

Bittenbinder, S., Pinatti de Carvalho, A. F., Krapp, E., Müller, C., Wulf, V. (2021): Planning for Inclusive Design Workshops: Fostering Collaboration between People with and without Visual Impairment. In: Proceedings of the 19th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.18420/ecscw2021_ep27

Planning for Inclusive Design Workshops: Fostering Collaboration between People with and without Visual Impairment

Sven Bittenbinder¹, Aparecido Fabiano Pinatti de Carvalho²,
Eva Krapp^{1,2}, Claudia Müller¹, Volker Wulf²

¹ Institute of Information Systems, esp. IT for the Ageing Society, University of Siegen, Germany

² Institute of Information Systems and New Media, University of Siegen, Germany

{sven.bittenbinder, fabiano.pinatti, claudia.mueller, volker.wulf}@uni-siegen.de,
eva.krapp@student.uni-siegen.de}

Abstract. Carrying out successful design workshops can be a challenging task. This can turn even more difficult, if one attempts to engage in more inclusive design workshops, where a broad range of user profiles are covered. If some of these profiles refer to people with impairments, things can get even more complicated. Furthermore, there are also associated challenges when trying to carry out something that is usually implemented as a face-to-face activity in an online format. This exploratory paper introduces a discussion on a few lessons learned from organising design workshops including both people with and without visual impairments. It also outlines our response to the situation created by the COVID-19 pandemic, which prevented us to engage in face-to-face design workshops.

Copyright 2021 held by Authors, DOI: 10.18420/ecscw2021_ep27

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Abstracting with credit is permitted. To copy otherwise, to republish, to post on servers, or to redistribute to lists, contact the Authors.

Based on feedback received from participants of a first in-person design workshop organised within one of our projects and on informal interviews carried out mainly over the phone to discuss ways to enhance the collaboration between people with and without visual impairments during such activities, we go on to introduce some relevant aspects that should be taken into consideration when planning inclusive design workshops. This is a preliminary contribution, meant to raise discussions on technology-mediated inclusive participatory design initiatives to further inform the development of a solid methodological contribution to CSCW.

Introduction

The value of a Participatory Design (PD) approaches for the conception and elaboration of interactive systems has been acknowledged since long ago within the HCI and CSCW communities (Bødker, 1996; Björgvinsson et al., 2012; DiSalvo et al., 2013). Currently, more and more HCI and CSCW researchers and practitioners draw on such approaches, as they go on to engage in user-centred design (Muller, 2002). Such approaches are even more relevant when designing for people with impairments, as there is a growing understanding that one should not design for people with a particular impairment if one does not share the same impairment or, at least, listen to those who experience it in their everyday lives (Bennett, 2018; Kane et al., 2014). The complexity of this equation increases when a system targets not only people with but also those without impairments and designers attempt to foster collaboration between the two of them during the design process.

This is what we have been experiencing in the project iDES^{kmu}. The project, which is funded by the German Federal Ministry of Labour and Social Affairs, sets out to investigate issues of accessibility in document and enterprise content management systems (DMS/ECMS) often used within small and medium enterprises (SMEs). The project goals concern, among other things, the understanding of the extent to what people with visual impairments would be able to use such systems in a work context. The project also aims at sensitising the general population about the relevance of accessible workplaces. Accessible software would be a relevant part of such workplaces, as demonstrated by findings from the literature (Branham & Kane, 2015).

The project hence addresses three different target groups: *companies* using or developing DMS and ECMS; *users* of such systems, both in an SME context or not; and *software development actors* or, in other words, people who contribute for the design and development of software systems – e.g., interface and user experience designers, usability and accessibility professionals and developers in general (de Carvalho et al., 2020). These target groups are naturally not mutually exclusive. For example, freelancers working with software development would be a representative of both companies and the software development actors. By the same token, accessibility evaluators, who also work with the types of software that

they evaluate, would be a representative of both the users and the software development actor target groups.

In order to reach part of its goals, the project proposes to design and develop an application that would allow people to evaluate the most relevant accessibility aspects of a particular system. We refer to this application as the Testing Suite (TS). Members of all three target groups mentioned above should be able to use the TS, independent of their level of expertise with approaches to testing software accessibility or the guidelines involved in it. By providing the community with such a tool, the project aims at providing people with the possibility to carry out elementary accessibility checks as they go on to: (1) engage in developing a particular system; (2) consider to buy a particular software; (3) make a case to change a particular software application in the workplace for one with better accessibility; among other things. Such a tool would thus contribute towards accessible software development and decision making processes in regard to buying or replacing a piece of software.

As part of the PD activities of the project, design workshops (DWs) have been planned to build the referred application together with the different stakeholders of the system. Despite our experience with DWs, engaging people with and without visual impairments in DW activities have proven somehow challenging. A survey of the literature have revealed a visible gap of research on how to foster collaboration between people with and without visual impairments in these activities. Even if some work on how to engage visually impaired people in design activities can be found (Magnusson et al.; 2018; Bischof et al., 2016), there is a lack of work on the interaction between participants with and without such impairments. This exploratory paper drafts the first lines of an answer to a related question. We therefore set out to provide preliminary results to answer the question: *how can we foster collaboration between people with and without visual impairments during DW activities?* It is not our intention here to provide a definite or final answer to this **research question**, but rather to engage with the community in exploring some findings that shed light on this and define future directions in the development of a solid contribution to the field.

Due to the COVID-19 pandemic, we have been faced with the need to carry out online DWs. This added a layer of complexity in the planning for our DWs, as will become clear across the Findings section. Our contribution, therefore, is not constrained to face-to-face DWs, but also online DWs, which until before the outbreak of the COVID-19 pandemic was quite uncommon (Singh, 2020; Martin et al., 2020). Furthermore, as already mentioned our contribution addresses a very relevant issue which, to-date, has not been satisfactorily addressed in our community: the collaboration between people with and without visual impairments in PD activities. With this study, we set out to investigate how we can carry out PD workshops in which we bring the full potential of all the involved parts. This means that, whilst we would like to provide visually impaired people with the opportunity

to fully participate in the activity, we are also keen to prevent constraining sighted people in their participation, as for example, by avoiding the use of visual artefacts.

The remainder of this contribution is organised as follows: section 2 (Context) gives an overview of the complex design research process involved in conceptualising the referred TS, making reference to the methods used for each of the relevant phases; section 3 (Methodology) provides information about the methodological approach that resulted in the findings related to our research question; section 4 (Results) introduces the analysis of the preliminary findings of our investigation; section 5 (Discussion) carries out a short discussion of the presented findings; finally, section 6 (Conclusion) lays out some concluding remarks and our plans to pursue this investigation.

Context

Taking into account the relevance of a user-centred and practice-based design approach for the conception of useful and usable applications (Rohde et al., 2016), we draw on the Design Case Study (DCS) framework (Wulf et al., 2015) for the overall design of our TS. The framework is organised in *three distinct phases*, which can coexist in some moments of the design and development process. The first phase, known as the *pre-study*, concerns the understanding of people's work contexts and practices. For that, qualitative or mixed-methods studies predicated on methods like *in-depth interviews* (Hermanowicz, 2002), *participant observation* (McKechnie, 2008) and *cultural probes* (Gaver et al., 1999) are carried out. Most often, an ethnographic approach is used during it, but it is not uncommon for this phase to be implemented as an interview study. At the end of it, design opportunities outlining the design space are identified. The *design* phase is predicated on methods like sketching and prototyping, as well as assorted usability evaluation techniques, as for example, Heuristic Evaluation (Molich and Nielsen, 1990) and Cooperative Evaluation (Monk et al., 1993). Most often, a PD approach is used, based on a series of DWs with representative people from the target group(s). Last but not least, the *appropriation* phase refers to the deployment of the artefacts generated during the design phase to naturalistic environments, and the study of how the usage of such artefacts will (or will not) change practices.

For our own purposes, we have used in-depth interviews and participant observations as the main data collection methods for the pre-study. The interview study included members of the three target groups previously mentioned (users, companies and software development actors) and focused on understanding the participants' awareness and knowledge about software accessibility and accessibility testing. During the interviews, participants also talked about the relevance of a tool such as the TS and how such an application should look like. The observations focused on practices of accessibility professionals in terms of carrying out accessibility tests. These observations have generated further

information about the features that an application like the TS should include, in order to support people in carrying out elementary accessibility tests. The collected data has undergone a *thematic analysis* (TA) according to Braun and Clarke's approach (Braun and Clarke, 2012) and generated a series of themes concerning design implications and requirements for the TS.

We are currently undergoing the design phase of our project. This phase has been predicated on a series of DWs to discuss and elaborate on the results of the pre-study with the participants. Furthermore, the DWs have been used to envisage and conceptualise the user interfaces and interactive mechanisms for the TS. Among the approaches that we have been using for the DWs are: *brainstorming*, *scenario-based design* (Carroll, 2000) and *low-fidelity prototyping*. These are traditional methods in PD initiatives, as widely acknowledged in the literature (Muller 2002).

The study originating the findings of this contribution emerged from our experiences with organising and running our first DW. This DW featured 8 participants, some of whom have also participated in our pre-study, as seen in Table I.

Table I. Participants of the first on-site DW

Participant #	Visual acuity ¹	Access. Expertise	Pre-study participant	Informal interview after 1. DW	Target Group
P1	legally blind		x	x	User
P2	legally blind				User
P3	fully blind	x		x	User
P4	sighted	x		x	Soft. dev. / Company
P5	sighted				Soft. dev.
P6	sighted	x			Soft. dev.
P7	sighted	x	x		User
P8	sighted	x	x		Soft. dev.

The decision to include participants from the pre-study as well as new participants was deliberate, as the literature suggests that this can bring an interesting dynamic to DWs: while participants from the pre-study could resonate with some of the data presented, new participants could either confirm or challenge it (Sharp et al., 2006). This was exactly the purpose of the brainstorming session that followed the introduction of the pre-study results.

1 Visual acuity refers to the extent to what a person can clearly see. Governments usually refer to a common acuity scales, in order to decide whether someone is entitled to receive some benefits from programmes sponsored by them. For instance, the US government use a scale that includes the categories partially sighted, low vision, legally blind *and* totally blind. How each of these categories are defined usually varies depending on the country. In Germany, for example, legally blind refer to people whose visual acuity is lower than 1/50 (Rohrschneider, 2018).

We tried to engage both visually impaired and sighted representatives from all different target groups. Unfortunately, we were not able to recruit any visually impaired person working in software development. Our experience suggests that there is lack of visually impaired software developers. In addition to that, we were only able to recruit one representative of the company target group, who turned out to be also a developer: he was a freelancer working with accessible software development.

We have planned this workshop as a series of activities focusing on brainstorming and group work. Table II portrays the agenda for our DW and, consequentially, the activities carried out.

Table II. Agenda for the first iDESkmu DW

09:15	Welcome
09:30	Agenda overview
09:40	Introduction round
09:55	Ice-breaker game
10:15	Brainstorming session on results from interviews and observations carried on in the project
11:00	Pause 1
11:15	<i>Parallel Group Session 1:</i> Prioritising and expanding design requirements for the Test Suite
12:00	<i>Presentation Round 1:</i> Presentation of results of group session 1
12:30	Lunch
13:00	<i>Parallel Group Session 2:</i> Selection of best ideas presented in presentation round 1
13:45	<i>Presentation Round 2:</i> Presentation of results of the group session 2
14:15	Pause 2
14:30	Final integration of results and prioritisation of requirements
15:15	Wrap-up
15:30	End

After welcoming the participants to our premises, we have started with a short overview of the agenda and an explanation of the dynamics of the workshop activities. In this moment, we have explained how participants would be working together and which sorts of artefacts they would have to produce. They have also been introduced to the materials that they could use, as for example, flipcharts, post-it notes, colour pens, etc. We consciously offered participants the opportunity to work and generate visual artefacts, but we have of course diligently worked to sensitise participants about the relevance that all of them – independently if with or without impairment – participated in all of the activities in their full capacity. Put differently, we were very keen that the visually impaired participants would be able to contribute to the activity, at the same time that we did not want that the sighted people would be constraint in what they could produce and use in the workshop. Therefore, we made very clear from the beginning that, while visual artefacts could be produced and used, they would have to be expressed in other formats as well, so

that the visually impaired people could understand, follow and contribute to the activity in question. Nevertheless, we have not established any prior mechanism for the interaction between people with and without impairments, which turned out to be one of the barriers for full participation in the workshop, as discussed ahead in the paper.

The initial session was followed by a short introduction round where everybody had the opportunity to introduce themselves. As next, we engaged in an ice-breaker game where participants had to say a potential fun fact about themselves and the other participants would have to try to guess if that was true or false. This turned out to be important for the collaborative work that followed.

The first work session was a brainstorm. The themes regarding the design features of the TS identified in the analysis of the pre-study data was introduced by one of the organisers and used as the discussion basis of the activity. Overall, participants discussed among themselves the extent to what the presented requirement corresponded to what they would envisage as an accessibility TS. After the initial brainstorm, participants were split in 2 groups and were asked to discuss which of the features presented would be relevant for the TS. They were also asked to add any new feature that they thought was missing. This was done, so that participants who were not part of the pre-study also had the opportunity to contribute to the requirements elicitation process of the TS.

In order to guarantee diversity in the groups, we purposively distributed users and software development actors evenly across the two groups. Consequentially, all groups had at least one visually impaired and one sighted person. This was from our perspective very important to bring different points of view to the discussion. Furthermore, having a visually impaired person participating in the discussions could enhance the likelihood that accessibility requirements would emerge. It is sensible to think, we argue, that these participants would share their experiences on how the TS should be designed, so that they could also use it.

After the presentation of the results of the first activity, members of the two groups were mixed, resulting in two new group configurations. We did that deliberately to create new dynamics in the discussions. In the second activity, group members were asked to create an integrated list of features, based on the results presented by the two groups, and asked to rank it according to the relevance. By the end of the activity, the integrated lists were compared and a final list of ranked features were elaborated. This integrated list was to be used in a second DW, where participants were meant to engage in scenario-based design and low-fidelity prototyping.

Although the second DW was also planned to be a face-to-face activity, we were faced with the second wave of the COVID-19 pandemic, and due to the social distancing restrictions, we were no longer allowed to meet personally, which demanded changes in the plans. The articulation work in preparing the second DW is one of the focus of this particular contribution. In addition to that, the feedback

during the debriefing session run immediately after the first DW to discuss the extent to what the activities were easy or difficult to achieve, we could notice some challenges regarding the collaboration between people with and without visual impairment. This brought us to the research question whose answer we explore in this contribution.

Methodology

In order to find an answer for our research question – i.e., *how can we foster collaboration between people with and without visual impairments during DW activities?* – we have adopted a reflective approach taking into consideration both the feedback collected during the debriefing session of the first DW carried out for the conception of the TS as well as a series of informal interviews carried out over the telephone, as we were planning our second DW.

As mentioned above, the debriefing session took place immediately after the first DW and lasted for about half an hour. It has been carried out as a short *focus group* and concentrated in the participants views on what they liked about the DW they had just participated in and what they thought it should be improved for future DWs. The session has been audio recorded and transcribed for subsequent analysis. Fieldnotes have also been taken by the three researchers who were facilitating the DW activities.

In terms of the informal interviews, as soon as we noticed that it would not be possible to carry out the next DW, we have articulated with participants how an online workshop could be made viable. Our main concerns were to make sure that the participants would be able to collaborate with each other during the workshop, independent of the sight condition.

Since participants were fully employed and already granting us valuable time for the DWs, we did not want to burden them with a long in-dept semi-structure interview. Furthermore, since we were not allowed to meet face-to-face, we have to carry out the interview remotely. Since they were meant to be very short interviews, we decided that using the phone, instead of a video conference system would be more appropriate. In addition to that, especially for our visually impaired participants, we were not sure about their experience with video-conference systems and which of them would be more appropriate for the interaction. Answers to the informal interviews have been recorded as field notes and served as information for the preparation of the second DW.

In terms of data analysis, we used a group reflection approach, in which the three first authors of this contribution have gone recurrently through the collected data together – both during the focus group as well as during the informal interviews – and sought for patterns in the answers, which have been also confronted with the knowledge available in the relevant literature. We present the preliminary results of this deep reflective approach in the following section.

Although some may have some reservations about the data analysis approach employed for this contribution, we would like to remind that it is not our intention to provide definite answers to our research question through this contribution. On the contrary, we would share preliminary findings with the community and further explore issues which we should pay attention to as we move on with our analysis. It is our intention to submit our data to a systematic TA, using the same approach as the one used for the pre-study data, so that we can provide the community with deeper insights on the themes herein introduced.

Results

The analysis carried out on our focus groups data and the informal interviews suggests that there are many aspects that should be considered in order to foster the collaboration between people with and without visual impairment during DW activities. The first of it refers to supporting different media artefacts, which allows participants from both groups to make the most of the senses available to them.

A general aim of DWs is to foster mutual learning among participants stemming from different domains and to reduce the “symmetry of ignorance” (Fischer, 2000). Tools which foster knowledge exchange and creativity used in such workshops predominantly address visual elements – e.g., paper and cardboards and whiteboards (Muller, 2002). Using these visual elements ideas for solutions are generated together with the participants, in that all the information developed is made available to all participants equally.

As explained before, we found it relevant not to constrain the sighted people, by prohibiting the production and use of visual artefacts. Nevertheless, our findings highlighted that a challenge to engage people with and without visual impairment in such activities is to effectively distribute the relevant and mostly visual information to the visually impaired participants. One of the critiques that we received from our participants during the debriefing session of the first in-person workshops referred to the accessibility of information provided during it or created by the sighted participants during the activities:

We are talking about accessibility and I had the feeling that I have to learn by heart what participants say and what comes out of the individual groups, because there was nothing barrier-free where I could get access to it again. Except that at some point I took out my computer and wrote down all the past information in no time at all. Who said when and what so that I could even see where we are? On this point, I would like us to become more accessible there too. For those who see nothing or can write on a piece of paper. (P3)

This draw our attention to the fact that the predominant usage of tools for visualisation in a co-present setting is hardly accessible for visually impaired

participants. Despite the fact that no activity of our first DW required any sort of sketching or visual mapping, sighted participant indeed used note taking during the discussion sessions in physical notepads, which has been used to report on the discussions in the group. Although visually impaired people could also have laptops for that activity, we have not asked them to bring their laptops or mentioned that they would possibly want to take note of discussions. We took that for granted and, as a result, we disabled the visually impaired people to fully participate of the experience. Furthermore, we used slide presentations to introduce our findings, which have not been previously shared with the participants, as we did not want them to come with pre-determined views on the issues that would be discussed. Nevertheless, this proved to be an erroneous decision.

Reflecting upon these findings, we get to the conclusion that verbal description of the information is indispensable for the explanation of the ideas that have been noted as bullet points in a block of paper or in a set of slides, but this is not sufficient for such a wealth of information and the impossibility to refer back to such notes and read them up can disadvantage blind and visually impaired participants. This finding has also been confirmed by the other visually impaired participants during the focus group. It suggests that there is a need for a common, electronic and accessible document that can be used by all participants. Any visual information must be possible to be translated to other type of outputs. It is sensible to think that artefacts generated during particular DW session would be available on all participants own computers so that they can individually explore it. These artefacts must be prepared in a way that, if a participant uses a particular assistive software, such as screen readers or magnification software, they would be able to use it without any problems (Coombs, 2010).

As mentioned before, these findings are not limited to the accessibility of the materials created during the DW, but also to those created by the organisers, such as agenda, time and task planning. All of these materials should be provided beforehand in an accessible format, in order to allow for a successful collaboration during the DW activities. Furthermore, templates for particular artefacts to be generated during such activities should be provided. For instance, for our second DW, we were planning that participants would engage in scenario-based design. One of the organisation aspects that we had in our minds were to provide templates for the scenarios that would be written during the DW activities.

Regarding possible formats of the most accessible documents, Coombs (2010) refers to the versatility of Office products (e.g. MICROSOFT OFFICE, LIBREOFFICE, etc.). In an informal conversation after the de-briefing, however, P3 reiterated that the mere possibility of using a shared, accessible online document on one's own computer does not mean that a detailed verbal description of graphics and other information during the meeting is no longer required, whether on-site or online.

Another aspect to be taken into consideration are ways to make it possible for visually impaired people to engage in low-fidelity prototyping. As previously

mentioned, for our second DW, participants will be required to engage in low-fidelity prototyping. We were not completely sure how we should approach the activity, so that people with and without visual impairment could cooperate successfully. Our main question was how blind participants would be able to contribute to the elaboration of a (visual) prototype and to "read" it beyond the verbal description by means of their own aids. Race et al. (2020) state that the most common methods for "making visually rendered information visible" are textual descriptions or tactile graphics – i.e., graphics to touch. On the other hand, by discussing the matter with our participants, we were suggested to use a spreadsheet to divide the screen into quadrants. Navigation through the individual cells into the spreadsheet editor would be possible using the keyboard and the screen reader in their laptops would read the content aloud. Participants could then textually describe what would be present in each quadrant of the screen.

These findings suggest that one would need a platform to centralise all of those artefacts. One of the possibilities would be to use something like GOOGLE DRIVE or MICROSOFT ONEDRIVE which integrate different editing applications, spanning text and spreadsheet editors to presentation editors. In addition to that, the demands we have observed, which suggest that DW based on the collaboration between people with and without visual impairment should be predicated upon the use of digital technology and the generation of digital artefacts, can be seen as a step towards the digitalisation of DW. This, from our perspective, would make it easier to make these DW totally online, since a whole infrastructure for the generation and sharing from the aforementioned artefacts should already been generated. The last step towards a complete online DW workshop would be the use of a proper video conferencing tool. This is particular interesting in a situation as the one we faced due to the second wave of the COVID-19 pandemic.

Among the available tools, participants have mentioned ZOOM as one of the platforms available in the market, which is also accessible. For instance, P3 and P4, both experts in accessible software, mentioned it as a good solution for video conference involving people with visual impairment, in conformity with findings presented by Hersh et al. (2020).

Our findings therefore suggest, that for fostering collaboration between people with and without visual impairment, we need an infrastructure for cooperative work. Figure 1 represents such an infrastructure, taking account the performance of online DW featuring people with and without visual impairment. In the case of face-to-face DWs, the infrastructure would be very similar. The only difference would be the elimination of the video conferencing tool to mediate the communication between participants of the workshop.

It is worth pointing out that participants have mentioned both during the focus group as during the informal interviews that, one of challenges organising online workshops would be to keep people engaged across long hours, as is the case of its face-to-face counterpart. Past and current research have demonstrated that long

video sessions are perceived as very exhausting and tiring for the participants (Wiederhold, 2020). This is something to be aware of when transferring a classic face-to-face workshop to the online world. A potential solution for this would be splitting the DW activities in several self-contained activities, which could be accomplished within one to two hours. Our findings suggested that this would actually enhance participation in DW. Participants recurrently mentioned that, despite their interest in participating in such events, the fact that they worked full time would prevent them to do so in a more frequent basis. It would be easier to coordinate short session between participants and to get them involved during the PD activities of the project. This is another relevant finding that should be taken into consideration when planning inclusive and sustainable DW.

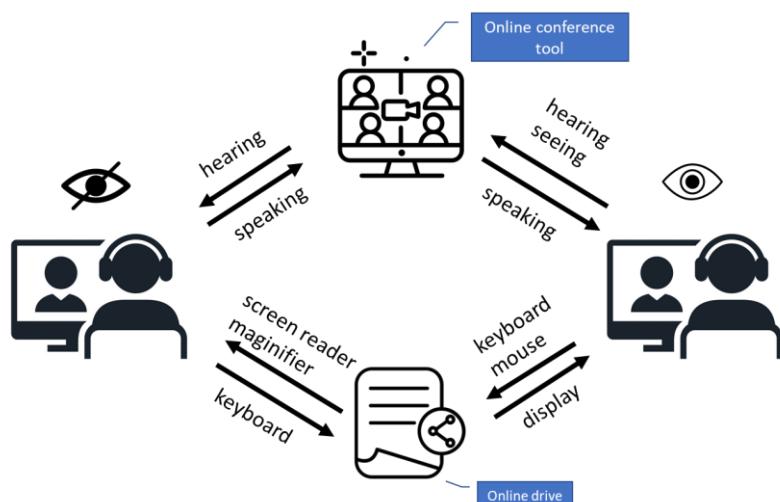


Figure 1 Set-up for Inclusive Online DW feature people with and without visual impairment

Discussion

As mentioned before, it is well accepted within the HCI and CSCW fields, that involving users in the design process of new solutions is a very important for the conception of useful and usable solutions. The involvement of people with impairments in the process of developing solutions for them has been considered even more necessary (Bennett, 2018; Kane et al., 2014). However, there is still a lack of literature and knowledge on how people with and without impairments can be effectively included in PD activities due to their different needs.

The shift in methods of collaboration from the analogue to the digital world, due to the Covid-19 pandemic, offers the opportunity to try out new ways of collaboration over distances and could be the ideal opportunity to also find new tools and methods (practices) for collaboration between people with and without

disabilities to develop and test in context of PD (Singh, 2020; Martin et al. 2020). The findings that we present suggest that this is actually a necessary change in paradigm, if we would like to foster collaboration between people with and without impairment in DW activities.

As introduced in the Results section, the provision of a second communication channel during a DW – be it online or co-located – can fulfil the formal requirements of providing blind and sighted participants in DWs with information of the same quality, even if the type of consumption is different. This communication channel should be based on the provision of accessible documents, which can be handled by different assistive technology, which participants with visual impairment may need to use, in order to make sense of the artefacts being conceived and contribute towards their conception.

Therefore, as answer to our research question of how cooperation between people with and without disabilities in DW activities can be promoted, we can potentially say that providing an infrastructure for the elaboration and sharing of digital artefacts, independent if in a textual or in a graphic format, is key.

Nevertheless, other factors can also play a role for success in practice, such as the ease with which the online conference tool and the online drive can be appropriated, i.e., their user friendliness, accessibility and the user experience that they can offer. It is therefore entirely possible that the tools used have an impact on the success of planned activities.

In addition to the mostly used possibilities of making material readable for blind people either by textual description or tactile graphics (Race et al., 2020), our results have shown another possibility of making visual information of a prototype accessible for blind and visually impaired people, namely in the form of screen reader-readable tables. Furthermore, it should be taken into consideration that many blind people are not blind by birth, so they are likely to know some software applications, may have used it in the past, and could imagine how to interact with software in an effective way to test software for accessibility. And much more, this kind of prototyping in digital form could open up completely new possibilities for prototypes other than software products.

Conclusion and Future Work

This contribution advances the state of the art by introducing a discussion of how collaboration between people with and without visual impairments can be fostered during DW activities. The findings we presented provide strong indicators of the need for adjustments when design for inclusive DW between people with and without visual impairments. We argue that the presented findings are of great value for the planning of DW which allow for successful collaboration between those actors.

As future work, we propose to subject the results presented in this contribution to scrutiny, by planning and carrying out a DW including people with and without visual impairment, supported by an infrastructure as the one introduced in our Results sections. The findings from this future initiative will allow us to assess the extent to what the proposed approach would effectively work for fostering collaboration between its participants and which other aspects must be taken into consideration to successfully achieving this goal.

References

- Bennett, C. L. (2018) ‘A toolkit for facilitating accessible design with blind people’, *ACM SIGACCESS Accessibility and Computing*, no. 120, pp. 16–19. doi: [10.1145/3178412.3178415](https://doi.org/10.1145/3178412.3178415).
- Bischof, A. et al. (2016) ‘Exploring the Playfulness of Tools for Co-Designing Smart Connected Devices: A Case Study with Blind and Visually Impaired Students’, in *Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play Companion Extended Abstracts*. New York, NY, USA: Association for Computing Machinery (CHI PLAY Companion ’16), pp. 93–99. doi: [10.1145/2968120.2987728](https://doi.org/10.1145/2968120.2987728).
- Bjögvinnsson, E., Ehn, P. and Hillgren, P. (2012) ‘Design things and design thinking: contemporary participatory design challenges’, *Design Issues*, vol. 28, no. 3, pp. 101–116.
- Branham, S. M. and Kane, S. K. (2015) ‘The Invisible Work of Accessibility: How Blind Employees Manage Accessibility in Mixed-Ability Workplaces’, in *Proceedings of the 17th International ACM SIGACCESS Conference on Computers & Accessibility - ASSETS ’15. the 17th International ACM SIGACCESS Conference*, Lisbon, Portugal: ACM Press, pp. 163–171. doi: [10.1145/2700648.2809864](https://doi.org/10.1145/2700648.2809864).
- Braun, V. and Clarke, V. (2012) ‘Thematic analysis.’, in Cooper, H. et al. (eds) *APA handbook of research methods in psychology, Vol 2: Research designs: Quantitative, qualitative, neuropsychological, and biological*. Washington: American Psychological Association, pp. 57–71. doi: [10.1037/13620-004](https://doi.org/10.1037/13620-004).
- Carroll, J. M. (2000) ‘Five reasons for scenario-based design’, *Interacting with Computers*, vol. 13, no. 1, pp. 43–60. doi: [10.1016/S0953-5438\(00\)00023-0](https://doi.org/10.1016/S0953-5438(00)00023-0).
- Coombs, N. (2010) *Making Online Teaching Accessible: Inclusive Course Design for Students with Disabilities*. Wiley (Jossey-Bass Guides to Online Teaching and Learning).
- DiSalvo, C., Clement, A. and Pipek, V. (2013) ‘Participatory Design For, With, and By Communities’, in Simonsen, J. and Robertson, T. (eds), *International Handbook of Participatory Design*, Oxford: Routledge, pp. 182–209.
- Fischer, G. (2000) ‘Symmetry of Ignorance, Social Creativity, and Meta-Design’, *Know.-Based Syst.*, vol. 13, no. 7–8, pp. 527–537. doi: [10.1016/S0950-7051\(00\)00065-4](https://doi.org/10.1016/S0950-7051(00)00065-4).
- Hermanowicz, J. C. (2002) ‘The Great Interview: 25 Strategies for Studying People in Bed’, *Qualitative Sociology*, 25(4), pp. 479–499.

- Hersh, M., Leprini, B. and Buzzi, M. (2020) ‘Accessibility Evaluation of Video Conferencing Tools to Support Disabled People in Distance Teaching, Meetings and other Activities’, in *ICCHPOpen Access Compendium Future Perspectives of AT, eAccessibility and eInclusion. 17th International Conference on Computers Helping People with Special Needs*, Online, pp. 133–140.
- Gaver, B., Dunne, T. and Pacenti, E. (1999) ‘Design: Cultural Probes’, *Interactions*, vol. 6, no. 1, pp. 21–29. doi: [10.1145/291224.291235](https://doi.org/10.1145/291224.291235).
- Kane, S. K. et al. (2014) ‘Collaboratively designing assistive technology’, *Interactions*, vol. 21, no. 2, pp. 78–81. doi: [10.1145/2566462](https://doi.org/10.1145/2566462).
- Magnusson, C., Hedvall, P.-O. and Caltenco, H. (2018) ‘Co-designing together with Persons with Visual Impairments’, in Pissaloux, E. and Velazquez, R. (eds) *Mobility of Visually Impaired People*. Cham: Springer International Publishing, pp. 411–434. doi: [10.1007/978-3-319-54446-5_14](https://doi.org/10.1007/978-3-319-54446-5_14).
- Martin, J., Loke, L. and Grace, K. (2020) ‘Challenges facing movement research in the time of Covid-19: Issues in redesigning workshops for remote participation and data collection’, in *32nd Australian Conference on Human-Computer Interaction*. New York, NY, USA: Association for Computing Machinery (OzCHI ’20), pp. 712–716. doi: [10.1145/3441000.3441055](https://doi.org/10.1145/3441000.3441055).
- McKechnie, L. E. F. (2008) ‘Participant Observation’, in Given, L. M. (ed.) *The SAGE Encyclopedia of Qualitative Research Methods*. Thousand Oaks: SAGE Publications, Inc., pp. 598–599.
- Molich, R. and Nielsen, J. (1990) ‘Improving a Human-Computer Dialogue’, *Commun. ACM*, vol. 33, no. 3, pp. 338–348. doi: [10.1145/77481.77486](https://doi.org/10.1145/77481.77486).
- Monk, A. et al. (1993) ‘Cooperative Evaluation: A Run-time Guide’, in *Improving your Human-Computer Interface: A practical Technique*. New York: Prentice-Hall.
- Muller, M. J. (2002) ‘Participatory Design: The Third Space in HCI’, in *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*. USA: L. Erlbaum Associates Inc., pp. 1051–1068.
- Pagon, R. A. (1988) ‘Retinitis pigmentosa’, *Survey of Ophthalmology*, vol. 33, no. 3, pp. 137–177. doi: [https://doi.org/10.1016/0039-6257\(88\)90085-9](https://doi.org/10.1016/0039-6257(88)90085-9).
- Pinatti de Carvalho, A. F. et al. (2020) ‘Fostering Accessibility at the Workplace through Community-based Participatory Research’, *Proceedings of 18th European Conference on Computer-Supported Cooperative Work*. doi: [10.18420/ecscw2020_ws07](https://doi.org/10.18420/ecscw2020_ws07).
- Race, L. et al. (2020) ‘Designing Educational Materials for a Blind Arduino Workshop’, in *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems*. CHI ’20: CHI Conference on Human Factors in Computing Systems, Honolulu HI USA: ACM, pp. 1–7. doi: [10.1145/3334480.3383055](https://doi.org/10.1145/3334480.3383055).
- Rohrschneider, K. (2018) ‘Blindheit in Deutschland im 20. Jahrhundert’, in *Blindheit in der Gesellschaft: Historischer Wandel und interdisziplinäre Zugänge*. 6th edn. Campus Verlag, p. 97.
- Sharp, H., Rogers, Y. and Preece, J. (2006) *Interaction Design: Beyond Human-Computer Interaction*, 2nd ed. West Sussex, John Wiley & Sons.
- Singh, V. (2020) ‘Workshops are now required to be conducted remotely: is this a bad thing?’, *Interactions*, vol. 27, no. 4, pp. 52–54. doi: [10.1145/3406102](https://doi.org/10.1145/3406102).
- Wiederhold, B. K. (2020) ‘Connecting Through Technology During the Coronavirus Disease 2019 Pandemic: Avoiding “Zoom Fatigue”’, *Cyberpsychology, Behavior, and Social Networking*, vol. 23, no. 7, pp. 437–438. doi: [10.1089/cyber.2020.29188.bkw](https://doi.org/10.1089/cyber.2020.29188.bkw).