Situated Scaffolding for Sustainable Participatory Design: Learning Online with Older Adults

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An extensive literature on participatory design with older adults has, thus far, little to say about the support older adults need when involved in online activities. Our research suggests that to empower older adults in participatory design, scaffolding work has to be done. Scaffolding interactions - creating temporary instructional support to help the learning of participants - is a common approach in participatory design. Yet, when applied in online participatory design with older adults, the traditional understanding of the concept does not match the way older adults' learn. Hence, we argue for a new understanding of this term, which we call situated scaffolding. We illustrate our argument with a case where older adults collaborate online as part of a participatory design project. We unpack the different dimensions of situated scaffolding and discuss how this novel understanding can be used to further inform sustainable participatory design for and with older adults.

CCS Concepts: • **Human-centered computing** • **Human-computer interaction (HCI)** • **Empirical studies in HCI**

KEYWORDS: Older adults, participatory design online, scaffolding, learning

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1 INTRODUCTION

The current demographic change (population growing older but also requiring more care), gives rise to a range of challenges. Digitalization of the "aging society" aims to address these challenges, leading to increasing digital complexity. However, these digital tools tend to assume homogeneity of experience and do not address the individual needs and requirements of the older adults, leading potentially to their exclusion from society [47]. A solution to this problem has started to be tackled by emerging local and national efforts. For example, in Germany, local computer clubs for older adults provide hands-on advice on how to solve problems connected to digital tools appropriation and support older adults in learning to use their digital devices.

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Further, nationwide activities such as classes in community colleges provide a range of structured learning opportunities. However, there is a complicated trade-off between these services: the local activities do not provide enough overview on the possible digital opportunities; and the national services provide more general knowledge, without a strong link to individual practices.

In this context, participatory design (PD) can become a possible space, where older adults gain necessary digital skills as well as more meaningfully contribute to the technology development. Previous research has shown that participatory design can be a suitable approach to involving older adults in the development of technology relevant to their needs, fostering mutual learning and facilitating digital literacy [30]. Nevertheless, when participation is managed online, we find some challenges exist, largely because digital literacy at an adequate level for collaborative learning is not always in place. Some work is necessary to make participation in collaborative projects online work, as the current design of digital tools makes progressive mutual learning difficult to achieve. Our own work suggests that, at best, learning might be hindered or "slowed down"; and adequate instructional support is hence required. However, as very few PD projects with older adults have been actually conducted online, we know very little about how satisfactory outcomes are to be achieved.

The gerontological pedagogy (often referred to as geragogic) literature argues that learning for older adults is a distinct process and requires instructional support but as yet has said little about how this takes place online. More specifically, in what follows, we draw on the idea of scaffolding which is a concept that originally comes from teaching and learning for school children [51,52]. The principle is that, in the first instance, teachers must provide considerable input on a new topic before students can begin to self- organize their learning, with the ultimate goal of becoming independent learners. Scaffolding is especially useful when dealing with groups of very heterogeneous learners [27]. We, therefore, draw on the notion of scaffolding. We suggest that three major benefits emerged from such an approach. Firstly, the establishment of learning resources in this way has long term effects, creating extended and sustainable support networks. Secondly, a progressive move towards self-directed and peer supported learning is geared more closely to the ordinary, everyday, practices of actors and has direct consequences for their engagement in PD processes [44]. Thirdly, there is an evident need to build capacity in relation to skills in a rapidly changing digital landscape.

Hence, the main research goal of our paper is to understand how to organize participatory design workshops with older adults online. More specifically, the following research question has guided our research:

- *How instructional support develops when older adults and younger researchers collaborate online in the context of participatory design?*

By drawing on ethnographic informed methods with action-research orientation, we use the case of older adults collaborating in participatory design online to develop a concept of situated scaffolding for more sustainable designing of digital technology for and with older adults. This paper, then, makes the following contributions:

- It provides a novel understanding of the scaffolding concept for the context of aging society
- It provides empirical insights from older adults and researchers engaging in online collaboration, dealing with the practical challenges and the necessary steps taken to make the participation of everyone work.

- It makes design recommendations for the use of online collaboration tools with older adults engaged in participatory design research.

The text is structured as follows: we first discuss current literature on older adults in PD, we then provide relevant geragogical literature about instructional support and the older adults' uptake of video conferencing tools, as well as present our conceptual framework based on scaffolding literature. Second, we present our empirical setting, how we establish contact with participants, and collect and analyzed our data. Next, we illustrate our findings focusing on the development of the instructional support and challenges we encountered when collaborating online. Finally, we discuss our findings in the context of the traditional understanding of scaffolding concept as well as current PD literature with older adults. Finally, we provide implications for sustainable PD online.

2 RELATED RESEARCH

In the following section we discuss current literature on PD with older adults and point out how it mainly focuses on on-site collaborative activities. Next, we present geragogic literature to present the common instructional support styles for older adults. Finally, we draw on learning science and demonstrate how we understand the scaffolding concept. We finish with identifying a gap in the current literature.

2.1 Participatory research with older adults in HCI

Among the substantial literature on participatory research and design for and with older adults we find discourses on the concept of participation and reflections on supporting processes of working with "less privileged participants" [28]. These form a foundation for the study at hand. The existing literature provides a broad picture on how participatory projects are conceptualized and being set up. Research work ranges from approaches which have a strong orientation to the Scandinavian ideals of participatory design (i.e. focus on democratization, empowerment, and transparency in IT design processes) on the one hand, to seeing participants as mere "data suppliers" on the other hand [33,39,41]. The fact that power relations between scientists and citizens in PD constellations are problematic has also been carefully examined [5,42]. Related to this, a recent survey on PD with older adults suggests a stronger systematisation of PD work and inspects the levels of engagement of older participants between the parties in different stages of a design project [33]. Some researchers even question whether participation is meaningful at all and recommendations point at the idea that working with older adults in early phases of IT design would not lead to meaningful results because visualisation and the imagination of future technology would be too demanding for persons with little or no experience with digital tools, and that only in the latter stages of prototype testing would user involvement influence the outcomes [9]. In contrast to this estimation, other HCI literature provides extensive discussion on concepts and methods for including older adults in design processes, e.g interview methods, the usage of tool kits, such as cultural probes [22], and workshops [30]. In any event, with older adults, we face a highly diverse and heterogeneous societal group in respect of lifestyles, socio-economic, educational, and health-related backgrounds, and other contextual factors [44]. However, for large proportions of the 65+ generation, studies point to not only a "first-level digital divide" with regard to low levels of internet adoption, limited access, and overall use but also a "second-level digital divide" in relation to low internet skills and literacy as further differences between generational groups [13].

Some PD studies take this differentiation into account with the development of concepts and methods that help tailor PD activities to the specific needs of older adults. Approaches suggested include organizing workshops as "tea parties" or with social elements that provide levels of comfort and informality [48]; concepts that foster empowerment and learning and skill transfer in the course of a PD project [20]; concepts of dividing groups to adapt to the heterogeneity of the participants' digital skills [38] as well as developing frameworks for sustainable outcomes from joint decision-making processes [34]. "Enabling for design" in the context of a PD project is another focus found in the literature encompassing two major goals: digital capacity building in participants so that they can become knowledgeable co-designers in the longer run, but also support for "identity building" so that marginalized groups are enabled to start have a voice in articulating their needs and desires [28,37].

2.2 Instructional support for learning of older adults

Geragogy and gerontology build on the assumption that older adults have specific learning needs. These needs are not solely determined by the changes connected to aging, but rather by the different socio-economical and technological background the older learners have [44]. Thus, adequate instructional support is the key in fostering the process of older adults learning to use digital tools. Historically, a teacher-centered approach with older adults was used, building on providing the older adults with direct step-by-step instructions and summaries of action. Recent studies critique sustainability of this approach and recommend a more learner-oriented approach, which builds on the learners' specific needs and interests especially when used over a longer period of time [53]. However, that remains a challenging task, because the learners lack not only digital literacy but also an overview of what is possible to know and do with digital devices [23]. Some studies report combining frontal teaching and hands-on advice to address the different needs of older adults, for example in a project where young students supported older adults in their use of smartphones [6]. Another approach involves building on peer to peer support, which seems to be especially suitable as it can lead to decreasing anxiety and fear from using computers, due to shared experience and background [43]. Such initiatives are often difficult to sustain over time, as they lack resources. Some projects' efforts are sustained through re-use of originally developed physical materials, such as printouts, which can be used to support the learners [40].

Especially during the latest developments connected to COVID-19, many local NGOs and even national networks moved online. Because of that one of the common tools to support collaboration online became video conferencing tools [35]. Research on video conference tools and how these are being appropriated by older adults are another area scarcely tackled in the research literature and are mainly located in residential care contexts. Studies show that the opportunity to stay in contact with family members via videoconference tools may provide benefits in reducing loneliness and social isolation and increasing enjoyment and closeness [11,45]. At the same time, a number of challenges are being discussed which emerged with videoconference tool usage, such as technical issues (unstable internet connections), physical limitations (vision and hearing deficits), as well as unfamiliarity with the technology use and related privacy concerns [36]. Further, according to [45] low levels of self-efficacy lead to further hindrances in the uptake of this technology when the users felt that they were too old to use the technology. Additionally, it is reported that massive support by the staff was needed, which may prove another hindrance when facing their actual workload [36].

2.3 Conceptual framework

The main goal of our paper is to understand how to organize participatory design workshops with older adults online, with a more specific focus on how instructional support develops when older adults and younger researchers collaborate online in the context of participatory design. Our interest in scaffolding has to do with our recognition, based on the experiences we report on below, that participation in online contexts, for older adults, can be problematic. Scaffolding (or sometimes also called instructional scaffolding) is a concept that has been explored within the learning sciences [4]. It has also been addressed in communities focusing on design (for example [24,31,37]. Our understanding of scaffolding builds on a combination of the above mentioned fields. We understand scaffolding as creating a temporary instructional structure aiming to support a learner in accomplishing a task; this structure is designed to be gradually taken away. Practically, scaffolding can involve a range of different methods and strategies, such as creating resources, modeling tasks, templates, and guides, and/or providing guidance. There are different types of scaffolding, such as hard (planned) and soft (not planned) scaffolding [21]. One approach that has proven influential derives from activity theory and specifically from Vygotsky's notion of the zone of proximal development (ZDP). Vygotsky developed this concept to understand the learning potential of a child and the efforts of those who are supporting it:

> "[ZDP] is the distance between the actual development level [of a child] as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers. ([49] p.86)"

In other words, tasks that learners are capable of doing are not predetermined, but dependent on the appropriate support provided. This appropriate support then needs to be delivered through collaboration with a peer who is more experienced in the particular task or an instructor. In the development of the ZDP, tools play a crucial role as they have a mediating function in the social interaction [49], and hence which tools are used will play an essential role in how to create and deliver the particular scaffolding [46]. Building further on these ideas, a range of scholars have focused on what the appropriate support could mean - in other words, how to structure the ZDP so that the learner can progress to the goal capability. One of the key steps is identification of the learners' needs; hence, scaffolding is suitable to be used especially in groups involving heterogeneous learners [27]. Next, the problems need to be continuously identified and understood [24]. Finally, though not covered by Vygotsky, the temporality of such support is key in developing scaffolding. Scaffolding is then appropriate instructional support provided to the learner by an expert (a more knowledgeable person or a peer in a collaboration), designed in a way that it should be gradually taken away.

Scaffolding is hence a useful concept to use to understand supporting learning in PD, as it often consists of participants with very heterogeneous skills and different needs. Scaffolding as a concept is dynamic as it depends on its implementation, the scope of the task, and the learners' ZDP [32]. Hence, when applying this concept in the aging society, we argue that there is a need to develop a more nuanced understanding of the role of scaffolding.

2.4 Identifying the gap in current research

To sum up, recent studies based on participatory design approaches with and for older adults demonstrate the need for careful planning and deployment of the co-production process if sustained and productive engagement is to result [20,22,30,37,38,48]. Thus, moderation of the

process and the support of negotiation of different expectations, different levels of skills and interests as well as exit strategies need to be recognized early on [2,34]. Nevertheless, detailed consideration of how exactly such ambitions might be realized in the context of online participation has yet to be examined. Further, current literature on learning of older adults suggests that instructional support is key when using digital tools [6,40,43,44,53]. This literature builds on supporting older adults' learning in person, by heavily drawing on the physical resources at hand (pointing with hands, looking at the same screen, printouts, non-verbal communication). Literature on video-conferencing tools has shown a potential to benefit older adults [11,36,45]; however this literature also suggests that older adults would require sufficient instructional support in the use of the video-conferencing tools. Our paper addresses this gap, by drawing on the conceptual framework of scaffolding and unpacks what instructional support is necessary for older adults to be enabled to take an active part and contribute to a participatory design online.

3 EMPIRICAL SETTING AND METHOD

The ethnographic informed methods [3] allowed for using the on-site workshops as well as the online activities as environments for learning about the older research participants' interests, practices, and routines. The action research orientation [17] made us conceptualize the joint activities as sources of mutual learning as well as practicing interventions in relation to the PD project. In this section, we will first describe the empirical context of our data that this study took place within, how we recruited participants, and who they were and then we will proceed to describe which data this study draws on.

3.1 Empirical context

The research reported in this paper is part of a European project aimed at supporting appropriation and understanding of the learning conditions pertaining to the use of digital tools by older adults. The broader focus of our subproject is on participatory design work with that demographic in pursuit of developing digital literacy as a means to reach higher autonomy in digital tool use. In this paper, we present findings from a study that is part of our subproject project aiming to understand how to organize participatory design with older adults' workshops online. More specifically, the following research question has guided our research: How instructional support develops when older adults and younger researchers collaborate online in the context of participatory design?

The participants' recruitment took place in line with our socio-technical and long-term research approach. Our research group maintains long-term relationships with both private households and organizations in the city through a series of collaborative research projects, of which this is the most recent. One such relationship is with a group of older adults living in the same neighborhood (Group A). Participants from Group A were informed about the upcoming research project during a social dinner (which was a closing event to the previous project) and later recruited through a Telegram chat, which was established during a previous research project and which the participants were using the past three years. A second group (Group B) had been recruited by contacting a local volunteer initiative consisting of a group of older adults who, in collaboration with the municipality, run a volunteer internet café (in this study labeled with the pseudonym Atlas@space), where local older people can come and get help with their digital devices three times a week. We invited our Group A participants in person during the introductory event; the instructors were familiar with the research group and have worked with

our department before. There are 10 instructors in all, all retired, of whom two had previously joined in prior projects and who can be relied on to distribute the invitations to our PD projects among their visitors. One of the instructors also engages in skill training offered by regional and national senior didactic programs. Two of these instructors joined our project.

The timeline of our research efforts was heavily impacted by the restrictions connected to COVID-19. Our empirical activities took place in the following manner (for an overview of the timeline of our empirical activities see Figure 1). We started with an introduction event in January 2020 of our research at Atlas@space as well as we started to conduct weekly participatory observations at the same place. Our workshops started taking place in February 2020 and are still ongoing, however in this paper we chose to report from the first 29 workshops (February 2020 - May 2021). As our work had digital literacy for older adults as its central motivation the original goal was hence to organize a series of on-site workshops, during which we would introduce a range of digital devices (for example smartwatches or voice assistants) for older adults to explore and test out at home. We have managed to organize two respective three workshops with each group, during which we introduced more in detail our project goals, fostered getting to know each other in the groups, established Telegram as our main coordinating tool as well as distributed new devices. However, at the beginning of March, we had to interrupt all our onsite activities because of the gradually imposed restrictions connected to COVID-19.

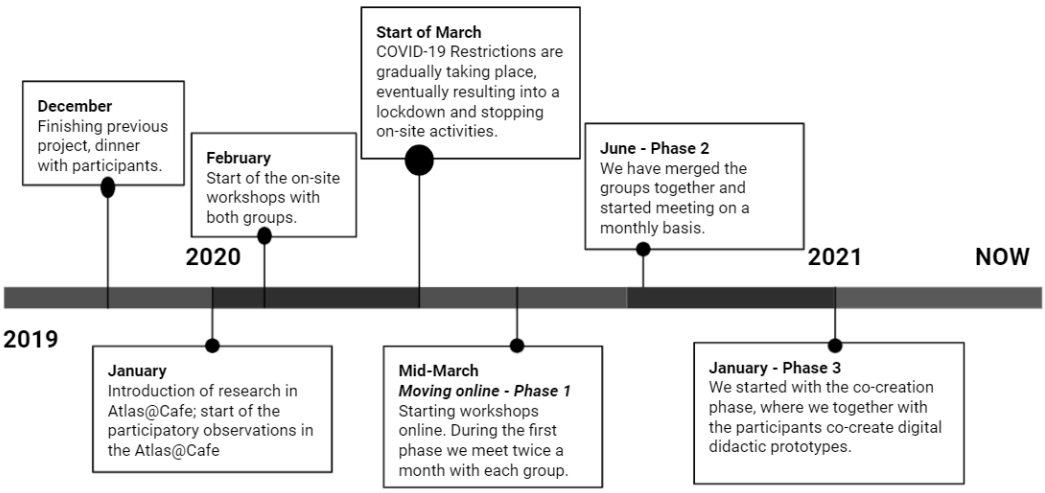

Figure 1: Timeline of the research work

In the following section, we reflect on the impact of the planned activities and how they had to change. Originally, the goal of the subproject was to develop a mobile demokit, a tangible artifact that would consist of digital artifacts guidelines co-created together with the older adults and the digital artifacts. Because of the COVID-19 consequences (working online and not preferring shared tangible objects, which could contribute to the spread of the virus), we have changed the goal of the project and instead of a tangible object, we started developing a website, where we present the results of our work, both made by the researchers, in co-creative collaboration with the older adults and by the older adults.

The following measures were taken to redesign our planned workshops. First, we made a decision together with our participants to move our workshops online. We discussed this decision in our Telegram chats with the participants. Second, we tested various tools with the participants,

including Jitsi, Skype, and Zoom. Third, through our experience, we gradually explored new ways to enable the older participants to take part in the online sessions. The majority of our participants knew little or nothing about video-conferencing tools but were motivated to participate in the workshops we had organized. This meant that a learning process had to be undertaken, one in which researchers needed to identify how best to provide the necessary support, and participants had to learn how to use the tools. Zoom in the end became our default option largely because of bandwidth quality and the additional features it offered, such as breakout rooms. As we discovered, our problem turned out to be not so much the management of interactional features of the sessions but quite simply enabling older participants to access the Zoom environment in the first place. It was necessary to manage instructions step-by-step, despite the fact that we had prepared and shared screenshots and written instructions through Telegram manual-like resources. Even with this careful guidance, the task turned out to be highly complex in some cases and we had to provide a very tailored form of scaffolding which consisted at different times of using devices with much lower overhead, such as texting through the common Telegram group or making individual phone calls.

Fourth, we have adapted our activities to the online mode. We have included the following types of activities:

a) *Ice-breaker activities (*simple tasks, which did not require high digital literacy);

b) *Discussions* (focused on specific themes, such as life during COVID-19 pandemic or also privacy online; later often taking place in breakout rooms). We know that many older adults are motivated by social interaction, hence we always tried including space for the older participants to share with each other.

c) *Task to learn* (a specific task to learn, that was the goal of the session, for example, explore an online tool together, test out different functions of Zoom etc., later often taking place in breakout rooms);

d) *Reflection* (taking place in a group and often at the end of each workshop).

Finally, we have also changed the way we planned the sessions by developing detailed step-by-step sequences of the planned activities; but at the same time, we had to be flexible and ready to change the order of the activities depending on the number of the participants as well as their digital literacy.

Two key aspects of video-conferencing environments impacted our online activities: that Zoom is a one-to-many communication channel (even though the whole group is present, only one person can, in principle, speak at a time) and that participants do not share the same physical space. Various studies have demonstrated that this can be a rather more challenging affair online (see e.g. [12]). Firstly, although relevance is clearly visible in relation to the way in which (typically) two persons seek to resolve a problem, the other members of the online group are reduced to the status of bystanders. Secondly, and this speaks to the relationship between the online and the offline world, what individuals are 'up to' when they attempt to deal with problems of various kinds, such as logging in, are not directly visible to other participants. Put simply, online spaces can be, at the same time, physical spaces, the latter not being equally available to all participants. In this respect, certain kinds of problem resolution become more problematic in the online environment. These elements were brought into sharp contrast by the fact that we had previous experience with the same group in working together in a shared physical site. When collaborating on-site, it was possible to address the emerging issues with learning to work with digital tools in a one-on-one manner, even though the approaches of older participants to their use

of technology sometimes varied. Sitting beside each other and pointing (with a finger) to specific parts of the phone or of the app were regular practices, in keeping with much of what we know about the relationship between gesture and talk (see e.g. [15,19]). Thus, the joint engagement between a person and a researcher around a device was always an important part of the on-site workshop, with embodied interactions being a critical feature (asking, listening, seeing, deictic practices (pointing "first click here, then here..."). Online interaction was more difficult. For some, immediate problems of technology use were the relevant matter, and largely dyadic interactions between researchers and older adults were the resource for resolution attempts. For others, the group existed to discuss general issues relating to the digital practices of older adults with a design agenda in mind. Hence it was challenging to keep on holding the online workshops while developing sufficient instructional support - as we will discuss below.

Altogether, we worked with 21 older adults who were between 65 and 80 years old. Group A included 11 participants (7 women and 4 men), group B included 10 participants (7 women and 3 men). Despite that, the number of men and women was not the same, as with increasing age also the amount of women increases [16], we did not consider this aspect of the group as something that would disturb our conclusions. The group was very heterogeneous when it came to their digital literacy (ranging from complete beginners to relative experts). They had different motivations for joining our project (staying up to date, teaching digital literacy to other older peers, enjoying collaboration with the university, and being in touch with younger people). Some had prior familiarity with university-run participatory projects (ranging from complete beginners to experience with collaboration over several years). All owned at least a smartphone and a tablet or a laptop.

The research team that organized the participatory workshops consisted of a junior and senior researcher (first and second author) and a group of four students who were employed to support the workshops. The junior researcher (first author) led the design of the different workshops (structure and content), and took part in each of them, during which she coordinated the different activities (pacing the group activity, making sure no older participant is being excluded, etc.). She also took notes during the sessions. The senior researcher (second author) has provided guidance for the workshops as well as played a key role when introducing the junior researcher into the field, as she was already familiar with some of the participants and the Atlas@space. Students had different roles during the workshops: moderator (a person who was guiding the participants through the session, explaining tasks); technical support (sometimes it was necessary to have one or two people to be able to get the older participants online by individually checking in on them, by either a Telegram message or a phone call, providing individually fitted support on how to for example join the Zoom room). Finally, one of the students often took field notes (if he or she was not supporting the older adults). The students were already familiar with some of the participants of Group B, which contributed to a relaxed and informal atmosphere (fourth author). All workshop sessions involved the above mix of people, that is older participants, local computer club instructors, and researchers.

3.2 Methodological approach

Our understanding of the problem of collaboration online with older adults builds on data collected during 20 hours of participatory observations in the local computer club, 29 workshops, and numerous Telegram conversations. Initial observations took place in the local computer club, where we were able to observe the motivations that people expressed for visiting the club and how counseling and problem solving were being provided by the instructors. During these observations, we also helped troubleshoot some of the problems the older adults had with their

devices. We subsequently organized three workshops with Group A and two workshops with Group B at the university. During these workshops onsite (in person), we collected field notes and made several video and audio recordings of the activities, which were transcribed. At this point, we had to stop due to COVID-19 and took the decision to move entirely online. Later, we merged the two groups into one.

We recorded all the online workshops and documented them by field notes. So far, five workshops on-site and 24 online with the older adults have been conducted starting March 2020. The average duration of sessions is 111 minutes, and the average number of participants was seven. The first online session was not recorded due to technical issues. We documented this session with field notes, screenshots, and a short (90 seconds) video. In addition, we also conducted seven interviews after the first session with Group B participants to better understand their experience of the online workshop. These qualitative interviews were conducted in line with interview guidelines that we have developed together with the research team. There were nine questions that centered around the first online workshop, inquiring about the participants' experience, which tools they used and preferred using, and which support they would prefer. In addition, we made 10 phone calls with the older participants in which we tried to try to understand their current COVID-19 related situation and which were also used as analytical material (documented by either recordings or field notes). Finally, we also draw on a field journal written during the activities, where the first author reflected how the workshops and the project were progressing; as well as notes from debriefing and informal interviews with the project organizers. All the older participants were informed about the goals of our project and have signed informed consent forms. All the materials were anonymized and the names used in this paper are pseudonyms.

We have analyzed our data by an approach informed by interaction analysis [25]. First, we have reviewed the video materials, looking for moments where older adults or researchers experienced challenges when using digital tools. We then transcribed these moments and re-read the transcripts multiple times. Through an iterative process of reading the transcripts, reflecting on our experience together with our team, and reading relevant literature, we have found that providing instructional support is the key aspect when going online with older adults. We have then focused on those examples which illustrated instructional support in a rich way and chose the concept of scaffolding to explain the mechanism of these interactions.

Holding the sessions and also analyzing this kind of material was extremely demanding. Video analysis has always been a demanding endeavor [18] for different reasons including the wealth of material and the difficulties of coding it. In our case, this was compounded because of its multi-modal character (combining audio and video from the workshops and text from the Telegram sessions) but also due to the complexity of the socio-technical space. For example, when people experience issues with the tool, they often stop talking, being focused on how to solve the problem - but how and why they do that was not always apparent. Furthermore, Zoom allows recording of the sessions but does not display all the information one might require for analysis. We do not, for instance, see on the video recordings if participants are muted or not and we draw our understanding from our field notes or the actual video (if we can hear them or not if participants are commenting on that). Our approach to transcription of this material heavily combined reviewing the field notes, reviewing the video materials from workshops multiple times, focusing on sections where people experienced challenges, and then trying to make sense of those moments together with the Telegram data.

The first workshops were instructionally the most intensive ones. With every session, practices were becoming easier and during the third and fourth session online (Group A and Group B respectively) the majority of participants were able to join us online. However, that did not mean that all the challenges were overcome. In the following section, we present examples that illustrate some of the most common issues which emerged and re-emerged during the course of these workshops. These challenges occurred repeatedly over the whole corpus of data. We focus below on how the challenges unfold interactionally, and how the session participants (both researchers and older participants) dealt with these challenges and tried to resolve them.

4 MUTUAL INSTRUCTIONAL SUPPORT WITH OLDER ADULTS IN ONLINE PD

In the following section, we describe the specific facets of instructional support for and with older adults in online PD. We start by demonstrating how problems become identified in the PD context; next, we show how such support is developed through participants mutually interacting with each other; and finally, we show what happens when such instructional support is taken away and how it might have to be brought back.

4.1 Identifying invisible problems

A common first phase of instructional support is traditionally called diagnosis [24], which refers to the importance of understanding the problem at hand. However, in online PD with older adults, this becomes an issue of not only understanding what the problem is but being able to identify that there is a problem in the first place. In the online environment, this is not a simple task as older participants do not always voice their problems and because of lack of shared physical space, it is not possible to simply see that they are struggling with tasks.

One of the evident facts about online group meetings is that the shared audio space is critically important. Struggles with conversations can be very consequential. For example, one of the reasons why, in our case, the first sessions were very confusing was that participants kept on talking over each other in this one-channel communication space (none of the participants were able to use the Zoom chat at that point). In addition, outside sounds, such as dog barking or clock ringing, also sometimes disrupted the session. While this may seem trivial, one should remember that older adults are more likely to suffer from hearing difficulties which, allied to poor bandwidth, makes for some interactional problems. Extraneous sounds, such as the loud clock that one older participant had, made it difficult to hear anything both for the researchers and for the older participants. Remembering the 'mute;' and 'unmute' buttons can be a little challenging even for habitual users of Zoom, and such issues are magnified given the lack of navigational competence, especially when several different devices might be in play. The following example illustrates some of the troubles arising in this situation.

Moderator Timo starts instructing older participants on how to turn off the microphone: "Move your cursor into the left corner and click on the microphone". Everyone seems to focus on the task, however, Isabella's face looks extremely confused which is something that the moderator does not seem to notice - there are seven older adults who are taking part at that time in the session - but she or anyone else does not say anything. The moderator hence goes on. After a while, we can hear barking from Isabella's place. The leader of the computer club Anabell, who is also in this workshop, starts explaining to her how she can mute herself and the following exchange takes place.

Excerpt 1. Isabella struggles with finding the right button

Anabell: Isabella, if you look down to mute. then we won't hear the dog anymore <laughs>
Isabella: I cannot find the button that is my problem
Anabell: You have to move the mouse down. And then mute is on the far left.
Isabella: I am on my cell phone.
(Group A, session 5)

This was only the second workshop to take place online, and the older participants were familiarizing themselves with the Zoom interface. In this excerpt, the moderator first explains how to do a task (muting and unmuting the microphone). Isabella is not able to perform the task but does not voice her struggles and hence her issue does not become apparent until a dog barks in her location. After a peer/instructor tries providing her with support, it only then turns out that the provided instructions were not relevant because Isabela joined from a mobile device (in contrast to instructions provided with a laptop in mind).

This example illustrates an initial move in providing adequate instructional support in the online environment to the older participants - identifying that there is a problem in the first place. That Isabella actually was not able to resolve her issue did not become obvious until her dog started barking. In a group with eight other adults, this was very "easy" to miss, as there were no other signs of her not managing. During our online sessions, it was quite common for the older adults not to voice their problems and we hence lost track of whether they might need support in the first place. Second, it illustrates the challenge of providing adequate support when older adults engage with a variety of digital ecologies, as it is not always possible to know which is being used to join the session [8]. That also makes it challenging to provide them with adequate support in relation to how to navigate in the app, for example, by providing them with instructions on which button to click. It also suggests that even peer-to-peer support which is often presented as a suitable teaching method for older adults in this environment does not always work - in this case, none of the participants (both researchers and expert older adults) understood what kind of problem Isabella was struggling with.

4.2 Building upon each other's descriptions

We now show through examples how actual instructional support is developed; more specifically, how a participant can struggle with a task they are supposed to do and how a moderator can provide them with instructions on how to overcome the task. Moreover, we show how success or failure depends very much on the choice of the strategy chosen by the moderator. Autonomy on the part of older adults in their use of digital tools was an explicit project goal, and hence a topic for one of the workshops was how to create their own Zoom room. To do that, we had to go through the process of navigating the registration processes of older adults (it is not necessary to register in Zoom in order to participate in an online session, but it is necessary for the creation of a room). In the example which follows, moderator Tim has just finished a presentation on how to proceed when registering in Zoom on a laptop. This is a necessary step - to first show the participants the whole process does, in our experience, improve understanding of the more specific steps [6].

Even though by this time we knew that older adults join with different devices, we also recognized the impossibility of providing instructions for all the different devices during one session. Hence our instructional approach was based on our assumptions about the commonly

used devices and accessibility for the moderators, and then to provide further individual support on how to deal with particular devices. Thus, we would gradually fit the instructions to individual needs. The degree to which such an approach can fail or succeed will be illustrated in the following example. After his walkthrough, Tim checked whether anyone had any questions and participant Mariane explained that none of this would work for her because she was on her iPad; she also expressed the view that she had no idea how to do any of these things. Because Tim did not have an iPad at hand and was not sure what exactly Marianne saw, he decided to ask her to share her screen which is a possible function on iPads. This is a task that was new for Marianne, and he hence needed to provide her with suitable support in doing so. The following interaction then took place. Tim and Filip are the moderators, Marianne is an older participant.

Excerpt 2. Mariane tries sharing her screen

Tim: Can you share your screen with us?
Mariane: No, I don't know how to do that.
Tim: Look, on the bottom, I don't know now if that's exactly the same view on the tablet. But at the bottom there are these symbols again, if you swipe your finger over them like this, they should come up.
Mariane: There are no icons at the bottom, there are only icons at the top.
Filip: They should be at the top of the bar, there should be a green box with an arrow pointing up.
Mariane: Yes, share content *(moves her finger across the display of the Ipad)*
Tim: Right.
Mariane: Yeah, now I have, now, what do you want me to share? Screen?
Tim: When you go to share screen, what options are there for you to choose from?
Mariane: I just have a simple screen and then screen capture, photos, zoom, messenger, start recording. That's when I open up the screen, nothing else.
Tim: Hmm then it says up there. Basic and expand.
Mariane: No under screen, then it says photos, icloud, web pages, bookmarks whiteboard. It says...
Tim: Then just go to share screen.
Mariane: Screen (*taps on display*)... Wait, it said share earlier, I didn't do that now either.... It says share content now. Then I go to the screen and then nothing comes up with share....
Tim: hmm, okay

In this example, for Tim to be able to provide Mariane with suitable instructions, he needs to first direct Mariane's field of vision to a particular spot on the device; even though he does not provide her with correct instructions (he points to the bottom, but the buttons are at the top), with the support of another moderator Philip, Marianne manages to find her way to the right place. The conversation further develops through Marianne eliciting further feedback from Tim and Tim trying to navigate her accordingly by instructing her to read out loud what she sees. However, as this effort does not seem to be successful, Mariane starts giving up, stating that "Doesn't matter, I just... then it doesn't work, I wouldn't create a zoom account anyway." And "I listened now and wrote down a little bit. If that then really comes into question, then I would then do that again with my son". However, Tim is not ready to give up yet and thinks of another solution - involving another device that Marianne owns - her smartphone. We know from our observations that older adults

usually have multiple devices which they use in different combinations, using different individual strategies to join our online sessions. Mariane's approach always involves both her smartphone with which she starts and her iPad as well (meaning she always joins with two devices). At this point, Tim realizes he can actually use this situation for the purpose of the session:

Excerpt 3. Tim uses Mariane's digital ecology to support her

Tim: You were still in there with the cell phone just now, right.
Mariane: Yeah, I turned it off because it always makes these weird noises about.....
Tim: Then turn that back on.
Mariane: Yeah. And then on zoom, or on what.
Tim: Well, open up the zoom app.
Mariane: Yeah, start a meeting?
Tim: Can you show me the screen so we can see that?
Mariane: Like this? Can you see that? *[she points her screen to her camera]*
Tim: No, a little further to the left... higher [Marianne doesn't know where the camera is on the Ipad.] . A little closer.... *(You can see the phone now)* So that's with you when you click on the zoom app, right? Then this view comes up?
Mariane: Yes
Tim: Okay. Then click on a meeting.... Wait, what does it say... Log in
Mariane: I don't know, I can't see that.
Tim: Can you hold it a little higher?
Mariane: I'll hold this to you.
Tim: A little higher, please. Log in and register it says. Okay, then click on register.
Mariane: *[clicks on register]* Then October ninth comes to confirm.
Tim: Yes, then confirm.

To summarize, Tim first instructs Mariane to turn her attention to her second device that she also joined with, her smartphone. She opens the Zoom application, and then instead of eliciting a verbal description as before, Tim asks Mariane to actually show her smartphone screen on the tablet. After some smaller adjustments she manages and he can instruct her further. As she cannot read what it says on the screen (the letters seem to be too small), Tim can read out loud what the screen says and asks Mariane to click on the particular button (Register). She does so and they return to the previous approach, talking out loud about what she sees on the screen. She starts filling in the necessary categories for her Zoom account and proceeds to successfully login into her Zoom.

These examples illustrate how verbal instructional support is used to help the older participants when trying to complete tasks (here: sharing a screen from an iPad; Registering for a Zoom account). Because of the lack of the shared space, the moderator cannot simply start providing Mariane with the fitting instructions based on what he sees on her screen. He first has to figure out how to understand what Mariane actually sees on her screen. The first strategy involves prompting the older adult to read out loud, or walkthrough, what they see on the screen. The way the moderator provides instructions to the older participant has a double function. On one hand, they help her to accomplish her task but in addition, they also show her an approach,

how to deal with Zoom (and possibly other digital tools), when not sure what to do: explore first what all the options are and then choose which one seems to be the most fitting one.

However, in this case, this strategy is not enough - even though Mariane has the support of Tim, she cannot proceed further, because the application does not seem to react. This is a situation we have also commonly experienced in our workshops - even though the older participants are perfectly capable of describing the textual information they see on their screens (such as the various options, as Mariane does); they sometimes find it more difficult to place it in the right context (for example based on the information available, it is still impossible to determine whether they are in the same application as we think they are) or choosing the right activity (for example, because they have limited shared vocabulary, they might say "I am clicking on the link", even though they might be clicking on some other element). Or as it seems to be the case in the case of Mariane, because, for some reason unclear to us, the button does not function (and does not actually start the sharing of her screen).

As a consequence - it is possible to have the older adults read out what they see; but to actually understand how to help them to do the task is not always possible based on their description - the sentence "`I press the button but nothing happens`" represents a problem we have seen quite often in our data/we have experienced quite often. For that reason, Tim decides to change his instructional approach and draws on Mariane's diverse digital ecology to help her solve the task. Instead of instructing her how to use Zoom, he first needs to instruct her how to use another tool to fix her first problem (in this case, her smartphone).

4.3 When collaborative socio-material resources are not enough

Traditionally, with scaffolding or instructional support, it is usually expected that it will be gradually taken away, often also called fading so as to facilitate a progressive move towards self-learning [46,51]. However, the following examples from our work illustrate how fading in the case of older adults in online PD is not a straightforward process. Right from the beginning of our workshops, the researcher team has developed a range of different instructional resources, both during the workshop and outside it. To begin with, we provided our older adults with a range of different materials: an instructional video on how to use Zoom, a PDF with instructions on how to use Zoom, and a Telegram message including coordinating information about the meeting, such as time and the link to the online meeting. As our older participants started to become more skilled in joining the online sessions and their joining started to take less and less time, we gradually took away the detailed written instructions, and only shared the video and the message. Finally, once joining the session became smoother (and took around 5 minutes with no major issues manifested), we stopped sharing the video completely and only shared the message with coordinating information. However, during a workshop in May 2020 our older participants asked that we include more instructions concerning how they should, for example, click on the link provided in the Telegram message; or highlight that we are still meeting online (one of the participants interpreted the fact that we had not explicitly stated that the meeting would be online to mean it would be face-to-face and came to the university in person).

The biggest challenge however came in the relation to the verbal instructional support and the characteristics of online PD with older adults. Some of the participants take part less often than others; which makes it demanding to hold the sessions, as their competence regarding our Zoom workshop varies. This is a situation that has to be tackled during every specific workshop and cannot be planned for. As a consequence, we have to balance the need for enabling the

participation of every participant but at the same time continuing to progress the workshops with regard to our primary goals, and to avoid boring the more advanced participants. The following situation took place during a workshop in May 2020. Every older participant except Rebecca has joined us on a regular basis for the majority of our workshops. Rebecca did join us during all the physical workshops (two) and was also a regular visitor of the local senior computer club. She also sometimes joined other online activities through Atlas@space, as we will see below. As mentioned above, sometimes it takes a while to identify that there is a problem in the first place: here, we did not know that Rebecca was trying to join our online session, as we did not get any messages or phone calls from her. As moderator Marvin has been doing a welcoming round to the last workshop of that phase, the following interaction took place. (Marvin: moderator; Pietro: participant online; Annabell and Wolfgang: instructors participating online).

Excerpt 4. Rebeca unsuccessfully trying to join the group online

Marvin: ... or you don't want to do one, that's up to you. Is there anything else you want to know?
Pietro: Not at the moment.
Marvin: Okay, but otherwise
Pietro: I see that at the moment Rebecca is here on her smartphone but gets no connection to the workshop.
Marvin: Have you tried to connect her or what do you mean?
Pietro: Yes, I also wrote her that... She only has to click on the link, but apparently it doesn't work for her.
Annabell: She probably has the Telegram only on her cell phone and not on her computer.
Pietro: I can't find a link here, she just wrote it *laughs*.
Annabell: She didn't read the Name_group[*name of the Telegram group*] at all, she's always rummaging around in her own stuff.
Marvin: Mhm
Annabell: I tried to help her, but she didn't answer her cell phone. You can do nothing with that
Wolfgang: Yesterday she was there, yesterday she was in our meeting.
Annabell: Yes, but she dialed in directly via Zoom.
Wolfgang: Yes, she can do that
Annabell: And now via the link, she can't manage that.
Marvin: But she is already trying to join via her smartphone.
Pietro: I will write her here again.
Annabell: I, I don't think that she has Zoom on her smartphone.
Marvin: Mhm, exactly, that can be the problem, that the link, when she clicks on the link, she is asked how she wants to open it and if she doesn't have the Zoom App, then she can't open it.
Annabell: No no
Marvin: That's why
Annabell: But even if you open the link it looks completely different than if you dial into Zoom directly.
Marvin: Yes that's right

In this example, the research team learned from Pietro that Rebecca, another older participant, is trying to join the session however is not able to do so. Providing instructions in this situation builds on a wide range of activities: Pietro is trying to instruct Rebecca through texting; Annabell tries calling her on the phone (unsuccessfully), and the whole group is trying to make sense of

how to support Rebecca so that she can join us. Wolfgang even mentions that she took part in another meeting hosted by the club, to which Annabell reacts that she must have "[dialed in] directly via Zoom". This statement points to the need for a Zoom ID. Interestingly, this is a common method for several of our participants; but to be able to provide them with a Zoom ID through email, we need to know that this is what the participant needs in the first place. Later during the session, Rebecca suddenly arrived at Pietro's home, as they are neighbors and friends and he helped her in-person to join. During the next online meeting she joined, but during the one after she again experienced troubles and did not make it.

This example points to two issues. First, following instructions is not a simple task. In the situation described above, Rebecca received three types of instructional support: a message in Telegram from the researchers, a message from her peer as well as in-person explanation from her peer. The first two textual supports include the instruction "click on the link". That we can also hear the participant say is not strange, as this is a phrase that, especially at the beginning, we used very often when prompting the older adults to join our online workshops, instructing them to "only click on the link". However, the problem of rules is that the rule (or instruction) does not tell you how to follow the rule (or the instruction) (Wittgenstein). So to be able to follow the instruction "click on the link", you need to know what a link is, where to find it and what "clicking" on it means. This might become confusing as many of the older participants joined with their tablets and phones, and technically it is not possible to "click" but only to tap/touch the link. In other words, only because you receive instructions it does not mean it will be automatically possible to also follow them.

The second problem this example illustrates is the need to embed instructional support in a manner that builds on the different constellations of social and material resources. As the example shows, the leader of the club knows Rebecca and tries calling her, because she knows she might have trouble joining the workshop because of the way we have built the instructions (clicking on the link vs sharing an ID). Further, Pietro and Rebecca are friends, and hence even during the times of COVID-19, it is not an issue for her to come to this house and elicit help, due to close physical (and emotional) proximity. Despite that, the participants in the call (except Pietro) cannot provide her with support, because she is not accessible (does not answer her phone, which makes her "unreachable" in the digital space); and even though he can provide her support at that moment, he cannot explain to her in a way that would allow her to join us on a regular basis. Social networks are sometimes not enough or can be even "harmful" (as it was in the case of a participant whose husband kept on "overriding" researchers' instructions, making it difficult for the participant to know what to do).

5 DISCUSSION

To our knowledge, no existing work has looked at the specific problems associated with instruction in an online group of older adults nor, more specifically with the kind of problems encountered and how one might begin to resolve them within the context of participatory design. Thus, we provide empirical material that illustrates what instructional support is necessary for older adults to be able to engage in PD online. First, older adults' problems can be easily overlooked by those supporting them in online environments, and a shared understanding of the existence of the problem has to be developed before its solution can be identified (Excerpt 1).

Table 1. Comparison of scaffolding definition and our empirical material

Aspect from definition by [24]	Why does it not fit the empirical material?
(1) ***Intersubjectivity or creation of a shared understanding*** of the activity is achieved when the expert and the learners are able to collaboratively redefine the problem or task so that there is combined ownership of the task and the learner understands the goal that she needs to accomplish. The expert's role is to ascertain that the learner is invested in the task as well as to help sustain this motivation.	Because of the distributed space, the understanding of the participants' problem depends on the way the instructions are delivered, it is hard to create a shared understanding, like it was in Excerpts 2 and 3. Further, in the classic understanding, shared goals are a prerequisite. In our situation, developing a shared understanding of shared goals is part of the overall situation. The participants' learning intentions or motivations are not clear from the beginning, as they might not be aware of the possible options; and we have to work on them together with the older participant. As such, it is our task as PD researchers to set the ground, to interest them in learning certain issues, to motivate them. A lot of collaboration had to take place before we could actually start learning from each other.
(2) ***Ongoing diagnosis*** is achieved through the dialogic and interactive nature of scaffolded instruction, which requires careful calibration of support provided to learners by experts using a repertoire of methods and strategies. The amount and types of strategies are different not only for different learners who are at different levels in their learning, but also for the same learner over a period of time;	This point is in line with our finding, as an ongoing diagnosis through conversations is taking place throughout the whole PD process. However, because of the group character in combination with the way the online tool is designed, it becomes problematic as it was difficult to not notice when someone is failing with the task (Excerpt 1). Even when people voiced having problems, it was not always possible to immediately address it (as it would be on-site), but we had to "re-organize" the communication around it, either make a phone call or let them wait (Excerpt 2).
(3) ***Fading of support*** after internalization has been achieved so that the learner is in control and takes responsibility for learning.	That fading of instructional support might never be taken away has already been reported [37]. Fading of support does not work for digital learners, because they will always be in need of support, as the digital tools develop at a speed not in line with the way they can learn. Excerpt 4 illustrates this when the community is heterogeneous and even though we have all been working on helping older adults joining zoom, it still did not become possible for all of us to provide proper support so that the older participant can join us.
(4) ***Distributed scaffolding*** refers to instructional designs that integrate a variety of social and material supports for scaffolding, essentially supporting learning by "doing". For instance, in science education, engaging in scientific conversation and dialogue is encouraged rather than solely using a textbook or encyclopedia.	This point is in line with our findings, however, the question is, where are such spaces for older adults? There are some such as the local computer clubs, but they have limited capacity and resources. For older adults to learn through just testing, they need to get comfortable and safe in the environment first. In Excerpt 4, we could see that only "access" to socio-material resources is not enough. The resources need to be contextualized by suitable meta-instructions and digital and physical spaces which could provide this are still missing.
(5) ***Adaptive scaffolding*** provides calibrated support to learners through multiple resources including static questions and dynamic support that guide students in their thinking	Older adults need more advanced support than "questions"; the adaptiveness has to come not from a range of resources but also how these are presented and made sense of together, pointing to the need for meta-instruction and meta-communication, the instructions need to be contextualized (Excerpt 1 and 4).

Next, instructions cannot be simply "provided", they have to be carefully crafted together in a mutual and collaborative manner (Excerpt 2). And finally, having access to both social and digital resources might still not be enough, and instructional support will have to be carefully managed when it comes to learning how to use digital tools by older adults in such collaborative environments (Excerpt 3).

Hence, our findings point to the need to change our understanding of scaffolding in the context of online PD with older adults, as we will show in the table below (Table 1). Current definitions of scaffolding do not fit the aging society and as such are unsuitable to draw on when organizing PD with older adults. To illustrate this we have chosen a cumulative definition of scaffolding [24] that involves the following features (see Table 1). We then align them with our empirical material and show how the current definition is not fitting. By doing so, we want to highlight the need for redefining our current understanding of instructional support for the purpose of participatory design and propose *situated scaffolding* with its elements.

To sum up, our critique is based on the idea that we need a more situated understanding of instructional support for the purpose of participatory design, one that is more sensitive to the current situation of being an older adult in the aging society. More specifically, first, instructions and learners' understanding are mutually constituted as a relationship between instruction and action as Garfinkel and others [14] have pointed out, but the difficulties encountered and their resolution here are outcomes of the interwoven nature of the tools used, the goals that are trying to be achieved and the group dynamic. Second, the notion of fading as a pedagogic pursuit might not work for older learners, and it is possible that for some older adults fading of instructional support will never be possible. And finally, there is a need for involving meta-instructions, as only the access to instructions might not be enough. In the following section, we elaborate more on these particular elements of the situated scaffolding and show how we contribute to the current literature.

5.1 Mutually built understanding and instructions

Building mutual understanding among the participants plays a key role in participatory design with older adults when digital tools are in play. However, that is a challenging task within PD with older adults online, and developing adequate ways of supporting the participants' understanding is key. For example, [50] explored the evaluation of tablets with older adults. Sometimes, interactional difficulties were encountered because the device was too heavy, leading to misclicking on different parts of the screen. Instructional support in the form of hands-on advice when sitting next to the older user largely resolved the problem. Further, [1] focused on co-development and evaluation of a multimedia computer system to support communication between people with dementia and their caregivers. While working with people who often struggle with memory and have other social and cognitive impairments they recognized the importance of non-verbal instructions through the relationship between the "higher status partner" and learner. In a traditional learning context, it is usually the teacher or the peer who recognizes that the learner experiences issues in the online environment [29].

However, in online PD with older adults, our findings point to the need to carefully build instructions and mutual understanding through verbal descriptions instead of or as well as traditional non-verbal cues such as pointing. We contribute to this area by highlighting that as a consequence of the dynamics of online PD who provides scaffolding to whom becomes more

blurred: On one hand, the moderator/researcher needs to support the learner in eliciting descriptions of their interface. On the other hand, the way the learner will be able to (or willing to) describe their interface, will impact the instructions the moderator will be able to provide. Hence, a different responsibility landscape emerges.

5.2 Different fading of instructional resources

The scaffolding literature suggests that one of the key aspects of traditional scaffolding is the final stage, so-called fading - that is, gradual taking away of the instructional support as learners become more independent. The timing of when to take away scaffolding is crucial. Various studies point to the removal of scaffolding when learners have internalized what is to be learned [24]. This temporal approach to scaffolding hence builds on the idea that it is possible to establish (and reach) learning goals in the traditional sense [26]. In complex projects like real PD with older adults, especially online, whatever learning goals might be formulated in advance, we see that unexpected problems continually arise. The goals of individual participants at particular moments are not always in line with goals envisaged by organizers. This might be actually more useful, as it promotes learning opportunities such that older adults with their different motivations can take what they want from those sessions. This is further enhanced by the benefit of doing these activities online, as the place where older adults join our online workshop can also be chosen. In the context of older adults as learners of digital tools in PD hence it is not always possible to take instructional support away, and it has to be sometimes brought in again, simply because unanticipated problems constantly arise. Our findings are hence in line with [38], who argue that, when it comes to older adults, it is not always possible to remove the scaffolding. We contribute to this literature, by further extending this argument and showing how socio-material resources play out in an online PD context. In other words, providing resources online is not a problem; the issue rather is how to support older adults in how to make sense of them in a sustainable manner.

5.3 Need for meta-instructions

When new tools become part of a new practice, to support learning of the members how to use them, a certain meta-approach to communication is necessary. Garfinkel [14] pointed out that rules always under-specify outcomes but what became clear to us was that the less specification, the more varied the outcomes were. There was a vast range of didactic resources directed at older adults which could provide them with instructions on how to reach and navigate the online space. The local computer club, for example, has developed a range of online resources for older adults. The German older adults association has developed extensive step-by-step manuals on how to work with online tools, such as Telegram or Zoom. However, as we have learned from our observations in the local computer club, not many older adults coming to the club use them. Moreover, in many instances, instructions only made sense to our participants in the context of their use. Contextualization often required human intervention. This type of contextualization hence might require an additional type of instructions for the older users. For example, during an appropriation phase of participatory design in chronic care with older users, the nurses developed a new way how to talk about the newly developed app. In their caring conversations, the nurses did not instruct the older users how to use the app alone but also how to communicate about their own use with the nurses [8]. Further, [48] explored digital cheques with older adults. Through a testing phase of physical checkups, the older adults got to experience what using such tools might be like. The researchers then continued to introduce a digital pen that in combination with a prototype could be used by the participants. When the older participants did not understand the

provided instructions on how to use the new digital artifact, the researchers instructed them to use it in a way that is similar to their previously built experience with physical cheques.

The additional complexities entailed in understanding instructed action and problems encountered when working in an online group context have not, as yet, been thoroughly explored. The moment that contextual use is mediated by any digital tool, the situation becomes additionally complex. We contribute to this body of work and through our findings point to the need to accompany available resources with meta-instructions: instructions on how to follow the instructions.

5.4 Specificity of older adults as a target group

The study results indicate that measures need to be considered particularly carefully for the target group of older adults as partners in online participatory design workshops.

Related to learning and appropriation settings of IT products, geragogical expertises point out particular characteristics in technology learning of older people, especially in terms of their motivation to engage with digital tools [44] and specific learning preferences (more informal learning, peer-learning [43]). Another important aspect that plays a role in the technology adoption of older people is self-efficacy and self-images. In the worst case, digital media can be perceived as threatening. [7] show in their study "Technology makes older adults feel older" how age stereotypes are self-reinforced by people when they feel they lack opportunities to master digital tools. Specific socio-demographic factors reinforce this image (low education, low income, gender) and are important determinants of a digital divide that needs special attention for older citizens. Transferring these geragogical findings to online learning settings shows that these factors become even more powerful when face-to-face interaction is missing. Here, it is necessary to think about special substitution measures; we contribute to this in this paper.

5.5 Design recommendations for situated scaffolding

In this section, we introduce design recommendations based on the different aspects of situated scaffolding. One of the main issues we and our older participants experienced was the problem of navigation in the tools when collaborating online. We would propose that to enable older adults to take part in online participatory design, the future designed systems should involve features that support building mutual understanding and instructions. More specifically, system features are necessary which enable not only the older users' navigation in the tool but mainly support the moderator in guiding the user through the tool, by for example enabling highlighting a specific section of a shared screen. In addition, to enhance managing the navigational issue as well as tackle the issue of invisible problems, the moderators could benefit from having access to meta-information about which tools participants join with as well as additional relevant information such as the quality of their internet connection (to get a better idea of the reasons for the difficulties participants have).

Further, in our work, we have seen a great need to not only provide the older adults with instructions but also how to follow these instructions. The combination of a chat in Telegram, video-conferencing through Zoom, and the different devices the older participants used allowed for a good environment where such meta-instructions could be provided. Further designed systems should include for example a chatbot supporting making sense of the provided instructions. Many of the problems we encountered would have arguably been a great deal worse were it not for the fact that many of our participants were already members of a Telegram group and were familiar with its functionality. That was a default channel for raising questions or

seeking help made our life somewhat easier. The lesson for us was to ensure that all participants are made familiar with such channels during an enabling phase.

Finally, effective supports are necessary not only for building systems supporting group work but also when organizing PD work to make it more sustainable. In this context, the issue of the fading of instructional support becomes especially important. For the purpose of designing PD workshops online, our experiences are illustrative of the need for keeping the support for a longer period of time, possibly also after the end of the project. This support can take various forms. Rather than developing generic "how-to" material, question and answer prompting sources or "how-to" material connected to a particular experience from the project might be the most effective method of resolving difficulties. Another option is to take into account the social environment participants can find themselves in and consider if others in participants' homes could support or benefit from participation in PD online. 'Others' in conversational exchanges of this kind can be a problem if one has little or no knowledge of who they are and what they are seeking to do. Finally, an effort to embed the findings and activities from the PD project into the local context, for example by involving the local actors in the process.

With hindsight, there are several things we might have prepared better, given the opportunity, such as the use of video conferencing tools, screen sharing, using screenshots, and so on. The fact that such preparatory work could not be done face-to-face was the source of much of our trouble. Practically, as participants often logged in at the different points of the session, or lost connection; when they came back to the call or logged in for the very first time, it was useful to go with them through the following checklist:

- Can you hear us?
- Can you see us?
- Give feedback on if we do or do not hear or see them
- If problems:
- Which device are you using? (Phone/iPhone/Laptop)

Our findings suggest that it was crucial to keep this checklist relatively brief because the struggles older participants experience emerge quite quickly and it is often necessary to address them in a rapid way. There are many things taking place at the same time during the online workshops (monitoring own screen, following tasks, listening to what other participants are saying), and losing contact with the Zoom room can cause quite intense distress to the older adults as well as to the organizers. Hence, it was useful to use this quick check-in when onboarding them back to the session or when the older adults started experiencing for example troubles with connection. It was hence necessary that these questions are brief so that they are also easy to understand for the older participants. In relation to the last point, since it was not possible to be familiar with all the different devices, it was useful to have print screens of how interfaces from the different combinations of devices and systems look like (android/Apple, tablet/phone/laptop).

6 CONCLUSION

In this section, we first address the limits of our work, the issue of trustworthiness, and then conclude the paper. Despite our best efforts, our work reported in this paper has its limits. The key limitation is the issue of the specificity of COVID-19 related context. Once the restrictions as a consequence of COVID-19 will be taken away, it remains to be seen if a preference for online PD with older adults will vanish. Despite that we believe that the situated scaffolding can be also found in contexts beyond online PD, it was here where the issues were the most prevalent and in

some cases became the least possible to solve. Future research should hence focus on instructional support and more specifically situated scaffolding and explore if and how it is meaningful to make use of it outside of the primarily online context.

Regarding the validity of our results, in contrast to quantitative studies, some authors have suggested discussing the trustworthiness of qualitative studies to evaluate the quality of their work [10]. Hence, we have included the following to increase the trustworthiness of our work. First, we made sure to include in-person contact when recruiting the participants (see section 3.1 focused on recruitment of participants through dinner and a previously established Telegram chat). Our point here is that the relationships we have been developing with our participants have been a continuation of our effort to develop aging research in the local area. Second, we have used different modes of communication to keep our online workshops inclusive (emails, messengers, phones, and video-conferencing tools). Third, during our workshops, we made sure to behave in an empathetic way and to stay patient with the older adults which was highly appreciated from their side. Thanks to this we were able to develop mutual trust with our participants, which is key in ethnographic research. Finally, as a form of triangulation we have included using a range of data collection methods: workshops video recording; taking field notes as a form of observations during the workshops; conducting interviews; continuous analysis of the Telegram chat; monitoring and analyzing individual supportive talks that took place.

To conclude, in this paper, we aimed to understand how to organize participatory design workshops with older adults online. More specifically, we explored the instructional support for older adults in participatory workshops online. By drawing on ethnographic informed methods with action-research orientation, we explored the case of collaborating and learning with older adults online. Our results provide a more nuanced understanding of scaffolding that we label situated scaffolding. We provide recommendations for system design and organization of participatory design online to achieve a more sustainable participatory design with older adults.

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