceptance of AR systems. Further, their individual physiological and social-emotional effects will be investigated and evaluated in a proof-of-concept. The suggested challenge scenarios serve as a blueprint for other development scenarios such as an AR-based marathon, biathlon, or triathlon or interactive experiences-oriented discovery scenarios at the point of interest, such as AR-supported city tours in urban environments.

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Augmented-Reality Approaches in Computer Supported Collaborative Sports: Early Empirical Insights explored from and designed with with Sport Associations

David Unbehaun[1], Christoph Mall[2], Jan Ellinger[2], Aydin Coskun[1], Jule Jensen[1], Konstantin Aal[1], Sarah Rüller[1], Eckehard Moritz[3], Charlotte Meixner[3], Urban Plangger[4], Volker Wulf[1]
University of Siegen[1]; Technical University Munich[2]; Innovationsmanufaktur GmbH[3]; UVEX SPORTS GROUP GmbH & Co. KG[4], Germany

Abstract. This work presents a practice-based design and research approach that was used to explore individual, contextual, and institutional requirements, conceptualize and design AR-based Outdoor-scenarios for individual and joint activities in outdoor sports. Based on the need for social interaction and computer-supported collaborative sports and the decreasing physical activity across all ages, game scenarios for the context of outdoor sports were formulated and implemented with a head-worn multimodal AR interface. Members from seven different sports associations were interviewed and design workshops conducted to understand how to design AR-applications to promote an active lifestyle. The prototype and approach presented here will serve to discuss and reflect our future research activities, methodological concepts, and experiences in the field of HCI, CSCS, CSCW, and Design Communities.

Introduction

A sedentary lifestyle, stress at work and omnipresent availability of industrialized food – collateral consequences of today's civilization and economic growth – create enormous new challenges to the state of health of many people [12, 21]. Physical Activity (PA) decreases, whereas obesity, diabetes, heart diseases and other related health problems increase almost worldwide [20]. PA refers to all movement including during leisure time, for transport to get to and from places, or as part of a person's work [21]. Furthermore, the reported prevalence of physical inactivity, as well as the high prevalence of mental health problems, can be linked to factors of increasing urbanization: An increase in land sealing as well as more difficult access to urban green spaces, especially for socio-economically disadvantaged populations. In contrast, a wide range of positive effects on health, cognition, and learning levels have been shown for the passive stay in as well as the active use of urban and rural open green spaces. The presence of green spaces in urban areas and the active usage is associated with enhanced PA, social interaction and mental restoration, stress reduction and enhanced vitality [4,5,22]. Already the exposure to nature alone can be seen as a preventive factor for psychological diseases [8]. Exercising in nature can then improve mood, self-esteem, and stress [9]. Tying in with new hybrid forms of exercise, as seen in the genre of Exergames and the example of Pokémon Go [1], the field of Computer-supported collaborative sports tries to make use of new technologies by expanding sports experiences through Visual Augmentations [16].

Users of sports games, for example, can receive additional information in real-time and in real-life environments during gameplay and experience a range of innovative forms of activity through augmented reality and mixed reality technologies (MR). AR glasses are already available in cycling, in areas such as movement training and rehabilitation [3] in billiard and table tennis [19], or sport climbing [7].

Prospective research directions refer to the opportunity to use AR more commonly on a recreational level, such as making sports more challenging by designing visual obstacles [19] or enabling the users to manually set their training, as is already the case in Augmented Climbing [7]. The related research stresses the importance of motivational, social, and acceptance factors to support individual and social sports activity [16].

Designing ICT-based systems to foster access and promote participation in PA, sports and social participation across all ages and abilities requires researchers and developers to explore individual and social daily life practices and motivational backgrounds of people involved in all forms of sports [1,2,11,12,16,17]. Additionally, of importance is the role that technology nowadays has and how it can impact the motivation and continuation of daily practices in sports and PA [10,13–15].

Our study aims to design and develop an AR-based system to foster physical activity, facilitate social interaction as well as create new innovative ways to access and promote sports and active participation across all ages and abilities. In this paper, we present insights from a project that identified individual and organizational requirements, designed, and developed an ICT-based System aiming to adapt sports activities, such as trim-trails or marathons, and combine them with AR approaches and multi-user applications to create new multimodal scenarios in collaborative and competitive individual and social outdoor interactions. The system was contextualized, designed, and developed with actors (athletes and clubs) and additional stakeholders (associations and multipliers). By exploring heterogeneous requirements and implementing the system in sport-communities, the goal is to enable an innovative and active social lifestyle for various social groups and establish a socio-technical "innovation space" [6], which promotes transfer innovations from academia and various industries into individual and institutional practices.

Methods, Data and Research Questions

Research Approach and Data Collection

As part of an interdisciplinary research project involving different research domains, including sports sciences, soft- and hardware engineering, and HCI, as well as sport associations institutions, we aim to develop the system and the practical scenarios together with the target group (athletes, clubs, associations, and municipalities) to identify factors in the early stages of development that are relevant for the continuous use of the solution. The paper work seeks to address the following research questions: 1) Which specific practice-based factors are concerned in designing an AR-based system to foster physical activity, enable social collaboration and encourage their long-term use, and 2) to what extent can individual and social activities in the context of sports be supported by AR-based activities? Regarding data collection, we followed the Design Case Study Approach by Wulf [18] by applying different methods and instruments from the fields of human-computer interaction (e.g., different levels of prototyping) and qualitative

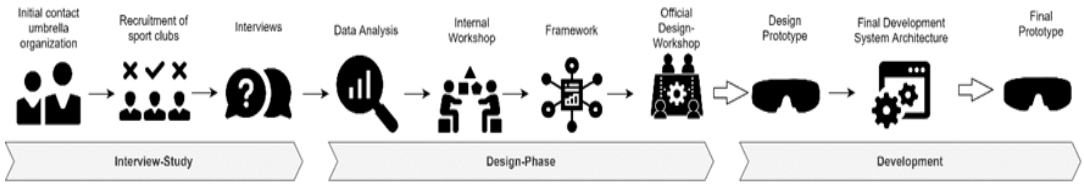

Figure 1: Project design and research stages

research (e.g. interviews, design workshops, participant observations). Our stakeholder network consists of practice partners from various political actors, sports clubs, and associations (see table 1) from different cities and rural areas. To gain meaningful insights into the structure, daily routines, and organization of sports associations, we began with an empirical study regarding existing practices, organizational and social perspectives, individual and social needs, and the challenges confronting our target group in their everyday surroundings. This involved semi-structured interviews with different sports associations.

Right from the outset, the approach enabled an open collaboration amongst a variety of actors, reflecting their different perspectives, knowledge, interests, and expectations. In a second, iterative step, we conducted a design workshop together with managers, training group leaders and sport club members to discuss possible scenarios, use cases, technical restrictions, and barriers. Following the pre-study, we applied a two-step approach in terms of data collection: In the first step, we conducted several semi-structured interviews. We emerged themes from the transcript that then served as anchor points for design workshops with the interview partners (Figure 1). After analyzing the data gathered during these interviews and workshops, we condensed a set of design challenges. Based on the initial interviews and internal workshops, the idea of a cooperative and competitive AR-Setup with various features evolved, which was then introduced to the sports associations and their members in the joint design workshop. All researchers participated in three sets of internal design workshops with different foci in which we developed the technical, organizational and social framework.

Participants and Data Analysis

The study included overall 11 participants from sport associations with different backgrounds (see table 1 for an overview) and 9 members of the research and development team. We conducted the interviews and the design-workshop by using Zoom, since the pandemic situation would not allow personal contacts during this time.

Table 1: Participant Overview

ID	Participant	Role	Institution
1	Mr. S	Project Manager	Local Umbrella Organisation <Name>
2	Mr. R	Regional Coordinator	Local Umbrella Organisation <Name>
3	Mr. B	Manager	Sports Association <Name> with > 50 members
4	Ms. S	Manager & Training Group Leader	Sports Association <Name> with > 500 members
6	Mr. G	Manager & Training Group Leader	Sports Association with > 450 members
7	Ms. K	Sports club member	Sports Association with > 450 members
8	Mr. D	Manager	Sports Association with > 200 members
9	Mr. R	Sports club member	Sports Assocation with > 200 members
10	Mr. F	Manager	Sports Assocation with > 80 members
11	Mr. B	Sports club member	Sports Assocation with > 80 members
12	Mr. U	Researcher in HCI	University of <Name>
13	Ms. J	Researcher in HCI	University of <Name>
14	Mr. C	Researcher in HCI	University of <Name>
15	Mr. F	Researcher in HCI	University of <Name>
16	Mr. A	Researcher in HCI	University of <Name>
17	Mr. P	Co-Founder	Sports Equipment Company <Name>
18	Mr. T	Co-Founder	Creative Management Solutions Company <Name>
19	Ms. M	Researcher and Project Manager	Creative Management Solutions Company <Name>
20	Mr. M	Researcher in Sport Science	Technical University of <Name>

The qualitative data consisted of audio recordings and field notes collected during the interviews and workshops. Our data analysis was performed using a Thematic Analysis (TA) approach [5]. This involves a series of established steps, including open coding of the data material, systematic revision of the coded segments, and identification of code families and their relationships in the search for themes [10]. After the transcription of the interviews, the transcripts were reviewed and coded in an iterative process leading to the compilation of the data categories present in the collected data and to the elaboration of relationships between these categories. In this analysis, we used a combination of bottom-up and top-down approaches to coding, which is very characteristic of TA. We started with the top-down approach by looking for excerpts that would fit the a priori codes we had developed. These were based on the interview guides used for the semi-structured interviews. We identified the following principal themes during the coding sessions: individual adaptability; social aspects; and technical requirements. These overarching themes were derived from our original codes, which included terms such as motivation, interaction, participation, engagement, movement, etc. Coding differences were discussed and eliminated by adding, editing, or deleting codes according to the outcome of the discussion.

Preliminary Findings

Individual and Institutional Customizability

The conducted interviews showed that there is a rising importance of digitalization within sports associations. Mr. D, the manager of the senior hiking sports association, explained: "*The tendency of digitalization has to happen within the next years. It is essential for sports clubs to keep their members and offer something attractive*". Similarly, Mr. B, the manager of a sports association founded in 2017, stated that additionally to the regular training practices, they "*want to achieve a digital regularity*". The most common reason for digitalization amongst the interviewees was the facilitation of data collection and thus training optimization and analysis. Most of the "*athletes that are to some extent ambitious already use sports watches*" described Ms. S, the manager and training group leader of a sports association with 500 members. Mr. G, a manager and training group leader of a sports association with 450 members, described how the athletes are mostly more digitally involved than he is when it comes to collecting data: "*Almost all of them have sports watches now. When they are done with their training, their watches show their timing. They tell me what the watch says, and I note them into my chart by hand*". Furthermore, Mr. G wished for a possibility to immediately transfer the athletes' data to his technical device and continued to express: "*It would be sensational if I could immediately analyze their data and my feedback in return would be instantaneous and always accessible*". The use of technology was not only perceived as convenient for the sports group trainers but also for the athletes themselves. As Mr. G ideated:

"*If the performance-driven athletes could see their development within the last weeks. What kind of training was beneficial or what do I still need to improve? Where are my weaknesses? Where are my strengths? And to be able to analyze that and compare it to another athlete that might have similar abilities*".

Besides the facilitation of training analysis, Mr. B emphasized the possibility of using that data to create individualized training offers through "*an app, based on the scope of previous training*". During the workshop, one participant suggested using your own data for a "*virtual race against the own personal best*". Ms. K, who is a sports club member herself, pointed out the recent importance of collecting data for the sake of sharing it online: "*If you did not record and upload an activity, it does not count*".

During the interviews and the workshop, the participants were asked to name what they consider to be the most essential functions and technical requirements of sports wearables. Mr. G emphasized the importance of "*a stopwatch to measure lap times*". Ms. S mentioned the importance of a "*route map*" and further explained, "*it is essential to explore new routes or retrace them*". During the workshop, one

participant stated: "*The wearable should convey some kind of diagnosis or motivation without the necessity to look on my watch*".

Social Connectedness and Motivational Aspects

The manager of a triathlon sports club, Mr. B, stated during the interview that "*feedback received through technology might be motivating but it is not essential*". Referring to digital sports watches used by members, he concluded: "*If you improved, you'll immediately get feedback on your watch. That can definitely motivate but to be honest, when looking at the whole season, the most motivating part is the competitions*".

The competitions turned out to be the most prominent factor in all the interviews we conducted. Mr. B mentioned in the initial interview, "*I know that the athletes miss one thing most during the pandemic: The competitions*". Due to the COVID-19 pandemic, training and competitions no longer took place, leading to interviewees pointing out how the athletes miss training and competing with all its long-term individual and social preparations and implications). During our Co-Design Workshop, one training group leader stated: "*In times where the direct comparison is not possible, the digital one is even more important*". Similarly, it was mentioned by Mr. G that the "*community that wants to compare themselves is very big*". Competitions were described as not only being motivating because of wanting to win but also the social component, "*to be together and talk about the great competition afterwards"* as argued by Mr. B. Other factors mentioned were the involved playfulness and related motivational aspects. For example, Ms. S mentioned, "*I always say: Adults turn into children when involved in activities that include competition*", and that in terms of group dynamics and competitions, "*everyone automatically wants to be a part of it*".

As seen in the foregoing statements, competitions were identified as an essential motivator for most athletes. Yet, not only for the reason of competing. It turns out to be of similar importance to cooperate as a team as well as to experience the competition together. As Ms. S, the manager of a sports club with approx. 500 members stated: "*Most members are in the sports club because they want social connection*". The social connection includes both the connection to other members as well as their connection to the trainers. As one manager pointed out: "*We realized that we have to keep in contact or else our members will leave*". The interviewees emphasized the importance of integrating a social component into sports technology. During our workshop, we explored several other scenarios that technology could achieve with the participants. One workshop attendant ideated: "*It would be great to compete in a race as a team, so that everyone is wearing augmented glasses and can see where everyone else is*". Another interviewee

suggested the following scenario: "*If you could meet together virtually, 2 pm Saturday, us three will meet for running, maybe two will take the bicycle, five are hiking with their parents, but all together. Having digital groups that can meet*". Another suggestion was to create a social sports platform that allows people to "*create small challenges, for example jumping across three rocks, and if you complete other people's challenges, you'll get an achievement*".

Design Concept and Outlook

Based on the empirical findings from the conducted interviews and the design workshop, several design challenges and scenarios were identified, which are the basis for the concept of the overall system. This illustrates how the overarching framework, scenario and technical infrastructure evolved and was developed. As stated, the participants considered it important that the data during the sporting activities are tracked and that feedback can also be derived from this in various dimensions (sports-related, but also health-related). Here it is important to provide different views on the same data as athletes and sports group trainers have different use cases; while the athlete wants to improve their time or keep track of the oxygen saturation and heart rate, the trainer can use the data to create individual training recommendations and keep track of the progress.

Another important element for the interview partners was the social component. Especially during the pandemic, training in groups was limited and smaller and larger competitions were completely canceled. Therefore, it was emphasized repeatedly that training together but also competing against each other must become an important part of the system. ICT can support this by providing different modes of cooperation or competition: by using a combination of different technologies the users can work out alone or use different features to do sports together or against each other. Based on this feedback, we have tried to develop scenarios on how the system can support multi-user activities. In the following we will focus on a scenario, where two groups consisting of two users are competing with each other.

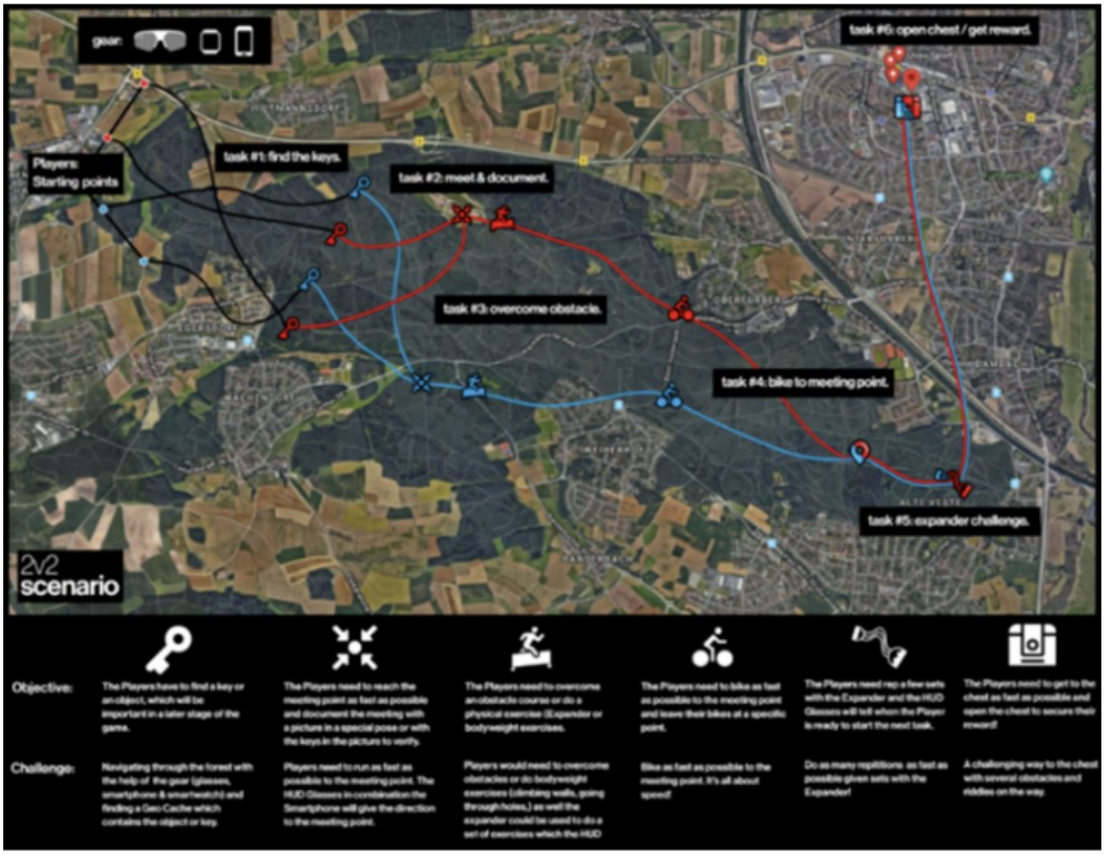

Figure 2: 2 vs. 2 Game mode

There are a lot of possibilities on how to organize a collaborative or competitive scenario in outdoor group interactions with Augmented-Reality solutions. We decided to combine both the collaborative and competitive elements which can be used in many different variations in a 2 vs. 2 example (see Figure 2). The displayed movements of the one team are colored in red and these of the others in blue. This specific scenario is divided into 6 tasks. Each task is important for the final task which will be to find and unlock the chest with a key or a digital code to get the reward. 1).

The players will start by foot at the same time and their first task will be to find the “keys” as fast as possible to then further proceed in the process of finding the chest. With the help of the technical equipment (AR glasses, smartphone & smartwatch) the players need to navigate through the forest and find a geocache that contains the object or key. 2)

The next task will be to get to the meeting point, where the team members of each team will meet, and must “verify” by documenting themselves with a picture in a special pose or scanning each other’s devices.

3) This task will be a physical task where both team members with the help of each other need to special tasks that can be defined by themselves or their trainer.

After reaching the final point of task three, the teams will get the next information for the upcoming task. After the physical exercise, the players need to reach a point where they can grab a bike and need to reach the next point as fast as possible.

4) Reaching the Expander Challenge, the players leave their bikes and are required to do a few sets with an Expander which is connected to the AR glasses. After finishing a specific amount of sets the system will inform the teams that they can proceed to the next and final task.

5) On the final task the teams will need to cross a course of obstacles filled with physical or cognitive exercises and games which need to be solved to get to the reward.

6) Finally, the chest can be opened with the key or key fragments which the teams obtained by finishing the different tasks on their way.

Discussion and Conclusion

To conclude, our work combines an early user integration by the different conducted participatory approaches and a simultaneously developed multi-user and multi-device AR-technology with the aim to promote PA and health from a long-term perspective. Our qualitative inquiry revealed that digital technologies are becoming more and more important in traditional sports clubs, from an athlete-, trainer- as well as management staff perspective. However, many study participants are not well informed on how to best implement such technologies into the regular training process and asked for further advice and guidance. Communication, social collaboration, as well as competition have been identified as the most important features of successful sport club activities. Future research and development in digital technologies should encompass these aspects to be able to create a successful appropriation and to fulfill user needs and expectations. With our qualitative approach, we do not aim to generalize our findings to a broader population but to elaborate deep insights into users' needs and specific circumstances.

Furthermore, due to the COVID-19 pandemic, we were not yet able to perform user tests in real-world environments so far. Therefore, in the upcoming work of our research project, we aim to implement a practice-based research and development approach to further evaluate the potential of the new multimodal, inclusive interaction techniques and collaborative AR environments in sport- and exercise-related contexts. For this purpose, the innovative AR-supported exercise concept based on a "Trim-Trail" will be further developed, implemented, and evaluated to offer natural, effective and uncomplicated green exercise opportunities, training exercises and methods for all genders, ages and fitness levels.

The project is intended to be used as a variety of assessments and method of measures to promote an active lifestyle and at the same time build a bridge to social life (club, association, city, and community) in a local but also supra-regional context. Based on an immersive and multi-user capable AR-technology, an innovative, individualizable opportunity of movement and cognitive training for the purpose of health promotion will hence be created. These multi-user sports- and exercise-related applications to be developed will be researched with regard to their suitability for everyday use and user acceptance of AR-systems as well as their individual physiological and social-emotional effects and evaluated in a proof-of-concept.

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Introduction and adaptation of an urban neighborhood platform for rural areas

David Struzek, Dennis Kirschsieper, Claudia Müller
University of Siegen, Germany
david.struzek@uni-siegen.de, dennis.kirschsieper@uni-siegen.de, claudia.mueller@uni-siegen.de

Abstract Various digital tools can be used to strengthen neighborhoods. This paper reports on a publicly funded participatory cross-sectional project in six German villages. In order to fulfill requirements of the villages, which were identified in citizen workshops together with local stakeholders, a selection procedure was carried out and the decision was made to use an already existing and known neighborhood platform. We demonstrate the challenges posed by the fact that the platform was not actually designed for the specific requirements of rural villages, but for larger cities or urban areas, so that various processes of adaptation and implementation had to be carried out. We reflect trade-offs and negotiations between research-led and community-oriented demands in the introduction and adaptation phase of the neighborhood platform in respect to usage motivations and roles of local stakeholder groups.

Introduction

In Germany, 90% of citizens live in rural areas, which face major challenges in terms of public services of general interest such as mobility, healthcare, commerce and availability of Internet access, which will increase in the future (European Network for Rural Development 2017, Löfving et al. 2021). Germany suffers particularly from the unfortunate combination of demographic change, slow digitization processes in rural regions and a corresponding lack of digitized services. Particularly problematic are dwindling social and family networks due to the migration of younger rural residents for professional reasons and the dismantling of public infrastructures for mobility and health and care needs. As medium-term solutions, the government is currently promoting local community-building interventions such as digitally-enabled neighborhood assistance and applications to strengthen social interaction, especially for the older population. In this paper, we refer to a research project funded by the German Federal Ministry of Agriculture and Food to explore and test digital and innovative solutions to support people in rural areas. During the three-year project period (2017-2020), digital and innovative everyday solutions were to be developed with the help of various participation processes (citizen workshop, focus groups). In this context, digitization was specifically understood and used as a tool to address several concerns at the same time. These include supporting organizational structures, relieving the workload of volunteers, and creating additional levels of communication to overcome distances. We report on the selection, introduction and implementation process of the standardized neighborhood platform nebenan.de and reflect on the associated challenges and opportunities of the project based on action research methods.

Related Work

The research to date basically indicates that neighborhood platforms, like other social networking platforms, enable social interactions to be decoupled from space and time, but on the other hand they re-establish a link to local social structures and local voluntary commitment (Masden et al. 2014, Kappes & Vollmann 2020, Kurtenbach et al. 2021). Moreover, they are not designed for interaction and communication to remain purely digital, but also to provide information about local events of encounter and for people to arrange physical meetings. In this sense, one can speak of “hybrid networks” (Schreiber et al. 2017) or “socio-digital neighborhoods” (Biniok et al. 2019).

However, these are very general insights, while our question is how such a platform can be successfully implemented in an existing neighborhood in the first place, so that people actually accept and use it. Vogel et al. (2020) developed a taxonomy of online neighborhood social networks and concluded that these networks are “socio-technical artifacts" where successful implementation in a neighborhood does not only depend on their technical functionality, but also on how they are embedded into the sociocultural context. Even more relevant are the works

of Renyi et al. (2022). From 2018-2021, they studied a project to introduce neighborhood platforms in 14 neighborhoods in Germany, Switzerland, and Austria. In the process, they encountered several challenges. First of all, the platform has to be publicized so that people know it exists. Awareness strategies and marketing measures must be applied and implemented. Furthermore, interesting content must be generated. In all of this, it is important to remember that there are different stakeholders with different interests and perspectives, and these often come into conflict with each other. As a main result, they say that they have learned three lessons, namely that digitization projects must fit into the overall strategy of the neighborhood development and must be driven by a committed (group of) responsible(s), secondly that choosing a technology is not a linear process and takes time, and finally that a high benefit is only achieved when many people actually use the platform. While Renyi and colleagues' study both urban and rural neighborhoods, they do not focus on the specific challenges of the latter. This is precisely where our study comes in and aims to make a further contribution.

Research Setting and Selection of the Platform

To meet the requirements of the funding program, the project sponsor imposed both rural and technical requirements on the village structures. Since the district consists of 53 villages, two selection procedures were carried out. In the first step, all localities were examined according to the number of inhabitants and geographical location, i.e. also Internet connection. In the second step, qualitative measures were carried out. So intensive discussions followed with the regional management of the region, the mayors as well as with the respective local chiefs and chairmen of the municipal associations of the remaining localities about the activities of the last years in the respective village communities. Thus, the choice initially fell on three potential villages A (500 inhabitants), B (860 inhabitants) and C (1360 inhabitants).

In order to identify regional needs and develop digital measures, citizen workshops were held in the respective model villages at the beginning of the project. Up to 30 citizens (16-75 years old) took part and worked in groups on the topics of village identification and tourism, mobility and services of general interest, organization and neighborhood, communication and village culture, and cross-cutting issues. An additional level of communication was a particular focus of the discussions and workshops. In this way, the topic of a digital communication platform crystallized as a cross-sectional topic. But the functions named for this level varied from digital bulletin board (information) to feedback and appointment tool (communication/organization). In addition, functions were named that were internally important for the respective village, but also cross-village, regional topics. Based on these requirements, the research team conducted intensive research and interviews with platform operators and users, resulting in the identification of 14 platforms. The idea to develop an own and cross-village platform or mobile application was quickly discarded. On the one hand, the own resources for the development of

a stable and above all technically usable solution were not sufficient. Both on financial, time and personnel level. On the other hand, and most importantly, due to the strong interest of the villages in a long-term and sustainable digital solution. This can be greatly simplified by an already externally developed and established platform, especially since it can be used directly.

As a result, both national and international platforms were selected and categorized according to the operators, the amount of transparent information, the promotion and funding, and the goal of the platform. Based on the requirements and collected information, five digital platforms could be narrowed down. The five platforms were compared and weighed based on the criteria of data storage, funding and costs for users, clear name function, registration options, categories and structure, and visibility. In the end, the platforms could be reduced to two. On the one hand, the neighborhood platform nebenan.de, which has been running since 2015 and has built up its own financing models, and on the other hand, the platform DorfFunk, which was developed by the Fraunhofer Institute IESE within the research project Digital Villages. Due to its reference to rural areas, the platform DorfFunk, which has been launched since 2018, proved to be a more suitable choice, as it aims to investigate the challenges of contemporary life in rural regions in relation to digitalization. However, due to the fact that funding after the end of the project was not yet secured at that time, nebenan.de with its experience, Germany-wide structures and constant further developments proved to be a suitable digital village platform for the project. The continuation after the end of the project is thus guaranteed, a central concern of both the project management and the users in the villages. However, it was already foreseeable that there would be some challenges in adapting it, as the platform was primarily developed for urban contexts. Nevertheless, there are no costs for development, maintenance and upkeep of the platform. It is ad-free, free for private users, and meets the highest data protection standards. Until October 2018, the platform had barely been able to gain a foothold in rural areas, so there was interest on the part of nebenan.de in cooperating with the project, as it was seen as a "door opener" for opening up rural areas. According to the platform operators, the reasons why nebenan.de has difficulties spreading in rural areas are: a low population density, so that the critical mass for an active platform is often not reached. To counter the problem of the low population density of the common model villages A, B and C of approx. 2,720 inhabitants, discussions were therefore held in advance with neighboring villages D (800 inhabitants), E (300 inhabitants) and F (1,100 inhabitants). The goal was to preserve and expand a geographically contiguous village setting for this potential cross-cutting project. After weighing the pros and cons with the village leaders, it was agreed to use nebenan.de for the project. This allowed a total population of 5,000 to be reached. The biggest concern of the communities was the excessive demands of implementing another communication channel, which could only be overcome with the support of the University of Siegen and the platform itself. So it was assumed that the introduction of a platform could only be done in close cooperation with the villages using methods of participation and action research.

Methodology

From the selection of the model villages to the introduction and appropriation of the neighborhood platform, various methods and approaches were pursued that can be assigned to action research. In addition to conducting citizen workshops and pre- and post-dialogs with responsible parties, the research team offered open technology workshops that were accompanied by further information campaigns. Especially when it comes to working with local stakeholders and identifying needs, because action research is explicitly democratic, collaborative, and interdisciplinary (Hayes 2011). Through participatory decisions about the appropriate platform, as well as its acceptance and adaptation, action research took place, according to Feldman, because villagers first had to explore and understand their own practices and then develop them further (Feldman & Minstrell 2000). Similarly, action research can be seen in the development and implementation of the different and adapted technology ideas, because according to Hayes, action research focuses on highly contextualized and localized solutions with an emphasis on transferability (Hayes 2011). For this reason, so-called "citizen workshops" were conducted at the beginning of the project, which fulfilled several objectives in the villages. In addition to identifying wants and needs for developing digital solutions, they served to establish initial contacts and introduce the project and the team to all citizens present. A citizens' workshop is a participatory process for citizens of a city and serves to develop and discuss common goals and visions. (Street 1997, Slocum 2003)

The invitation to these workshops was made by the local chief and the local associations. To support discussion and idea generation among the participants in the group, the topics and expressed contents were collected using the brainstorming method according to Osborn (1953). The top themes were pinned by the research team in advance, and all participants then had the opportunity to express their thoughts on each theme. The themes were clustered, sorted, and prioritized. For ease of reference, the citizen workshops were photographed and recorded. In addition to the citizen workshops, the project held focus group meetings, but these consisted of only selected stakeholders (village leaders and association chairs), the research team, and other gatekeepers (e.g., person in charge of the village hall, treasurer). In these, the implementation possibilities of the ideas and needs were discussed and decided on the basis of the citizens' workshop. The focus groups were thus understood as "[...] a participatory instrument, i.e., for the involvement of citizens in social and political decisions [...]" (Schulz 2012:11). The focus groups were recorded.

For the technical introduction of the nebenan.de platform, open user cafés or technology workshops were conducted, which can be understood as experience-based participatory design workshops. The experiential participatory design workshops essentially aim to bridge the gap between people's actual practices in their everyday lives and the digital platform's imagination

for meaningful technology support, i.e., to create a shared thinking space of future possibilities for using the platform, but also for further wishes and requirements (Müller et al. 2015).

The offer was addressed to all villagers and people interested in technology, the main goal was to promote the enjoyment of the platform, but also the understanding of being able to influence something about the project, e.g. design issues or features on the platform, by participating in the workshops. In addition to the technology and platform introduction, groups for technology issues were set up on the nebenan.de platform. To promote cross-village communication and increase the chance of getting a question answered, a cross-village technology group was also set up. This was intended to help people help themselves. The workshops were recorded, protocolized, and in some cases photographed with the consent of the participants.

Measures for the introduction and implementation of the platform

After the decision was made to use the existing nebenan.de service on the basis of the requirements analysis from the first public events and the discussions with the local leaders, an implementation concept was developed in planning discussions with the operators. These were adapted to the regional conditions. The activities for this can be arranged on three levels. On the first level are activities with all responsible people from the villages, who can be seen as trusted multipliers and door openers. On the second level, activities with the respective villagers are described to introduce and launch the platform. These include 1. information campaigns, 2. an online quiz and contest, and 3. open technology workshops. The third level refers to the adaptations of the platform based on the experiences and results of the 1st and 2nd level.

Information campaigns

In cooperation with nebenan.de, a "Your Village" campaign was carried out in all participating villages at the turn of the year 2018/19 to launch the platform, with each village using its own communication channels.

The campaign was accompanied by articles in the local newspapers with subsequent reporting and information events in the villages. One specific communication channel that could be used was the general meetings of the local associations, which take place annually at the beginning of the year. At these general meetings, the village leaders and the local associations intensively promoted nebenan.de. In addition to the meetings and newspaper articles, the local leaders distributed postcards with information and invitations to nebenan.de to all households. The campaign resulted in registration numbers in Q1 2019 that far exceeded expectations. A second campaign was launched in the villages in mid-November 2019, in which postcards were distributed to all households in the model villages via the village leaders.

The design of the postcards in both campaigns included universal invitation codes to keep barriers to entry as low as possible. These codes, generated by nebenan.de, enabled registration without address verification via ID card. In order to minimize residents' fears of trust, the postcards were written and signed in the name of the local chiefs in agreement with them.

Online quiz and contest

The company nebenan.de maintains a foundation that organizes the "Day of the Neighborhood" annually and throughout Germany with high-profile activities. In 2019, this day, May 25, was also used for the activities of the research project. The project team developed an online quiz to use this day for public relations. For this purpose, a platform was created using the online survey software LimeSurvey, on which questions about the local conditions of the individual villages were posted. These were, for example, photos, local idioms and dialect forms of terms, or specific knowledge questions about the individual villages. This content had been developed in advance with the local workshop groups. The quiz, i.e. the LimeSurvey application, was open for participation for four weeks, from May 1 to May 25. The intention behind it was to find a low-threshold access to bring the individual villages into exchange with each other, to make knowledge about each other visible and discussable. And all of this was done in a humorous and playful way in order to make the nebenan.de platform more widely known.

This online approach was also linked to a special celebration in a village on the day itself, the "Neighborhood Day". The inauguration of a new fire station took place, during which the quiz could also be completed on the day itself as a print version. More than 600 visitors took part in the fire department festival, which was again a good opportunity for the information campaign for nebenan.de. The cross-village winners were

Open technology workshops

In the citizen workshops, the desire was quickly expressed not to exclude older residents who have little familiarity with digital media, but to develop inclusive measures to help them use smartphones and Internet applications. In the period from July to December 2019, the project team organized six meetings in two villages, so-called "technology cafés", which were open to all participating villagers, where coffee, tea and cake were served and conversations could be held around the use of smartphones and tablet PCs. These technology cafés were held in village community centers. When asked about the motivation to attend the first workshop, one participant cited her children as the reason, "If you ask the kids [...] you don't get it explained," and another participant cited caution and concern as the motivation, "I have a smartphone, a tablet, a cell phone [.... I go on the Internet [...] But I ask my wife how to download something [...] I don't know either because of privacy [...] there is so much text [...] so I would like to learn how to download something."

The number of participants varied at each meeting, usually around 10 participants. Typical topics were that people were looking for help with using various apps on their smartphones and tablets, but also, most importantly, support needs and start-up help with registering on the nebenan.de platform. Information about the meeting was also organized in a nebenan.de channel "Digital help for all" to enable exchange between participants and local volunteers who want to support the digital "beginners". In addition, some had a guilty conscience because the researchers each had a long journey (> 1 hour by car) and they found it morally reprehensible that the researchers could come for free. Phrases like "now you drove all the way and the others didn't come" were often said.

To maintain this support structure for digital skills over the model period, solutions were developed in the open technology workshops. In particular, networking with younger digital "professionals" was found to be helpful.

However, the idea of involving youth organizations did not work initially. Therefore, the researchers organized three more appointments for which other stakeholders were approached who might be interested in supporting the older residents. Eventually, two local supporters interested in technology (a former teacher and an IT specialist) already came forward, but the format did not work in the long run, as fewer and fewer participants came from the older adults as well, and the looming pandemic situation did not allow for more meetings.

Adaptations of an originally urban platform for rural areas

Definition of the village boundaries technology-wise

Since a district on nebenan.de can assume a certain radius of different streets, a village was defined as a municipality in consultation with nebenan.de, which is seen as a neighborhood in the city. For each village and municipality, the corresponding postal code was added, which applies based on certain defined boundaries. For this, the staff of nebenan.de used Google Maps as a geographical basis. Which is a standardized procedure. When the boundaries were presented, supporters of the team, who were also villagers, were not pleased with this procedure, as certain village boundaries are historically attributed to other communities regardless of geographic location. In the workshops, participants confirmed this case when they saw that their village belonged to a different zip code, which contradicted their perception of the villages' historically established boundaries. Technical limitations did not allow for further changes to represent the historically evolved boundaries.

Personalization of the start page

During the citizen workshops, it became clear that the local connection of the villagers plays an important role. With the introduction of the platform, this became clear once again. Thus, the desire arose to have one's own village presented in its exact boundaries, to present the most important news and dates on one page. Both for local villagers and for external visitors. On the one hand the community and the history are better represented, on the other hand also non-

members are to be motivated to participate by the regional reference. But also former villagers who have moved away and could thus stay in touch with village events are to be addressed. Thus, individual start pages were created, which is otherwise rather unusual for the platform. These location-based start pages were installed in such a way that they can be accessed before registration and entering one's own zip code.

Fostering networking between villages

In addition to the strong focus on interactions within the villages, in addition to an intra-village technical group on the platform, an inter-village group was set up for all project participants to support exchanges between the six villages. This channel was primarily used by all who interacted with the researchers in the citizen workshops and internet cafes. The group should be seen as an accumulation of various questions about the platform and technology that can be used across villages. Here, conversations for further discussion took place between the regular on-site workshops. In the longer term, these issues developed in the workshops and presented on the platform served as "tickets to talk about" (Svensson & Sokoler 2008) to bring people together across villages who would likely not have otherwise come into contact with each other.

High initial registration figures and declining usage figures

Due to the above-mentioned publicity campaigns with strong commitment from central local gatekeepers such as the village presidents and chairpersons of local village associations, the initial registration numbers were very high, so that one could speak of a critical mass in the metrics of the nebenan.de staff. For example, in the first twelve weeks of the introduction, the registration numbers were around 500 participants. This accounted for 30% of the households within the six villages. These registration figures are more than double those of the top 15 towns on nebenan.de, where the figures are between 4% and 14%. The research team was initially very pleased with the high registration numbers. On the one hand, because this exceeded the company requirements of "critical mass", but also against the background of the funding project and the perceived obligation to be able to communicate good figures to the funding body, which supposedly show a high level of acceptance. However, the usage figures measured in terms of entries on the platform show a different picture. Over 14 months of observation, a total of 250 entries were counted. Compared to the high number of registrations, this number seems quite low over the period of more than a year.

Discussion

For more large-scale considerations of digital infrastructures such as neighborhood platforms, it is natural to consider quantitative metrics. However, our example shows that it is worthwhile looking at appropriation practices as situated collaborative practices. With a

praxeological approach, based on an understanding of cooperation as the "*mutual making of common goals, means and processes*" (Schüttpelz, 2017:24) gives visibility to the multifold qualitative, generative and discursive aspects which make up the local fabric.

Roles and relationships in the local fabric

An important factor for the initial interest of many residents is the high recognition they give to the commitment of the village presidents. Many of them registered for the portal because they wanted to do these highly committed people a favour, as a kind of quid pro quo for their commitment. However, this also shows the duplication of roles and attributes of the social practices in the platform: the association presidents also have prominent roles and are thus mainly responsible for communication and information of the members within the associations. There was apparently an interest among some to maintain this structure and not to minimise their prominent role through their own contributions. It also shows that digital literacy plays an important role and, in the case mentioned, prevents a woman who does a lot of association work in her everyday life from seeing the portal as a communication platform because digital use is far from her mind. Despite the support and the learning environment in the technology cafés, more steps would probably be necessary for her to see meaning in the use of the portal for her association work. There is also a certain relevance in the relationship between participants and researchers as a motive for participation. But it is not sustainable because it is not intrinsically based. For this, more time and space would be needed for the joint exploration of local people and researchers of possible spaces for future uses of technology. This is similar to the findings of Ekeland et al. (2012), who show that "parachuting in" technology cannot be completely satisfying, especially when working with people who are not very tech-savvy.

Trade-offs: research-led vs. community-led

We have identified a key trade-off that involves both elements, technology-orientation and community-orientation. The example also shows challenges that are often visible in IT research projects that adopt participatory and action research methods. Action research is essentially oriented towards the local community, its needs, wishes and interests (Hayes 2011). In retrospect, one would have to ask here, what alternatives would there be to the platform for promoting social interaction within and between villages? A "pure" action research approach would have put the technology on the back burner for the time being and focus on the social processes in the first step.

The immediate appearance of the platform idea was due on the one hand to the specific funding format. But also due to the strong motivation of the village presidents, i.e. a specific stakeholder group. As long as this group of people was very active, they were able to exert their strong influence and interest their residents in the overall project and in the platform. But this level of motivation did not last long. In retrospect, we have to say that the balance between

"research-led" and "community-led" approaches was often not so well balanced. With the decision for the nebenan.de platform, the focus was then strongly on quantitative metrics, for which some actions were also carried out quite successfully. However, qualitative aspects such as learning spaces, the creation of meaning and the formation of new practices, co-design in the sense of the further development of roles and practices, and the processes of initiation were not sufficiently taken into account.

The CSCW literature on technology appropriation in general (e.g. Pipek & Wulf 2009) and specifically on the appropriation of older, non-technology-savvy people shows the importance of learning spaces or "meta spaces" in which different stakeholder groups jointly and discursively construct mental spaces of possibility. Spaces in which sense-making of possible novel digital practices can be practised and reflected upon (Cerna & Müller 2020, Meurer et al. 2018). In an ideal world, projects should be designed in this way, but unfortunately this is not always possible.

Portal usage motivations and activities on the platform

We attribute the high initial registration numbers to the strong commitment of local key persons. At the beginning, the village presidents and some association leaders were very present in the public events and in the subsequent citizen workshops.

In addition to their strong presence at the events, the village presidents also sent out the invitations to all households on their behalf. The key people seemed to enjoy extremely strong trust on the part of the population. This is evident from the fact that the participants in the citizen workshops as well as in the technology cafés did not question the platform itself. But, there was one person with an IT privacy background who initially had privacy and data protection concerns, but these dissipated over time. This was expressed during an introductory event, which also seemed important to him. The usefulness of the platform was hardly mentioned or questioned, but rather the desire to receive assistance with registration was expressed. If one looks at the individual categories of use and the related posts on the platform, it becomes apparent that predominantly rather official event announcements and association-related information were posted. Much fewer posts, as previously hoped, in other categories around neighbor help or marketplace with more personal content were posted. One reason could be that participants in the Technology Café meetings reported that they like to watch, but never post themselves. For the most part, only the same people would post contributions, for example the chairpersons of the local associations.

But there were also role differentiations among the committed people of the association. For example, a woman at a technology café meeting said that she could well imagine using the platform for her association work. However, there would have to be someone who would post the content first. She would not trust herself to do that, "even if everyone uses it, someone has to post the content, someone has to take responsibility ... I would do it, but I don't know how".

Conclusion

Digital approaches for the promotion of social interaction and social participation in rural areas are increasingly in the focus of funding initiatives, especially in order not to leave older rural residents behind and to use digital platforms as an element to secure their services of general interest.

This is often done with good intentions on the part of funding agencies, researchers and the central gatekeepers and decision-makers in rural regions. However, we see major challenges in bringing technology to regions with a low number of residents and diversity in terms of age groups, interests, digital literacy and desire to volunteer locally.

Especially if the technology is to be used sustainably and acceptance depends heavily on achieving critical mass in a given time window.

Mostly, trade-offs arise between the element of a more technology-led approach, which is to be coupled with participatory and action research approaches. This trade-off is usually present, but oftentimes not made visible. We find it important to make this trade-off visible and to look more closely at the practices, motivations, roles and relationships of and between different actors, especially when it comes to bringing different communities together through digital solutions. Despite the various challenges (such as reaching critical mass, communicating across villages, building participatory sustainable strategies, adapting the platform), the platform was successfully established within the villages and is still being used today. Nevertheless, even though the technology is already ready for use, the time for a trustworthy introduction must not be forgotten, especially since each village and community must be seen individually.

We therefore appeal to researchers in future projects to recognize these conflicts at an early stage and to initiate a participatory and sustainable implementation process from the very beginning.

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Cultural Design Compass: Who Do You Design For?

Laura Stojko
Universität der Bundeswehr München
laura.stojko@unibw.de

Abstract. The cultural background of our users and its impact on using technology as well as the cultural background of the developers and its influence on design decisions, is often not considered in research. This paper demonstrates how to self-assess previously derived design recommendations regarding cultural preferences and how to discover potential for improvement. Therefore, 52 design recommendations for large public displays were assigned to cultural dimensions of Hofstede. They were derived by our research group within the last 4 years. As a result, a cultural design compass was developed, visualizing the distribution of design recommendations across the cultural dimensions and indicating areas of focus (e.g. high uncertainty avoidance). The distribution of design recommendations among the cultural dimensions almost completely coincide with Hofstede's cultural dimension indices for the German culture, showing that there is a high chance to subconsciously derive design recommendations based on our own cultural imprint. In addition, the compass can be used to incorporate cultural indices of other user groups and nationalities to identify design aspects that need improvement. Consequently, without having in mind that cultural preferences and differences exist, the design may not fit users with different cultural backgrounds. The cultural design compass should support future research within human-computer- interaction to design more precisely for a particular user group, to better classify design recommendations, and to verify whether they match the required users' cultural preferences.

Introduction

Culture is an important aspect, not only when it comes to the usage of technological artifacts but also during its design phase. As stated in research, which covers the user interface designers' collaboration with (Solanki and Heimgärtner, 2013) and understanding for users (Heimgärtner et al., 2011), we should be more aware of the impact culture can have on the design decisions we make as it could lead to subconsciously inappropriate design which may affect usability. Even in our research group, the aspect of culture and its impact has not been actively considered when analyzing design for large public displays and deriving recommendations. Due to that, I developed the cultural design compass as visualization for self-assessing design decisions. For this purpose, I analyzed our 52 design recommendations for large public displays to identify whether we designed for users from the same nation (Germany) or others. With this result, we can identify improvement potentials, when we want to design for another user group as design recommendations that may be suitable for our environment here, may be challenging or disrupting other user groups with other divergent cultural backgrounds. For this reason, it is important to consider the subconscious cultural aspects that influence our decisions. Consequently, we should identify whether and how our design must adapt to our user groups' cultures already in design phase. Therefore, this paper will focus on the research questions "How can we review our design decisions in terms of cultural preferences and ensure that the cultural preferences of our user group are taken into account?"

Firstly, the related work section presents existing research for intercultural usability, cultural design, and cultural dimensions. Secondly, the methodology describes the development of the cultural design compass, before it is presented and analyzed. Finally, a short conclusion and outlook is provided.

Related Work

This section begins with a summary of related work for intercultural usability and cultural designs. The second part introduces cultural dimensions and describes the concept of Hofstede, which are fundamental for this work, in detail.

Intercultural Usability and Cultural Design

Many research can be found describing the influence of culture on how people **use** technology. For example, looking at research for (inter)cultural usability of digital artifacts, many findings were reported regarding web design (Alexander et al., 2017; Barber and Badre, 1998; Beck, 2010; Salgado et al., 2016) and desktop applications (Santoso and Schrepp, 2019). More insights have been identified for the intercultural usability of mobile applications by Walsh et al. (2010), grid computing applications by Rusu et al. (2010), automotive interfaces by

Heimgärtner et al. (2017), and even whether Google standardized symbols increase intercultural usability for a bakery dough sheeter by Papageorgiou et al. (2020).

Furthermore, there are research results concerning the consideration of culture in the design process, which also tries to take into account the influence of the designer's culture on the design. Reinecke and Bernstein (2013) proposes an adaptive web interface for cultural diverse users by considering cultural preferences according to Hofstede's cultural dimensions. Another analysis of university websites regarding cultural preferences for organizational and graphical design has been reported by Callahan (2005). Moreover, Lachner et al. (2018) describes a culturally sensitive Q&A website design. Marcus and Gould (2000) conducted an extensive analysis of websites' cultural design, by analyzing websites elements of different countries and matching them with aspects of Hofstede's cultural dimensions (Hofstede, 1984; Hofstede et al., 2010). The result is a summary of culture influenced user interface aspects for each cultural dimension. Most of this work use Hofstede's cultural dimensions to integrate the cultural aspect into the design process. In addition, this research provides insights about how culture influences the designers' decisions and how researchers try to consider cultural preferences. Nevertheless, a hands-on tool and visualization for self-assessing the own design decisions has not been in the focus of many. The cultural sensitive user interface aspects reported by Marcus and Gould (2000) and their allocation to cultural dimensions for website elements were used as a guide to assign our own 52 design recommendations to the dimensions.

Cultural Dimensions

Looking for a definition of "culture" is a great challenge as many scientists of various field are discussing this term. For this work, the definition by UNESCO is used: "UNESCO defines culture as the set of distinctive spiritual, material, intellectual and emotional features of society or a social group, that encompasses, not only art and literature, but lifestyles, ways of living together, value systems, traditions and beliefs." (UNESCO, 2001)

For a better understanding of cultural aspects, dimensions of cultures can be identified. A cultural dimension is defined as: "an aspect of a culture that can be measured relative to other cultures." (Hofstede et al., 2010, p. 10) Many researchers have identified such cultural dimension, e.g. Hall (1977) or Trompenaars and Hampden-Turner (2008) as well as Hofstede (1984). Hofstede's dimensions are criticized by many. Dimitrov (2014) analyses the framework by Hofstede regarding its application and criticism. He provides an overview of the criticized aspects regarding the cultural dimensions, e.g. the methodological perspective, "national culture" as construct, etc. Though, he also identifies that the cultural dimensions are very popular in academic research, also regarding the analysis of information systems and its design. Therefore, Hofstede's cultural dimensions are used for the categorization of design recommendations of this work. Hofstede has derived his cultural dimensions based on a study with IBM

between 1967 and 1973 (Hofstede, 1984, p. 41). The aim was to learn more about the attitude and values of the employees by two survey iterations. In sum, 116,000 answered questionnaires from 72 countries in 20 languages were collected. Hofstede derived the first four dimensions based on this study: Power distance, individualism, masculinity, and uncertainty avoidance. In the 1980s, the fifth dimension "long-term orientation" was derived in cooperation with Michael Harris Bond of the Chinese University of Hong Kong who conducted a "Chinese Value Survey" (The Chinese Culture Connection, 1987) and encountered this dimension during his study. The last dimension "indulgence" was discovered in cooperation with Michael Minkov, who conducted a World Value Survey, and was finally added to the cultural dimensions of Hofstede (Hofstede et al., 2010, p. 44).

The following section describes Hofstede's dimensions and their indices and meanings for Germany (Hofstede Insights, 2021):

- Power Distance: How does the culture cope with inequalities? Which means, "the extent to which the less powerful members of institutions and organisations within a country expect and accept that power is distributed unequally." (Hofstede Insights, 2021) Germany has a value of 35 in this dimension which indicates a low power distance culture. Equality, collaborative and direct communication is essential in work and private life while control is not appreciated.
- Individualism vs. Collectivism: This dimension describes the degree of interdependence between society members. It is based on their self-image and whether they focus either on "I" or "We". In individualistic cultures, such as Germany with an individualism score of 67, people are focused more on themselves and their direct family (parents-child relationships rather than uncles and aunts). In contrast, people in collectivism cultures belong to and take care of a group and hereby receive loyalty in exchange.
- Masculinity vs. Femininity: This dimension is about the motivation of the society in question: Want to be the best (masculine) or love what you do (feminine). A high value in this dimension describes a masculine culture. This means, that a society is driven by competition, performance, and success based on a value system that is already established in school. On the contrary, in feminine cultures people are more caring for others and the quality of life, which is an indicator for success for them. Germany with a masculinity score of 66 is a rather masculine society as achievements are highly important. Already in school children at the age of ten are separated in different school types. When working, people derive their self-esteem from their work tasks, they are expected to be resolute and persistent and flaunt their status by materials things (e.g. cars, watches, technical devices).
- Uncertainty Avoidance: This dimension is about how cultures deal with unfamiliar and equivocal situations, especially regarding the future. With an uncertainty avoidance index of 65, Germany has a high score. People strongly prefer deductive methods for thinking, presenting, and planning and they avoid uncertainties whenever possible.

- Long-Term vs. Short-Term Orientation: Short term oriented cultures (low index) focus on traditions and norms whereas they are skeptical of societal change. Long-term oriented cultures (high index) are pragmatic and foster modern education and changes that prepare for the future. Germany is a long-term oriented culture with a score of 83. Distinct signals for this value are pragmatic orientation, their belief in the truth depending on situation, context, and time, and their fast adaption of traditions to new conditions. Moreover, they are persistent in achieving results, thrifty, and tend to save and invest their money.
- Indulgence vs. Restraint: This dimension is about how strongly people regulate their cravings and impulses by dint of how they grew up. A relatively strong control is "Restraint", in contrary, a relatively weak control is "Indulgence". A high score in this dimension indicates an indulgent culture, a low score a restrained one. Germany is a restrained culture with a score of 40. This means, Germans tend to be pessimistic and cynical. Moreover, they do not attach much value to leisure time as well as gratification of their cravings. Social norms restrain actions, evidently, they feel uncomfortable when indulging themselves.

Understanding a culture regarding Hofstede's dimensions, needs taking into account that a low or high score does not indicate whether a dimension is more or less important or better or worse. It rather describes the preference of a culture within this dimension. Furthermore, it is important to consider that those indices are supposed to be used for comparing nations' cultural preferences.

Methodology

The overall objective is to provide a tool for researchers and designers for the review of their own designs which enables them to examine where they have been influenced subconsciously by their own culture and whether the design decisions match with the cultural preferences of the users cultures. Therefore, I have developed the cultural design compass which allows us to classify and visualize the design recommendations in different cultural dimensions and compare them with Hofstede's culture indices for a specific or multiple nations.

I firstly summarized all design recommendations that were derived by our research group (Lippert, 2020; Lösch, 2020; Nutsi, 2018; Ott, 2018) for the design of large public displays which resulted in 52 recommendations. Secondly, based on the cultural sensitive user interface aspects identified by Marcus and Gould (2000), I assigned each design recommendation to the respective cultural dimension and corresponding degree (low or high) (Table I). Finally, I visualized the result as the "cultural design compass" by contrasting the design recommendations assignation with the cultural dimension indices for Germany, which is described in the next section.

Cultural Design Compass

The cultural design compass (Figure 1) consists of Hofstede's cultural dimensions (Hofstede, 1984; Hofstede et al., 2010), which are evenly distributed in a circle. The cultural dimension indices for Germany are displayed as radial line within the circle, with 0 in the middle and 100 on the circle line. The recommendations are then positioned within the dimensions: Design recommendations for a high expression of the cultural dimension are situated on the outer, design recommendations for a low expression can be found on the inner area.

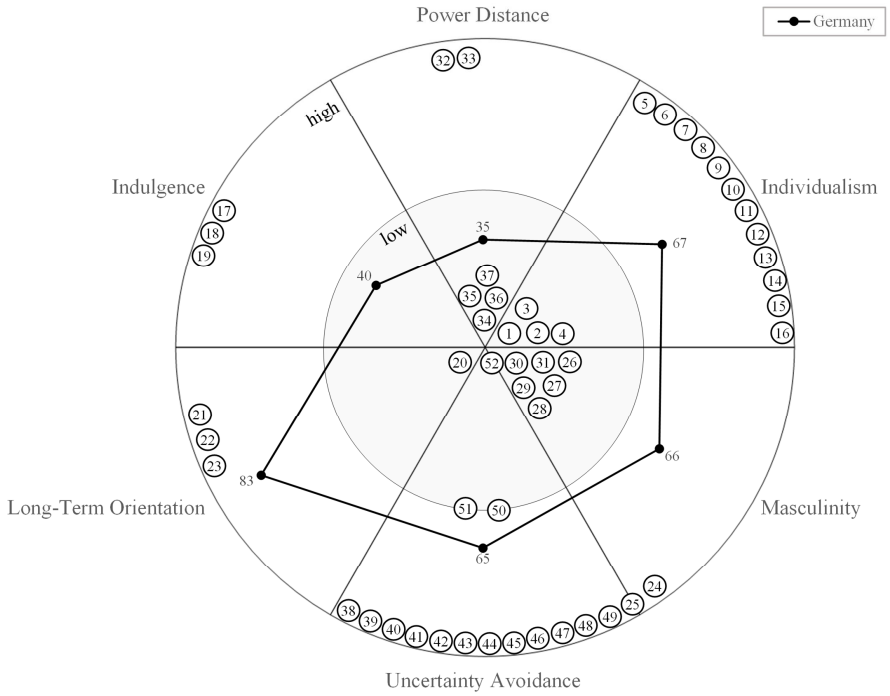

Figure 1. The cultural design compass with design recommendations in the respective cultural dimension classified into "low" (inner circle) and "high" and the dimensions indices for Germany. Further details about the design recommendations can be found in the appendix A.

The cultural dimension indices for Germany are in sum: Low for power distance and indulgence. High for individualism, masculinity, uncertainty avoidance, and long-term orientation. The distribution of the 52 design recommendations indicate that we derived them for the following cultural dimension degrees: Low power distance and masculinity (femininity). High individualism, uncertainty avoidance, long-term orientation, and indulgence.

Contrasting the distribution of design recommendations with the cultural dimension indices for Germany (Figure 1), it emerges that in most cases we have derived design recommendations according to our expression of the cultural dimensions. The recommendations that do not correspond to our culture dimensions indices are for "masculinity" and "indulgence". This is probably due

to the research goals we are pursuing: To motivate users to interact with large public displays (Lösch et al., 2017), having fun while interacting with the large public display (Fietkau, 2019), and to share information that is interesting for the user group but not actively sought after on large public displays (information radiators) (Koch et al., 2017; Lippert and Koch, 2022). In addition, it must now be verified whether the result of the other cultural dimensions is also influenced by the research objectives. Looking at the "power distance" dimension, Germany is a low power distance nation and the design recommendations suggest to lower barriers of access for a large public display and consequently, to enable equal access abilities for everyone. This result may also be influenced from the research goal, to enable access and increase large public displays' use. The dimension "individualism vs. collectivism" has clearly more design recommendations for individualism and Germany is an individualistic nation with an index of 67. The design recommendations in this dimension mainly pursued the research goal of enabling and fostering interaction of multiple users (Nutsi, 2018). The design recommendations for fostering multi-user interactions focused mainly on individualistic elements, e.g. DR09: "Users should be able to control the display of personal data on a large wall display and sensitive data should not be requested." This indicates subconscious design decisions because in other nations multi-user interactions with large public displays may be encouraged by more collectivist design aspects, e.g. they may find it pleasing sharing personal sensitive data. The design recommendations belonging to the "uncertainty avoidance" dimension mainly have the goal of preventing users from failure, getting lost in the application, and embarrassment in public. Germany has a very high uncertainty avoidance index of 65 and, in general, technology should prevent users from having those issues. Nevertheless, other nations with a low uncertainty avoidance index may prefer a more unstructured and exploratory design. Also embarrassment due to usage failures is not an issue to everyone, especially not for low uncertainty avoidance cultures. The last dimension "long-term vs. short-term orientation" shows that the design recommendations of our research group represent a long-term oriented culture. The research goal of those design recommendations is to ensure user attention and update the content of the large public display. Furthermore, this dimension indicates that other cultures may prefer other designs for this goals, e.g. more frequently updated content or new features all at once.

Consequently, this result shows that we have subconsciously designed in most design dimensions for our own cultural preferences without taking into account others. There are two possible consequences: The first is to improve the current design by analyzing the deviations or lack of design decisions regarding cultural preferences (in our case this would concern the dimensions masculinity and indulgence). The second is to include the perspective of other cultural preferences, when designing for another user group. For example, if we design a large public display for an Austrian university, we should include the Austrian cultural dimension indices (Figure 2). This would allow a comparison between our cultural indices and emphazise where we need to improve our design for Austrian users.

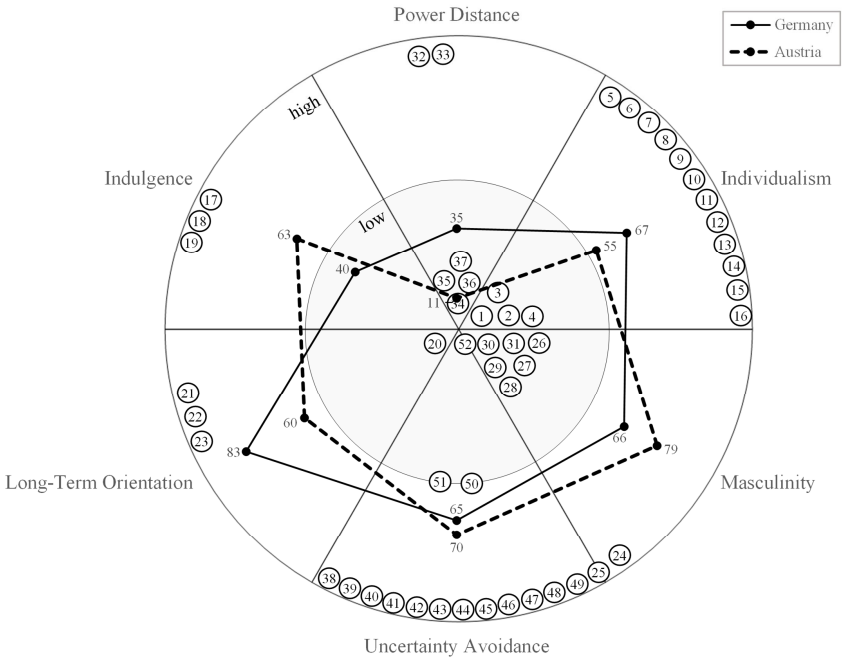

Figure 2. An example of how to include a comparison of different nationalities into the cultural design compass. The cultural design compass with design recommendations in the respective cultural dimension and the dimensions indices for Germany as well as Austria.

Using the compass, researchers and designers may be able to review existing designs and answer the following questions for improvement purposes:

- For which cultural dimensions is our design suitable?
- Is the design suitable for our user groups' culture(s)?
- Does our culture match with our users' culture?
- Have we subconsciously oriented the technology's design on our cultural imprint and does it suit the user group's culture?

In best case scenarios, cultural preferences are already considered during the design phase. Therefore, I propose to consider additionally the following aspects:

1. **Get to know the users culture**: Identify the cultural background of the users, who will use the technology in the end. (Using the Hofstede cultural dimensions, nationalities can be used for orientation.)

2. **Identify cultural preferences**: Inform yourself about cultural preferences of the users by identifying the indices for the cultural dimensions of Hofstede. (If the users are intercultural, take into account several indices and address various degrees of cultural dimensions where differences occur.)

3. **Consider cultural design aspects**: Take into account cultural preferences when designing technological artifacts.

4. **Validate the cultural orientation of your design**: Categorize your design aspects and decisions into the cultural design compass and compare the result with the cultural dimension indices. Have you designed for the user? Which aspects need improvement regarding cultural preferences?

Conclusion

This analysis assigns 52 design recommendations for large public displays of our research group to the cultural dimensions of Hofstede. The self-assessment shows that in most cases we may have subconsciously designed for users with the same cultural background. Visualizing the result as a cultural design compass enables a hands on overview for which cultures we have designed our artifacts. Comparing the result with the user groups' cultures we can identify whether our design decisions match or where we should reconsider and further improve our design. This paper should motivate other researchers and user interface designers to review their work and support them on how to self-assess and include a consideration of cultural preferences and differences. The cultural design compass can be improved by providing more details about how to assign the own design decisions to the cultural dimensions. As the assignment of design recommendations to cultural dimensions is prone to bias, it can be improved by involving multiple, context-neutral people or even an artificial intelligence in the classification process. However, it needs to be mentioned, that the compass cannot cover individual preferences in general but rather provides an overview what designers and researchers could take into account when designing for users with other cultural background and whether they have designed for the right user groups. Furthermore, adding multiple national indices as radial lines to the compass may lead to lack of clarity. For future research, this approach will be used to derive design recommendations and improve the current large public display design for intercultural user groups with the focus on using the display as socio-technical device to train the individual's intercultural competence.

A Appendix: Design Recommendations and their Assignment to Cultural Dimensions

The following table displays the design recommendations from our research group and their assignment to the respective cultural dimension with either high or low expression.Each recommendation contains a letter at the end depending on the author of the original source:

- **a**: Lösch (2020)
- **b**: Nutsi (2018)
- **c**: Ott (2018)
- **d**: Lippert (2020)

#	Cultural Dimension	High/ Low	Design Recommendation (DR)
DR01	Individualism VS Collectivism	Low	When choosing the input modality, consider the phase in the interaction process in which it will be used. (a)
DR02	Individualism VS Collectivism	Low	Attach the visual stimuli to a virtual representation of the user to address and support each user individually in the multi-user scenario. (a)
DR03	Individualism VS Collectivism	Low	The socio-technical integration of the various devices is established on the one hand via the common context of use and on the other hand via the technical integration of the underlying IT systems. When designing a large-screen application, care should be taken from the initial stages to ensure that the additional user interfaces fit synergistically into the interspace and complement the interface portfolio of collaborative knowledge processes with specific semi-public use cases instead of cannibalizing existing systems. (c)
DR04	Individualism VS Collectivism	Low	A multi-user large wall display application should offer multiple independent entry points. (b)
DR05	Individualism VS Collectivism	High	Avoid repetition in the sequential use of visual stimuli and allow the user to discover something new about the application with each new stimulus. (a)
DR06	Individualism VS Collectivism	High	Interactions of one user should not have an unintended disruptive influence on the interactions of others. (b)
DR07	Individualism VS Collectivism	High	Deployment in highly exposed locations should be avoided. Ideal are places where people often pass by and wait. (b)
DR08	Individualism VS Collectivism	High	To ensure a Minimum Viable Information Space, an opt-out process may be preferable to an opt-in by social actors. (c)
DR09	Individualism VS Collectivism	High	Users should be able to control the display of personal data on a large wall display and sensitive data should not be requested. (b)

#	Cultural Dimension	High / Low	Design Recommendation (DR)
DR10	Individualism VS Collectivism	High	Visual differentiation strategy: When there are several users, it is no longer possible for new actors to differentiate which system interaction was caused by which actor. To avoid this, [...] the visualization of the respective personal territory as a "user zone" can help (cf. Section 4.4.5). In multi-user scenarios, system interactions of the actors [...] can be distinguished by different colors of the [...] chronologically generated user zones [...]. (c)
DR11	Individualism VS Collectivism	High	Personal workspaces should be flexible in both their placement and size by the user. (b)
DR12	Individualism VS Collectivism	High	The entry paradigm of the avatar effect should be considered to make individually relevant content easily accessible. (c)
DR13	Individualism VS Collectivism	High	Viewers and users of a large wall display application take on different roles, each with different requirements. The application should specifically support these roles. (b)
DR14	Individualism VS Collectivism	High	In a multi-user application, modal elements should be avoided. (b)
DR15	Individualism VS Collectivism	High	Content should be able to be copied or shared with other users. (b)
DR16	Individualism VS Collectivism	High	The use of sounds, output on loudspeakers, is suitable for joint exploration on the large wall display, but not for focused, individual work. A volume adapted to the environment must be selected. (b)
DR17	Indulgence VS Restraint	High	Make the overlap of the application's focus and nimbus with the path of passersby as large as possible, so that interactive stimuli are visible for as long as possible in their periphery by passersby. (a)
DR18	Indulgence VS Restraint	High	Keep the difference between the focus and the nimbus of the installation as small as possible, so that interactive stimuli are already visible when passersby first look at the display. (a)
DR19	Indulgence VS Restraint	High	Playful elements that allow relevant information to be "discovered" by chance should be considered conceptually. (c)

#	Cultural Dimension	High / Low	Design Recommendation (DR)
DR20	Long-Term Orientation	Low	The data integration from the source systems should be designed in such a way that new InfoRep are visible as immediately as possible. (c)
DR21	Long-Term Orientation	High	New features should not be rolled out all at once, but in small packages on a regular basis to promote the curiosity effect. (c)
DR22	Long-Term Orientation	High	Ensure user attention before presenting stimuli with information content that changes over time. (a)
DR23	Long-Term Orientation	High	In semi-public permanent use, regular cleaning cycles for touchscreens should be scheduled, if necessary several times a day. (c)
DR24	Masculinity VS Femininity	High	Reasonable deployment locations should be designed so that the context of use integrates energetically with other activities. (c)
DR25	Masculinity VS Femininity / UA	High	Feedback must be immediate and it must be clear which user triggered feedback. It also serves awareness in multi-user interactions and should convey who controls which part of the application at what time. (b)
DR26	Masculinity VS Femininity	Low	Guide the user with the help of impulsive stimuli when a hurdle to be overcome is particularly large, and otherwise allow free exploration of the application based on permanently available informative stimuli. (a)
DR27	Masculinity VS Femininity	Low	Use physical stimuli to expand the focus and nimbus of the installation and break down barriers. (a)
DR28	Masculinity VS Femininity	Low	For successful multi-user interaction, directly interacting users should have awareness information displayed regarding the activities of others in their workspace. (b)
DR29	Masculinity VS Femininity	Low	To ensure that content can be read from a distance even when it is obscured, a dynamic text display is recommended. Here, the text should be moved horizontally across the screen at a display rate of 100 to 115wpm. (b)
DR30	Masculinity VS Femininity	Low	Textual content of a large wall display application should be displayed in different font sizes, adapted to the distances of the local situation. (c)
DR31	Masculinity VS Femininity	Low	Use the moment of attention after a user interaction to present visual stimuli in a highly perceptible way. (a)

#	Cultural Dimension	High / Low	Design Recommendation (DR)
DR32	Power Distance	High	Choose the screen size to fit both the intended number of users and the type of interaction. For simultaneous interaction of at least two people, the wall screen should have a minimum size of 65”. (b)
DR33	Power Distance	High	There should be sufficient free space in front of and next to the large wall display. (b)
DR34	Power Distance	Low	Structurally fixed barriers must be considered when choosing an installation site due to the inability to influence the system design. (c)
DR35	Power Distance	Low	Interior architectural barriers, on the other hand, can usually be actively co-designed in the course of the deployment of a large wall display, e.g. in order to deliberately shade certain areas or to set up "comfort spaces" for "protected" observations by spectators. In order to [...] create a digital-virtual participation opportunity in collaborative knowledge processes, the addition of a Distributed Display Environment (DDE) to the setting can make sense. (c)
DR36	Power Distance	Low	Artificial pathway barriers should be avoided as much as possible within the perceptual zone, unless they serve to channel the flow of users, such as deliberately "leading" them laterally into the active zone, because they can interfere with enticement. (c)
DR37	Power Distance	Low	To avoid coverage by other users, content should be partially displayed above head height. (b)
DR38	Uncertainty Avoidance	High	Display and clearly clarify linkage of objects and positioning within the information structure. (d)
DR39	Uncertainty Avoidance	High	Automatic cleanup, restrictions, and a customizable level of detail help maintain the clarity of a multi-user application. (b)
DR40	Uncertainty Avoidance	High	User influence on the displayed particularity and scaling of the current level of detail. (d)
DR41	Uncertainty Avoidance	High	Combination of detail and distance displays: [...] the system interaction of an actor to the detail display should not negatively affect the distance perception and consequently the peripheral information supply of other actors. (c)
DR42	Uncertainty Avoidance	High	Control functionalities should be freely positionable, either multiple or duplicable. Controls with global effect are an exception. (b)

#	Cultural Dimension	High / Low	Design Recommendation (DR)
DR43	Uncertainty Avoidance	High	InfoRep should be designed generically, but including the content context and with particle type specific components as preview. (c)
DR44	Uncertainty Avoidance	High	Enable individual assessment and classification by displaying context and environmental variables. (d)
DR45	Uncertainty Avoidance	High	Additionally complement objects' visualization by proactive and interaction-independent representations. (d)
DR46	Uncertainty Avoidance	High	Objects' representation with current or virtual content relevance for the potential user of the system. (d)
DR47	Uncertainty Avoidance	High	Test cases should be designed to emulate real user behavior, such as first-use feature testing. (c)
DR48	Uncertainty Avoidance	High	The application should be intuitively controllable and convey that the risk for social embarrassment is low. (b)
DR49	Uncertainty Avoidance	High	The large wall display application should be intuitive to use, and advanced functionalities should be discoverable step by step. Observing other users should also provide interaction possibilities. (b)
DR50	Uncertainty Avoidance	High/ Low	Based on the level of awareness and complexity of an interaction opportunity in the context of the application, decide how much support users need to execute it. (a)
DR51	Uncertainty Avoidance	High/ Low	Use stimuli sequentially to address the different hurdles in the exploration process one at a time. (a)
DR52	Uncertainty Avoidance / MAS	Low	Various strategies exist for preventing conflicts. However, it is advisable not to exclude all possible sources of conflict in an application, since conflicts can trigger positive effects (e.g., communication, awareness). (b)

Table I: Overview of Design Recommendations of Large Public Displays assigned to Cultural Dimensions.

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Datashare: exploring the potential of reusing data for third sector organisations to support their collaboration

Olena Saienko, Stefano De Paoli, Iain Donald
Abertay University, Dundee, Scotland
o.saienko1900@abertay.ac.uk, s.depaoli@abertay.ac.uk, i.donald@abertay.ac.uk

Abstract. This paper describes a Participatory design case study on how the reuse of context. While many Third Sector Organisations collect data about their own services and local communities' needs, this data is rarely reused by the organisation or shared with others, due to a lack of resources and funding. To explore this issue, we have engaged in Participatory Design research with six locally based social organisations from Scotland. As an outcome of this research, the organisations have imagined the concept of the "Datashare" platform. This is a platform that would allow reusing and sharing of their data by exchanging it widely through the sector and beyond. The paper contributes to knowledge by bringing reflections on the role of the PD process in fostering open data culture for collaboration for Third Sector Organisations highlighting the potential impact of the designed solution.

Introduction

Open Data is both an idea and a movement based on the assumption that data should be freely used and made available to anyone, in order to foster knowledge creation and problem-solving. The value of Open Data to economic growth, improvement of public services, and community wellbeing has burgeoned in the past decade, but the rewards remain inequitably distributed in favour of large-scale organisations that have capabilities and skills. Third Sector Organisations (TSOs), especially micro-to-medium ones (0.5 to 249 employees), often lack the skills and resources necessary to realise the benefits of Open Data for the communities they represent. TSOs are generally defined as "a range of organisations that are neither private sector nor public sector and may include voluntary and community organisations, charities, social enterprises, cooperatives, associations, self-help groups and community groups" (National Audit Office, 2010).

The goal of this paper is to report on the research conducted for designing a prototype of an Open Data sharing platform, together with micro to small Third Sector Organisations (TSOs) (1-55 permanent employees). This is an ongoing PhD research that is part of a larger project called Mapping for Social Innovation (MAPSI). MAPSI explores how to build user-driven social innovation initiatives with and for TSOs. These organisations are based in the city of Dundee, Scotland. They largely operate locally, catering often for groups coming from disadvantaged backgrounds. In this paper, we present the preliminary results of the Participatory Design (PD) research conducted for the initial design of a social innovation digital platform, called Datashare.

Datashare, as the name implies, relates to the need expressed by local TSOs to have a way to share some of their data with others in an open and secure manner. Their need was to find a way to improve their services, considering the lack of resources that they face, by benefitting from a potentially broader collaboration with other similar organisations operating in the local area. For example, organisations working on distributing food parcels in the city could benefit from the sharing data among them, in order to improve the process by which the food is really distributed in the areas where people are in need i.e., optimising the service across the city, in a pooled manner, by sharing the respective data.

There are two main reasons why the focus was made on relatively small locally based social organisations. First, each organisation gathers specific local data related to their services and thus has unique knowledge that may contribute to the local community development. Second, these actors require support in designing their own solutions and explore the possibilities of data reuse, (Charity Digital Skills Report, 2019; Harvey, 2016; de Las Casas et al. 2013). With this research, we aim to answer the following research question: What kind of digital resources can support the reuse of data for micro to medium TSOs? The

objectives of this paper are to: 1) present the process conducted for co-designing with TSOs the concept of a potential solution for data reuse; 2) reflect on the role of Participatory Design (PD) in fostering open data culture for TSOs.

To envision a potential solution, we conducted a set of PD activities, involving 6 organisations. We adopted the methodology proposed by Spinuzzi (2005) and adapted it to our context and actors. Via a focus group, a workshop and a prototyping phase, we created the wireframes of a digital solution, the Datashare, whose implementation could address the needs of these organisations.

This paper brings additional value and knowledge. Indeed, previous research on conducting PD with TSOs has highlighted the need to co-design solutions for the Third sector that supports communication and collaborations between TSOs (Erete et al., 2016; David et al., 2014). Current literature also discusses the challenges for TSOs to engage with Open Data. However, existing PD case studies focused on the Open data for TSOs, rarely reflecting on the role of PD in fostering open data culture for TSOs, focusing more on the benefits of the designed solution.

Along the process, we have learned that TSOs are keen to explore the possibilities of sharing data with others, however, they struggle to manage this process independently. In this situation, PD can serve as a platform to start a dialogue between TSOs around how to effectively share data in order to improve the service delivery as well as, to envision challenges in making TSOs' data open for the sector.

In the following pages, we begin by presenting the literature on the current state of open data usage by TSOs and on conducting PD with TSOs. We then turn to a description of our design approach and process, followed by a presentation of the results and in particular the designed solution, the "Datashare" platform concept. Finally, we reflect on the opportunities and challenges of conducting PD with TSOs in the context of open data culture and highlight the potential impact of the designed solution for TSOs.

Literature review

The term Open Data refers "to data that can be freely used, shared and reused by anyone". (Open Data Handbook, 2022). With the potential to foster innovations, stimulating positive social changes (Neves et al., 2020), Open Data has been successfully adopted in Private and Public sectors, including in governmental and research institutions (Enders, et al., 2020; Markus et al., 2020). It remains, however, a largely untapped resource for TSOs, especially micro to medium ones (Hall et al., 2012; Erete et al., 2016). Authors have pointed out how Open Data has the potential to support the work of TSOs (Harvey, 2016; Hall et al., 2012: de Las Casas et al., 2013) by improving their services, enhancing advocacy, fundraising, knowledge sharing and impact evaluation. In addition, it might

contribute to the possible collaborations among the Third and Private sectors (Hall et al., 2012).

The possibilities for TSO to engage in developing the knowledge economy depend on many factors. Such as their domain of operation, their size, age and the area in which they offer their services, available support and partnerships (Harvey, 2016, Hall. et al., 2012). While commercial companies, most of the public sector and large TSOs have access to resources to use data, micro to medium non-profit organisations are lacking the possibility to do so (Boswell et al., 2016; Metcalf, 2013).

Amongst the challenges that prevent TSO's from using Open Data efficiently are: the lack of digital skills (Charity Digital Skills Report, 2019); the lack of knowledge related to data science (Harvey, 2016); the lack of awareness of the potential of data (de Las Casas et al. 2013) and a lack of financial support (OSCAR, 2020). In addition, TSOs struggle to gain access to relevant Open Data and often interpret raw data by themself (Erete et al., 2016).

While current research focuses on the benefits of Governmental open data or third party data available online, there is still little research on the reuse of existing data produced in the Third Sector. Following the successful examples of data reuse in the Private sector (Custers & Uršič, 2016), the Third Sector can create more value for the communities they serve by making data open. Back in 2012, for example, the Nominet Trust Charity organised Open Data Days - workshops for Charities to explore with them the potential of using Open Data, concluding that Charities may produce their own Open Data on their activities and could benefit from sharing information between organisations. (Davies, 2012).

However, the practicalities of sharing data for TSOs meet also privacy and confidentiality barriers (Harvey, 2016; Ursic & Custers, 2016), which might require some organisational changes in how data is processed and stored. Also, from a technological perspective, the reuse of data through sharing requires appropriate technical infrastructure (Custers & Ursic, 2016), which is not always available for TSOs.

An important role in supporting TSOs toward reaping the benefit of Open Data could be played by Participatory Design, as this approach can support the explorations of current barriers as well as offer a way to envision appropriate solutions. Current research actively involves TSOs in PD with different roles: 1) as one of the participants with other types of stakeholders such as citizens, universities, private organisations, local government etc. (Whittle, 2014; Mulder et al., 2018; Prost et al.,2019; Del Gaudio et al., 2014); 2) individual TSOs as the main participant and beneficiary of the co-design (Pawar & Redström, 2011; Björgvinsson et al., 2010; McPhail et al., 1998; Selloni & Corubolo, 2017); 3) as part of the group of TSOs to co-design a solution that would benefit Third Sector and communities (Haskel & Graham, 2014; Erete et al.,2016, Marshal et al.,

2016). Researchers who have conducted PD with TSOs around digital technologies defined some challenges and needs to be addressed. For instance, Voida (2011) defined 3 main challenges: 1) computational literacy; 2) extreme test of usability with TSOs, with implications that reach beyond the interface; 3) need for TSOs to engage with other sectors with drastically different goals, values and technological capabilities (for instance, community members who use social media extensively). Erete et al. (2016) while exploring the Open Data usage among TSOs, suggested that designed solutions should facilitate communication and support relationships between TSOs. The authors stated that TSOs can benefit from sharing past experiences, best practices, data processes, and stories amongst each other. Similarly, there is a need for cooperation and collaborations among TSOs to bring benefits to the community (David et al., 2014).

At the same time, there are limited reflections on what it means to conduct a PD process with TSOs as well as what is the potential impact of using PD for working with TSOs. Markel et al. (2007) illustrated engagement challenges in building PD with TSOs and emphasised the importance of understanding the social culture of TSOs and stakeholders. Strohmayer et al. (2018) encouraged the research community to discuss this gap through a workshop as part of the Conference on Human Factors in Computing Systems 2018 (CHI),. with the aim to define the impact of the PD on the TSOs. However, the outcomes of the workshop are not yet published.

Design process

As seen in the previous section, there still is limited literature and research accounting for the challenges that TSOs face in using Open Data, and the question of how to reuse it efficiently. Moreover, there is still a lack of practical research on understanding what type of tools can better support TSOs in taking advantage of their existing data. In particular, focusing on the need of micro and small organisations which generally lack knowledge, culture and capacity to have an Open Data strategy. Exploring this problem was a key goal of this research, which, as anticipated, we approached with Participatory Design.

The design process was developed with the aim to explore how organisations currently collect and use data about their services and see how this data could be reused to foster novel social innovation initiatives. As an outcome, we expected to build an initial prototype interface for a potential digital solution.

To achieve this, we have adapted the PD methodology proposed by Spinuzzi (2005) adjusting our design activities to the specific research context in which we were operating (See Table I). Distancing ourselves from the workplace orientation of the original methodology, we focused instead on working with a number of TSOs, keeping the main three stages of the PD methodology: (1) Initial exploration of work, (2) Discovery and (3) Prototyping. As this approach is quite

flexible by its nature, the data collection activities were chosen to suit the purpose of each stage and at the same time to minimise intrusion for participant organisations.

It is also important to note that all PD activities were conducted online (as a consequence of the COVID19 restrictions), using MS Teams (for the discussion), Miro (as a board for conducting workshop activities) and Figma (for designing the prototype).

Table I. The overall process of the project consists of 3 phases: Initial exploration of work, Discovery, Prototyping

Initial exploration of work		**Discovery process**		**Prototyping**	
Outcome: a defined design query and context		**Outcome:** definition of requirements for solution		**Outcome:** production of a prototype of SI	
Goal	**Method**	**Goal**	**Method**	**Goal**	**Method**
To define main stakeholders and what are their socially-oriented needs	Persona	To arrange communication between social organisations to share common needs and issues	Focus group (Teams)	To develop the prototype	Digital prototyping in Figma
Identification of specific needs related to data	Individual Meetings	To define the design query and ideate possible solutions	Design workshop (Teams, MIRO)	To test the concept	Remote testing

The methodology assumed that all participants would take part in all 3 stages of the process. Keeping in mind that small social organisations generally have a lack of resources, an intense workload and a small team, we organised the research to make sure it would not impact their usual work. We scheduled all activities with a time distance of a minimum of 1 month from each other, whilst trying to find a common time for all participants for each session. Thus, the focus group was arranged for March 2021 and the Workshop in April 2021. However, even with these arrangements, not everyone could take part in all activities.

Participants

The research involved 6 micro to small TSOs (1-55 permanent employees), recruited via various meetings and other contacts. The participating organisations were selected because all of them were looking for ideation around the issue of sharing their data with others in order to offer better services. These TSOs, bar one, are based in the city of Dundee, Scotland. They largely operate locally and focused on different aspects of community development: one provides caring services, two of them have the goal to tackle food insecurity in the city, two

provide a wide range of advices to citizens (for example around unemployment of financial education), and the remaining one is an organisation that supports the work of TSOs more broadly, offering services which include also data management support. This last organization operates from Edinburgh and is directly cooperating with TSOs from Dundee. This last organization also is comparatively larger than the other five, which are instead very small organisations, and has some technical infrastructure in place to manage data.
Overall, 6 participants took part in the research, each participant represented a separate organization. These participants were either employees responsible for data management or employees in managing positions. Therefore the individual participants were all, in different ways, concerned with the collection and use of data for the purpose of the service delivery in each organisation.
As was mentioned before, not all participants could take part in each stage of the PD process, thus 5 participants took part in the Focus group, 4 participants took part in the Ideation Workshop, and 4 - evaluated the prototype.

Initial exploration of work

In the context of the methodology proposed by Spinuzzi (2005), the purpose of the Initial Exploration stage is to define the main stakeholders and explore their interests and needs. This was done, in our case, in relation to exploring the needs around data usage in general terms (e.g., whether organisations collect data and for what purpose). This stage serves as a starting point and is the base for the Discovery process. The initial exploration was organised around two main activities.

First, we have started by defining and preparing the profiles of the organisations that are the main stakeholders. In this way, we have identified small charitable organisations and social enterprises as the main types of participants (TSOs broadly defined). The profile outlines a summary of the characteristics of the group of charities. Each profile (see Figure 1, for an example) contains a generalised overview of the main characteristics of organisations: social needs, strength, connections, activities, and goals. The profiles were created based on the research performed by another member of the MAPSI project and based on a set of qualitative interviews, conducted with representatives of different types of TSOs in the local area.

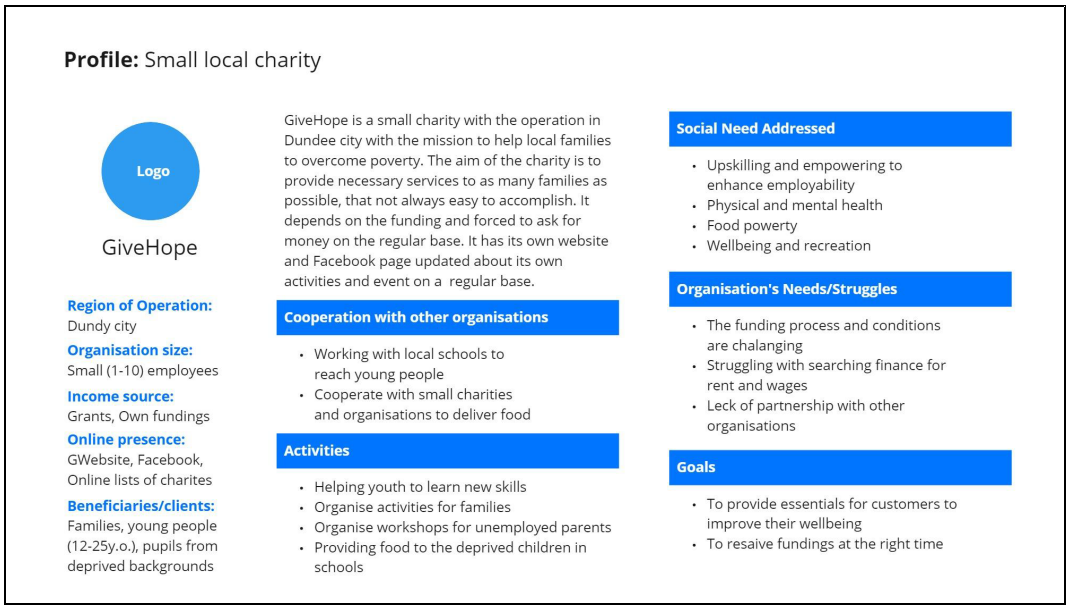

Figure 1. Example of the organisational profile for a small local charity for the Initial exploration of the work stage

Second, to identify specific needs related to data usage and navigate the next stage of the design process we have arranged individual meetings with each of the identified organisations. As the purpose of the Initial Exploration stage is to define the main stakeholders and explore their interests, the meetings were arranged with the objective to understand their potential interests in data and to invite them to the next activities of the research. The purpose of these initial meetings was therefore not that of collecting data yet. The meetings were conducted through MS Teams with one or two representatives from each organisation. In this phase, we have explored participants' current processes of using data and their intention to reuse it. We also asked their ideas on 1) how data might be used for the third sector and 2) how it might benefit community development. At this stage, we took note of some similarities and differences in the current state of data management processes among the TSOs invited to these exploratory meetings. For instance, it emerged that most of the participants were storing their data in MS Excel sheets, others in plain text format using MS Word or simply having it in emails. In contrast, the bigger organisation has special software for data storage and analysis as well as dedicated employees to manage data. Already at this stage organisations expressed their ideas about data reuse with common purposes: to use existing data to better serve local communities. For example, reusing data to gain a better understanding of the city's current situation and to visualise how the situation is changing over time. One of the organisations imagined, as a possible solution, a map that would show the presence of local TSOs in the city.

Discovery

To define a design problem and ideate possible solutions, in the Discovery phase of the methodology we started with the conduction of a focus group, oriented at discovering a common vision among the participating organisations and then the focus group was followed by an ideation workshop to support participants in envisioning solutions.

Focus group

The focus group was conducted online through MS Teams, where 5 TSOs took part. We have encouraged participants to share their current practices of using data and to highlight their challenges and needs. From the focus group data, using Thematic Analysis, we extracted information on the main pain points that organisations experience when working with data. These pain points then served as the basis for the Ideation workshop.

Overall, what emerged is that TSOs collect and use data in various forms, such as: "*client profiles*" or *"we use the quantitative data, but we also use qualitative as well, and so we use our own feedback, and we use case studies, and we gather that information too*". A participant also said that they "*use data on a day-to-day basis to communicate with customers, but probably the most benefit of it is for regular performance monitoring*". (e.g., for their annual report). In contrast, the large organisation uses the data they collect to both produce monthly statistics and analysis but they also "*look at old data nationally and look at trends. Look at changes, such as a shift in client profile*". From the focus group, it also emerged that some organisations are already, to a limited extent, sharing some of their data on a general level with such institutions as Universities: "*It's pretty much high level and anonymous data and I can't think of a situation where we share is actually customer information*". Overall, it emerged that participants are open to sharing their data with other organisations on request. Organisations agreed that sharing their data among the sector might be beneficial for defining the gaps and deficits in the city. For instance, one participant commented that this would be useful: "*where there were gaps in provision, particularly with the food insecurity network*". However, to enable the sharing, the data should be processed to ensure it follows GDPR.

The focus group discussion served as a starting point for the further Ideation Workshop. Apart from the data collection process, there was additional value for participants: the exploration of how other organisations are managing collected data and what type of data they are collecting. In this way participants found commonalities and possible ground for cooperation in the future.

Ideation Workshop

Based on the information gathered during the focus group we have created the Ideation Workshop, where 4 participants took part. The goal of the workshop was to map all existing issues faced by participants in terms of Data reuse and together with them select one issue to focus on, in order to envision a solution to it. The workshop was conducted online using MS Teams and Miro for the ideation exercises. The workshop followed 5 steps: Define the main pain points, Group pain points and vote, Explore the problem, Brainstorm, and Define the idea. The data from the workshop was analysed through affinity mapping to group all characteristics of the future solution and understand its potential impact.

In the first stage "Define the main pain points" we have gathered 25 pain points (see Figure 2). Next, we grouped the pain points into 5 groups based on their themes: Confidentiality, Sharing data, Tools, Accessibility, and Skills. Participants were then invited to vote for the themes that would be explored further in the workshop. The participants decided to continue with 3 themes: Sharing data, Tools and Accessibility.

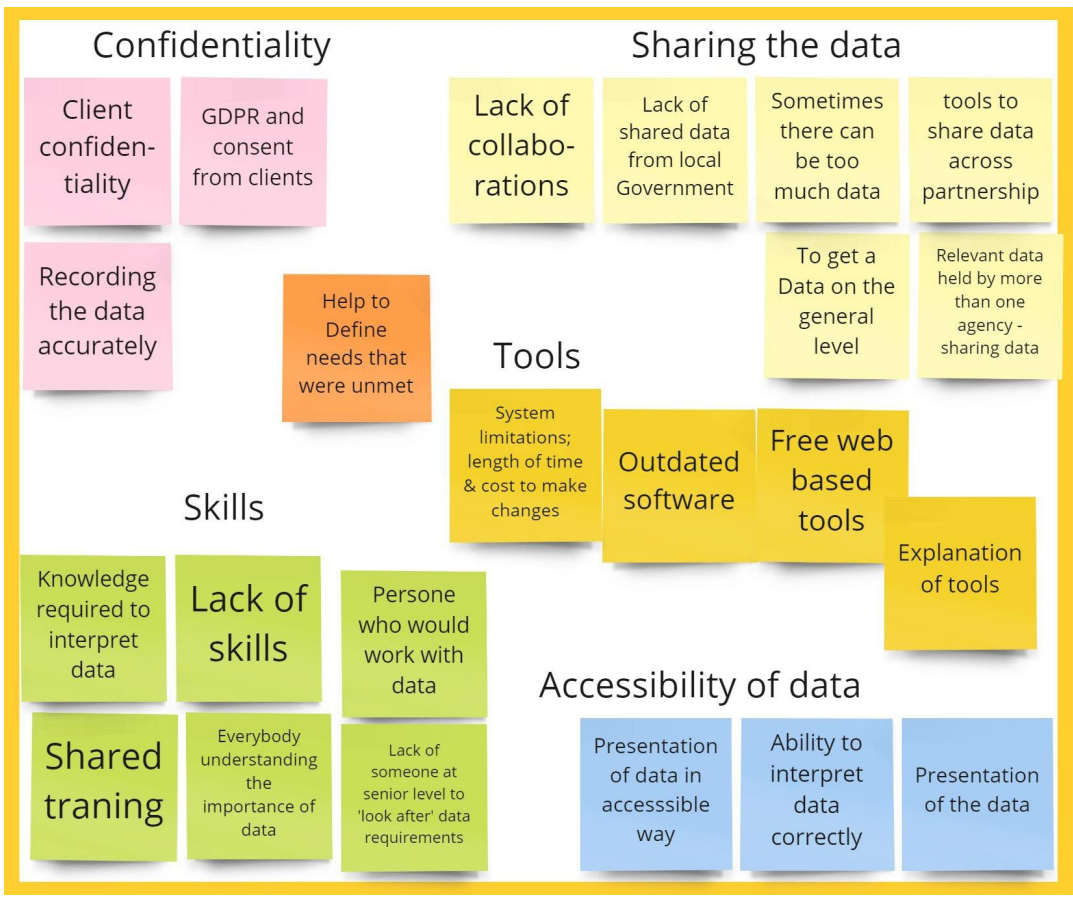

Figure 2. Grouped issues defined during the ideation workshop

At this stage, the participants together with the facilitator formulated the problem to be explored, as follows: organisations are not able to share and present the data in an accessible way. Then this problem was further refined, via an understanding of its components, such as the ability to interpret data correctly, the presentation of the data in an accessible way, the lack of free web-based tools and the lack of collaborations. After the discussion, the problem was turned into a “How might we...?” (Rosala, 2021) question: How might we share and present the Data in a more accessible way? This reformulation technique allowed to transform the defined problem into potential opportunities for design and helped to better frame the problem into a particular challenge for ideation.

To Brainstorm on the “How might we...?” question, participants first ideated individually and then discussed all ideas they generated. For the ideation, they were offered an "Inspiration table" (see Figure 3) that includes 4 columns with components: Space + Collaborations + Type of activity + Type of Data. Each column (component) included from 10 to 12 options with examples of the particular component. While answering the formulated question participants were required to use 1 or more options from each column. In this way, each participant created an idea that included 4 components: Space, Collaborations, Type of activity, and Type of Data.

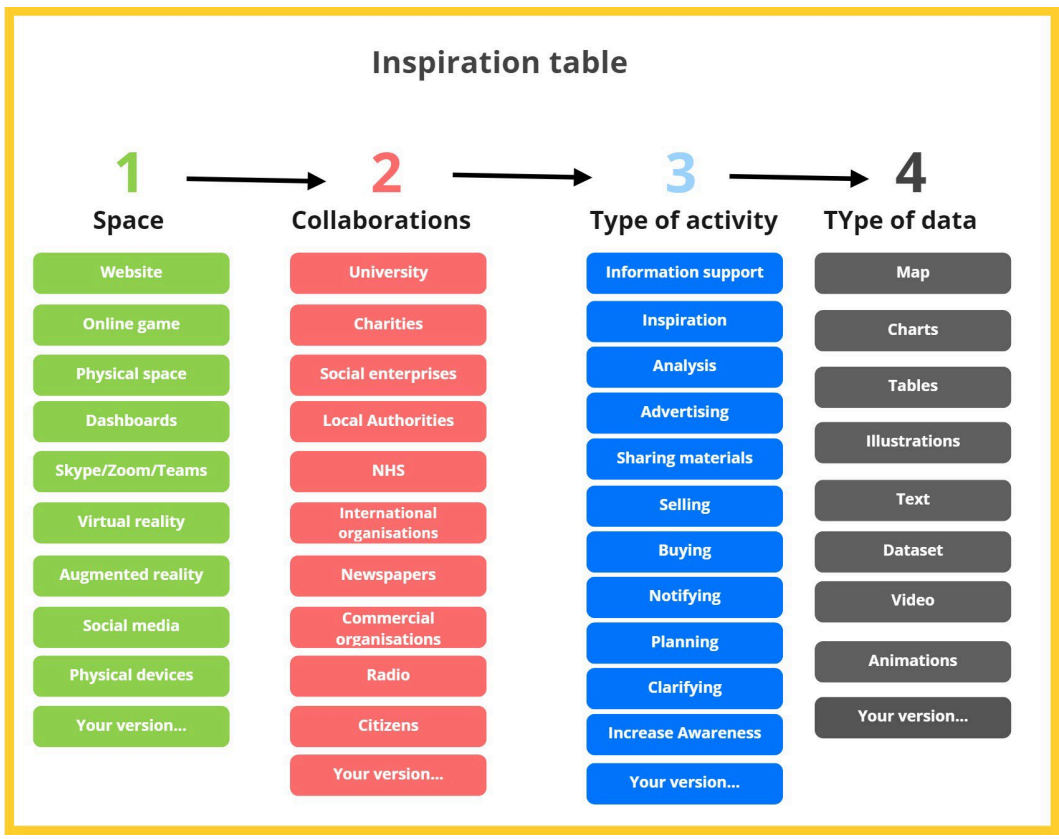

Figure 3. “Inspiration table” - brainstorming activity at Ideation workshop

As an outcome, participants formulated very similar concepts of a digital platform to exchange data. Though, each idea included slightly different details and characteristics. Due to the similarity of ideas, the facilitator together with the participants decided to unite all ideas and create one concept on which to work on: "*Digital shared place for data with different types of data representation*".
In the last stage, the participants defined the main requirements for the platform (see Table II). They also defined two main limitations: the confidentiality of shared information and technical skills for data management. The participants also defined the main benefits of the platform as "*Enhancing the contribution of TSOs*", "*a way to generate data across the sector*", and "*Improved outcomes for communities*".

Prototyping

Based on the requirements and the findings from the other stages of the research, the research team created an interactive prototype of the Datashare platform, that imitates the functionality of the real platform (see Figure 4).

The main features proposed in the prototype are the sharing and searching functions. Moreover, a further important feature is that it would allow organisations to visually represent interesting data in an easy way (See table II.). The interactive digital prototype was tested with the same participants, asking them to perform two simple tasks: 1) to upload one of their dataset to the platform and 2) to search and download a particular dataset. The testing was performed individually and then participants were asked to fill in an online questionnaire to reflect on the concept. The goal of testing was to illustrate the platform potential to the TSOs and to evaluate the overall concept, defining possible points for improvement. A user experience evaluation of the interface was not included in the testing at this stage.

As an outcome of the evaluation activities, we have received positive comments about the concept overall. However, participants pointed out practical challenges that may occur while using the solution. The main warning of participants was about ethical issues related to the GDPR while sharing the data. Keeping in mind GDPR restrictions some organisations may need to prepare the data before uploading it, in particular with a focus on anonymisation and they might require support in doing this. Similarly, some organisations are not familiar with the licences that cover data sharing, so the solution would need to support users also with the choice of a license. Other comments were related to additional functionalities of the platform such as a greater selection of data visualisation tools and an educational flowchart to explain the work of the platform for users without a technical background.

Table II. Designed features to address organisations' requirements for the platform

Solution requirements	Offered features
Get access to meaningful data to address the right local issues	Sharing/searching data; Visuals; Preview of the dataset and description; Offer Keywords for searching
Presentations of data in accessible ways, that is easy to understand	Datasets, maps, charts
Possibility to engage with stakeholders	Sharing own data/ downloading other's data; Community forum; Community meetups; Quarterly data submission reminder (through email)
The tool should be free and easily accessible	Online platform with free access
Support from specialists to help with visualisations and managing the data	Video tutorials/ guidelines; Tech support; Templates; Generation of visualisation based on submitted datasets
Reporting possibility	Possibility to download data and visualisations for reports
The clear data sharing agreement	Terms and Conditions; Licenses selection support

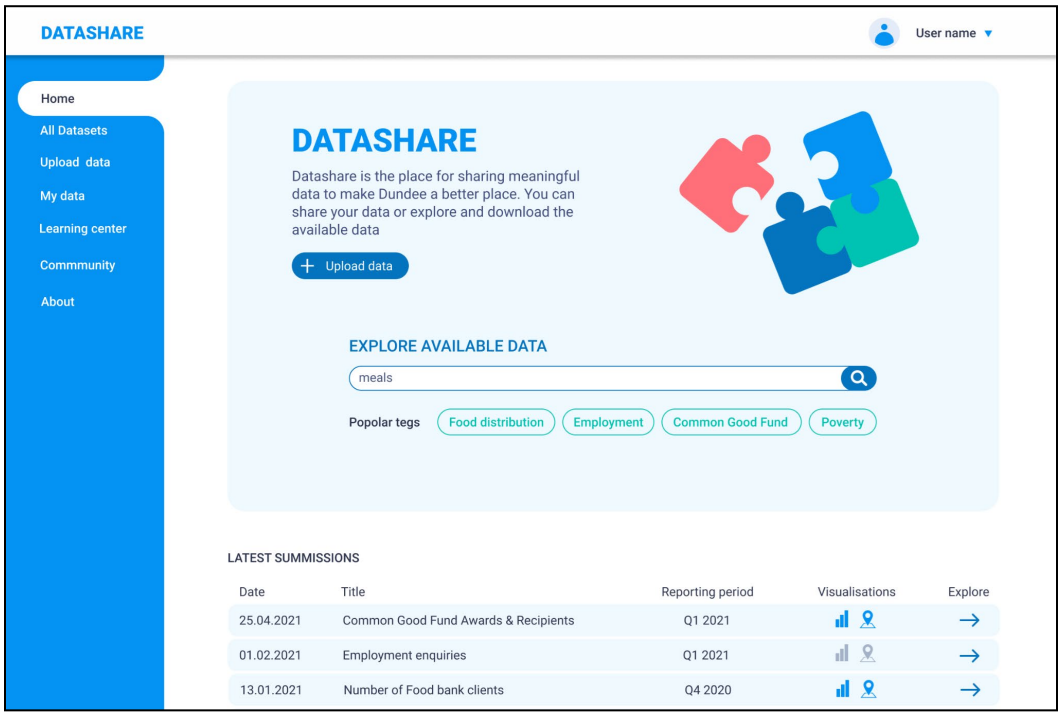

Figure 4. Home page of the Datashare platform prototype

Discussion

Through the conduction of this research, in this paper, we have defined the possible value of the designed Datashare solution for TSOs as well as the role of the PD process in supporting an Open Data culture for TSOs.

Potential impact of the design solution on the work of TSO

The Datashare prototype was designed based on the PD process and the findings of the research, thus addressing the current needs of organisations. PD served the important role of allowing to envision a solution oriented to improving TSOs work. We have outlined the main potential benefits, that, the designed solution can deliver for local TSOs:

(1) Through PD activities participants concluded that identifying deficits across the city might help them to better distribute local services. Similarly, the current research defined the potential of the Open Governmental Data to improve the services of TSOs (Harvey, 2016; Hall et al., 2012). By providing TSOs with the opportunity to exchange data, Datashare could empower TSOs to improve existing services and create opportunities for new ones.

(2) As lack of resources (Boswell et al., 2016; Metcalf, 2013) and computational literacy (Voida, 2011) are among the challenges for TSOs to efficiently work with data, Datashare can stand as a practical toolkit for TSOs to expand their capacities by providing relevant guidelines, templates, and community support.

(3) Current research showcases the need and importance to support communication and collaboration among the TSOs through digital solutions (Erete et al., 2016; David et al., 2014). Similarly, our findings show that local TSOs see benefits in cooperation and would like to have the possibility to engage with stakeholders around data matters. Thus, our designed solution can enhance communication and cooperation possibilities through such features as: sharing data; a community forum; community meetups.

(4) The research has highlighted a number of challenges that prevent organisations from applying data-driven approaches, including lack of resources and problems with e.g. GDPR. Datashare can empower TSOs by providing a simplified tool for data sharing for non-experts, enhancing equitability towards a digital society.

Role of the PD process in fostering an Open Data culture for TSOs

This research also shows how PD can support and facilitate the involvement of TSOs in the Open Data culture. We defined the main contributions of PD toward

the Open Data culture as: providing a platform for dialogue and ideation; raising awareness regarding possibilities of data use and exchange; envisioning the practicalities and challenges in sharing data between TSOs.

Our PD research provided the space for mutual learning and dialogue for TSOs through a focus group and an ideation workshop. This allowed TSOs to initiate a discussion about the data that organisations are constantly collecting and explore possible benefits of its reuse and sharing. While current literature (Erete et al., 2016; David et al., 2014) highlights the importance of building dialogue among TSOs as part of a designed solution, our study extends this literature by providing evidence of the importance of the dialogue among TSOs not only as part of the final solution but also during the stages of the design. Initially, organisations realised the benefits of having up to date information about other Tsos' activities and their data, but they didn't know how to start a dialogue and how to find common areas of interest on this. Thus, PD contributed toward fostering this conversation about Open Data culture for TSOs.

Building on previously defined challenges that prevent TSOs from using Open Data, such as awareness of the potential of data (de Las Casas et al. 2013) and the lack of data science knowledge (Harvey, 2016), PD and our process contributed towards raising awareness regarding possibilities of data use, reuse and exchange. For instance, the focus group allowed each participant to learn about current practices of using and sharing data of the others. It also allowed them to explore what kind of data is used and collected by other TSOs. Similarly, during the Workshop, participants learned about the ideas of other organisations, in particular in relation to how exchange data and what benefits this may bring to the community.

Another important contribution is envisioning the practicalities and challenges in sharing data between TSOs. As part of workshop activities, participants shaped the concept of the future solution step by step, defining requirements and discussing the potential challenges of adopting this solution. During the prototyping stage of our PD process, they had a chance to envision the practicalities of working with data through the future solution and defined the challenges in what could be the future usage of the platform for them: such as lack of awareness about licenses and needs concerning pre-processing the data for sharing. Thus PD helped to raise awareness of the practicalities of working with data for non-professionals, providing participants with a more realistic vision of how much effort it will take to use a system like Datashare.

Future work/Areas of further investigation

We have proposed Datashare as a possible tool to support TSOs, empowering them through raising awareness, enhancing networking, and getting inspired by the PD process. However, the designed concept has limitations that challenge the

exploration of practical ways to implement similar solutions. More specifically, how to take into account GDPR while sharing existing data and at the same time optimise the process for non-expert users. Moreover, it would be necessary to secure funding resources to transform the prototype into a fully functional and operational platform. While the team is actively working on this aspect, until the prototype is transformed into a work platform some of the envisioned impacts will not be able to be realised in full.

As the platform was designed to support locally-based organisations, it would also be important to explore the value of this solution on the broader landscapes. While on the city level, organisations are motivated to share and explore local data, on the country level there might be other motivational factors and benefits for organisations.

Conclusion

In this exploratory paper, we have reported the PD process conducted for investigating new possibilities in reusing data for TSOs. We have engaged 6 TSOs through all stages of the design process in a remote context to ideate innovative solutions. As a result, we have created and tested the prototype concept of the “Datashare" platform, as a practical tool for data exchange among TSOs. Along with the potential value of the solution for organisations and the value of PD in fostering a dialogue among participants about their place in the Open Data culture, we defined the main limitations of the concept, such as ethical and data protection issues of sharing the data. This work contributes to knowledge by outlining how TSOs can work together via Open Data and appropriate tools supporting their service delivery.

Acknowledgements

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Cooking Stories: Connecting Remote Families Through the Sharing of Cooking Experiences

Forum Modi*[1], Colin LeFevre*[2], Nikhil Dinesh*[2], Aswati Panicker[2], and Chia-Fang Chung[2]
The College of New Jersey[1], Indiana University Bloomington[2]
modif1@tcnj.edu, clefevr@iu.edu, ndinesh@iu.edu, apanicke@iu.edu, cfchung@iu.edu

*The contributions of these authors are equal.

Abstract. Families can facilitate beneficial discussions on healthy eating, and in so doing provide important support for each other's health habits. However, distance, e.g., an adult child moving away, makes this interchange more challenging. In this paper, we introduce *Cooking Stories*, a research tool designed to investigate how the sharing of cooking experiences between remote families can be supported by HCI researchers. We conducted an IRB approved interview study with five participants between the ages of 20-67. Preliminary findings indicated that *Cooking Stories* addressed sharing barriers that study participants had experienced in previous systems. Based upon our participants' engagement with the *Cooking Stories* prototype, we identified three themes: focusing on cooking experiences, incorporating cooking processes, and emphasizing familial community. We discuss the potential for these themes to be expounded upon by future work, in order to better support the sharing of full cooking experiences between distanced family members.

Introduction

Eating is not an isolated choice. Individuals rely upon environmental support to maintain healthy habits; family members can provide this support by engaging in conversations about food and health habits (Delormier et al., 2009). However, physical separation from family, e.g., an adult child attending a distant college, lessens the health support they receive and hinders their ability to collaborate with family members on food choices (Binda et al., 2018; Panicker, Basu, and Chung, 2020). Providing support mechanisms for sharing and collaboration over food choices could alleviate these challenges that distanced family members face, and help promote healthy eating, habits, and mindfulness.

Technology that promotes healthy eating through celebratory experiences over corrective measures creates a positive environment for change (Grimes and Harper, 2008). Based on this perspective, users of DECAF (Diary of Emotion, Context and Food) also reported feeling more comfortable sharing and reflecting on their personal health information (Cordeiro et al., 2015). Previous work has identified family support as a key factor in maintaining a healthy lifestyle. Technological tools are used to communicate healthy food habits, nudge family members to adopt healthier lifestyles (Sandbulte et al., 2021), and facilitate the changing familial roles (Panicker, Basu, and Chung, 2020). Current solutions explore photo-based experience sharing to promote mindfulness (Epstein et al., 2016), connect individuals to family members (Biemans et al., 2009; Binda et al., 2018), and exchange health information (Sandbulte et al., 2021). Other solutions such as EATProbe (Grevet et al., 2012), and Performance Apron and Talking Bottle (Chai, Soro, Alessandro, Roe, and Brereton, 2017) enhance food-related communication to overcome feelings of isolation through synchronous, text, and voice-based communication. However, although synchronous communication provides rich interaction opportunities, it could be challenging for family members who are separated by time zones or with misaligned schedules.

Our work expands photo-based food experience sharing through the design of a mobile application prototype, *Cooking Stories*. *Cooking Stories* encourages remote family members and friends to share food experiences akin to the experiences they would have in-person, such as shopping, prepping, and cooking together. In particular, *Cooking Stories* incorporates sharing to support family members' desire to create shared food-related experiences. We developed the prototype and conducted preliminary evaluation studies with five participants who were distanced from their families and had an interest in sharing their *Cooking Stories*. We analyzed the interviews through open inductive coding and affinity mapping. We summarize and discuss three preliminary themes of how technologies could bring remote family members closer together over conversations about cooking and food.

Related Work

Our research focuses on supporting distanced family members' healthy eating practices through the mutual sharing of cooking experiences. These elements of healthy habits, family dynamics, and cooking experiences place our work within the Human-Computer Interaction (HCI) disciplines of food, health, and domestic HCI research. We focused our review of prior HCI work on four interdisciplinary themes we felt best encompassed our work: celebratory technology, family support, photo sharing, and asynchronous communication.

Celebratory technology began with Grimes and Harper (2008), who argued that systems within food research should complement the usual corrective approach with a celebratory approach. More succinctly, users should feel celebrated and affirmed for their food choices. This perspective has been applied to the sharing of health and food information with some success. Ferdous *et al.* (2017) found that celebratory technology enhanced family interaction at mealtime, and Cordeiro *et al.* (2015) found that celebratory technology made individuals feel more comfortable recording personal health information. We extend prior work on celebratory technology by applying the concept to the context of cooking experience sharing. Our aim is to create a celebratory, welcoming environment for individuals to connect with their remote family members over all types of cooking.

Family support is an integral component of supporting an individual's health needs. In the context of Sociology, Delormier *et al.* (2009) discussed the social nature of eating— food choice is dependent upon environmental contexts, and social support can change an individual's eating habits so long as the support remains. They posited that adopting an individualist view on eating tends to disproportionately overstate the extent to which logic and rationale behind food choices influence health. Although eating is an individual act, it is situated in a social context, and therefore is impacted by social and environmental factors. Their work shows that family members are best positioned to influence eating habits of others within the family as eating habits themselves are deeply ingrained not only in familial environments but also through interactions with parents and siblings. Prior work within HCI builds on these findings. Sandbulte *et al.* (2021) found that family health habits, such as eating, moved family members to adopt more healthy lifestyles, and that those habits were at times communicated through technological tools. They delineated three obstacles to family collaboration to foster healthy eating practices: a lack of interest, a lack of consistency, and a lack of understanding. To address these challenges, Sandbulte *et al.* (2021) proposed design recommendations for family-centered healthy eating technology to include motivational factors, foster shared memories, and build sustainable practices. In our study, we aim to leverage the relationships between family support and adopting healthy eating practices informed by these studies.

Panicker et al. (2020) discussed the dynamic roles within the social context of intergenerational families, suggesting that systems supporting individuals should account for changing familial roles. They considered eating and meal preparation to be social activities, and suggested that sharing these experiences may promote connectedness and wellness. The paper explored through the lens of symbolic interactionism, how changing roles within families can be a source for tensions and conflicts between non-collocated family members. They identified the tradeoffs between maintaining shared values, existing routines, rituals, and individual autonomy as crucial considerations for family-centered systems. More succinctly, Panicker et al. (2020) emphasized the need for systems to account for family dynamics, supporting the transitions between various familial roles that individuals inevitably make. We follow the call to support individuals' healthy eating habits through family relationships, and hope to facilitate connections between distanced family members by accounting for dynamic family roles.

The use of photo-sharing can facilitate the exchange of health information. Epstein et al. (2016) found that a lightweight, photo-based approach could increase conversation and promote mindful eating. In the context of family, Binda et al. (2018) recommend using photo-based systems to motivate family members to share health activities. Biemans et al. (2009) similarly found that even photos of mundane events connect individuals with family members. We adopt these prior photo-based approaches to facilitating the exchange of healthy eating experiences. Similar to Binda et al. (2018) and Biemans et al. (2009), we focus on sharing ordinary, mundane experiences in the context of cooking to connect individuals and their family members.

Asynchronous and synchronous methods of communication both have merit. Prior work has shown that systems supporting synchronous communication can connect individuals and, in so doing, prompt further synchronous communication (Judge *et al.,* 2010). In the context of a family, synchronous communication, such as live video calls, is often preferred but cannot fully bridge the communication gap between distanced members due to conflicting schedules, time zones, etc. (Cao *et al.,* 2010). Asynchronous communication has the potential to address this gap. Prior work has shown that systems supporting asynchronous communication, such as photo and text message sharing, can connect individuals (Bernheim Brush *et al.*, 2008) and meet the needs of busy families (Romero *et al.*, 2007). Ultimately, people base their media choices on the context of shared information (Muñoz *et al.*, 2013). When designing a system, the choice between synchronous and asynchronous communication revolves around that context. To support the sharing of the experience and process of cooking, instead of only the products of cooking, we adopt an asynchronous communication model. We believe this model empowers individuals to record, elaborate, and curate their experience and stories.

There has been some work within HCI focusing on the sharing of food-related experiences. Prior work like *PhamilySpace* (Sandbulte *et al.*, 2021) has used photos

to asynchronously facilitate the sharing of health information but has not focused on supporting the sharing of cooking experiences and practices. Other prior works, such as *EATProbe* (Grevet *et al.*, 2012), *Messaging Kettle* (Brereton *et al.*, 2015), and *Performance Apron* and *Talking Bottle* (Chai, Soro, Alessandro, Roe, and Brereton, 2017) have focused exclusively on cooking and eating moments, but synchronous, text- and voice-centric communication may not be applicable to families who cannot cook or eat together. We distinguish our work from past systems by focusing on asynchronous, photo-centric sharing to encourage cooking and food making within remote families. By facilitating photo-centric, asynchronous sharing of cooking experiences, we hope to support healthy eating practices that account for various types of family routines, dynamics, and practices.

Cooking Stories Design

Our prototype design built on the 27 interviews Panicker, Basu, and Chung conducted with older adults and adult children (2020). Participants in the study reported that shared cooking experiences between family members are a valuable social experience that enhance connectedness; when families become distanced due to extenuating circumstances, members often continue this sharing through technology, e.g., sending photos of their cooking to each other through messaging tools. However, participants also reported tensions when these food preparation roles and contexts within family change. They also worried being judged or criticized when sharing food experiences. We designed *Cooking Stories* as a research probe to further examine how to support family members to share and collaborate on food experiences in various contexts.

Design Principles

Based on the findings from Panicker, Basu, and Chung's (2020), wee identified three design principles supporting the sharing of cooking experiences through technology, in the context of distanced family members: supporting transitions between food preparation roles, promoting the capture and curation of full cooking experiences, and focusing on the celebratory experience.

Supporting Transitions between Food Preparation Roles

Building from Panicker *et al.*'s work (2020), we acknowledge the different food preparation roles family members often take and transition between. In our design, we want to enable family members to engage with the app in more than one way. In the context of cooking, this could mean being able to teach a recipe to another family member, learn from each other, or simply create a shared experience together. By supporting these opportunities, we seek to engage family conversations through varied contexts they consider appropriate and desirable.

Promoting the Capture and Curation of Full Cooking Experiences

As reported by Panicker et al. (2020), family members often used existing messaging apps to share short snippets of their cooking experiences. While this type of sharing provides opportunities to promote conversations, they may overlook the contexts that are important to create mutual understandings and shared experience. In our design, we seek to support the full cooking experience, allowing family members to choose and curate their stories as well as situate these conversations within the context they deem appropriate.

Focusing on Celebratory Eating and Cooking

In Grimes' and Harper's call for celebratory food technology (2008), they emphasize the positive and delightful aspect of how people engage with food as a potential design space. In our design, we are interested in creating a pathway for family members to share the stories as well as setbacks of the home cooking process. To support this goal, we intentionally focus more on the experience and the nuances involved, instead of step-by-step recipe creation. Furthermore, we do not create functionality specifically focused on healthy foods, meals, etc.; rather, we strive to promote healthy habits through the connectedness that joyful sharing brings.

Application Features

Cooking Stories (see Figure 1) is an asynchronous sharing application where users can post photo- and video-centric "*Cooking Stories*" and other users can respond to and discuss those posts in a thread-reply format. Before we discuss the application's core features, however, we think it important to give an example of the types of scenarios we envision this application being used in, such as when adult children move away from their family.

Jane Doe has recently begun attending a university several hundreds of miles away from her family. The Doe family has a long-standing tradition of cooking together as a family, and Jane wants to continue that tradition while distanced. Her busy schedule and time zone makes synchronous sharing of her cooking difficult, and general text messaging applications do not let her share the full details of her cooking easily. Hearing that Cooking Stories is an asynchronous, family- and cooking-focused application, she downloads it and asks her immediate family members to download it. They use its detailed, cooking-specific posting format to share their cooking with each other and provide comments and critiques. They do not prefer the app to cooking together in-person, but find it a more compelling option for staying connected than existing communication tools, such as WhatsApp and FaceTime.

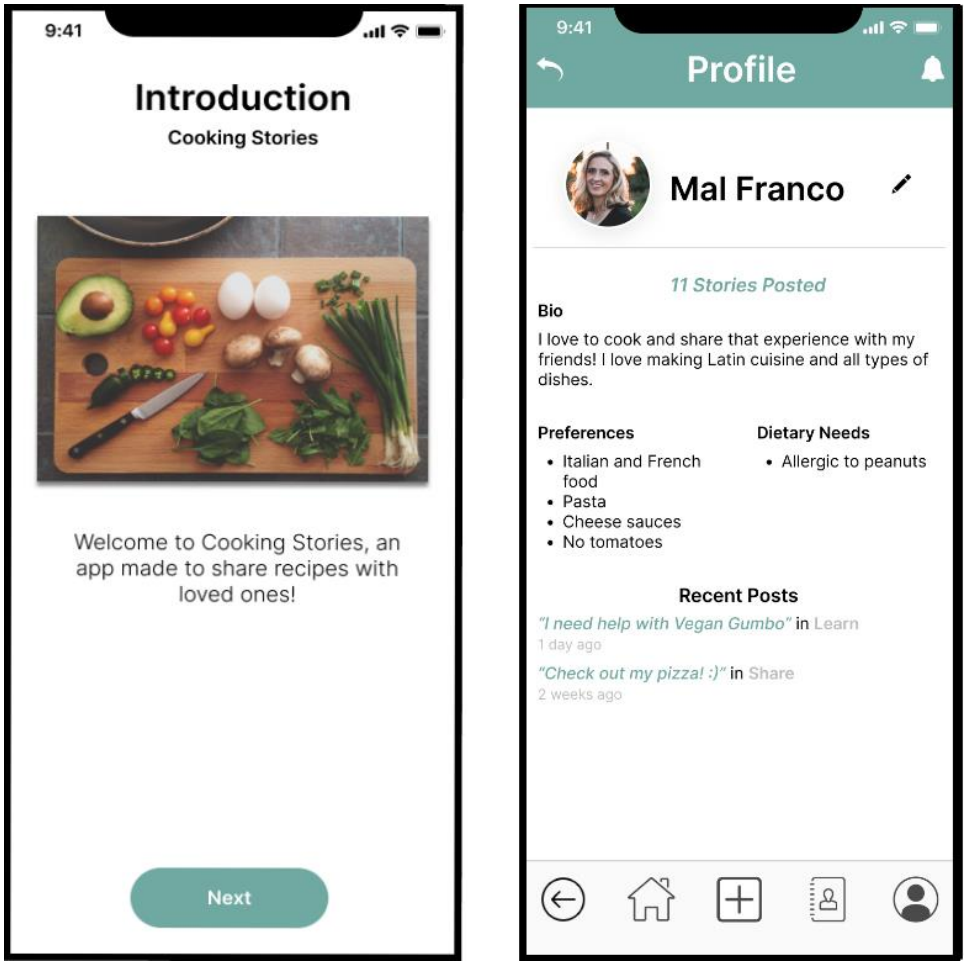

Figure 1: *Cooking Stories* welcome page (left) and *Cooking Stories* profile (right). Users can create a profile to share their cooking interests.

Now that we have established the scenario in which we envision this application being used, we will go through each of the core features, describing them in detail and providing our design rationale.

Asynchronous Sharing Between Family Members

Cooking Stories functions as an invite-only, close circle form of social media to connect family members over cooking experiences; therefore, to view a post from a specific user, other users must be added as friends (see Figure 2). *Cooking Stories* posts are asynchronous, meaning users can make posts whenever they are cooking, and other users have the freedom to comment and/or respond with their own

creation whenever they have the free time. *Cooking Stories* posts remain on user's profile so they can always respond to what they or a family member has posted.

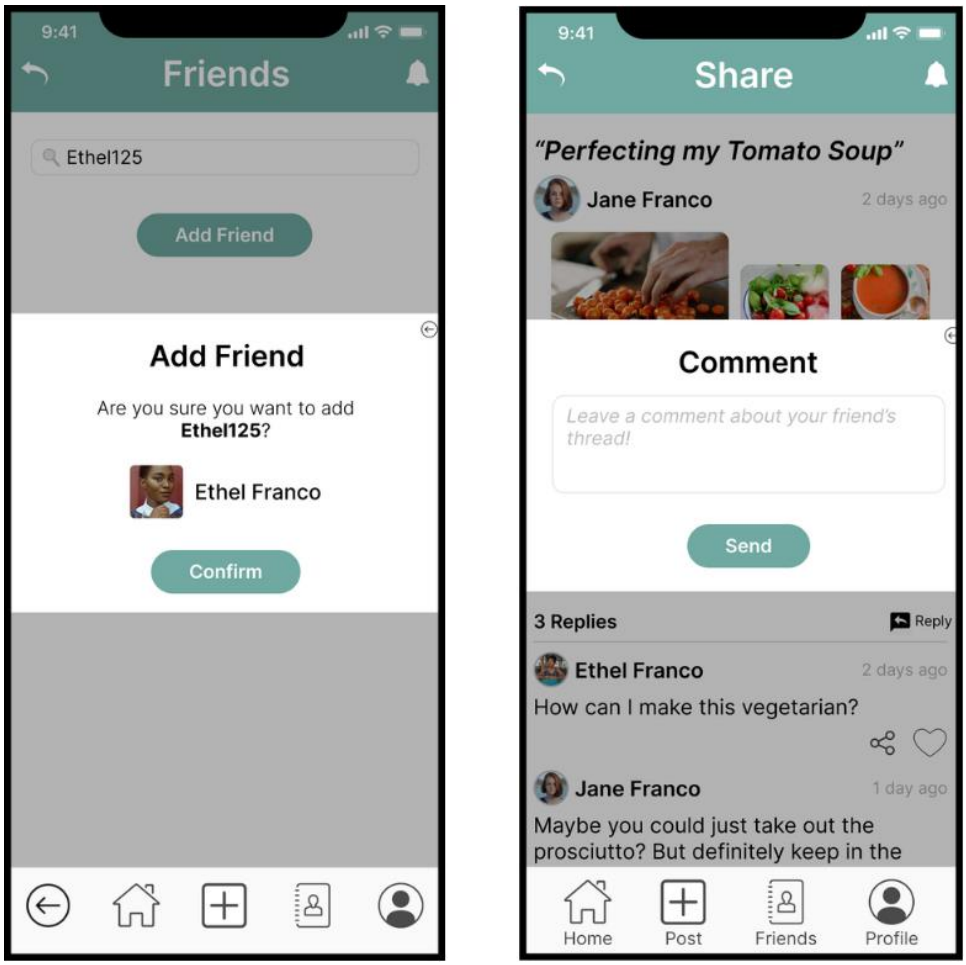

Figure 2: Example of adding friends to a *Cooking Stories* profile(left) and leaving a comment on a Cooking Story (right).

We chose to focus on asynchronous sharing between family members it best fit the type of sharing we want to support. Prior work (Bernheim Brush *et al.*, 2008; Romero *et al.*, 2007) has shown that asynchronous sharing can meet the needs of family in different scenarios. Asynchronous sharing allows users to quickly record their cooking in ways that are convenient to them and share at a later time. The in-person sharing we are striving to replicate virtually is not just large family cooking events (e.g., a potluck or a holiday meal); rather, it also includes small, everyday moments of cooking between only a few family members (e.g., making lunch for a few people). The disparity between these scenarios calls for a flexibility that asynchronous sharing provides. By implementing asynchronous sharing, we hope

to capture the authenticity and intimacy in sharing mundane, seemingly uninteresting events, while recognizing that not everyone wants to synchronously share their everyday cooking all the time.

Photo- and Video-Centric Posting Format

Cooking Stories provides structured flexibility in the posting format (see Figure 3) so that users can be as descriptive as they like when posting about their cooking experiences. First users enter a name and general description about their Cooking Story. Then they can add images showing the process of their cooking with corresponding captions. Finally, users have the options to add all the ingredients in the recipe and can post their Cooking Story.

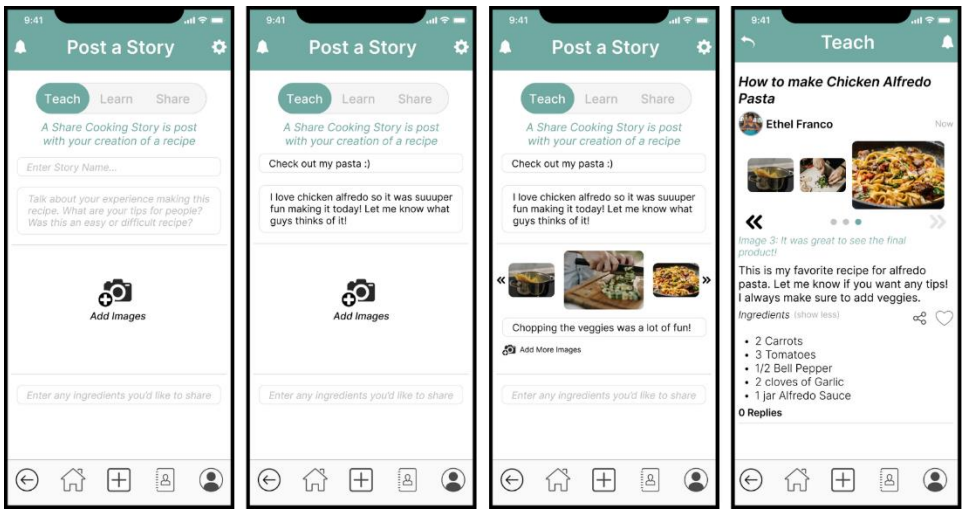

Figure 3: Example of Ethel's process creating a post about making pasta tonight for dinner. From left to right, the example shows the flow of creating a Cooking Story, adding a description, images and captions.

This extended posting format is designed to maximize the intimacy of this asynchronous application, allowing others to partake the full experience of cooking even when they are not physically together at the moment. Given the wealth of prior work on photo-centric sharing (e.g., Binda et al., 2018; Biemans et al., 2009), we naturally gravitated towards photo and video sharing; but, especially given the different age groups which the application is designed for, we also wanted to provide sharing mechanisms for those who do not have an affinity for photo and video sharing. By giving users many ways to convey their experience in a post—images and videos, captions, an experience description, and recipe ingredients—, we hope to support the sharing of fuller, more vibrant, and focused experiences among people of different preferences. Furthermore, by supporting conversation

threads and replies, we hope to emulate the conversations that naturally occur in-person.

Posting and Thread Categories

Posts are sorted into three categories: "Teach", "Learn", and "Share". These categories are designed for specific types of cooking roles and experiences (see Figure 4). A "Teach" post might be a cooking tutorial, a "Learn" post might be a user sharing their first attempt at a new recipe, and a "Share" post might be a user simply wanting to connect with family over a dish they recently made. Users select one of these three categories when they create a post; based on the category they choose, the textual prompts differ. For example, a "Learn" post prompt encourages a user to describe what they're struggling with, whereas a "Share" post prompt asks them to describe what they liked the most about making a particular dish. When viewing others' posts, users can sort the posts by these categories or use the "All" category to show all posts regardless of category.

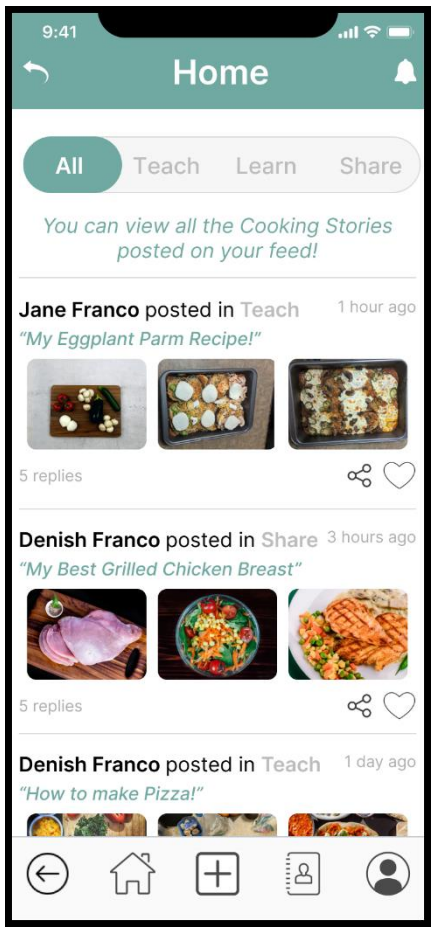

Figure 4: Example of *Cooking Stories* homepage, showing the posts based upon the three categories: Teach, Learn, and Share

We chose these categories because we felt they represent the different roles that naturally emerge from cooking. For example, “Teach” for those seeking to pass along their skills, “Learn” for those seeking to improve their skills, and “Share” for those more interested in simply connecting over food. By utilizing these categories, we can support the type of interactions between family members that lead to enhanced connectedness. Furthermore, the ability to post in any category supports members when their roles or contexts change. An adult member transitioning out of a food receiver role, for instance, may begin posting in “Teach” rather than “Learn” as they take over the food preparation role.

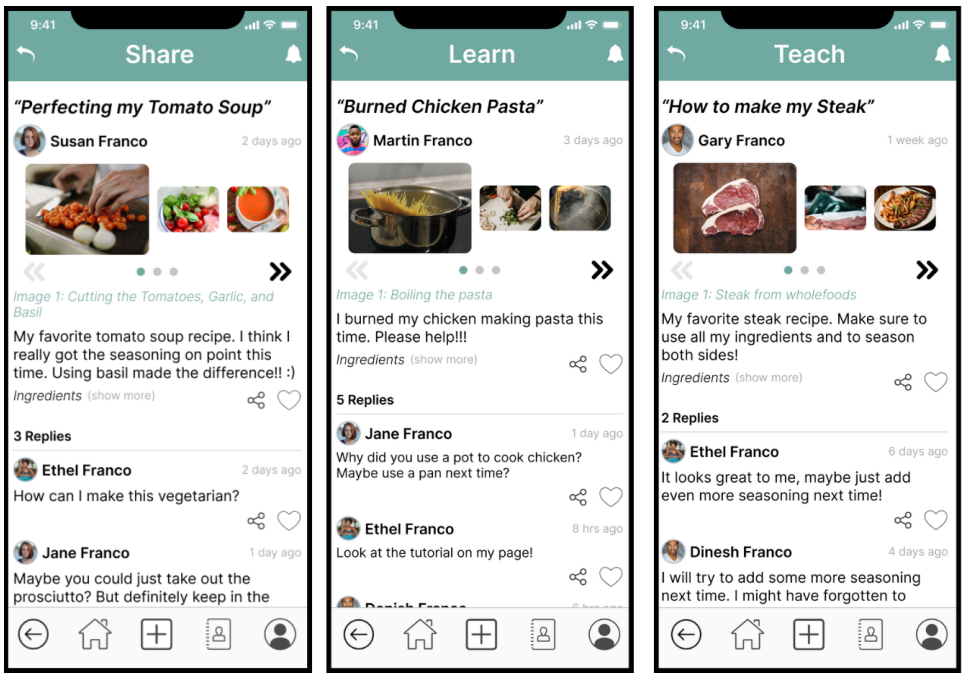

Figure 5: Examples of a “Share” *Cooking Stories* where Susan perfect her Mom’s soup recipe (left); a "Learn” Cooking Story posted by Martin who is asking advice after burning chicken (middle), a “Teach” Cooking Story where Gary shares his family recipe for steak (right).

Promoting Celebratory Eating and Cooking

Celebratory eating and cooking are not only represented by a singular feature in *Cooking Stories*. Instead, we tried to weave their themes throughout our different features. While many cooking-centric applications, e.g., *Whisk*, have an explicit focus on healthy eating and nutritional content, we instead focus on experiences: we want users to connect over, rather than criticize, each other’s cooking.

This rationale framed all three of our primary features. We chose sharing among families because we felt that the familial context lent itself better to celebration; a public posting context could easily devolve into excessive criticism of user’s food choices. For the posting process, we felt that celebratory cooking

conversations was an inherent part of sharing fuller cooking experiences; by supporting users' sharing of contextualized experiences, we augment others' understanding of that experience and, by extension, their ability to celebrate rather than criticizing it. In creating categories, we wanted to guide how participants interact with the application; all three avenues of interaction we offer—Teach, Learn, and Share—are all designed to support celebratory, rather than, corrective activities, further encouraging users to interact with each other in a celebratory fashion.

Methods

With approval from our institution's Institutional Review Board, we conducted a qualitative study with five participants between the ages of 20-67 to answer our research questions:

- Which technology do distanced family members currently use when sharing cooking experiences with each other, and in what ways do they use them?
    - How does *Cooking Stories* compare to this technology?
- What technology shortcomings do distanced family members currently experience that make it more difficult for them to share their cooking experiences with each other?
    - Does *Cooking Stories* address these shortcomings? If so, to what extent? If not, how could it?
- What features do distanced family members desire in technology centered on the sharing of cooking experiences?
    - How does *Cooking Stories* support these experiences? If not, how might they be incorporated?

In conducting this study, our goal was to examine, as the first steps of the iterative design process, how *Cooking Stories*' features support distanced family members to share their cooking experiences with one another. Our preliminary questions were informed by the interviews by Panicker, Basu, and Chung (2020) and contextualize participants' experiences interacting with the application. By interviewing and designing concurrently, we hope to better understand user needs and iterate on design features. Looking forward, our ultimate aim is to leverage these early findings to inform future, larger-scale studies and deployment.

We recruited participants by posting flyers to online cooking forums and reaching out to personal connections who fell within our target group, i.e., adult children or parents of adult children who communicate with distanced family members about their cooking experiences. Given our focus on early design feedback, we recruited individual participants rather than paired family members. Recruiting in pairs would be ideal for a long-term deployment study, but our goal was to iterate on early feedback in this exploratory study.

We conducted the studies via online Zoom meetings. Our study consisted of a short semi-structured preliminary interview, a usability test of *Cooking Stories*, and another semi-structured follow-up interview. These three components took place consecutively within the same Zoom meeting. The entire study sessions were video recorded, with participants' consent.

Table I: Participant Demographics and Experiences with Sharing Cooking Experiences

Participant #	Gender	Age	Distanced Sharing Family Member	Prior System Use
1	Female	20	Siblings, Mother, Relatives Abroad	Snapchat, Instagram, Text Messages
2	Non-Binary	23	Siblings, Mother, Extended Family	Snapchat, Instagram, Group/Text Messages
3	Female	20	Siblings, Grandparents	Instagram, Tiktok, Whatsapp, iMessage
4	Male	57	Daughter, Extended Family	iMessage, Facetime
5	Male	65	Daughters	Text Messages, Zoom

Our preliminary interview asked participants questions about their cooking experiences: what they share, how they share it, and with whom they share it. Participants then engaged in usability testing. This testing focused on the fundamental features of *Cooking Stories*: asynchronous sharing between family members, a unique posting format centered on cooking experiences, and post categories supporting changing roles and contexts. We sought to learn how participants across different age groups valued the core functionalities of *Cooking Stories* and saw themselves adapting it into their personal lives. Our follow-up interview asked participants questions about their experience using *Cooking Stories* in comparison to other sharing technology: how they felt about their experience using it, how it compared to the current applications they use, and whether they could see themselves integrating it into their sharing habits.

We conducted inductive qualitative analysis on these interviews; we performed open coding on the transcripts using Saturate[1], a web app for coding and memo creation. We then used affinity diagramming to organize our open codes into high-level themes, which formed the basis of our findings and further analysis.

[1] http://www.saturateapp.com/

Findings

In our study, we focused on understanding the barriers our participants faced while sharing cooking experiences with remote family members, and how, if at all, *Cooking Stories* addressed those barriers. We identified three themes throughout participants' complaints about experience sharing, *Cooking Stories*' features, and participants' thoughts on interacting with the prototype. These themes are focusing on cooking experiences, incorporating cooking processes, and emphasizing familial community.

Focusing on Cooking Experiences

Our participants experienced hesitancy sharing cooking experiences through popular communication apps, such as WhatsApp, Snapchat, and Instagram. They described deliberating over whether an experience was appropriate to share, often opting not to share it. The criteria for suitability differed between participants. For example, Participant 1 described choosing not to share a cooking experience because she felt it did not match the food interests of family members; Participant 3 described choosing not to share because she felt her experience would not be exciting to friends and family; Participant 5 described choosing not to share because his daughter has a *"busy adult life"* and he did not want to intrude. Our participants shared the same fundamental barrier: because general-use communication tools may not provide appropriate context for sharing, it becomes challenging to decide when and with whom it is appropriate to sharing their cooking and food experiences. This barrier is particularly problematic because opting not to share an experience with family reduces the social support an individual receives for their healthy eating habits.

After interacting with *Cooking Stories*, participants felt that having a dedicated channel for sharing cooking experiences addressed their concerns over the suitability of sharing. By focusing explicitly on cooking, *Cooking Stories* allows individuals to dedicate any experiences relevant to the cooking process within family contexts. For instance, Participant 2, who had previously described their difficulty sharing experiences in their family group chat, appreciated that the app was a *"dedicated space for [cooking]"*.

Incorporating Cooking Processes

Participants expressed that their preferred mobile applications did not fully support their sharing of cooking experiences. The goals and features of these applications often did not align with or meet the participants' sharing needs. For example, Participant 2 criticized Snapchat for not allowing her to share permanent posts of her cooking. Participant 4 felt that existing cooking apps had too great a focus on

calories and therefore did not meet his needs; in his words, *"I don't have a problem with my weight…[but] that's what a lot of mobile apps are [about]."* Participant 4 also disliked that text messaging and FaceTime, his preferred method of remote communication, did not support the sharing of full cooking experiences: *"you can't really show how you start from the beginning of making, prep-making, and preparing food to actually cooking."* The shared complaint among all participants was that their chosen apps did not incorporate cooking processes. Snapchat, Instagram, WhatsApp, etc. can display a small part of a cooking experience but lack the functionality and atmosphere conducive to a full-length, start-to-finish experience.

Participants felt that *Cooking Stories*, to an extent, did address this issue by directly incorporating cooking processes into its design. They felt that its features, i.e., ingredient lists, multi-photo stories, and post categories, created an environment conducive to the sharing of fuller, longer cooking experiences. For example, Participant 1 stated, *"I like how, like, the recipes are on there…you don't have to message [your friend], like, 'what's the recipe for this?'"*

Participants also had specific feature recommendations to enhance *Cooking Stories*' incorporation of cooking processes. Participant 2 felt limited by stories only showing ingredients and suggested that stories could also include specific recipe steps. Participant 4 suggested a "live", in-progress story which could be posted incomplete and then iteratively added to. These suggestions indicate that these features resonated with our participants, to the extent that they wanted to see them improved and more fully incorporate cooking processes.

Emphasizing Familial Community

Unlike the past two areas of focus, users did not express any frustration over a lack of familial community. Similarly, there was no greater barrier originating from community that all participants shared. However, despite no barrier to serve as a catalyst, participants shared a desire to engage in a cooking-oriented community when presented with the opportunity to do so.

When interacting with the prototype, participants responded positively to the emphasis it placed on inter-personal, communal connection. The interaction with family appealed to all four participants; each readily described different individuals who they could see themselves using the app with. Participant 2 in particular explicitly emphasized community, describing the app as a *"community space"* where they and their friends could have a *"community based around cooking, as opposed to…social media"*. Participants 1, 2, and 3 (ages 20-23) expressed interest in using the application to connect with family members; their only reservation was whether their older family members, e.g., parents, would be willing to download the app. Participant 4 (age 57) expressed some interest in using the application with his adult daughter. He felt that the posting process was time-consuming and

expressed that he would use *Cooking Stories* to share longer experiences when he had time but would use text messaging to share shorter experiences. Participant 5 (age 67) appreciated the app's features but was uninterested in using the app to connect with family members; he self-described as a technological *"neanderthal"* very uninterested in using mobile applications to communicate with his family.

Importantly, though we designed *Cooking Stories* with familial community in mind, Participants 1 and 2 were as interested in friend-focused communities as they were in family-focused communities. Both saw *Cooking Stories* as a way to engage their friends who are uninterested in cooking. Participant 1 said that she could see herself using it to create tutorials and that her friends would *"be like motivated to cook"*.

Discussion

Several of the participants' shared experience confirmed understandings from related work. Similar to prior studies, participants in our study responded positively to the photo-centric approach to experience sharing (Biemans *et al.*, 2009; Binda *et al.*, 2018; Epstein *et al.*, 2016). They also thought that our celebratory approach provided comfort in sharing, particularly appreciated the family-centric nature of *Cooking Stories.* Though we were not able to fully evaluate the efficacy of *Cooking Stories* prototype's categories, we did note that all our participants responded positively to the "Teach/Learn/Share" categories, which shows the potential to support interactions among dynamic family roles.

We also found unexpected participant reactions. We specifically designed our community features to be focused on family rather than friends, and yet participants nonetheless associated *Cooking Stories* with friends just as frequently as with family. This could be attributed to the fact that many of our participants were under the age of 25 and associated social media as a way to interact with friends as well as family. Although we primarily design for a family-centric application to support the experience sharing among remote family members, there are potentials for the system to extend beyond family members. For example, though Participant 4's dislike of weight-loss-centered apps did partially fit within our focus on celebratory rather corrective sharing, it also has unanticipated implications — by not focusing on weight loss and nutritional intake, *Cooking Stories* could implicitly provide support to some individuals outside of the context of family social support. More succinctly, our app's celebratory sharing could be an element of support in of itself. Finally, Participant 1's desire to use *Cooking Stories* as a family recipe catalog suggest that the app could be construed as a cultural artifact (Davis *et al.*, 2014).

Overall, our findings suggest that an asynchronous, photo-centric mobile application for the sharing of cooking experiences holds promise for connecting remote family members. Participants responded positively to the app and could envision themselves using it to connect with distanced family members, to varying

degrees. The core features and functionality resonated with them, particularly the specific elements we most wanted to emphasize—celebratory sharing within a familial community. However, we acknowledge that findings from this preliminary study may not represent participant experience in the wild. Future studies are necessary to further examine and evaluate how these features support real life experience in sharing and collaboration of cooking experience..

Limitations and Future Work

Our preliminary study included five participants due to time constraints. Recruiting more participants from a wider age bracket and family roles would give more insight on the diverse ways in which individuals would interact with our application.

Future work would build on current findings, further reinforce the three themes supporting family connection and sharing, as well as incorporate user feedback, such as design changes and feature recommendations. Following these changes and additions, we will transition from online prototyping to developing and deploying a fully functional mobile application.

Conclusion

In this paper we introduce *Cooking Stories*, a mobile application which aims to connect distanced family members through the sharing of full cooking experiences in a collaborative online environment. In our preliminary qualitative study (n=5), our participants envisioned how *Cooking Stories* could support the sharing and collaboration of cooking experience with remote family members. . We believe systems like *Cooking Stories* have the potential to further support family connections over cooking experiences, and encourage further work to future examine such support in real life contexts.

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Bjørn, P., Borsotti, V., Boulu-Rødje, N., López, C., O'Neill, J. (2022): Doing Research in Complex Interwoven Research Engagements, In: Proceedings of the 20st European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies - Panels, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.18420/ecscw2022_pa01

Doing Research in Complex Interwoven Research Engagements

Pernille Bjørn
University of Copenhagen, Denmark
pernille.bjorn@di.ku.dk

Valeria Borsotti
University of Copenhagen, Denmark
valeria.borsotti@di.ku.dk

Nina Boulus-Rødje
Roskilde University, Denmark
ninab@ruc.dk

Claudia López
Universidad Técnica Federico Santa María, Chile
claudia@inf.utfsm.cl

Jacki O'Neill
Microsoft Africa Research Institute, Kenya
jacki.oneill@microsoft.com

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Abstract. When we conduct empirical work within CSCW research, we engage ourselves with various people, fields, domains, and topics which are part of the contexts which we study and/or are designing for. In many situations, the field, we study comprises interwoven multiplicities of technologies, artefacts, infrastructures, and people, which cannot easily be separated during fieldwork, in the analysis of the data, or in the write-up and presentation of the results. In these situations, we as researchers, produce specific engagements with our context of interests - and these engagements shape and challenge the kind of research we can do, are allowed to do, ethically can do, ethically are allowed to do, as well as what we want to do. In this panel, we will discuss what it means to do research as complex interwoven research engagements, and which methodological and ethical challenges which arises.

Interwoven Research Engagement

Can all empirical CSCW research be characterized as complex interwoven research engagements - or what makes empirical CSCW research into a complex interwoven research engagement? Multi-sited ethnography and design stipulates that the nature of the 'field site' cannot easily be bounded into one specific place or space for examination (Bjørn & Boulus-Rødje, 2015; Williams, Lindtner, Anderson, & Dourish, 2014), but instead is a social construction made for analytical purposes by the researchers (Blomberg & Karasti, 2013). The 'field site' is constructed through the choices and actions of the researcher, and past decisions shape future potential actions (Bjørn & Boulus, 2011). The 'field site' is shaped by the research interest, epistemological interests, and the theoretical assumptions arriving with the researcher. The perspective and positioning of the researcher matters for what is made visible or invisible when engaging with the field site, and thus matters for which kind of results can arrive from this work.

In this panel, we will discuss the methodological and ethical challenges which arrive when CSCW researchers enters complex interwoven engagements with their empirical field site. We will do this by asking and reflecting upon a set of questions across the various field sites, research interests, and epistemological positionings, which the panelists bring to the field. Together, the panelists bring experiences from multiple empirical cases, from different countries, within/outside organizations, focusing on understanding practice (Bjørn & Christensen, 2011; Bjørn, Scupola, & Fitzgerald, 2006; Borsotti, 2018; Borsotti & Bjørn, 2022; Boulus-Rødje, 2018; González-Pizarro, Figueroa, López, & Aragon, 2022; Muralidhar, Bossen, & O'Neill, 2022) and design of technologies (Bardzell et al., 2017; Green et al., 2017; Nov, Arazy, López, & Brusilovsky, 2013; Tandon, Siri, Mehra, & O'Neill, 2019). We will bring in our experiences and specifically reflect upon the challenges which arrive when we study our own organizations, political contexts, vulnerable populations, or online politics.

Together we will discuss the following questions:

- What makes your research a complex and interwoven research engagement?
- What are the common characteristics of the three types of complex and interwoven research engagements in this panel?
- Which methodological challenges are you experiencing in your research engagement?
- Which ethical challenges have you experienced in your research engagement?
- What are the lessons learned based upon your experiences in engaging in interwoven research relationships you would like to share?

Finally, we will discuss with the ECSCW2022 audience: Which methodological and ethical challenges arises when engaging in complex and interwoven research engagements?

Panelists

Pernille Bjørn (panel chair) is Professor and Deputy Head of Department for Research at the Department of Computer Science, University of Copenhagen, Denmark. Her research spans multiple areas within CSCW including global software development, healthcare technologies, tech entrepreneurship, cooperative virtual reality, and equity in computer science. Most recently, she is starting up a new research project focusing on artistic explorations of the future of work in hybrid settings. Together with associate professor Nina Boulus-Rødje, she leads the Danish part of the ERASMUS+ FESTEM research project, where they explore tech entrepreneurship in Palestine.

Valeria Borsotti is a PhD candidate at the Department of Computer Science, University of Copenhagen (Denmark). She researches how socio-technical systems shape opportunities and constraints for equity, particularly in the domain of computing education. Her research is situated CSCW and feminist/queer HCI. Valeria is also interested in exploring experimental ethnographic methods. Valeria's research is part of the FemTech program directed by professor Pernille Bjørn. FemTech is a practice-based research programme that addresses the problem of how to facilitate inclusion in computing.

Nina Boulus-Rødje is Associate Professor in the Sustainable Digitalization Research Group, and the Director of Studies for Informatics (BSc) and Digital Transformation (MA), at the Department of People and Technologies, Roskilde University (Denmark). Her research is situated within CSCW and HCI, with special interest in tech entrepreneurship in developing countries, ethnographies of technologies, digital transformations, and sustainable digitalization. She co-leads the Danish part of the ERASMUS+ FESTEM research project.

Claudia López is an Assistant Professor at the informatics Department, Universidad Técnica Federico Santa María (UTFSM) in Valparaíso, Chile. She is also an Associate Researcher at the Chilean National Center for Artificial Intelligence (CenIA), where she works on Human-centered AI. Her research focuses on designing and empirically evaluating social technologies for local politics and small organizations. She is an active member of the CSCW/HCI community in Latin America and participates in several initiatives to increase the participation of women in computing. She serves as program co-chair of ECSCW 2022.

Dr Jacki O'Neill is founding Director of Microsoft Africa Research Institute (MARI). She is passionate about designing technologies which enhance, rather than remove, agency and create sustainable futures. She brings this passion to the MARI where she is building a multi-disciplinary team, combining research, engineering, and design to solve local problems globally. An ethnographer by trade, her research aims to drive innovation in order to make the best possible technologies for work, health and society. Before leading the MARI, she was a Principal Researcher in the Technology for Emerging Markets (TEM) area at Microsoft Research India. She has led major research projects in the future of work from new labour platforms to workplace AI and chat; digital currencies and financial inclusion, and Global Healthcare.

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Robots in heterogeneous contexts: Negotiation of co-creative lifelong learning spaces through participatory approaches

Richard Paluch[1], Katerina Cerna[2], Galina Volkova[1], Michael Seidler[3], Tim Weiler[1], Mohammad Obaid[4], Claudia Müller[1]
[1] IT for the Ageing Society, University of Siegen, Germany
[2] Division of Human-computer interaction, Department of Applied IT, Gothenburg University, Sweden
[3] Institute for Social Science Research (ISF Munich), Germany
[4] Interaction Design Unit, Department of Computer Science and Engineering, Chalmers University of Technology, Sweden
richard.paluch@uni-siegen.de, katerina.cerna@ait.gu.se, cocreativespaces2022@gmail.com, michael.seidler@isf-muenchen.de, tim.weiler@uni-siegen.de, mobaid@chalmers.se, claudia.mueller@uni-siegen.de

Abstract. Learning is inherently social. This raises several questions that relate to how contexts and spaces can mediate co-creative learning. In this workshop proposal, we refer to the interrelated aspects of space, learning, and embodiment and how these aspects mediate the human-robot interaction. Our assumption is that robots are interpreted variously and used in different ways. We are interested in the interrelation between interpretation and use, which are constitutive for the establishment of different co-creative learning spaces. Reflecting on this leads to an understanding of what to look for in

Participatory Design studies. It matters, for example, whether persons in a nursing home have any say at all in how robots are perceived and in what technical practices robots are to be integrated and adopted. This is a crucial aspect for the appropriation of technical artifacts and for the development of new (E)CSCW or HCI paradigms.

Background

> "How to behave in the situation [when different actors perceive robotic artifacts differently], whether you prefer to do this constantly in individual situations or with an entire group, how to deal with the dynamics. These are all things that can be better explained by such studies [on learning processes regarding robots] at some point." (Paluch and Müller, 2022, p. 23).

This quote is an interview excerpt from our study in which robotic pets were used in a nursing home. One of our research interests was the creation of mutual learning spaces for the residents, care attendants, and university researchers. The care attendant had pointed out that co-creative learning spaces were necessary for developing an imagination on how the usage of robotic pets could be meaningful in different care situations. In our view, such spaces for mutual learning and co-creation are necessary to foster the development of functionally better technologies and reflect on their use with all participants.

We need to co-create spaces for people to appropriate new technologies such as robots (Stevens and Pipek, 2018). For this, three questions are important: (1) How to include spatial aspects in design? (2) What could be learned in various spaces? (3) What role does the body play in human-robot interactions? Thus, we define three interrelated foci:

(1) The emphasis is on not only developing a specific technology, but also having a space in which to explore a technology. A robot also needs an environment in which it can function and be used (Lindemann and Matsuzaki, 2014). That includes spatial aspects that we would like to emphasize in our Participatory Design (PD) approach (Simonsen and Robertson, 2013).
(2) How can learning processes be supported through PD? It is not only about how to use technology. One also needs to learn in which situations it is appropriate to use technologies (Cerna et al., 2022).
(3) The human-robot interaction is characterized by the fact that both the human and the robot have a body. Robots are embodied technical artifacts. This distinguishes robotic systems from other digital technologies (Bartneck et al., 2020, p. 7).

Creation of learning spaces through PD

In PD, emphasis is placed on allowing users to participate in all stages of design. Design ideas are gained by focusing on usage practices, and novel technical possibilities can be explored. This can be achieved by discovering a more creative solution to a problem. With PD methods, it is possible to strengthen mutual learning in an iterative development. In addition to the socio-cultural structures or technical artifacts, this also requires an environment in which collaborative participation is possible. Thus, PD studies need to create suitable learning spaces (Bratteteig and Wagner, 2012; Suchman, 2011). Compared to user-centered design, we would like to use the term PD to emphasize that this is a co-research process in which the emphasis is on the inclusion of all perspectives (Duque et al., 2019).

In co-creative learning spaces, where groups of people from different contexts take part, the sense of technologies could be negotiated together. Negotiating in spaces have been crucial in participatory research methods and Scandinavian design for decades based on the democratic ideal that everyone should have the right to participate in decisions impacting one's own life (Ehn, 1993; Nygaard, 1996). In co-creative learning spaces, this approach has a central importance, as freedom of expression is an essential aspect in successful participation and negotiation, and at the same time contributes to maximizing the learning effect and empowerment (Brown et al., 2014; Ogonowski et al., 2018). Co-creation is consequently always a learning journey (Akhilesh, 2017), which makes it an appropriate format to support learning effectiveness and autonomy (Kaptelinin and Bannon, 2012; Vassilakopoulou et al., 2018).

Learning and empowerment through interaction with robotic technologies

Learning to use technical artifacts is an important practice that remains with people throughout their lives and takes place in various spaces, environments, and situations, covering formal, non-formal, and informal learning (Aoki, 2020). In societal discourse, current debate is about how lifelong and lifewide learning can be designed and supported (Findsen and Formosa, 2011; Fischer, 2000; Zhuang et al., 2017), and in which social contexts learning processes must be placed to generate positive impacts such as empowerment and improved living standards (Carr et al., 2018). For example, scientific studies refer to how older persons can learn technical skills so that they can use different technical artifacts (e.g., Lee and Riek, 2018; Schreurs et al., 2017). There are also a variety of digital technologies that teach people in everyday life (e.g., Cerna et al., 2022; Fong et al., 2021; Johnson et al., 2012; Kuoppamäki et al., 2021; van den Berghe et al., 2019).

In this context, empowerment describes a social construct or interpersonal process between at least two people in which tools, resources, and environments are combined and made available in ways that increase the capabilities of the

empowered persons and develop new skills (Hawks, 1992). This empowerment supports individuals' abilities to make purposeful decisions and thus transform them into desired outcomes. Thus, empowerment not only describes the goal itself, but is also considered a driver for development (Alsop, 2006). Accordingly, it is also necessary to evoke the feeling of empowerment in the participating individuals in advance so that they can efficiently and effectively participate in the negotiation processes of co-creative methods (Fraser et al., 2006).

Human-robot interaction and embodiment

The different aspects of embodiment have been explored in various fields of science and from diverse perspectives, for example in studies in communication and psychology, modern philosophy, HCI, (E)CSCW and sociology. We align our work with existing (E)CSCW and HCI literature on embodied interaction and action (Al-Sada et al., 2021; Ducheneaut et al., 2009; Schmidt, 2018; Yamazaki et al., 2012). Our understanding of embodiment builds on two key points:

> "First, that cognition depends upon the kinds of experience that comes from having a body with various sensorimotor capacities, and second, that these individual sensorimotor capacities are themselves embedded in a more encompassing biological, psychological, and cultural context" (Varela et al., 1991, pp. 172-173).

In other words, it is the bodily engagement with the social and physical environment that constitutes the interaction between humans and robots (Dourish, 2001).

Using the term "embodied", we aim to highlight that both humans and robots interact with the world through their bodies (and not only their minds or software) and this active experience of the world shapes how they perceive their surroundings. The embodied aspect is crucial as it mediates our various human-robot interactions (Klemmer et al., 2006; Lindemann and Matsuzaki, 2014).

Workshop goals and activities

For (E)CSCW and design approaches with participatory research, interdisciplinarity is crucial. We would like to contribute on how co-creative learning spaces can be supported in heterogeneous contexts and what different disciplines can say about learning and negotiation using robots as an example. This offers both workshop participants and organizers an insight into different approaches and a broader picture regarding the concept of lifelong learning in different fields. We thus build on the considerations and results of Cerna et al. (2020) and Cerna and Müller (2021).

- How to augment the physical properties of a robot so that it is possible to make sense of it by the possible users?
- How to organize the socio-materiality of a space including a robot to make it into a negotiation space that enables different forms of learning?
- What skills do people need to be able to negotiate their co-creative learning spaces?
- How to responsibly frame the notion of empowerment that represents heterogeneous actors in PD?
- What new (E)CSCW or HCI paradigms concerning human-robot interaction in heterogeneous co-creative learning spaces can be identified?
- How can we understand learning to deal with robots?
- How to imagine mutual learning among human and non-human actors?

We plan the workshop for one full day. First, right after the acceptance of our proposal, we will go live with our workshop website and immediately send a call for papers to all our networks. We will then prepare all the necessary infrastructures, such as a common document to collect all the relevant information, a place where we will collect all the submitted texts and a Miro board (https://miro.com/) for virtual participants. Before the actual workshop, participants will receive the submitted texts in advance to read and prepare for the workshop as well as access to the online common document. In this document, we will keep an updated version of the workshop schedule and other relevant information, such as images, prototypes, findings, ongoing reflections, etc. We will prepare for an offline, online, and a hybrid variant of our workshop. We will use a Miro board and/or a whiteboard as an interactive tool for the workshop so that discussion is directly captured and to evoke discussions among all participants.

Workshop introduction

At the beginning of the workshop, there will be a round of introductions in which the participants and the workshop organizers can introduce themselves briefly. Afterwards, the main topics are introduced: (1) space, (2) learning, and (3) embodiment.

Mini-presentations

Each participant is given the opportunity to describe her or his research focus in a short presentation. Thus, there are several loops in which the workshop participants can present themselves, their contents, and their texts. At the same time, everyone also could familiarize themselves with the scientific directions and focal points of the respective participants.

World Café

Next, we will organize an activity called the World Café (Schley and Balzer, 2020). We will arrange the participants into three working groups, each focusing on one of the challenges connected to our topics: (1) space, (2) learning, and (3) embodiment. Each group will discuss one topic for a specific period and document their discussion, and once the time is up, move to the next table. Each participant will be given the opportunity to share aspects at the three topic tables. Through sticky notes on Miro or notes on the whiteboard, insights are collected and documented.

Common discussion

In the second half of the workshop, the results are collected and classified according to our topics of (1) space, (2) learning, and (3) embodiment. This categorization is discussed among the participants to capture important categories and dimensions of the identified aspects. An organizer takes written notes throughout the session to document the progress of the workshop.

Next steps

We collect results, central aspects, and further thoughts. Through this we expect to be able to define new paradigms and how co-creative learning spaces for handling robots can look like in heterogeneous contexts.

Table I. Workshop Agenda

Time	**Activity**
9:00 - 09:10	Brief workshop introduction
9:10 - 10:30	Mini-presentations and discussion of pictures, sketches, wireframes, mockups, and prototypes
10:30 - 12:00 (including break)	World-Café: Three topic tables with the focus on space, learning, and embodiment
12:00 - 13:00	Lunch break
13:00 - 15:00 (including break)	Common discussion of the three topics based on the results from the World Café
15:00 - 16:00	Next steps

Submission details

Potential participants, who are interested in the workshop, will be asked to submit a position paper. This paper should have no more than 5 pages including references.

We would like to encourage potential authors to refer to our three workshop topics in their contributions. Papers can address philosophical or theoretical considerations, present methodological insights, or empirical cases. Submissions will be sent by email. The organizers of this workshop will review the submitted papers and select them according to their quality, innovation as well as coherence with the three thematic foci: (1) space, (2) learning, and (3) embodiment.

- March 14, 2022: Workshop website is published together with the call shared in all our communication channels;
- April 19, 2022: Deadline for paper submission;
- May 2, 2022: Acceptance notification;
- June 27 or 28, 2022: Participation and presentation.

We will notify participants of acceptance at an early stage so that both the early bird rate can be selected, and conference travels can be arranged in case of the offline or hybrid variants of the workshop.

Post-workshop and expected outcomes

Our plan is to publish the submitted papers. To do this, we plan to publish a workshop report in IRSI – an open source online journal (https://www.iisi.de/international-reports-on-socio-informatics-irsi/), where we will publish papers revised by the authors after the workshop. Finally, we also want to work with the workshop participants to extend their research further by inviting them to submit to a journal special issue on the workshop's topic. To be able to continue the discussion around the topics of robots, we will agree on creating a communication channel with the participants. It is also pursued to enable a sustainable cooperation between the participants and to enable a future collaboration in production or research (Obaid et al., 2016).

Organizers' short bio

Richard Paluch is a PhD Student at the University of Siegen, Germany. His research focuses on the robotization of care. Possibilities and limits of robotic systems for nursing are analyzed and standards for reasoning and assessment are developed for people in need of care.

Dr. Katerina Cerna is a HCI lecturer at the Division of Human-computer interaction, Gothenburg University, Sweden. She has a longstanding interest in combining learning and PD, especially in enabling citizens in co-creating their own solutions and the necessary knowledge they need to develop to do so. Currently she is exploring these topics in the fields of HCI, sustainability and well-being.

Dr. Mohammad Obaid is an Associate Professor of HCI and the Head of the Interaction Design Unit at Chalmers University of Technology, Gothenburg, Sweden. He worked at several international research centers including the Human Centered Multimedia Lab (Germany), HITLab NZ (New Zealand), and the Social Robotics Lab (Sweden). Dr. Obaid is one of the founders of the Applied Robotics Group at Chalmers University of Technology. He also (co-)authored of over 78 publications within the areas of his research interests on Human-Robot Interaction and Human-Computer Interaction.

Dr. Galina Volkova is Junior Research Fellow. Among her main professional interests – features of researchers and engineers as a specific group of highly qualified knowledge workers (including those involved in robotics), their skill sets and lifelong learning patterns.

Michael Seidler is a PhD student at the Institute for Social Science Research (ISF Munich, Germany). His research focuses on work, human-machine interaction as well as learning and development. He is particularly interested in thinking about how a human-machine interaction could systematically promote informal workplace learning for human and non-human actors.

Tim Weiler is a research associate at the University of Siegen, Germany. His research focuses on PD and Co-Creation in health care. Hybrid interaction systems for maintaining health even in exceptional situations are analyzed and a framework for co-creative methods is to be defined.

Prof. Dr. Claudia Müller is an Assistant Professor of Socio-Informatics, specializing in "IT for the ageing society" at the University of Siegen, Germany. Her expertise is PD with and for older adults, vulnerable user groups and local communities. She is representative chairwoman of the commission of the Eighth Federal Government Report on Older People.

Recruitment and participants selection

Our goal is to include people from different disciplines in this workshop. The workshop is planned for 10 submissions with approximately 15 participants – this does not include the organizers. To recruit an adequate representation of participants, we will send out our call via email lists connected to the different institutions. These include HCI and (E)CSCW lists on the one hand, and interdisciplinary mailing lists on the other.

These include, for example, EUSSET email list, Research Network "Ageing in Europe" of the European Sociological Association, the German Network for Participatory Health Research (Netzwerk Partizipative Gesundheitsforschung) (PartNet), Health Geography, feminist geography, and the German Research Center for Artificial Intelligence (Deutsches Forschungszentrum für Künstliche Intelligenz) (DFKI).

In addition, our research partners will be informed about this call. Since these are interdisciplinary EU projects, we will thus be able to reach out to different disciplines as well. Finally, we will set up a website that we will use to promote our workshop. We want different disciplines to have their voice in our workshop, so we will select participants according to their perspective on our focus of interest.

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Oliver Baron & Diego Alatorre (2022): Intergenerational Design Activism, In: Proceedings of the 20th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies - Workshops, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.48340/ecscw2022_ws02

Intergenerational Design Activism

Oliver Baron & Diego Alatorre
Köln International School of Design (KISD, TH Köln, Germany); Centro de Investigaciones en Diseño Industrial (CIDI, UNAM, México) + Centro de Estudos Interdisciplinares do Século XX (CEISXX, Universidade de Coimbra, Portugal)
oliver.baron@th-koeln.de; diego.alatorre@cidi.unam.mx

Abstract. Activists of all generations unite! With the same goals, we are designing an alternative to Greta Thunberg's "Fridays for Future". While this movement is largely age-homogeneous, accuses its parents' generation, and relies on renunciation as a solution, we demand intergenerational cooperation, bracket moral arguments, believe in the power of innovation and make dialogue qua digital media strong. Our project is provocative and playful, as an opportunity to reflect on the ecologically and politically complex problem we are addressing today. As a result, we will present the name of the (fictitious) new alliance, its program, a manifesto, a flag, an anthem, a "key visual", posters, flyers, banners a strategy for the (digital) dialogue as well as the "pro's and con's" of the dogmas.

Objective

Instrumentalize youngster discourse by inspiring attitudes of play, honesty and ingenuity that inverts the directionality of knowledge flow within traditional learning spaces.

By working with youngsters to discuss current issues such as global warming and discrimination, we aim to take a fresh perspective to learn about the environment, to come up with new ideas and representations, to build on

prototypes, and to test them: empowering the youngest, not only to be heard, but to establish new agendas and turning their discourses into actionable tools.

In return, we invite grown-up scholars, researchers and professors, to sit in the other side of the classroom, listen and learn how new media is transforming the way people organize and collaborate.

Set-up

The workshop will be the result of a collaboration between high school, bachelor and master students from different educational institutions in Mexico and Germany. The workshop will function as a melting pot for critical thinking, cultural exchange and creative motivation aimed at designing a political campaign to address social and environmental challenges.

The workshop will be facilitated by the students that will take part into this experiences, structured in the following way:

Morning: present the distributed team (in Mexico, Germany and Portugal) and introduce the Intergenerational Activists Manifesto (that will be written from May to June).

Afternoon: crash course on intergenerational online collaboration. Since most students won't be able to attend the conference in Coimbra, we will divide the group into teams. Each team will discuss relevant topics and base their reflections on an online whiteboard, the same that will be projected and interacted with onsite.

Website

https://sites.google.com/cidi.unam.mx/ecscw2022designactivism

Participants

We are looking for 15 enthusiasts, from young clever students to grown-up scholars, researchers and professors interested in sharing ideas, listening and learning from each other. We encourage the latest to invite their children, nephews and nieces, especially those already interested in using their creativity for good.

Coordinators

Dr. Oliver Baron: Professor at Köln International School of Design (KISD, TH Köln, Germany) - oliver.baron@th-koeln.de

Msc. Diego Alatorre: Professor at Centro de Investigaciones en Diseño Industrial (CIDI, UNAM, México) + PhD student at Centro de Estudos Interdisciplinares do Século XX (CEISXX, Universidade de Coimbra, Portugal) - diego.alatorre@cidi.unam.mx

Ongoing Experience

The present workshop is the result of an international collaboration that has taken place since 2018 through different schemes and configurations. Along these years we have explored concepts such as inclusion and exclusion, sustainable lifestyle, power dynamics in design education, decolonization, online participation & playful interaction.

By working in stretch collaboration with different stakeholders, our previous experience involves mainly design students from different ages and backgrounds, professors and institutional representatives from international organizations such as Goethe Institute and Hong Kong Polytechnic University.

Picture

The fruit of our work has been published at multiple online events, one international conference and it is currently being reflected in two students' master thesis.

Graphic Evidence

As designers, the evidence of our work is better communicated using images. The following figures show two different stages on the development of the ideas that inspire the present workshop.

Figure 1 is a screenshot of a video introducing the participants of the second iteration of the international collaboration project that is better explained in the report visualized by figure 2. Both figures refer to other documents that can be download though the following links:

Figure 1: https://youtu.be/ABQEyG5uZr0

Figure 2:
https://drive.google.com/file/d/1Y_7kPuldMvmWySqj7CYuQW1A7Do6D7V5/view?usp=sharing

Figure 1. Team introduction.

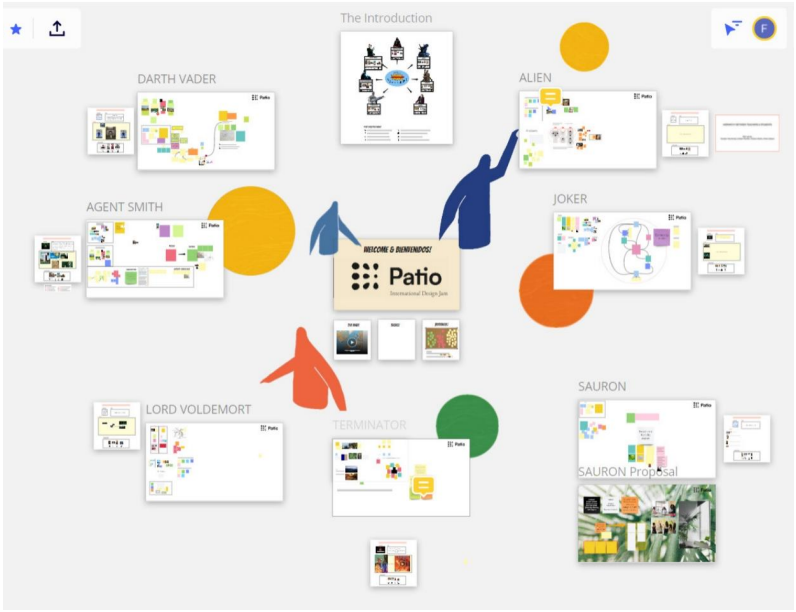

Figure 2. Patio report.

Airi Lampinen, Naja Holten Møller, Riyaz Sheikh, Asbjørn Ammitzbøll Flügge, Kristin Kaltenhäuser, Baki Cakici (2022): CSCW and Algorithmic Systems. In: Proceedings of the 20th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies - Workshops, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.48340/ecscw2022_ws03

CSCW and Algorithmic Systems

Airi Lampinen, Naja Holten Møller, Riyaz Sheikh, Asbjørn Ammitzbøll Flügge, Kristin Kaltenhäuser, Baki Cakici
Stockholm University, University of Copenhagen, IT-University of Copenhagen
airi@dsv.su.se, naja@di.ku.dk, riyaj.shaikh@dsv.su.se, awaf@di.ku.dk, krka@di.ku.dk, bakc@itu.dk

Abstract. The European Union announced recently that Europe should be a global hub and leader in the development of Artificial Intelligence (AI) that guarantees safety and fundamental rights (European Commission (2021)). In this workshop, we investigate how we can approach this challenge from the perspective of Computer-Supported Cooperative Work (CSCW). Starting with a general conceptual focus on *algorithmic systems* and their increasing role in society, we are particularly interested in such systems *in* and *as* organisations, and the questions that come up when investigating them as part of complex, cooperative work practices. The full-day workshop, designed for up to 20 participants, advances a CSCW-perspective on algorithmic/AI systems by bringing together researchers within (and where possible beyond) the CSCW community who study algorithmic systems, with the aim of sharing ongoing research and connecting participants with others who share their research interests.

Introduction

The European Union announced recently that Europe should be a global hub and leader in the development of Artificial Intelligence (AI) that guarantees safety and fundamental rights (European Commission (2021)). In this workshop, we

investigate how we can approach this challenge from the perspective of Computer-Supported Cooperative Work (CSCW) – building on the kinds of conceptual insight and methodological approaches that our community is known for. Instead of considering algorithms or data in a narrow technical sense, this workshop focuses on *algorithmic systems* and their increasing role in society: *'It is not the algorithm, narrowly defined, that has sociocultural effects, but algorithmic systems – intricate, dynamic arrangements of people and code. Outside of textbooks, "algorithms" are almost always "algorithmic systems"'* (Seaver (2019), pp. 418–419).

When it comes to the prior study of algorithmic systems, there has been a strong emphasis on widely used commercial platforms, with scholars examining what platform companies do and how platform users relate to them (Bucher (2018), Gillespie (2017), Lee et al. (2015), Rosenblat and Stark (2016)). More recently, increasing attention has been paid to the role algorithmic systems play in the public sector, how they shape civil servants' work practices, and what implications they have for citizens and non-citizens (Flügge et al. (2020); Holten Møller et al. (2020)).

In this workshop, we are particularly interested in algorithmic systems *in* and *as* organisations, and the questions that come up when investigating algorithmic systems as part of complex, cooperative work practices. These are issues where questions for computer science are fundamentally intertwined with those of social science – a combination that is at the heart of the CSCW community's scholarly pursuit. How do we contribute to the kind of society we believe is best suited for human values of participation, agency and accountability? What metaphors – either knowingly or unknowingly – shape how we imagine the future of algorithmic systems in, for example, public services?

The workshop advances a CSCW-perspective on algorithmic/AI systems. As one example, such a perspective can center on showing the boundaries and inadequacies of applying techniques from data science (i.e. ML and NLP) on an "incomplete" dataset and the context and practices that shaped it (Rask Nielsen and Holten Møller (2022)). Another pertinent question is how we can understand the datasets that are necessary for algorithmic systems as a work practice that increasingly involves the citizens of a society. This importantly includes questions on who are considered as "Europeans" and what are the perspectives left out (Cakici et al. (2020)), the non-citizens. Normatively, CSCW is committed to the practitioners – and to the people – that data, algorithms and AI should be useful to. The aim for this workshop is thus to built a shared understanding of what concepts, cases, methods, and historical trajectories can help us advance this body of research and how (if?) we as scholars see ourselves as contributing to the European project with the commitments of a CSCW-perspective.

Workshop themes

The workshop considers what it means to take a CSCW perspective to the study of algorithmic systems with the help of four broad themes. Participants are encourage to articulate their interest in the workshop in connection to one or more of the following:

- **Concepts and metaphors.** Algorithmic systems have been approached with various concepts and metaphors, including but not limited to street-level bureaucracy and street-level algorithms (Alkhatib and Bernstein (2019)), bureaucracy and uncertainty (Pääkkönen et al. (2020)), games and strategic interaction (Haapoja et al. (2020)), and algorithmic power and different conceptions of power. We welcome contributions that examine and/or advance the use of metaphors and concepts in understanding algorithmic systems as a part of society.
- **Empirical cases.** When it comes to empirically oriented contributions, we welcome research focused both on algorithmic systems *in* organisations (changes in work practices, strategic interaction in the workplace, such as efforts at negotiating workflows with and around algorithmic systems, etc.), and algorithmic systems *as* organisations, that is, how algorithmic systems in some cases essentially bring about the workplace by configuring workflows and managing labor (such as in the case of food delivery apps). That said, we are especially interested in research that engages with the public sector.
- **Performativity.** We are also interested in works that draw on theories of performativity (Mol (2002), Law (2004)) and analyse algorithmic systems as methods that participate in the enactment of new realities. In an organisational context, this entails asking questions such as: What kinds of organisations do algorithmic systems bring into being? Or, to what extent do these systems create the very problems they set out to solve? Such questions also lead us to the politics of algorithmic systems, that is, if different systems bring into being different realities, who benefits from the use of these systems, and who suffers the costs?
- **Methodology.** We identify methodology as an area that can help articulate what a CSCW perspective to algorithmic systems could be and where fresh ideas and experience sharing can be valuable to participants. We welcome methodological accounts and reflections, from different types of algorithmic audits to ethnography and research-through-design – and beyond.
- **Historical Trajectories.** While the notion of algorithmic systems is relatively new, the CSCW community has been working on related themes since its inception. Our final theme is an invitation to critique the notion of an algorithmic system (do we really need it?) and/or connect it to longstanding CSCW concepts and research trajectories (workplace technologies, workflow systems, workarounds, ...). In developing the CSCW

perspective to the study of algorithmic systems, we wish to do so from a historically informed standpoint.

Workshop goals

The goals for this workshop include:

- Bring together researchers within (and where possible beyond) the CSCW community who study algorithmic systems, with the aim of sharing ongoing research and connecting participants with others who share their research interests.
- Reflect collectively on what a CSCW perspective can contribute to the study of algorithmic systems and their increasing role in society at large and in organizations in particular.
- Facilitate in-depth conversations about research during the event, while also seeking to support and scaffold collaborative efforts that exceed the short duration of the workshop.
- Discuss how participants could (and already do) collaborate not just with other researchers but also with practitioners, civic servants, journalists, and other relevant stakeholders.
- Facilitate the formation of this sub-community in CSCW and HCI, and discuss possibilities for a lightweight collaborative infrastructure to sustain it (e.g., a listserv or a wiki page for resources).

Workshop activities

The workshop is structured as a full-day event. The workshop will consist of diverse activities, with an emphasis on in-depth conversations and community building:

- **Introductions.** The organisers open the workshop by introducing the agenda and goals for the day. They then facilitate a round of meet-and-greet, giving each participant a moment to introduce themselves and their interest in the topic.
- **Panel discussions.** The participants will be organised into thematic panels based on their position papers. Everyone will give a 6-minute presentation, followed by a collective discussion. The organisers will take shared notes to generate material to be worked on collaboratively.
- **Walk-and-Talk in Break-Out Groups.** Participants will split into groups of 3-4 people to further explore shared interests. The recommendation is to discuss while taking a walk, if that is feasible and desirable to everyone in the group. For this activity, groups will be encouraged to focus their conversation in particular on methodological issues. The goal is to identify key ideas and questions for discussion.

- **Summarising.** In this session, participants will be given a moment to review the collective notes taken during the day and to note down key insights and reflections. We will then go around the room so as to listen and respond to each others' thoughts.
- **Next Steps and Closing.** The workshop will conclude with a shorter discussion around possible next steps to advance CSCW research on algorithmic systems and to consider opportunities for further collaboration.

Participant recruitment and selection

The workshop is planned for a maximum of 20 participants (including the organisers). Participants will be recruited from the CSCW and CHI communities, and from the extended research networks of the organisers. Detailed information about the workshop will be made available at our workshop website. We will reach out to international, interdisciplinary networks by circulating the call on relevant listservs (EUSSET, AoIR, etc.) and through social media.

Those interested in the workshop will be invited to submit a short position paper (or equivalent material) that addresses the workshop themes. We encourage potential participants to discuss their interest in the themes, welcoming reports of (preliminary) empirical results, theoretically oriented pieces, as well as methodological reflections. To promote broader participation, in particular from the industry and civic organizations, we offer the option of submitting alternative material of rough equivalence (e.g., a design portfolio, white paper, or similar). Submissions will be reviewed by the organisers and accepted based on the relevance and development of their chosen topic, as well as participants' potential to contribute to the workshop.

Equipment needs

The workshop has no equipment needs beyond the usual: a room to host the event, wireless network connectivity, and a projector. Some supplies for group work, such as post-it notes, flipboard-sized paper, and pens, would be helpful.

Organisers

The workshop is organised by a group of scholars with significant experience in the study of algorithmic systems and a longstanding engagement with the CSCW community:

Airi Lampinen is an Associate Professor in Human–Computer Interaction at Stockholm University, Sweden, and a Docent in Social Psychology at the University of Helsinki, Finland. She holds a PhD in social psychology from University of Helsinki, Finland. Lampinen currently runs the Kone Foundation

funded project *Algorithmic systems, power, and social interaction*, and leads the NOS-HS workshop series *Nordic Perspercctives on Algorithmic Systems: Concepts, Methods, and Interventions*.

Naja Holten Møller is an Assistant Professor in the Software, Data, People & Society section, Department of Computer Science, at University of Copenhagen – and the founder of the Confronting Data Co-Lab (www.confrontingdata.dk). She holds a PhD in Computer-Supported Cooperative Work from the IT University of Copenhagen, Denmark. Møller is currently a co-investigator in the *Public Administration and Computational Transparency in Algorithms (PACTA)* research project as well as the *Data for Asylum Legal Landscaping (DATA4ALL)* research project.

Riyaz Sheikh is a PhD student at the Department of Computer and System Sciences, Stockholm University. An HCI design researcher interested in probing the intelligent algorithmic authorities behind conventional and emerging technologies, he intends to design for socially asymmetric and pluralist societies. Sheikh has a background in computer science and holds a Master's degree in Interaction Design from Industrial Design Centre, IIT Bombay.

Asbjørn Ammitzbøll Flügge is a PhD student in the Software, Data, People & Society section, Department of Computer Science, at University of Copenhagen. From a CSCW-perspective he studies how cooperative work in public services is affected and changes through the implementation and use algorithms and AI for decision support. With a focus on transparency, he investigates how caseworkers in job placement use profiling algorithms in their daily work. Flügge has a background social science and holds a Master's degree in Digital Innovation and Management from the IT University in Copenhagen.

Kristin Kaltenhäuser is a PhD fellow in the Software, Data, People & Society section, Department of Computer Science, at the University of Copenhagen. Drawing on participatory design and data science methods, her research evolves around grounded sense-making of data in asylum decision-making in the Nordic countries. She has a MSc in Software Development and a MA in Intercultural Communication with a focus on Gender Studies.

Baki Cakici is an Associate Professor in the Technologies in Practice research group at the IT University of Copenhagen, Denmark. He holds a PhD in Computer and Systems Sciences from Stockholm University. In his research, he draws on theories from the field of Science and Technology Studies. Cakici's research interests include surveillance, politics of numbers, digital state infrastructures, and the history of computing.

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Building Appropriate Trust in Human-AI Interactions

Fatemeh Alizadeh, Gunnar Stevens
University of Siegen
Fatemeh.alizadeh@uni-siegen.de

Oleksandra Vereschak, Gilles Bailly, Baptiste Caramiaux
Sorbonne University
vereschak@isir.upmc.fr

Dominik Pins
Fraunhofer Institute for Applied Information Technology
dominik.pins@fit.fraunhofer.de

Abstract. AI (artificial intelligence) systems are increasingly being used in all aspects of our lives, from mundane routines to sensitive decision-making and even creative tasks. Therefore, an appropriate level of trust is required so that users know when to rely on the system and when to override it. While research has looked extensively at fostering trust in human-AI interactions, the lack of standardized procedures for human-AI trust makes it difficult to interpret results and compare across studies. As a result, the fundamental understanding of trust between humans and AI remains fragmented. This workshop invites researchers to revisit existing approaches and work toward a standardized framework for studying AI trust to answer the open questions: (1) What does trust mean between humans

and AI in different contexts? (2) How can we create and convey the calibrated level of trust in interactions with AI? And (3) How can we develop a standardized framework to address new challenges?

Introduction

Artificial intelligence (AI) plays an important role in helping people make sensitive decisions with uncertain outcomes. Yet the inner workings of AI-powered systems are often hidden from users. These opaque processes have been criticized as biased, discriminatory, and misleading, and users cannot be assured that their interests are respected (Eslami et al., 2019). However, building a collaborative partnership between human decision makers and AI-powered systems depends primarily on users' trust in the systems (Vereschak et al., 2021). In general, Human-machine trust can be defined as, *"An attitude that an agent will achieve an individual's goal in a situation characterized by uncertainty and vulnerability"*(Lee & See, 2004).

Since AI is a broad term that has never represented a single technology in a specific time period (Alizadeh et al., 2021), the question arises whether this general definition of trust between humans and machines is still applicable to all types of systems under this umbrella term. Especially because trust in AI-enabled systems has been shown to be context-dependent. In the context of voice assistants, for example, trust has been shown to evolve around user privacy concerns (Završnik, 2021), while in medical systems, trustworthiness is equated with the accuracy of the system and its outcomes (Ghassemi et al., 2018). Moreover, previous approaches to building and assessing trust tend to be binary. That is to say, there is a lack of research on the multidimensional nuances that must be considered in long-term interactions with AI-enabled systems (Hoffman, 2017).

In this workshop, we aim to explore these challenges by enabling researchers and practitioners in the field to move toward a more flexible and standardized framework that accounts for these differences and promotes a shared understanding of the notion of human-AI trust across different contexts and applications of AI.

Background

In this section, we describe trust in the context of human interactions with AI-powered systems and address the challenges of establishing and evaluating trust. The questions we raise are not necessarily new, but are nonetheless relevant because they have not been satisfactorily answered for emerging cases. While we do not wish to limit the workshop to these challenges, we believe they are and will be important in past, current, and future research.

Human-AI trust

AI is being used to develop algorithms that increasingly make decisions about our daily lives. They decide for us what we read, what we watch, what we buy, and even who we date (Fry, 2018). However, AI algorithms are becoming increasingly opaque. Such a black box makes it difficult for users to understand, verify, or trust these potentially biased systems (Eslami et al., 2019). The demand for transparency and the need for users to trust AI-embedded systems has not only led to the European Commission issuing detailed guidance on the requirements for trustworthy AI models (Smuha, 2019), but has also led HCI researchers to investigate how to develop and ensure trustworthy AI. As a result, previous work has examined the factors that influence user trust (e.g., Cai et al., 2019; Robert Jr, 2016), how trust is established (e.g., Al-Ani et al., 2013; Passi & Jackson, 2018), and how it can be modeled (e.g., Ajenaghughrure et al., 2019; Knowles et al., 2015). Jacovi et al. have leveraged these requirements and combined them with standard research documents and explanatory methods to specify a set of useful contracts, namely (1) human agency and oversight, (2) technical robustness and safety, (3) privacy and data governance, (4) transparency, (5) diversity, non-discrimination, fairness, (6) societal and environmental well-being, and (7) accountability (Jacovi et al., 2021). According to the authors, the European Commission's guideline is based on the premise that trust is the ability to anticipate intended behavior through the belief that a contract will be upheld. Therefore, an AI model is trustworthy with respect to a contract if it is able to honor that contract (Jacovi et al., 2021). But how can the guidelines for trustworthy AI be used to establish appropriate trust in AI-embedded technologies, and what are the challenges in this process?

Designing appropriate Human-AI trust

Researchers have argued that trust and trustworthiness are completely decoupled. For example, Ghassemi et al. have shown that physicians' trust in a tool can be increased by making changes to the tool's user interface without changing the tool's trustworthiness (Ghassemi et al., 2018). To clarify this disentanglement, Jacovi et al. distinguished between warranted trust and unwarranted trust. In this context, they defined warranted trust when trust is calibrated with trustworthiness and users do not feel betrayed because they trusted a model that was not trustworthy (Jacovi et al., 2021). Calibrating trust for trustworthiness is critical to avoid the risk of misuse, abuse or disuse of technology (Parasuraman & Riley, 1997).

However, there are several challenges to establishing appropriate Human-AI trust in practice. First, while AI is a broad umbrella term(Alizadeh et al., 2020), trust in AI is context-dependent (Vereschak et al., 2021). People can trust one thing in one context, but not in another (Hoffman, 2017). This is particularly important because different requirements are assigned different value in different contexts. For example, while privacy and data governance are the main important

requirements for adoption of personal assistant systems (Liao et al., 2019), fairness and non-discrimination are much more important for AI decision-making systems for criminal justice (Završnik, 2021). This has led to different research focuses and approaches to trust in different applications of AI-embedded systems, making it difficult to interpret results and compare across studies.

Another challenge is that trust cannot be viewed in binary terms, but is multidimensional and changes over time and throughout the course of an interaction. Hoffman elaborates: "*In my own relation to my word processing software, I am positive that it will perform well in the crafting of simple documents, but I am simultaneously confident it will crash when the document gets long, or when it has multiple high-resolution images. And every time that there is a software upgrade, the trusting of many of the functions becomes tentative and skeptical. [So,] trust is not a single state"*(Hoffman, 2017). This suggests that even within the same context, we need models that account for the nuances of trust throughout the interaction process, rather than relying on single states.

Moreover, previous research has defined the boundary between interpersonal trust and human-machine trust in terms of reparability (Hoffman, 2017; Jacovi et al., 2021). That is, unlike interpersonal trust, which can be restored after a mistake, users lose their trust in the machine completely when it makes a mistake, with no opportunity to forgive it (Hoffman, 2017). However, further research shows that in some cases, users are able to forgive and accept the mistakes of AI-enabled technologies. For example, users of voice assistants have been shown to develop a sense of tolerance for miscommunication with their devices and to forgive their mistakes (Lahoual & Frejus, 2019). Thus, there is a need to explore useful mechanisms to restore trust in case of errors and loss of trust. Having said all this, the question remains how we can overcome these challenges to build and restore appropriate trust in human-AI interactions.

Workshop Goal

As approaches to experiences with building trust differ, we aim to find a common ground, based on the shared experiences from the field. In addition to finding possible solutions, we want to give participants the opportunity to connect and collaboratively work further on the discussed topics. Together, we want to rethink existing binary approaches and start working on a nuanced model, that better serves the needs of specific circumstances.

Organizers

Fatemeh Alizadeh (main contact) is a PhD student and research associate at the Institute for Information Systems and New Media, University of Siegen. In her

research, she combines her knowledge in HCI with her computer engineering and AI background to study unexpected situations with intelligent systems. Her main research interest is to improve the understandability, explainability and trustworthiness of AI-embedded technologies.

Oleksandra Vereschak is a PhD student at ISIR, Sorbonne Université. Her main focus of interest is users' trust in AI, which situates her work in the interdisciplinary domain of Human-AI interaction. She predominantly focuses on the AI-based systems assisting human decision making in the high-risk contexts such as medical, recruiting, and credit decision making. She studies not only what influences human trust, but also how to improve experimental protocols to evaluate it drawing from her social sciences background.

Dominik Pins is a PhD student and a research associate at Fraunhofer Institute for Applied Information Technology (FIT) in the department of Human-Centered Engineering and Design. As a usability engineer and research associate with sociological background he focuses in his research on user needs and practices regarding trust and privacy in the home environment and the design of trustworthy technologies, specifically AI systems.

Gunnar Stevens is a Professor of Information Systems at the University of Siegen and Co-Director of the Institute for Consumer Informatics, Bonn-Rhein-Sieg University of Applied Sciences. He has been researching and publishing in the fields of HCI, CSCW, Usable Security and Digital Consumer Protection for years. For his research he received the IBM Eclipse-Innovation Award in 2005 and the PhD Award of the IHK Siegen-Wittgenstein in 2010.

Gilles Bailly is a CNRS researcher at ISIR, Sorbonne Université. His research is at the crossroad of human-computer interaction (HCI), skill acquisition, decision making, artificial intelligence (AI) and robotics. He designs novel interaction techniques (desktop interaction, mobile interaction, gestural interaction, etc.) and builds predictive models of performance and knowledge with a focus on the transition from novice to expert behavior.

Baptiste Caramiaux is a CNRS researcher at ISIR, Sorbonne Université. He conducts research in human-computer interaction (HCI), examining how machine learning (or artificial intelligence) algorithms can be used in various fields such as performing arts, health or pedagogy. He is particularly interested in learning technologies when they are integrated with communities of practice. In particular, he sees technology as a reflective tool that allows people to question their practice, learn, and express themselves.

Each of the organizers has a research background in transparency, explainability and trust of AI-embedded systems, and has in particular experienced the challenges and struggles of building and exploring trust in human-AI teams. It was through the sharing of these experiences among the co-organizers that this workshop was initiated. Each organizer will present their own position and research in the introduction of the workshop to start the discussion and open the floor for the participants.

Pre-Workshop Plans

The workshop will be promoted through a new website that will communicate the aims and structure of the upcoming event, and subsequently present its outcomes. By spreading the websites through a broad variety of mailing lists as well as personal contacts, the workshop will reach researchers, activists and practitioners. Candidates will be required to submit a position paper discussing their current, previous or planned work. These papers can be in immediate relation to trust in voice interaction design or they can be an example of work which was challenging with regard to the mentioned topics. We envisage a maximum of 10 participants (excluding the organizers), who will be selected based on the relevance and potential contribution of their position paper to the workshop topic and activities. The quite small number of participants will ensure a relaxed and safe environment to talk about sensitive topics.

Workshop Plan

We plan to hold an interactive workshop, during which the participants will mostly work on different tasks and questions instead of just presenting their previous and current work. The workshop will begin with an ice-breaker and short introductions before the morning coffee break. Following the morning coffee and lunch breaks, participants will work in small groups, formed based on their position papers and research interests. The aim is to share experiences and identify common aspects and workarounds of designing trust in voice interactions. Participants are invited to critique and rethink current concepts, methods and frameworks building trust that do not address the arising challenges. The outcome from the group sessions will be shared in a plenary after the afternoon coffee break, with a view to formulating more viable and practical approaches for designing trust with a focus on long-term voice interactions. The workshop will conclude with a plenary discussion of future plans for a collaboration on the further development of these guidelines.

Timetable

Timeslot	Activity
09:00-09:15	Welcome
09:15-10:00	Icebreaker and short presentation of participants
10:00-10:30	Coffee break
10:30-12:00	Identifying and discussing challenges of building and evaluating appropriate trust in human-AI interaction and the existing approaches
12:00-13:30	Lunch
13:30-15:00	Formulating possible solutions in small groups
15:00-15:30	Coffee break
15:30-17:00	Presentation and discussion of the formulated approaches
17:00-17.15	Closing of the day and future plans

Post-Workshop Plan

All the notes, documentation and other materials that are created during the discussions will be shared amongst the workshop participants and revised, prior to being uploaded to the workshop website. Follow-up workshops on other conferences will help this newly formed collaboration to continue, through discussions and new initiatives, thereby encouraging more researchers to reflect upon their own challenged they come across when building trust in voice interactions. In addition, the workshop participants should be become part of exchange group which should serve as support line when help is needed dealing with an uncommon situation.

Call for Participation

This one-day workshop aims to provide a forum for researchers as well as practitioners and activists to discuss challenges in building trust and to start working on solutions that are more practical and viable to adapt in the AI interaction context. The topics include but are not limited to:

- Definitions of trust and reliance.
- Interpersonal trust and lessons from social sciences.
- Qualitative and quantitative methods for building and evaluating trust.
- Challenges of designing appropriate trust and tradeoffs with other objectives.

- Solutions (and their limitations) for promoting appropriate trust (e.g., XAI, control mechanisms, human agency, communicating uncertainty etc).
- Safety mechanisms for when trust is broken.

We invite anyone interested in participating to submit a two to four-page position paper. Papers should critically reflect upon the authors' experiences from the field or research area related to challenges they face when building trust in AI interactions. Authors' prior experience does not have to be specifically concerned with these challenges, but the position papers will be expected to demonstrate how their experience is relevant to the workshop's topic and can be applied within the workshops' context.

Submissions should be sent to Fatemeh.alizadeh@uni-siegen.de in .pdf format. Position papers will be reviewed based on relevance and potential for contribution to the workshop. At least one co-author of each accepted paper must register to the ECSCW 2022 conference to attend the workshop.

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Revisiting Patient-Clinician Interaction in 2022: Challenges from the Field and Opportunities for Future Research

Francisco Nunes[1], Nervo Verdezoto[2], Tariq Andersen[3], Stina Matthiesen[3], Chia-Fang Chung[4], Sun Young Park[5], Woosuk Seo[5], Paul Studenic[6]

[1]Fraunhofer Portugal AICOS, [2]Cardiff University, [3]University of Copenhagen, [4]Indiana University Bloomington, [5]University of Michigan, [6]Medical University of Vienna

Contact Author: francisco.nunes@fraunhofer.pt

Abstract. The goal of this workshop is to revisit the concept of patient-clinician interaction, a classical concept of CSCW research in healthcare. While the CSCW community has been working on patient-clinician interaction for decades, the last years have seen a number of changes to care provision, motivated by the COVID-19 pandemic, the strong uptake of remote care technologies, or the introduction of patient-generated data technologies. Recent advancements in Artificial Intelligence (AI) in healthcare also promise to impact patient-clinician interactions as we know it. For all these reasons, the workshop will engage in participatory discussions to take stock, analyse challenges from the field, reflect on opportunities for technologies, and craft future research agendas for CSCW research in healthcare.

Background and Motivation

The CSCW community has had an interest in healthcare since its early days. The first CSCW papers were published on the second edition of the ACM CSCW conference (Gorry et al., 1988; Engestrom et al., 1988), and the inaugural ECSCW conference published two papers related to healthcare (Bødker and Grønbæk, 1989; Pettersson, 1989). In the years that followed, CSCW welcomed a consistent stream of studies focused on different aspects of healthcare (Fitzpatrick and Ellingsen, 2013). Patient-clinician interaction has been an important topic for the CSCW community, with studies looking at the communication issues, shared decision making practices, impacts of using technologies in medical appointments, or remote care provision; focusing on supporting strong partnerships between clinicians, patients, and their caregivers (Aarhus et al., 2009).

More recently, researchers employed patient-generated data to increase self-awareness, disease monitoring, and clinical communication or decision-making (Bardram and Frost, 2018; Cerna et al., 2020; Figueiredo et al., 2020). Patient-generated data has influenced patient-clinician interactions introducing data work before, during, and after the medical appointments, supporting distributed collaborative care (Islind et al., 2019) and revealing social and emotional experiences of patients and caregivers in the process (Kaziunas et al., 2017; Costa Figueiredo et al., 2021). Data collection has been facilitated by consumer wearable devices and mobile health applications (Nunes et al., 2015), with patient-generated data and technologies becoming collaborative sense-making tools (Costa Figueiredo et al., 2017) and boundary negotiating artifacts between patients and clinicians (Chung et al., 2016). Another stream of research focused on supporting asynchronous and distributed interactions (Andersen et al., 2011), highlighting the importance of designing technology features that support the alignment of concerns among patients and clinicians (Andersen et al., 2019).

The COVID-19 pandemic has brought additional challenges to patient-clinician interaction. Early in the pandemic, many medical appointments in the Europe, United States, and the rest of the world, had to be made over telephone or videoconference technologies, for minimising the risk of transmission (Frick et al., 2021; Raj et al., 2022). Videoconference technologies enabled care to take place, but also contributed to shifting expectations and re-adapting the role of the involved stakeholders (Bhat et al., 2021). On the one hand, clinicians perceived that virtual medical appointments saved time for additional diagnosis and treatment planning (Frick et al., 2021). On the other hand, video medical appointments were perceived as not good enough for patients as the technology did not enable them to feel the same level of empathy and care (Bhat et al., 2021) leaving them worried that their symptoms might be dismissed (Raj et al., 2022). Patients with less technology literacy or access were especially affected (Raj et al., 2022), thus families, volunteers, or municipality workers mobilised to support them in training or using videoconference and other care-related technologies (Miele and Nunes, 2022). Having said this, the COVID-19 pandemic has

continued to evolve, and care provision is provided as a mix between in-person and remote care provision, which merits additional study.

Recent advancements in AI also hold the promise to improve patient-clinician interactions. AI-based systems are expected to support diagnosis through chatbots (Athota et al., 2020), to enable patients to find patterns in their symptoms and engage in self-care (Hollis et al., 2017; Desai et al., 2019), or to support clinical care by passively "listening" to conversations during medical appointments (Langston, 2019). Communicating the role and ways of operating of these systems will be complex in many cases, leaving clinicians with an additional task in their hands (Schiff and Borenstein, 2019). The introduction of AI agents in the patient-clinicial interaction is also likely to impact the distribution of responsibility and accountability, and new occupations may be needed to curate and serve as communication bridges between patients, clinicians, and medical information records (Nov et al., 2021). Nevertheless, there are many open questions. For example, will patients consider AI agents as an extension to the clinician's role and perspective, or, on the contrary, as a partner to the patient ready to support preparations for care encounters? Will the AI agent be a team player, or an individual member that is the source of conflict or issues? All of these questions are worth discussing and the workshop is interested in welcoming research that focuses on them.

Workshop Goal and Themes

The goal of this workshop is to revisit the concept of patient-clinician interaction in 2022. The time when we organise the workshop is characterised by the COVID-19 pandemic, a strong uptake of remote care technologies, and thriving research developments in AI in healthcare, all of which promise to change healthcare provision and infrastructures. Revisiting the concept of patient-clinician interaction at this time will help uncover challenges from the field and opportunities for technology, as well as to craft future agendas for CSCW research in healthcare.

The workshop will promote a participatory design approach involving researchers, patients, and clinicians (rheumatologists). While researchers will present their position papers at the start of the workshop, all participants will be encouraged to discuss the position papers. In the second part of the workshop, researchers will engage with patients, to discuss their experiences and practical challenges while using or interacting with healthcare services, and with clinicians, to discuss their experiences and challenges in patient-monitoring, adding other layers to the discussions on patient-clinician interactions.

Possible themes for position papers include, but are not limited to:

- Technology-supported patient-clinician interaction during COVID-19;
- Patient-generated data and patient-clinician interaction;
- AI-in-the-loop within patient-clinician interaction;

- Intended and unintended consequences of technology-supported patient-clinician interaction, including emotional work, and other types of invisible labour;
- Ethical considerations in technology-supported patient-clinician interaction;
- Patient-led research and its contributions to technology-supported patient-clinician interaction;

Pre-Workshop Plans

Workshop promotion

We will create a website for the workshop that will support the promotion and archival of workshop contributions and results. Before the workshop, the website will display the call for papers, workshop plan, and brief biographies of the workshop organisers. After the workshop, the website will also include the position papers from participants, short notes about the session, and pictures from the workshop.

To promote the workshop widely, we will distribute the call through social media as well as scientific mailing lists from CSCW, Human-Computer Interaction (HCI), Design, and Science and Technology Studies (STS).

Position paper submission and selection

We encourage submissions from researchers, engineers, designers, data scientists, social scientists, clinicians, and patients, who are interested in the workshop topic. Position papers can describe or discuss case studies, experiments, prototypes, ethnographic fieldwork or qualitative studies, theoretical accounts, literature reviews, and critical reflections. Position papers should be submitted using the ECSCW template, and have up to 4 pages (excludes references).

Our plan is to disseminate the call for papers in early march. The submitted papers will be lightly reviewed by the workshop organisers. Position papers will be selected based on their quality, originality, and fit to the workshop topic. Notifications to authors will be sent by the end of April and camera-ready versions of the position papers will become available at the workshop website two weeks before the workshop.

Video presentation of position papers

Authors of accepted position papers will prepare 5-minute videos about their work. The videos will be added to the workshop website two weeks before the event, to enable participants to start reflecting about the work of authors before the workshop takes place. The videos from the position papers will also enable website visitors to become familiar with the work presented and discussed at the workshop.

Participants, equipment, and materials

The workshop will host up to 20 participants, including organisers, patients, and clinicians. Required equipment includes a projector. Organisers will bring workshop materials like flip-charts, post-its, pens, or paper.

Workshop Activity Overview

Position paper presentations: The workshop will start with presentations by position paper authors. The authors from each paper will have five minutes for making a presentation and five minutes for answering questions from the audience. Following these presentations, the organisers will facilitate a large group discussion focusing on issues, challenges, or opportunities that were raised in different position papers and corresponding presentations.

Group discussions with patients and clinicians: Following the lunch break, researchers will seat in small groups together with a patient with a rheumatic condition or a rheumatologist. The goal of discussions will be to enable the exploration of issues, challenges, or opportunities for patient-clinician interaction. After one hour, researchers will change group, enabling most participants to speak with both patients and clinicians. Moreover, as patients and clinicians watched researchers presentations it will also be possible to discuss how the technologies or study results, presented earlier in the workshop, would be applicable to their everyday lives or clinical work.

Large group discussion At the end of the workshop, the groups will share their insights with the larger group. Organisers will note down main issues, challenges, and opportunities for future research, and will encourage reflection from the group about them. Finally, the organisers will discuss the next steps and organize with participants how to proceed (e.g., regarding the summary blog post).

Group dinner: The workshop will finish with an optional group dinner to continue discussions and foster collaborations between workshop participants.

Post-Workshop Plans

The position papers and corresponding videos will be uploaded to the workshop website. Following the authorisation of participants, we will also share pictures or short videos from the workshop. Finally, we will be writing a blog post summarising the conversations for the EUSSET.eu blog or Medium.

Workshop Organizers

Francisco Nunes is a senior researcher at the Human-Centred Design department at Fraunhofer Portugal AICOS. His research focuses on understanding and designing technologies for self-care and informal care contexts.

Nervo Verdezoto is a Senior Lecturer at the School of Computer Science and Informatics at Cardiff University. He has investigated the invisible work across multiple care settings. His recent work explores how care infrastructures and socio-technical and cultural practices influence maternal health in the Global South.

Tariq Osman Andersen is a associate professor of Health Informatics at the Department of Computer Science, University of Copenhagen. His current research focuses on co-design and socio-technical evaluation of AI-based tools for improving patient-clinician interaction in cardiac care.

Stina Matthiesen is an assistant professor in Software, Data, People and Society at the Department of Computer Science, University of Copenhagen. Her research focuses on analysing and co-designing data-driven technologies for patient-clinician collaboration and clinical decision support in cardiac care.

Chia-Fang Chung is an assistant professor in Informatics at Indiana University Bloomington. Her research examines how the design of ubiquitous computing and personal informatics systems can support relationships, health behaviour, and care.

Sun Young Park is an associate professor at the University of Michigan in the Stamps School of Art and Design and the School of Information. Her research uses design ethnography to study patient engagement, patient–provider collaboration, patient-centred health technology, and technology adaptation.

Woosuk Seo is a Ph.D. candidate at the University of Michigan in the School of Information. His current work focuses on designing technology to enhance health communication and collaboration between child patients with chronic illness and their parents.

Paul Studenic is a rheumatologist and post-doctoral researcher at the Medical University of Vienna and Karolinska Institute. His research focuses on outcomes in inflammatory rheumatic diseases, with a special emphasis on methodology, patient perspective and digital health.

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Exploring Human-Centered AI in Healthcare: Diagnosis, Explainability, and Trust

Nazmun Nisat Ontika[1], Hussain Abid Syed[1],
Sheree May Saßmannshausen[1], Richard HR Harper[2], Yunan Chen[3],
Sun Young Park[4], Miria Grisot[5], Astrid Chow[6], Nils Blaumer[7],
Aparecido Fabiano Pinatti de Carvalho[1], Volkmar Pipek[1]
[1] Institute for Information Systems, University of Siegen, Germany
[2] The Institute for Social Futures, Lancaster University, UK
[3] Department of Informatics, University of California, USA
[4] School of Information, University of Michigan, USA
[5] Department of Informatics, University of Oslo, Norway
[6] Eleanor Health, USA
[7] Gemedico, Germany
{nazmun.ontika, hussain.syed, sheree.sassmannshausen, fabiano.pinatti, volkmar.pipek}@uni-siegen.de, r.harper@lancaster.ac.uk, yunanc@ics.uci.edu, sunypark@umich.edu, miriag@ifi.uio.no, astrid.chow@eleanorhealth.com, blaumer@gemedico.com

Abstract. AI has become an increasingly active area of research over the past few years in healthcare. Nevertheless, not all research advancements are applicable in the field as there are only a few AI solutions that are actually deployed in medical infrastructures or actively used by medical practitioners. This can be due to various reasons as the lack of a human-centered approach for the or non-incorporation of humans in the loop. In this workshop, we aim to address the questions relevant to human-centered AI solutions associated with healthcare by exploring different human-centered approaches for

designing AI systems and using image-based datasets for medical diagnosis. We aim to bring together researchers and practitioners in AI, human-computer interaction, healthcare, etc., and expedite the discussions about making usable systems that will be more comprehensible and dependable. Findings from our workshop may serve as 'terminus a quo' to significantly improve AI solutions for medical diagnosis.

Introduction

Artificial intelligence (AI) technology is highly demanded these days in healthcare, with the potential to empower healthcare professionals in their decisions, by providing them relevant information at a glance when it matters the most. The grim fact is that there are insufficient specialist physicians to fulfill the increasing demand for healthcare (IHS Markit Ltd., 2021). However, by incorporating AI into healthcare, we can possibly assist physicians to become more productive and efficient, helping to make informed choices easily and quickly. AI technology has great potential in decision-making because it is able to process a large amount of data in a short period of time, thus quickly providing medical professionals with a pre-diagnosis which builds the capacity to enhance the final judgements (Alsagheer et al., 2021).

Despite the great recent developments in AI across many sectors, especially healthcare, just a fraction of AI systems has effectively transitioned from the laboratory to medical practice. The absence of a human-centered approach while developing the systems, the complexity and unreliability of the final applications, the failure to include people in the development loop, and the lack of explainability for practitioners are frequently depicted as the key obstacles for greater AI adoption, but with reasonable reasons (Abdul et al., 2018). Different components within an organizational infrastructure are integrated through standardized interfaces enabling the work practitioners to channel merits like reflexivity, longevity, resilience, and heterogeneity (Hanseth & Lundberg, 2001; Pipek & Wulf, 2009; Syed et al., 2021). Medical organizations and practitioners, we argue, would have a difficult time dealing with AI if it does not integrate effortlessly into their present infrastructure, or even worse if it adds more complications. Moreover, any new technology can be difficult to develop, and even more difficult to gain trust when having a strong infrastructure as healthcare, where physicians must take immediate choices with foreseeably many further implications. Numerous endeavors to design usable systems for physicians fail due to insufficient task analysis, in which essential needs are either not discovered or their importance is undervalued (Preim & Hagen, 2011). Despite AI having demonstrated great promise in healthcare and medicine, so much of this development has not been implemented because machine learning models are trained on quasi data and

assessed only in controlled experiments that are quite different from real-world implementation circumstances (Okolo, 2022).

Human-AI systems operating jointly, rather than alone, have a great potential for high effectiveness (Ahuja, 2019; James Wilson & Daugherty, 2018). Since the relationship between a person's faith in automation and the capability of automation differs (J. D. Lee & And Moray, 1994; Muir, 1987), it leads to overtrust and distrust (J. D. Lee & See, 2004). Several pieces of research have revealed how medical practitioners overlooked suggestions identified by AI (de Boo et al., 2009; Nishikawa et al., 2006) and, also missed anomalies that AI failed to identify (Jorritsma et al., 2015) because of distrust and overtrust of AI, respectively. Adoption requires trust, which is difficult to earn (Pipek & Wulf, 2009). On the one hand, AI excelled physicians in identifying breast cancer quicker and better (Killock, 2020), but on the other hand, certain AI systems fared badly and might unwittingly cause more damage than good if used to influence treatment decisions (Wynants et al., 2020). Hence, for the diagnosis and treatment support, practitioners should remain in a position to make the final decisions. AI should aid them in pre-analysis rather than taking over the ability to make decisions.

Humans must be placed at the heart of AI development lifespans (Harper, 2008; Inkpen et al., 2019). Real users should be at the forefront and must be engaged with the system from the very beginning. We must go beyond the technology to comprehend the entire context of use. The fundamental pain points will be illdefined unless we grasp the true needs of the users through field investigations (Wulf et al., 2018). This would allow the creation of dynamic learning systems by keeping humans-in-the-loop (Syed et al., 2020). Furthermore, users must be aware of what an AI system can and cannot accomplish, as well as on what data it has been trained and for what it has been optimized. AI systems have gotten considerably more reliable and robust because of the emergence of deep learning, but they have also become somewhat difficult to comprehend (Ribeiro et al., 2016). The AI system's black-box aspect can be a barrier to credibility, which is why we must overcome the hurdle of interpretability by making AI's discoveries as apparent as feasible and necessary (Goldstein et al., 2015; Molnar, 2022; Wachter et al., 2017). We need to observe the practitioners in using the system to understand how mental models evolve with every success and failure, but also how the AI systems influence their decisions (Green & Chen, 2019).

Value Sensitive Design (VSD) (Friedman et al., 2006); is an approach that can be helpful to address the issues above. According to its premises, designers should design all technologies in a principled and comprehensive manner, accounting for human values throughout the design process (Friedman & Hendry, 2019). Human values such as fairness and responsibility should be included early in the design process to help designers apply their design abilities wisely. VSD may also assist in identifying aspects in technology that promote, impede, or prohibit certain values once the effects and significance of the selected values are recognized. VSD

encourages us to think about human values as a design requirement in the same way that we think about efficiency, effectiveness, usability, accessibility, and dependability (Davis & Nathan, 2015). It has been argued that VSD will keep expanding and shape the future way of thinking while designing solutions (Friedman et al., 2017; Umbrello & de Bellis, 2018).

Performance and explainability are currently on the table as a trade-off. Models with the highest performance (e.g., deep learning) are generally the least explainable, whereas models with the worst performance (e.g., linear regression, decision trees) are often the most explainable (Kelly et al., 2019). The true objective of Explainable AI (XAI) ought to be to guarantee that end-users can perceive the results, thereby assisting them to enhance their decision-making performance (Gunning et al., 2019). Researchers in charge of building explanatory user interfaces should be involved in the development of Human-centered AI (HAI) technologies (Shneiderman, 2020). Moreover, end-users need to be engaged in the development of such explanation interfaces. The interface should supply descriptions for any algorithmic decisions, but it should also supply various layers of rationalizations, allowing the end-user to question the AI decision-making operation, possibly down to the stage of any datasets used in the machine learning development in exploring the complete data origin and its boundaries (Xu, 2019). Engaging people in the design and putting them in the limelight enhances the likelihood that the resulting systems will be ethical, adaptable, useful, and deployed, and that adverse unexpected effects of AI systems are avoided (Bond et al., 2019).

In terms of adoption, it is sensible to think that XAI techniques are likely to speed up the adoption of AI solutions in medical environments while also fostering crucial transparency and trust with potential users, since any mistakes might not only affect the patients but also impede the use of such solutions (Adadi & Berrada, 2018). Here, visualization becomes an important aspect. Through visualizations, the decision of the AI system is made more understandable and transparent, which leads to a fair and responsible perception (M. K. Lee, 2018). This, in turn, can lead us forward in a discussion of whether visualization can be the first step of explainability because we need to find more techniques to represent medical knowledge more meaningfully.

Graphical user interface design is also a critical aspect to consider for any product development. Healthcare physicians, as users in general, want user interfaces that are simple to operate yet aesthetic, as well as intriguing and encouraging (Wang et al., 2021). In order to get to this point, qualifications that go beyond visualization techniques are necessary (Preim & Hagen, 2011). Hence, collaborations with researchers in the field of human-computer interaction (HCI) are strongly encouraged, with especial attention to issues from psychology, visual design, and user interface design, etc. These interdisciplinary collaborations can

potentially lead to more useful and usable advanced user-centered medical visualization mechanisms.

This workshop provides an incubator for the researchers and practitioners to create a joint consortium for research towards a wide range of practices and technologies. The workshop offers a great opportunity to instigate the discussion about shortening the gap in Medical AI and human-centered design. Emerging ideas will be further pursued in future publication plans. Our workshop targets contributions showing how different HCI approaches for XAI have been used in current and past research and field works and aim at reflecting on the lessons learned from them. Incorporating HAI into healthcare effectively is a significant venture with constraints that entail a multi-disciplinary approach combining specialists from HCI, AI, healthcare, psychology, and social sciences. This workshop will address important HAI concerns, enabling optimal human-machine integration by enhancing the trustworthiness between humans and technology. We will discuss ways to assure that AI applications focus on the end-user, put humans in the loop, and emphasize human values in a responsible manner. We will explore different prototyping and evaluation techniques; also, how we can integrate the context of use with real user needs and usage scenarios into task analysis methods; and how all these can help make new strategies to improve the overall user experience.

Workshop Goals and Topics

The goal of this workshop is for participants to explore various approaches of Human-Centered AI and to develop a strategy for future scientific investigations on healthcare solutions. We will use a cross approach, gathering different points of view together to discuss the numerous benefits and drawbacks of such innovations. We would also like to learn from other fields and approaches, that are developing and using AI with visualizations in similar contexts with a human-centered approach.

We hope to address the following themes and questions but are not limited to:

Workshop Themes:

- Human-Centered AI for medical visualizations
- Physician-in-the-loop for HAI
- Explainable AI in healthcare
- Trust and fairness issues of AI in healthcare
- Ethics in AI for healthcare
- Security and privacy in medical AI

Research Questions:

- What are the existing human-centered approaches for designing an AI-based medical diagnosis?
- How are end-users integrated into the development process?
- How is it possible to make AI decisions comprehensible and transparent to the end-user?
- What are other examples/ use cases, in which image-based detection/ diagnosis is done?
- What is the role of visualization in XAI?

Participation

Our two-half-day workshop will be held in person, providing that the current pandemic situation allows. However, we will also provide alternatives for participants who cannot attend it in person - e.g., though a Zoom link. The infrastructure for the in-person workshop will be provided by the conference and secured by the workshop organizers. Participants attending online will be responsible for arranging the necessary equipment, namely a computer, video camera (external or integrated with laptop), microphone, paper, pen, etc. to attend the workshop. However, the organizers will support the participants for any technical troubleshooting (e.g., handling presentations on Zoom, doing activities on Miro, etc.) during the sessions. Considering attendees will be engaging on microphones and cameras within an academic community during the interactive workshop, it will necessitate a private place, free of unwanted distractions and disruptions.

We will invite researchers and practitioners from academia and industry pursuing research about HCI, AI, HAI, XAI, and Healthcare Informatics. A call for contributions will be sent. The organizers will also directly contact different communities and relevant social media outlets. Through distribution lists, social media, and personal contacts, people with industry expertise and interest in adjacent sectors will be approached. All information on the workshop, including the workshop themes, submission process, and important deadlines are available on our workshop website available at https://ecscw2022-hcai.yolasite.com.

A maximum of 10 position papers and 20 participants, excluding the organizers, will be admitted for the workshop to provide a more structured discussion and increase the likelihood of achieving useful outcomes. The workshop will require a minimum of one author from each accepted paper to register and attend. To participate actively in discussions, all participants are encouraged to read the workshop contributions, which will be accessible prior to the workshop.

Submission and Selection

Workshop participants will be asked to submit a position paper following the ECSCW template 2-4 pages including bibliography, short use-cases: presenting materials, ideas, AI technology or artifacts they would like to discuss in the workshop. Submissions should include a brief outline of the main ideas and arguments for the contribution. Participants can also submit case-studies or reports on the recent experiments in their research context, prototypes, demos, or other research formats, they would like to demonstrate or discuss during the workshop. Participants who wish to contribute to the discussion without submitting material are not required to submit a position paper. The submission and the review process will be managed over e-mail. Workshop participants must submit a position paper by the deadline to **hai.health.ecscw2022@gmail.com**. The submissions should not be anonymized and will be reviewed by the workshop organizers and selected based on their quality, consistency with the workshop theme, and potential to generate fruitful discussions during the workshop.

Important Dates

- April 22nd, 2022: Submission of position papers
- May 6th, 2022: Notification of acceptance
- June 3rd, 2022: Camera-ready
- June 27th - 28th 2022: Workshop Days

Workshop Structure

The hybrid workshop will be held on two consecutive days, on June 27th and 28th with three hours each day including short tea break in between, within conference preferred timeslots, 14:00-17:00 UTC+1. The tentative event structure of our two-day interactive workshop is (roughly) as follows:

Workshop initiation: The organizers will initiate the proposal, laying out the workshop's objectives, goals, and anticipated benefits in detail. The participants will briefly introduce themselves during this session.

Interactive case study analysis: Participants will showcase the material they bring to the discussion. All the participants will be asked to engage through questions and answers. A minimum of 25 minutes will be dedicated to each case study. This time can be slightly longer, if less than 10 position papers are accepted. This activity is designed to engage the gathering with personal observations and to stimulate conversation on subjects that will be discussed in future sessions. Naturally, this will not allow for in-depth study of the cases, and this is also not the

intention. Instead, we intend to increase group topic motivation while identifying substantial discussion themes.

Interactive brainstorming session: We will next proceed by selecting problems for further discussion as a group. We will break off into smaller groups for discussion. A smaller number of organizers will moderate each group, which will be given a theme to discuss upon. The topics will be examined in further depth, this time using the example set of case studies to investigate the many issues that arise.

Plenary session: Following the group work, we will gather as a group and report briefly on the various conversations and conclusions.

Wrap-up: The organizers will provide closing comments and highlight the workshop's key lessons.

The organizers will also address the idea of teaming with the participants on a collaborative publication to make the findings available to the CSCW, HCI and AI research community.

Organizers

Nazmun Nisat Ontika, M.Sc., is a Research Assistant at the chair of CSCW and social media at the University of Siegen. Her research interests of late include Human-computer Interaction, User-Centered Technology Design, Child Computer Interaction, Virtual and Augmented Reality for better Accessibility and Usability. Her current research includes Human-Centered Artificial Intelligence in Radiology.

Hussain Abid Syed, M.Sc., is a Ph.D. scholar at the chair of CSCW and social media at the University of Siegen. His research interests are in crisis informatics, infrastructures, explainable AI, and human centered AI. His current research includes exploring the phenomena of organizational resilience and infrastructuring in small and medium enterprises and developing lightweight socio-technical solutions using technologies like service-oriented architecture, rest APIs and data science pipeline.

Sheree May Saßmannshausen, M.Sc., is a Research Assistant at the chair of CSCW and social media at the University of Siegen. Her research interests are in the field of Human-Computer-Interaction and Human-Centered-AI in the context of healthcare. Her current research includes User Experience Design for technologies like Augmented Reality or Artificial Intelligence.

Richard HR Harper, Ph.D., is a Professor of Computer Science and Director of the Institute for Social Futures at Lancaster University. He is a Fellow of the IET, Fellow of the SIG-CHI Academy of the ACM, Fellow of the Royal Society of Arts,

and Visiting Professor in the College of Science at the University of Swansea, Wales. His research is primarily in Human Computer Interaction, though it also includes social and philosophical perspectives. His research on trust in HCI has ranged from explorations of file abstractions, the role of trust in the self, and how trust is a taken for granted feature of interaction. He has written 13 books, including 'Trust, Computing and Society' (Ed. CUP, 2015) the IEEE award winning 'Myth of the Paperless Office' (MIT: 2003)); and 'Choice' (Polity: 2016). He holds 26 patents, including ones for new cloud-based interaction devices (such as the 'Cloud Mouse'), new secure data stores and lightweight mobile phone data exchange protocols. Prior to joining Lancaster, he was Principal Researcher at Microsoft Research.

Yunan Chen, Ph.D., is an Associate Professor of Informatics in the Donald Bren School of Information and Computer Sciences at the University of California, Irvine. Her research interests lie at the intersection of human-computer interaction (HCI), computer-supported cooperative work (CSCW), and health informatics. She is interested in data-driven technologies and human-centered AI for consumer health. Currently, she serves as Director of the Undergraduate Minor Program in Health Informatics, Vice Chair of Undergraduate Affairs at Department of Informatics, and Co-Director for the Health and Information Lab.

Sun Young Park, Ph.D., is an Associate Professor at the University of Michigan in the Stamps School of Art and Design and the School of Information. Her research lies at the intersection of Health Informatics, Human Computer Interaction (HCI), Computer Supported Cooperative Work (CSCW), Participatory Design, and Design Research. Her research uses design ethnography to study patient engagement, patient–provider collaboration, patient-centered health technology, and technology adaptation. Her work has been awarded by the National Science Foundation (NSF) and the Agency for Healthcare Research and Quality (AHRQ).

Miria Grisot, Ph.D., is an Associate Professor at the Department of Informatics, University of Oslo. Her main research interests are in the areas of information systems innovation, complexity and socio-technical systems, and organizational change, specifically in healthcare. She is engaged in research on AI in context. She is affiliated with the AI4users project addressing the "black box" problem contributing to the responsible use of AI for the digitalisation of public services. She is a member of the Association of Information Systems. She has worked mainly with an Information Infrastructure perspective, published in JAIS, CSCWJ, JSIS, SJIS.

Astrid Chow, M.S., MBA, is a Principal Product Designer and Strategist building the UX Design and User Research practice at Eleanor Health, a healthcare start-up

that focuses on substance use disorders, alcohol use disorders, and mental health. Astrid serves as a VP board member for the User Experience Professionals' Association (UXPA) Boston Chapter. Additionally, she is a frequent guest speaker and panellist on the topic of AI & Design Ethics at events such as the HFES Health Care Symposium, Connected Health conference, ACM CHI and CSCW conferences, and O'Reilly's AI Conference. She is teaching an elective course on Design Ethics in Practice for the University of Washington.

Nils Blaumer, M.A., is the Managing Director of Gemedico GmbH. His research interests are in workflow automation and digitalization of health processes. His current research includes the detection of prostate carcinomas in MRI images with the help of AI in order to considerably facilitate the daily routine of radiologists.

Aparecido Fabiano Pinatti de Carvalho, Ph.D., is an Associate Researcher at the Institute of Information Systems and New Media and Deputy Director of the Chair of Computer Supported Cooperative Work and Social Media, University of Siegen (Germany). His interests span human-computer interaction (HCI), computer supported cooperative work (CSCW), practice-centred computing, artificial intelligence (AI), software accessibility, cyber-physical systems, mobile and nomadic work, and informatics in education. The focus of his research is on technologically mediated human practices, more specifically on the understanding on how practices can help identifying the design space of new and innovative technologies, and how they can shape and be shaped by their usage. He has published several articles on topics related to these fields of research in prestigious international conferences.

Volkmar Pipek, Ph.D., is a Professor for Computer Supported Cooperative Work and Social Media with the Institute for Information Systems at the University of Siegen, Germany. He currently chairs to the board of trustees of the International Institute for Socio-Informatics (IISI). He has widely published books and articles in CSCW, with a specific interest in infrastructuring. He is also the co-leader of the project "INF - Infrastructural Concepts for Research in Cooperative Media" at the Collaborative Research Centre 1187: Media of Cooperation and the leader of the Project PAIRADS, which is a research project in the field of the integration of artificial intelligence in radiology at the University of Siegen.

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Introduction to Practice-centred Computing

Aparecido Fabiano Pinatti de Carvalho
Institute of Information Systems
University of Siegen, Germany
Fabiano.Pinatti@acm.org

Abstract. Practice-centred computing has been at the heart of much of past and current Computer-Supported Cooperative Work (CSCW) and Human-Computer Interaction (HCI) research. Paying attention to people's practices in context has proved to be essential to understand what types of support they would need in particular situations and think of innovative technological solutions for them. In this masterclass, the ontological and epistemological foundations of practice-centred computing will be introduced and discussed. Special attention will be dedicated to the Grounded Design (GD) research paradigm, a praxeological worldview focusing on investigating the quality of technological artefacts by the understanding of how human practices change, as people engage in using and appropriating them. In particular, the masterclass will address different methods and methodologies that can be used within this paradigm, and how these methods and methodologies can be systematically organised within a research framework, which can be instrumentally used for the design of useful and usable computer technologies.

Contextualisation

Computer-Supported Cooperative Work (CSCW) interest in human practices dates back to its inception in the 1980s, when researchers and practitioners concerned with Human-Centred Computing (HCC) acknowledged the limitations of the human-factors perspective, underpinning most of the Human-Computer Interaction (HCI) research at that time, and started advocating for a change towards a human-actors perspective, taking into account people's skills, shared practices and the context surrounding them (Bannon, 1995). This perspective, it has been claimed, would allow HCC professionals to understand how people, technology, work requirements and organisational constraints relate to each other, and how these relationships can inform the design of useful technologies, which can be effectively appropriated (Bødker, 2015). As a result, a new wave of HCC research and practice emerged, focusing on the contextual and situated use of computer technologies, and their role in mediating human activities Bødker, 2006). Practice-centred computing has been proposed as a valuable frame for this paradigmatic change, suggesting ways to articulate emerging issues from the field and inform the design of new and innovative technologies with and for the users Kuutti and Bannon, 2014; Wulf *et al*., 2015).

The philosophical assumptions of practice-centred computing, spanning ontological, epistemological, methodological and rhetoric orientations, have been captured in Grounded Design (GD), a praxeological research paradigm for practice-centred computing highly influenced by *pragmatism*, which focuses on the use and appropriation of digital technologies to inform the design of new and innovative solutions that can effectively support human practices and, eventually, facilitate improvements of existing practices or the establishment of new ones (Rohde *et al*., 2016; Stevens *et al*., 2018). In GD projects, HCC professionals set out to understand how people go about accomplishing their tasks and achieving their goals in different contexts to identify design opportunities and think of solutions to support people de Carvalho *et al*., 2021). These professionals focus on people's practices – i.e., mediated actions spanning both physical and mental forms of activities, associated with routinised patterns that normatively frame contingent activities – and the context where such practices unfold to identify the design space for the conceptualisation, development, and introduction of new, innovative and, above all, useful technologies Wulf *et al*., 2015; de Carvalho, 2021).

Although there are many different ways to implement GD projects, a framework has been particularly elaborated with this design research paradigm in mind. Design Case Study (DCS), as it has been termed, is an approach to GD based on three main elements: contextual study, design activities, and investigation into the appropriation of the designed artefacts. Each of these elements are addressed in a dedicated phase of the framework, which will most

likely coexist as the project develops. Following the pragmatic orientation of GD, DCS makes use of many different socio-scientific and design methods and approaches to accomplish its goals. Among them, it is worth mentioning ethnographic, living lab and participatory design approaches, predicated upon methods such as participant observations, in-depth interviews, contextual enquiry, design workshops, cooperative) prototyping, cooperative evaluation, and usability testing. Quantitative approaches, often based on the analysis of survey data, are also a possibility within the framework, although they are not so commonly used as their qualitative counterparts (Wulf *et al*., 2015).

Goals and Activities

The main goal of this masterclass is to provide HCI and CSCW professionals who are interested in exercising practice-centred computing with the necessary tools and knowledge to carry out successful design projects under the auspices of this tradition. Special focus will be given to the GD paradigm and the DCS framework proposed for it. The masterclass will concentrate on the main conceptual and theoretical aspects of the paradigm as well as the relevant methodological aspects of the framework. By the end of the masterclass, participants should be able to successfully plan a GD project, drawing on appropriate design and research methods for the design problem that they would like to address. This should support them to accomplish impacting results with their initiative, both in terms of research results as well as of the quality of the designed artefacts.

The masterclass will be conducted in a hybrid format based on short presentation sessions to introduce the relevant concepts, theories, and methods, followed by brainstorming sessions to discuss their understanding, doubts and difficulties with any of the presented constructs. Examples from past DCSs carried out by the organiser will be introduced and alternative strategies will be discussed, so that participants can have a better understanding of the options they have to carry out methodological sound practice-centred computing projects.

Target Group

This masterclass targets young researchers planning to engage in practice-centred computing. It can, nevertheless, also be of interest to researchers who have already been exercising it, but still have doubts or reservations about any associated aspects.

Format and Duration

This masterclass is planned to be a half-day in-person masterclass.

Number of Participants

To assure focused discussions and exchanges, a maximum of 15 participants will be allowed.

Required Resources

In terms of infrastructure, a lecture hall capable of accommodating the maximum number of participants according to the COVID-19 regulations still in place by the time of the conference, provided with a projector, a proper space for projection, sound system and a flipchart board with paper. Participants are not required to bring any particular resources for the activities.

Organiser's Short Bio

Fabiano Pinatti, PhD, is the Deputy Director of the Chair of Computer Supported Cooperative Work and Social Media of the University of Siegen (Germany), the EUSSET Community Building Chair and one of the EUSSET Competence Network Co-Chairs. He holds a BSc and a MSc in Computer Science from the Federal University of São Carlos, São Paulo, Brazil, and a multidisciplinary PhD developed within a joint project between the Interaction Design Centre of the Department of Computer Science and Information Systems, University of Limerick, Ireland, and the Department of Sociology at the same university. His interests span Human-Computer Interaction, Computer-Supported Cooperative Work, Practice-centred Computing, Interaction Design, Software Accessibility, Cyber-Physical Systems, Mobile and Nomadic Work and Informatics in Education. Since 2016, he has been leading and carrying out assorted Grounded Design projects predicated on the Design Case Study framework. The focus of his research is on technologically mediated human practices, more specifically on the understanding on how practices can help identify the design space of new and innovative technologies, and how they can shape and be shaped by their usage. He has published several articles on topics related to these fields of research in prestigious international conferences.

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Pinatti de Carvalho, Aparecido Fabiano (2022): Introduction to Practice-centred Computing. In: Proceedings of the 20th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies – Masterclasses, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.48340/ecscw2022_mc02

Practising Thematic Analysis: From In-Depth Qualitative Data to Implications for Design

Aparecido Fabiano Pinatti de Carvalho
Institute of Information Systems
University of Siegen, Germany
Fabiano.Pinatti@acm.org

Abstract. Much of Computer-Supported Cooperative Work (CSCW) and Human-Computer Interaction (HCI) research and practice is noticeably grounded on deep understandings of users' contexts and practices. In order to achieve such understandings, assorted socio-scientific qualitative methods for data collection – e.g., in-depth interview, ethnographic observation and focus group – and analysis – e.g., discourse analysis, content analysis, and thematic analysis – have been appropriated and used within these fields. In this masterclass, participants will be introduced to a particular approach to thematic analysis (TA), which has been instrumental in many CSCW and HCI projects. The masterclass will particularly focus on how TA can be successfully used to move from rich qualitative data towards empirically grounded implications for design to orient the conceptualisation and development of new and innovative computer technologies. By means of a practical exercise, consisted of thematically analysing an interview transcript collaboratively, participants will have the opportunity to go through all the phases of the referred approach and understand how it can help them demonstrate rigour in the generation of implications for design.

Contextualisation

Computer-Supported Cooperative Work (CSCW) research and practice have been traditionally predicated upon the appropriation and use of different socio-scientific methods to generate the conceptual and theoretical constructs necessary for the design and development of useful computing systems. Within the realms of *practice-centred computing*, special attention has been placed on *qualitative methods* (Wulf *et al*., 2015). Methods like *in-depth interviews* (Hermanowicz, 2002), *participant observation* (McKechnie, 2008), and *diaries* (Gaver, Dunne and Pacenti, 1999) have been recurrently used to provide accounts of the user contexts and their practices. These methods inherently generate an extensive and rich body of data, which needs to be carefully analysed in order to generate the abovementioned conceptual and theoretical constructs.

There are many and various methods and approaches at the disposal of researchers for the analysis of qualitative data, e.g., phenomenological analysis (Finlay, 2012; Finlay and Eatough, 2012), conversation and discourse analysis (Wooffitt, 2005; Trappes-Lomax, 2018), qualitative content analysis (Mayring, 2014) and the approaches for the construction of Grounded Theories (Glaser and Strauss, 1967; Strauss and Corbin, 1998). Thematic Analysis (TA) is one approach which has become more and more popular among Human-Centred Computing (HCC) professionals over the years.

As for the many of the approaches mentioned above, TA can be carried out in slightly different ways - see e.g., Gibson and Brown (2009), and Braun and Clarke, (2012) for some examples. TA is a flexible and self-contained method, which does not bring with itself any conceptual and theoretical frame. It is a unique method in its own, which has been proven valuable in supporting qualitative researchers in finding, organising, and providing insights in patterns of meaning across data sets. The method provides qualitative researchers with the necessary guidance to carry out thorough, plausible, and sophisticated data analysis. It allows researchers to identify and elaborate a deep understanding of both collective and shared experiences and meanings. It allows researchers and practitioners to navigate along three different dimensions of qualitative research, concerning orientation towards (1) **theory** (*inductive* versus *deductive*); (2) **data** (*experiential* versus *critical*), and (3) **ontology** (*essentialist* versus *constructionist*) (Braun and Clarke, 2012).

Within Human-Computer Interaction (HCI) and CSCW, there seems to be a trend towards using Braun and Clarke's (2006, 2012) approach to TA. A possible explanation for this is the fact that Braun and Clark present a straightforward and systematic method to carry TA out, which contributes towards *trustworthiness* and *authenticity* of the analysis results (de Carvalho, 2021). Other authors mostly do not introduce well-defined steps and guidelines for it, concentrating on what should be done, instead of how it can be accomplished.

TA provides HCC professionals with a framework to develop a deep and accurate understanding of the users, their contexts, and their practices, as they try to find solutions for the many types of wicked problems underpinning the field (de Carvalho *et al*., 2018, 2021). Using TA does not mean to limit the creativity inherent to design. Instead, it means finding the right food for thought to feed the process, so that the resulting solutions really speak to the user contexts and needs and, as such, can support users with their practices, in a useful manner (de Carvalho, 2021).

Goals and Activities

The goal of this masterclass is to introduce the grounds and mechanisms of Braun and Clarke's TA (2012) approach and give the participants the opportunity to engage in a practical exercise to master it. Furthermore, the masterclass will dedicate special attention to demonstrate how TA can be used to (a) guarantee rigour to the user studies carried out as part of user-centred and practice-based design projects and (b) support the generation of strong conceptual and theoretical constructs out of it.

During the masterclass, the six steps of the approach proposed by Braun and Clarke (2012) – namely (1) *familiarisation with the data*; (2) *codes generation*; (3) *themes search*; (4) *review of potential themes*; (5) *themes naming and definition*; and (6) *report production* – will be introduced, and participants will have the opportunity to test their understanding about each of these steps by completing each of them as they go on to analyse a short data artefact. Participants will be introduced to the mechanisms of coding (Benaquisto, 2008) and systematic qualitative data analysis. Furthermore, they will learn about how a systematic data analysis can contribute towards the *credibility*, *transferability*, *dependability*, and *confirmability* of research findings (Guba, 1981).

By the end of the masterclass, participants should be able to carry out TA and aware of the many decisions that they will have to take as they progress in the analysis process, and the consequences they will have in the results.

Target Group

This masterclass targets any HCI and CSCW professional interested in: (1) learning or perfecting the mechanisms and procedures of TA; (2) understanding how it can be used for user-centred and practice-centred design of interactive systems; and (3) find out how it can contribute to the quality of the designed artefacts.

Format and Duration

This masterclass is planned to happen in person. Given the extent of the masterclass activities and the time needed for them, the masterclass is planned as a full-day event.

Number of Participants

To make it viable to assist the participants properly in all the masterclass activities, a maximum of 15 participants will be accepted.

Required Resources

In terms of infrastructure, a lecture hall capable of accommodating the maximum number of participants according to the current COVID-19 regulations, provided with a projector, a proper space for projection, sound system and flipchart board with paper will suffice.

Participants will be required to bring a laptop with MaxQDA 2022 Standard installed[1]. In case participants do not have a licence for the application, they are advised to download and install its trial version before the masterclass. The trial version is valid only for a few days and can be installed only once. Therefore, participants should assure that the version will still be active by the time the masterclass happens.

Organiser's Short Bio

Fabiano Pinatti, PhD, is the Deputy Director of the Chair of Computer Supported Cooperative Work and Social Media of the University of Siegen (Germany), the EUSSET Community Building Chair and one of the EUSSET Competence Network Co-Chairs. He holds a BSc and a MSc in Computer Science from the Federal University of São Carlos, São Paulo, Brazil, and a multidisciplinary PhD developed within a joint project between the Interaction Design Centre of the Department of Computer Science and Information Systems, University of Limerick, Ireland, and the Department of Sociology at the same university. His interests span Human-Computer Interaction (HCI), Computer-Supported Cooperative Work (CSCW), Practice-centred Computing, Interaction Design, Software Accessibility, Cyber-Physical Systems, Mobile and Nomadic Work and Informatics in Education. The focus of his research is on technologically

[1] https://www.maxqda.com/products

mediated human practices, more specifically on the understanding on how practices can help identify the design space of new and innovative technologies, and how they can shape and be shaped by their usage. He has published several articles on topics related to these fields of research in prestigious international conferences. He has been practising Thematic Analysis since 2013. The method has been central to many of his research studies and has been supporting him in generating relevant conceptual and theoretical constructs to advance the state of the art of HCI and CSCW research.

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Schorch, M. (2022): ECSCW 2022 Masterclass on 'Qualitative Methods in CSCW', Proceedings of the 20th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies - Masterclasses, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.48340/ecscw2022_mc03

ECSCW 2022 Masterclass 'Qualitative Methods in CSCW'

Marén Schorch
Computer Supported Cooperative Work and Social Media
University of Siegen
maren.schorch@uni-siegen.de

Abstract. Qualitative methods like open or semi-structured interviews and participant observation, focus groups, design workshops, or cultural probes have been essential parts of many research and design projects in CSCW. Most of these methods have their origins in sociology, social sciences, and anthropology. In contrast to quantitative studies, the aim of qualitative empirical studies is not to test a theory or hypothesis but to openly explore and meet the complexity of cooperative and collaborative practices in the respective setting. Doing qualitative research in CSCW is exciting but time-consuming and demanding, especially if such methods have not been part of your academic curriculum. Since the Covid19 pandemic started, the basic premise for fieldwork "on the ground" has also been challenged. Over time, we had to adapt and expand our methodological spectrum with online interviews, cultural probes (Gaver et al. 2004), etc. This masterclass aims at imparting knowledge about qualitative methods, related frameworks such as ethnography (among others Randall et al., 2007; Hammersley and Atkinson, 2007) and Grounded Theory (Glaser and Strauss, 1967), and explicitly diverse options for data collection, preparation, and data analysis. We will discuss a larger spectrum of possible methods and how to take one's pick, depending on the respective research and design interest.

Format and schedule

The masterclass is planned as an on-sight event at the University of Coimbra, San Francisco Convent, Coimbra, Portugal, on **Tuesday, 28th June 2022,** from **9:30-12:30 UTC+1**.

Outline:

1. Welcome & introduction
2. Basics of qualitative methodology
3. Qualitative research as a process and sequence of decisions
   - Epistemological frames: Grounded Theory (GT) (Glaser & Strauss 1967) and ethnography (i.a. Randall, Harper and Rouncefield 2007)
   - Contextualisation, research agenda, ethical issues, etc.
4. Doing qualitative research in CSCW
   - Data collection: e.g., different forms of interviews, participant observation, video interviews, virtual ethnography, cultural probes, design workshops, etc.
   - Data storage and preparation: transcription, anonymisation
   - Data analysis: GT, content analysis, triangulation
   - Data analysis groups, collaborative work
5. Wrap up (how to face some of the challenges)

Target group

Students of CSCW or HCI on Masters or PhD level who are interested in an overview of qualitative methods applicable to empirical projects in our fields of research and development. You are welcome on any level: novice and with basic knowledge. And as always in qualitative research: being curious and open-minded is very helpful.

First recommended reading:

Blomberg, J. and Karasti, H. (2013): 'Reflections on 25 Years of Ethnography in CSCW', *Computer Supported Cooperative Work (CSCW)*, vol. 22, no. 4-6, pp. 1-51.

Organiser's short bio

Marén Schorch is a PostDoc researcher with a PhD in Sociology and specializing in qualitative social methods, preferring ethnographic approaches. She was the leader of the interdisciplinary junior research group "KontiKat" at the University of Siegen, Germany (2017-2021). Using her long-term experience in multidisciplinary research projects and settings in CSCW, she has been involved in

multiple participatory design projects at the University of Siegen and international partners since 2013. Her PostDoc research focuses on the interplay of continuity and (digital, social, economic) change in the context of crisis, the construction of "safety", and its impact on cooperation and collaboration in small and medium-sized companies and society. More particularly, she has conducted multiple empirical studies dealing with risk awareness, crisis experience, and practices of (emergency) preparedness as part of the resilience of people and organisations. She has published many articles on her varied research and co-organized several CSCW-related workshops such as ECSCW 2011, 2020, 2021; CSCW 2014 and CSCW 2017; COOP 2016, and GROUP 2016. She has been AC for CSCW 2021, CHI 2018, and 2020, chair for the track "Exploratory papers" at ECSCW 2019 (with Ingrid M. Erickson), and regularly reviews for ECSCW, CSCW, GROUP, CHI, etc.

Contact: maren.schorch@uni-siegen.de
Website: https://kontikat.de/en/931-2/dr-maren-schorch/

Schorch, M. (2022): ECSCW 2022 Masterclass on 'Doing CSCW research with small and medium enterprises', Proceedings of the 20th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies - Masterclasses, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.48340/ecscw2022_mc04

ECSCW 2022 Masterclass 'Doing CSCW research with small and medium enterprises.'

Marén Schorch
Computer Supported Cooperative Work and Social Media
University of Siegen
maren.schorch@uni-siegen.de

Abstract. Small and medium enterprises (SMEs) are often described as "the backbone of the European economy" (Annual report on European SMEs 2014/2015), counting about 22 million active SMEs in 2014 and employing almost 90 million people (ibidem). You can find various branches and fields, including diverse examples such as IT start-ups, shops, metalworking, and the ancillary industry. Many successful, long-standing SMEs have already experienced multiple socio-economic changes and phases of transformation like the "third industrial revolution" with the integration of automatisation and information and communication technologies (ICT). Many companies have faced the so-called "industry 4.0" development and the correlated digitalisation processes within the last decade. Since the start of the ongoing Covid19 pandemic in early 2020, some of these processes were accelerated (home office, coving phases of quarantine, shift to e-commerce etc.), and some additional aspects like delivery problems, loss of orders, sales collabs, absence of personnel) are an enduring challenge for many SMEs. These issues are interesting from a CSCW perspective: How do the involved actors in the companies deal with such challenges and processes of digitalisation and technological transformation? How do the different stakeholders cooperate on an intra-, inter-, and external level (meaning within the respective SME, with their collaborative partners and providers of infrastructure etc.), especially in times of crisis? In the masterclass, you will zoom into SMEs, learn about crucial concepts connected with the outlined issues above, discuss methodological

approaches, and engage stakeholders for cooperation when conducting research and design projects in this practical field.

Format and schedule

The masterclass is planned as an on-sight event at the University of Coimbra, San Francisco Convent, Coimbra, Portugal, on **Tuesday, 28th June 2022,** from **14:00-17:00 UTC+1.**

Outline:

1. Welcome & introduction
2. Some 'facts': definitions of SMEs, examples etc.
3. Continuity in long-standing SMEs: a tale of changes and transformation
   - Down on memory lane: the four stages of the 'industrial revolution'
   - 'Industry 4.0' and digital transformation processes
4. Crisis management for SMEs
   - Vulnerability and resilience: experiences from the Covid19 pandemic
   - Business continuity management (BCM)
5. CSCW research projects and collaborations with SMEs
   - Some methodological challenges…
   - … and how to cope with them
6. Wrap up

Target group

Students of CSCW or HCI on Masters or PhD level who are interested in the topic and - ideally – have some project experience with SMEs (but that's not a requirement). You are welcome on any level: novice and with basic knowledge.

First recommended reading:

Syed, H. A., Schorch, M., Ankenbauer, S. A., Hassan, S. S., Meisner, K., Stein, M., Skudelny, S., Karasti, H. and Pipek, V. (2021): 'Infrastructuring for organizational resilience: Experiences and perspectives for business continuity', *Proceedings of the 19th European Conference on Computer-Supported Cooperative Work (ECSCW 2021) – Workshops, EUSSET* (ISSN 2510-2591), doi:10.18420/ecscw2021-wsmc02

Syed, H. and Schorch, M. (eds.) (2021): 'Infrastructuring for organizational resilience: A workshop report', *International Reports on Socio-Informatics (IRSI)* 18 (1). Download: https://www.iisi.de/wp-content/uploads/2022/02/IRSIV18I1.pdf

Organiser's short bio

Marén Schorch is a PostDoc researcher with a PhD in Sociology and specializing in qualitative social methods, preferring ethnographic approaches. She was the leader of the interdisciplinary junior research group "KontiKat" at the University of Siegen, Germany (2017-2021). Using her long-term experience in multidisciplinary research projects and settings in CSCW, she has been involved in multiple participatory design projects at the University of Siegen and international partners since 2013. Her PostDoc research focuses on the interplay of continuity and (digital, social, economic) change in the context of crisis, the construction of "safety", and its impact on cooperation and collaboration in small and medium-sized companies and society. More particularly, she has conducted multiple empirical studies dealing with risk awareness, crisis experience, and practices of (emergency) preparedness as part of the resilience of people and organisations. She has published many articles on her varied research and co-organized several CSCW-related workshops such as ECSCW 2011, 2020, 2021; CSCW 2014 and CSCW 2017; COOP 2016, and GROUP 2016. She has been AC for CSCW 2021, CHI 2018, and 2020, chair for the track "Exploratory papers" at ECSCW 2019 (with Ingrid M. Erickson), and regularly reviews for ECSCW, CSCW, GROUP, CHI, etc.

Contact: maren.schorch@uni-siegen.de
Website: https://kontikat.de/en/931-2/dr-maren-schorch/

David Struzek (2022): Sketchnoting. In: Proceedings of the 20th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies - Masterclass, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.48340/ecscw2022_mc05

Sketchnoting

David Struzek
University of Siegen, Germany
david.struzek@uni-siegen.de

Abstract. As a result of the pandemic situation, we have increasingly shifted our professional context to the digital world and consequently increased the amount of work in front of and with computers. Conferences, staff meetings, collaboration with research partners, and user research have mostly taken place online without informal exchanges. The essential data collection and protocoling for researchers can quickly become stressful due to the monotonous nature of the work, on the receiving side as well as on the transmitting side. Sketchnoting can be a helpful method for documenting information creatively and visually. Words and pictures are combined to better illustrate contexts, to explain facts more easily and to retain content longer or to deliver it in a sustainable way. This masterclass introduces the basics of the sketchnoting method as well as the psychological background and approaches. Practical exercises will be used to get to know the method and to discuss its use in socioinformatics and qualitative research contexts.

Contextualisation

Taking minutes and notes is part of the daily routine of many researchers, whether in conversations, joint meetings to develop common ideas, or with specific stakeholder groups in workshops or conferences and events. This of form of work can be very stressful. Informal exchanges could be used as a balance to stimulate creative thought and reduce stress away from scientific activities (Buunk and Verhoeven 1991). During the COVID-19 pandemic, work in front of and with computers increased dramatically. Collaboration with colleagues and specific stakeholder groups as well as the conduct of various events was largely done only online. This has resulted in a large increase in workload (Schmitt, Breuer and Wulf 2021). Freehand drawing can be used here as a way to balance out the flood of information and the resulting overload. In fact, drawings offer the possibility to be used as a supporting medium. In this way, drawings tend to be used subconsciously for personal expression, whether in professional or domestic contexts (Cohn 2012), which are then not shared with other work colleagues. However, these visual and thus more tangible "sketchnotes" offer many cognitive and performance potentials (Brown, 2014). Among other things, drawings can enhance creativity, improve retention, and increase memory (Dimeo 2016; Brown 2014). In groups, they can initiate exchanges, support discussion and collaborative ideation (Paepcke-Hjeltness and Henry 2017), and more easily represent processes (Sturdee 2019). So, sketchnotes are described as visual representations of information (e.g., thought processes or presentation outcomes) that are very different from ordinary text notes and transcripts because they include self-drawn images in addition to written words to highlight content intentionally (Zheng et al. 2021). Sktechnotes tell a story (Sturdee 2018; 2019) that can be used to improve retention and memorization of results through "active" listening (Dimeo 2016). Sketchnoting as a method can support collaboration with colleagues, as well as with specific stakeholder groups in the field (Lewis et al. 2019), but can also build one's confidence to create drawings (Paepcke-Hjeltness, Mina and Cyamani 2017; Camporro and Marquardt 2020).

Goals and Activities

The goal of the masterclass is to be able to understand the topic and especially the helpful use of sketchnoting as a method related to the psychological background. At the end of the event, participants should be able to use sketchnoting as a method for creative and visual documentation of information.

In addition to the method itself, participants will learn about the differences between various sketching approaches. For the interactive part, basics and forms will be introduced to be able to make their own sketchnotes. Participants will understand that no special knowledge or artistic talent is necessary for sketchnoting. Thus, a mutual exchange should take place in order to gain self-confidence to present one's own sketchnotes to the group.

Target Group

The Masterclass is intended for all students, master students, as well as PhD (undergraduate) students of HCI or CSCW, who would like to learn more about the use of visual tools in scientific or professional contexts. The event is also interesting for scientists who communicate teaching or learning information, need to overcome language barriers with different stakeholder groups, or want to learn methods for deal with information overload.

Format and Duration

The Masterclass is planned and prepared as a presence event. Alternatively, the event will be held in a hybrid format. The Masterclass will be held on Monday, 27 June from 14:00 to 17:00 UTC+1. In addition to the presentation of the contents, the participants will also perform their own exercises.

Number of Participants

In order to give all participants enough time during the interactive discussions and activities, a maximum of 12 participants will be admitted.

Required Resources

For the Masterclass, a lecture hall or a room with enough workstations (tables and chairs) for the specified number of participants is sufficient. If there are COVID-19 pandemic regulations that must be followed at the time of the conference, the workstations should have the required minimum spacing. The room should have a projector, sound system, and flipchart and multi-color flipchart makers. Should the conference and consequently the masterclass take place as a hybrid variant, a laptop or a PC with webcam is sufficient. In this case, the masterclass will be held via Zoom. For on-site participation, participants do not need a laptop. Various writing and painting materials are needed for participation. A blank booklet is also recommended to be able to use the contents afterwards. Alternatively, a stack of white A4 paper can be used, 10 sheets per participant. Alternatively, a notepad can be used at home. For drawing and painting, a pencil and eraser will be needed, as well as highlighters in different colors and a black pen. Otherwise, ballpoint pens and colored pencils can be used.

Additional Resources

Nicolai Marquardt and Saul Greenberg. (2012). “Sketchnotes for Visual Thinking in HCI” Workshop Paper at ACM CHI ’12 Workshop on Visual Thinking

and Digital Imagery;
http://grouplab.cpsc.ucalgary.ca/grouplab/uploads/Publications/Publications/2012-Sketchnotes.CHIWorkshop.pdf

The Sketchnote Handbook: The Illustrated Guide to Visual Note Taking (2012).
ISBN-13: 978-0321857897
The Sketchnote Workbook: Advanced techniques for taking visual notes you can use anywhere (2014). ISBN-13: 978-0133831719
by Mike Rohde

Visual Thinking: Empowering People & Organizations through Visual Collaboration (2017).
ISBN-13: 978-9063694531
by Willemien Brand

Organiser's Short Bio

David Struzek is a PhD student and research assistant at the Chair of Information Systems, especially "IT for the Aging Society" at the University of Siegen. Currently, in addition to teaching activities, he coordinates the internationally funded research project Active City Innovation, fostering joy of movement in public space. David Struzek graduated with a Master's degree (M.Sc.) in Human Computer Interaction at University of Siegen. David's further research interests are User Experience, Usability & Accessibility and Creative Science.

Contact: david.struzek@uni-siegen.de
Website: https://italg.wineme.uni-siegen.de/team/david-struzek/

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