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Making online participatory design work: Understanding the digital ecologies of older adults

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Abstract. Participatory design (PD) is a meaningful approach to involve older adults into design; however, currently we lack understanding how to do such work online. In our paper, we report from a study where we organized 19 PD workshops online with older adults. We argue that to do so in a meaningful way, a mutually shaped understanding of older adults' digital ecologies is at the core of organizing such PD processes. We present an empirical account of how digital ecologies of our older participants have become an issue to tackle in the online PD workshops. Further, we provide a solution, a mapping technique, and report from our efforts to evaluate it, that should help to overcome the situation when digital ecologies become a problem in PD online.

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Introduction

To make participatory design (PD) work, a certain type of work is necessary - as researchers we need to make the participation of everyone involved *work*. This is especially true when designing with and for communities that are not digitally well attuned and who need support in becoming able to participate in the PD process, such as for example older adults. Currently, PD is viewed as a meaningful way to involve older adults' into ideation and development of design concepts and digital technology. Traditionally, participatory design builds on the ideals of participation for everyone, involvement of heterogeneous stakeholders and the need for mutual learning (Kensing & Blomberg, 1998). In case of PD for and with older adults, mutual learning involves not only learning by the researchers about the stakeholders' situation to produce suitable technological solutions, but also about building the digital mastery of the older participants (Joshi & Bratteteig, 2016). CSCW and HCI literature provides a vast discussion on methods for including older adults in such processes, e.g interview methods, the usage of tool kits (Rogers et al., 2014), PD as a space for dialogue (Vines et al., 2012), cultural probes (Hensely-Schinkinger et al., 2018), and workshops (Pradhan et al., 2020). Locally employed measures for building empathy and mutual trust have been described as pivotal elements of PD workshops to make older adults feel comfortable in the overall situation, but especially also in their digital learning practices (Lindsay et al. 2012).

All these approaches build on the possibility to actually meet *on a physical site* and *in person*. However, meeting constantly in person might not be always possible. For example, Joshi and Bratteteig (Joshi & Bratteteig, 2016) show how participation was fluctuating due to the participants changing needs and capabilities. Also Vines et al.(2012) report that their older participants took part in only two to four particular workshops. It can be a matter of mobility, being sick or as we have seen recently due to COVID-19, but as a consequence it might not be possible to meet in person at all. But to build up the necessary digital skills for meaningful participation a regular attendance is necessary. Meeting online instead of on site provides a possible opportunity to tackle this problem. But to meet online, certain socio-material resources are necessary, such as personal devices (smartphones, laptops, stationary computers) with various applications or programmes. We understand this personal network as digital ecologies.

To our best knowledge, there is no PD involving older adults taking place online through video-conferencing only. This is not a surprise given that to meet in person to contribute to a design project is preferable for the participants as their main motivation is often social contact and learning in a group. Currently, we are hence lacking research on how to enable the older participants to participate in

online PD in a meaningful way. This study therefore focuses on the challenge of how to deploy a participatory design project aiming at co-creating didactic prototypes online with and for older adults. More specifically, we are interested in how older adults may be best supported in understanding their digital tools at home so that they have meaningful experiences from their participation in a series of 19 online workshops.

Through our collaboration with 20 participants we have learned that to organize online PD with older adults, a mutually shaped understanding of the respective digital ecologies is at the core of organizing such PD process. With our paper, we aim to contribute in the following ways. First, we would like to contribute with more facets from practice, how older people organize their personal digital ecologies and on sense-making processes in becoming participants in a collaborative and fully online-based project. With fleshing out particular instances from practice we would like to contribute to sharpening of the concept. Second, we propose a strategy how to map the digital ecologies of older adults for the purpose of online PD.

Related work

The ecological perspective on digital environments has been established in HCI for a long time (Blevis et al., 2015; Forlizzi, 2008). Using Gibson's ecological approach, Jung et al. (2008), for example, studied young students and how they manage personal digital artifacts interconnected to and woven into their lives. Ecologies of digital tools hold a potential to support collaboration and coordination of the users (Vasiliou et al., 2015). However, various studies also point out that engaging with ecologies of digital tools might be problematic as they are not static but dynamically evolve over time (Bødker & Klokmoose, 2012). Another study emphasizes that in daily life communities where the ecologies tend to be more "messy" reflect the different preferences and competences of the communities (Bødker et al., 2017). The metaphor of an ecology of tools is useful in a number of respects. It draws attention to the way in which different devices are used for different purposes, to the fact that such an ecology implies a certain elegance and artfulness in use, and to the fact that too rapid changes in such ecologies create serious difficulties for certain populations.

To sum up, where the majority of studies of this kind have focused on the work context or on the so-called 'digital native' (Prensky, 2001), we, in contrast,

focus on older adults and how they deal with using their own digital devices, and specifically online collaboration tools when going online in situ. To our best knowledge, digital ecologies of older adults have not yet been explored, especially in the context of online PD.

Empirical setting and methods

In this section, we will first describe the method, followed by the empirical setting. This study reports from an ongoing participatory design project, whose goal is to enable older adults to become more autonomous in regards to digital tools. Methodologically, we want to reach this by co-creating a set of didactic digital prototypes together with the older adults which will promote and support learning of older adults and other relevant stakeholders. This project is part of a broader interdisciplinary effort called [ACCESS](#) focusing on fostering digital literacy of older adults.

Originally, the project was supposed to be taking place on-site, at the University and in local community facilities in a small German city. We recruited older participants from our existing research networks and through the local senior computer club: we started with 20 participants (11 women and 9 men). We invited the participants through our already existing social networks. Namely, we drew on our previously established collaborations with the local senior computer club. In addition, we also invited a group of older adults that was created for a previous research project. By drawing on already established connections, it was possible to continue developing our research work in a closer relation with the local communities. The participants were quite a heterogenous group, having various digital experiences and competences. In addition, three of the older participants who volunteer as instructors in the local senior computer club also took part in our PD project. The participants (including the instructors) were motivated in a different way to keep on engaging with our project: they wanted to keep on learning about new digital technologies, keep on collaborating with the university and engage with young people on a regular basis.

During the first on-site meetings, we installed a messenger application (Telegram) on their smartphones, which we used as the main coordination tool with the participants. Every participant joining our workshops already had at least one smartphone, although this was not a requirement. We were open and had some

smartphones to distribute to interested people as well as helping them to do the first steps with a digital device (Müller et al., 2015). Only one participant received a smartphone from us, however, she never took part in the online workshops.

As the global pandemic started to unravel during early 2020, we had to adjust and move with our workshops online. Even though it was not the original plan to conduct our empirical work online, it allowed us to explore how our participants made use of their digital devices and how they engaged online in making sense of their own practices in our joint collaboration sessions with tools which were familiar to them (smartphone or tablet) but also with new tools (such as Zoom or Miro) which we introduced.

Methodologically, we draw on an ethnographic-informed approach and on participatory design. We were interested in developing a rich understanding of the older adults' every-day practices so that we can build on them in our PD process (Randall et al., 2007). The work in the project is ongoing, but so far, we have conducted 24 workshops (5 onsite, 19 online). In addition, we have also conducted additional interviews as well as observations on-site when it was still possible (8 hours of observations in a local senior computer club). All online workshops were recorded, producing 50 hours of video materials. During the workshops, usually ten participants took part; accompanied by three moderators (German speaking) and one coordinator (not fully German speaking, first author).

We analyzed our data through an approach informed by Suchman and Trigg (1995). We rewatched the videos multiple times, searching first for problems the older adults experienced when participating in the online workshops; and we used our ethnographically-informed knowledge of the field during the analysis. One of the most visible problems was the issue of dealing with various devices to join the online session. We then searched for the particular instances of this problem in the whole corpus, which we then analyzed more in depth by drawing on elements of interaction analysis (Jordan & Henderson, 1995). By searching for themes in this chosen data, we then categorized these issues into themes: vocabulary, connection and possible activity. Even though we illustrate these issues by only one example, we could see a strong pattern of these issues in the data. All the transcripts were anonymized and all the names used in this text are pseudonyms.

Even though our research originally was not motivated by the global pandemic, it has had a big impact on our research activities. Majority of our participants were not familiar with video-conferencing tools, so we had to go through a learning phase for both us researchers (how to best support our participants?) and for our participants (how to use the video-conferencing tools?). Together, we tested out different tools (Jitsi, Skype and Zoom), and at the end

decided to use Zoom, because it provided us with the highest quality of video call in combination with necessary features, such as breakout rooms.

One of the key problems turned out to be not so much holding the sessions, but enabling older participants to reach the Zoom environment in the first place, as we had to instruct them how to use the technology *through* the particular technology. We have created and shared through Telegram manual-like resources with our participants (involving screenshots and written instructions). Despite that, this task turned out to be highly complex in some cases and we had to augment the initiation of the joint video calls with different tools of lower complexity, either texting through the common Telegram group or making individual phone calls.

Two key aspects of video-conferencing environments were heavily determining our online activities: Zoom is a *one-to-many communication channel*. Even though the whole group is present, it is only one person that can talk at once; often resulting into a pair of people having a conversation (instead of the whole group engaging), for example, to try solving a problem, and the rest of the group listening). Further, the *lack of access to the same physical space* was key (hence, for example, participants do not see what is happening on each others' screens). Both of these aspects change dramatically the way the researchers, instructors and peers can support each other (or not) in dealing with the digital tools and the online environment. These elements became more obvious, as we had the 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 to address the highly individualized approaches of older participants. Sitting besides each other and pointing (with a finger) to specific parts of the phone or of the app were regular practices. The on-site workshops mostly had two parts: giving individual advice and help and talking about the workshop topic as the second part. Thus, the joint engagement between a person and a researcher on a device and about individual practices always was an important part of the on-site workshop with physical interaction and all senses involved (asking, listening, seeing, deictic practices (pointing “first click here, then here...”). This was in stark contrast to our online interaction. Especially one issue made the situations very complicated - which was that the researchers could not see with which devices and in which way the participants were trying to connect to the online sessions. Hence it was challenging to set up the online workshops on the basis of rather underexplored digital ecologies the older participants were acting in - as we will elaborate more below.

Understanding digital ecologies of older adults

In the following section, we will first describe the observed practices connected to digital ecologies of older adults, and illustrate the connected challenges in an engagement with a video tool of one of our participants displayed in an online workshop session. The empirical example illustrates that learning to use new tools can be challenging, especially when there is no support possible in presence. Second, we will present our own solution to this problem, a mapping technique, and the lessons learned from its evaluation.

The problem of digital ecologies

We encountered the issue of digital ecologies already during early stages of the online workshops, when we were testing out if we can use Zoom with our older participants. We have identified the following elements as constituting the digital ecologies of our older participants.

First, the older adults own a range of devices, such as smartphones, laptops and/or a tablet, with accompanying software. Each device involves their own “inner” ecology of interfaces, which the participants have to understand to be able to use the digital tools. Findings from our long-term online workshop observations indicate that the digital interfaces are all too similar for our older participants to distinguish them, and especially when switching between different programs (such as for example Zoom and browser) this becomes an issue as they cannot identify where exactly in their inner digital ecology they are. In addition, when joining the online workshops, we never knew in advance which of their devices the older adults will use and which will work during the particular session (sometimes for example sound would not work on their laptop and hence they would switch to a smartphone instead). This was again important information for us to have, as different devices and OS have also different interfaces and hence require different types of instructions.

Second element of digital ecologies are the individual practices of the participants. Even though it is conceptually problematic to distinguish between individual and group practices, as these are mutually shaping each other (Giddens, 1986), here we are using this term as a way to help us understand that older adults engage in a range of practices that differ from each other. For example, when it came to joining the Zoom session, which became the key step to be able to participate in the online workshops at all, the older adults have developed a range of different practices to do so. These practices involved for example typing the ID into Zoom, typing the link into the browsers, clicking the link in Telegram or in email. The different practices the older adults developed sometimes as a

consequence dealing with other contexts (for example, one woman struggled with joining our Zoom workshops, because we used a link instead of Zoom ID, as she was used to from her online choir). As we will see in the empirical example below, to have a range of practices like this is problematic for online PD, as it becomes difficult to support the older adults.

Third, another important part of the digital ecologies are the joint tools that we use to organize our PD online workshops. These involved Zoom (video-conferencing tool), Telegram (messenger) and Miro (white-board-like collaborative online tool). For the majority of our older participants these tools were new and they had to learn how to use them. The main difference from the individual devices and their software is that these tools would be the ones we were using to hold and coordinate the workshops and they were often an addition to the usual apps. Hence the older adults had to learn how to use these tools and we as a research team had to learn how to support the older adults in using them. The learning to use these tools often took the form of learning-by-doing.

To sum up, all these different combinations of devices, programs and (learning) practices form the digital ecologies of older adults. To make this all work together in the context of online PD, it is necessary to provide the older adults with support. However, to be able to provide them with support, we as researchers had to understand the particular ecologies. Since the older adults are often not aware of all the aspects of their own ecologies, it then becomes a challenge, how to incorporate it in the actual PD work. The following empirical example illustrates how the issue can develop during a particular session.

For example, some participants wanted to join the online workshops through their laptop; however, we first started to share the Zoom link through Telegram as that was our main communication channel with the participants. Majority of the participants had Telegram only on their smartphones and in turn did not know how to join the workshops with their laptops. This mismatch caused multiple troubles and we had to gradually establish new practices to attend this problem, for example, sending an email with the Zoom link, which the participants were able to access from their laptops. Talking about how one can join the Zoom session hence became a frequent topic at the beginning of the majority of the workshops, as it took several weeks before the joining practices became established. During a session in April 2020, when participants were prompted to reflect over the sessions, Monika takes a word:

Monika: So here's the thing, I tried with my cell phone to get this ID and the link in the first place and then I found out that with the PC and this ID it's much easier to get into the program than if I click on the email address and then mark it and then take it and whatever. That was quite simple, I wondered.

(both of the researchers' faces get a really confused look)

Monika: That's much easier than going into the email program and transferring the link and the ID and there... the link.

Researcher: Can you explain again how you did it in the end? I didn't quite understand that.

Monika: There was a number, I typed it in and then I was in.

Marvin: Oh, you typed the link that was in Telegram into the computer.

Monika: Exactly.

Marvin: Ah okay.

Monika: Yes, much easier than going into the email program and then transferring everything.

At this point researcher Marvin points out “You have Telegram, I think, yes, I think also on the computer”, and as Monika confirms this statement, Marvin’s continues: “Theoretically you can also do that, that if you open Telegram and then you should also just click on the link.” Monika agrees with this utterance too.

We provide this example to illustrate how the mutual understanding of the digital ecologies was shaped through the moderators and older participants’ interaction. In her account, Monika describes her preferred strategy on how to join the Zoom environment. As it is not very clear to the researchers what exactly she means, she explains further: instead of transferring the Zoom link from her email, she *types* the ID in a browser. As the workshop participants are trying to figure out how Monika actually enters Zoom, researcher Marvin points out that she also has Telegram on her laptop and hence can join the Zoom session from there, trying to point to a connection she missed.

The example illustrates several issues which are key to the problem of digital ecologies. First, there is the issue of *vocabulary* - to be able to make sense of the digital devices in the context of online PD, the participants and the researchers need to establish a common vocabulary. In the example above, we can see that Monika has not mastered the shared vocabulary yet, as she calls *link* an *ID* or says she clicked on an email address. Creating a common ground is a traditional aspect of PD (Kensing & Blomberg, 1998). However, in the context of online PD with older adults, mastering vocabulary is one of the first necessary steps to be able to create the common ground. Without the shared physical space, this step is key, as it is not possible to support the older adults in use by non-verbal gestures. In addition, as the possible range of terms is quite broad, the terms themselves are quite abstract (again, without the possibility to simply show the particular digital elements) and often Englishised hence make it more difficult for the older participants to remember.

Second, there is the issue of *connection* between the different devices and applications. In this example, Monika did not yet understand that since she had Telegram on both her laptop and her smartphone, she could access the Zoom meeting through Telegram message instead of using other ways. The only reason why the moderator Marvin knew that she had Telegram on her laptop is because they had installed it together several days before the workshop. Accessing one information through multiple devices is a common solution for example for digital nomads, who need to move seamlessly through their own digital ecologies and hence need a range of devices. However, in the context of online PD with older adults, this issue gains a new type of dimension, as this connection becomes a problem rather than a solution; as the researchers are at first not aware that Monika is missing the connection, they cannot provide her with appropriate support.

Finally, there is the issue of *possible activity* of the links (she does not have to copy a link in a way she finds complicated, she can click on it, which seems to be unclear to her); this is not only a problem of her not knowing *how to interact* with parts of the digital ecology; even though Monika says “ID”, at that time, we actually did not provide our participants with the ID to enter the Zoom room. This example illustrates that the lack of Monika’s understanding makes it difficult for the researchers to understand how she actually reached the Zoom room, and hence how to support it in case she would need help.

Were we successful in supporting Monika in her understanding? If joining the session does not become a problem, we actually do not know how the participants joined the session. However, during our workshop in August 2020, another participant was again struggling with accessing the Zoom room with her preferred device and was inquiring in the Zoom room about the necessary steps; on which Monika commented „Like I said, I just opened Zoom and clicked on the last Access Meeting and then I was already in“. Here we can see that Monika has adopted the more common vocabulary as well as the established way to join Zoom. Even though she states that she clicked on a link in Zoom on the last meeting, that is not a common function in Zoom (and we assume that she meant link from Telegram). However, she did leave her previously established practice of typing information in and switched to a more common clicking on the link. To sum up, to be able to hold online PD workshops with our older participants, we needed to develop a mutually shaped understanding of the respective digital ecologies as they are at the core of organizing such PD processes.

Mapping technique development and evaluation

To address the problem of understanding the digital ecologies, we have developed a technique to map them. In this section we first describe the development of the technique and its consequential evaluation. As the mutually shaped understanding of digital ecologies builds on the interplay of learning how to use a particular tool by using it and the appropriate support learning-by-doing and self-directed learning was hence an important aspect to address when designing the mapping technique. In addition, we supported the older adults in their learning by providing necessary resources, such as visualizing elements of the digital ecologies and written and verbal instructions. To be able to mutually understand the digital ecologies of our older participants, we have developed a mapping technique that would support the process of mutually understanding the digital ecologies. By engaging in the collaborative process of mapping their own digital ecologies, we were aiming to support their own understanding of the connections among the devices, how to call particular parts of the ecologies and what activities are possible to do.

Practically, we chose to use a Miro board (a white-board like shared collaborative environment) because of its variability that is easy to adapt to our purpose; as well as the possibility to visualize the different connections. In addition, we already used Miro once two months before the evaluation workshop, which was a fun and an engaging session for our older participants. We structured the Miro space in a way so that participants could choose relevant elements relating to the particular challenges (an app/program, a device and an activity that could be done with an app, such as, joining a Zoom session) and then move it to their “spot” (Figure 1); gradually hence developing a map of their ecologies. We prepared both written and verbally delivered instructions for the older adults during the workshop. When introducing the task, we encouraged the older adults to navigate around in Miro by themselves, because during the last debriefing they expressed a wish to be allowed to do more tasks during our workshops autonomously; in addition this is also aligned with the overall aim of the project (supporting older adults in becoming more autonomous in regards to digital tools).

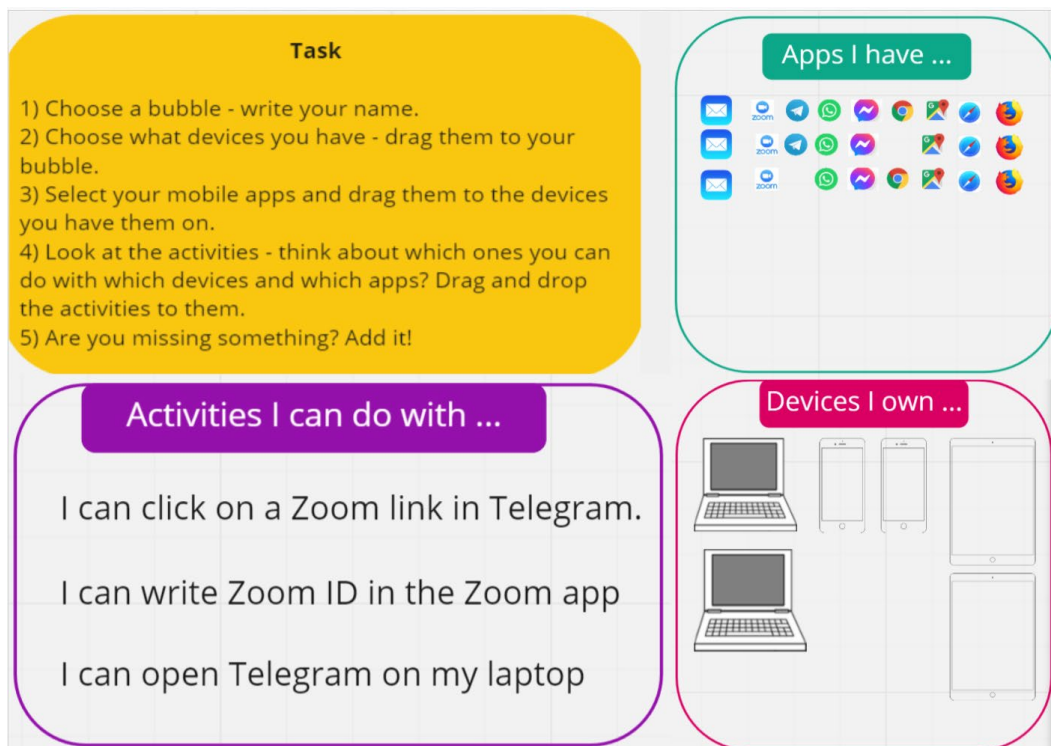


Figure 1: Section Task involves written instructions how to proceed; Section Apps I have involves icons of different applications; Section Devices I own involves different devices; Section Activities I can do with involves descriptions of different activities starting with “I can”

To understand how our prototype could be developed to be further appropriated by our older participants (and people outside of our PD context), we have dedicated one section of our online workshop to evaluate this particular aspect. The session was conducted in the same format as our regular online workshops that are through Zoom. However, this time Miro instead of enabling the understanding of the digital ecologies hindered their understanding of it.

We encountered troubles already at the beginning of the evaluation, when participants were “only” supposed to write their names into the Miro board. There were various reasons for this, for example that the current design of Miro does not change the cursor into the “typing” one, which is common in other contexts; hence making it difficult for the older adults to know where they are supposed to start typing. This seemingly trivial problem took more than 20 minutes of the session moderator trying to solve it; which often involved trying to attend to three participants having a problem at the same time. Overall, this also set up the task in a very confusing way.

Another challenge was to be able to recognize which application on their laptops the participants actually see. As we describe above, this is a common problem connected to the inner digital ecology of older adults. Leaving Zoom and switching to another program such as a browser is often a problematic moment, as the participants can “get lost” in their own ecology. As we can only rely on the older adults’ verbal description of where they are, it becomes a challenge especially when dealing with new tools such as Miro.

After 20 to 30 minutes of trying to support the older adults in their own activities, we decided to change the strategy to be able to proceed with the session. Instead of the older adults exploring Miro and mapping their ecologies themselves, the session moderator shared his screen and started to build the ecologies based on the older participants’ instructions. Through this approach, we were able to map the digital ecologies of the older adults in a way that maybe was not so “self-exploratory” as we wanted it to be but on the other hand it became possible to engage in the activity for everyone, not just the digitally more advanced. The final product can be seen in Figure 2.



Figure 2: Final overview of the digital ecologies mapping

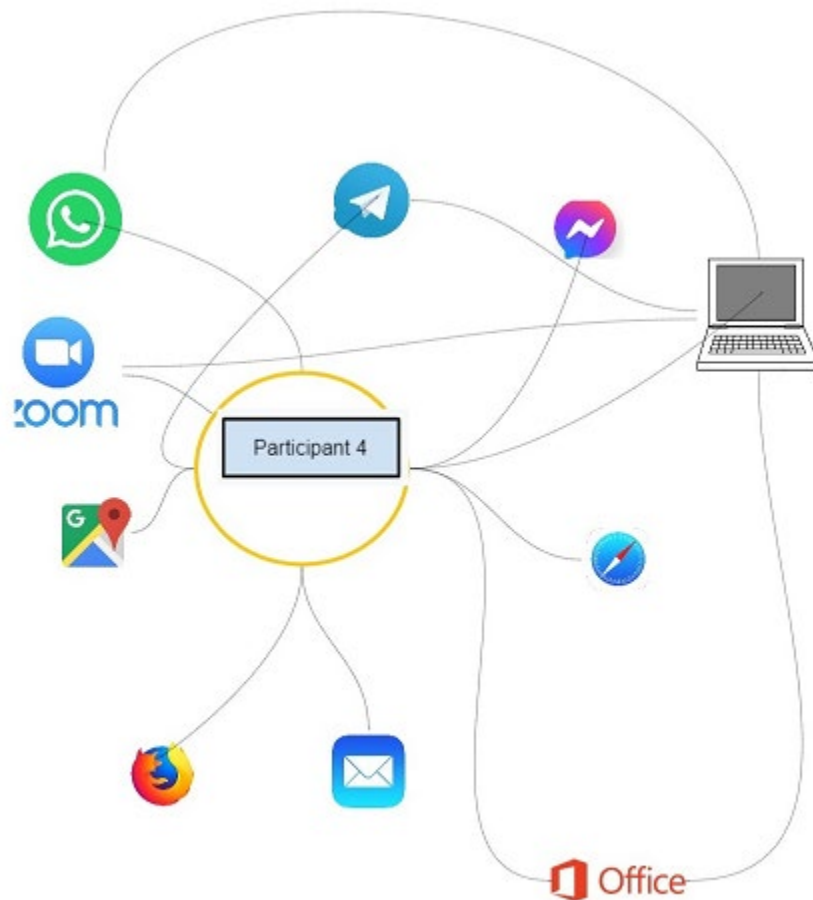


Figure 3: Zoomed-in excerpt from the digital ecologies mapping

After the session, during the debrief, participants expressed unclarity and confusion about the task, especially related to the speed of the instructions “Miro is too intense”, which is an evaluation which we did not hear during the previous Miro mediated session. On the other hand, the process also contributed to some extent in what we were hoping for; one of the participants for example said: “Miro was my biggest issue, but I was impressed by the mapping of the ecologies, about how much apps I and others use”.

To sum up this section, we have learned that to support mutually shaped understanding of the particular digital ecologies of older adults, it is possible to map them, however if the following is included.

- 1) If exploring the digital ecologies through another digital tool, the researchers need to consider that the possible change to the existing digital ecology might be a challenge. This enrichment should be gradual and in pace suitable to the older participants.
- 2) It is necessary to consider an adequate support for the older adults to navigate in their inner ecologies, when switching between the different tools. This might involve teaching older adults how to share their screen or taking photos of it and share them in a common communication channel.
- 3) It is key to reflect together on the final result. This step for us got lost because of the early difficulties, however even debriefing together at the end showed us some things our participants have learned (or not) from the mapping.

Concluding remarks

To sum up, in our paper we have presented how the digital ecologies of older adults can pose a challenge when involving the older adults into online PD. Variety of devices and programs, which are connected in various ways; individually established practices from a variety of contexts and jointly used tools which are introduced and used through error-trial and learning by doing for the older adults, they all form together the digital ecologies of the older adults. The digital ecologies of older adults are not a problem *per se*. However, since the online workshops build on involvement of new tools into the existing digital ecology of them, they will need support when accessing the online workshops. To be able to provide them with meaningful support, we as researchers need to understand which devices the older adults use, which program they see on their screens and which individual practices each participant is used to. This creates a complex environment, which is not automatically obvious at a first glance. More importantly, the only way to understand it is through supporting the participant in their own understanding of the digital ecologies. Without this understanding they will not know which parts of the ecologies are relevant for the online PD context and in turn possibly how to use them. In other words, understanding of digital ecologies is not a one-way process, but emerges from activities that mutually shape each other.

A question also is if the above described challenges are common for older adults or connected to the novelty of described technology. We believe that the possible explanation is somewhere in between: the older adults did not struggle with the digital tools because of their age, but rather because of their particular

needs. These needs are formed by the older adults' life and learning trajectories - many older adults did not use digital tools at work, as well as many of them are not used to the learning-by-doing approach. As a consequence, it was for example difficult for them to distinguish the various apps on their devices. Further, the designers of the involved digital tools do not consider some changes which are common for aging, such as troubles with sight (many of our participants struggled with the small size of the buttons) or less sensitivity in fingers or the heterogeneous interests and practices of this group.

Through our empirical work, we have learned that to organize online PD with older adults, a mutually shaped understanding of the respective digital ecologies is at the core of organizing such PD processes. More specifically, the researchers and participants can make the online PD work through the following activities:

- Developing a common vocabulary as the first step that helps everyone involved to orient themselves in digital ecologies.
- Understanding how the different devices are connected through installed applications and programs.
- Support the participants in learning the different activities they can do to join and participate in the online PD.

In addition, we have also explored ways how to overcome the challenge of digital ecologies in online PD with older adults. When mapping the digital ecologies of older adults, it is key to consider:

- which additional technologies one is adding to the existing digital ecologies by the mapping,
- adequate support for “inner” ecology navigation,
- and reflect over the mapping process and the final result of the mapping.

To conclude, to make online PD with older adults work, a specific type of work is necessary. This type of work needs to be focused on mutually shaped understanding the digital ecologies that the older participants use to join the online activities. In our paper, we propose a mapping technique that can be used to deepen the understanding of digital ecologies and hence secure a meaningful participation in the design process for the older adults.

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