

# Assembling Fragments into Continuous Design: On Participatory Design with Old People

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**Abstract.** The paper takes a close look at a participatory design (PD) process with old users. We discuss how we organized and carried out the PD process so that they could participate in the mutual learning and co-construction activities on their own terms. We use the design of a radio to illustrate how the old users participated in the co-construction. We discuss some important topics to consider when organizing PD with old users: recruiting, timing, continuity, representativity and immediacy.

**Keywords:** Participatory design · Old users · Mutual learning · Co-construction

## 1 Introduction

The origin of Participatory Design (PD) is the democratic ideal that those who will be using an artifact should be given the right to decide on its design: its functioning as well as its form, and through this gain more control over the use situation and achieve a larger space for action [1–4]. The most important consequence of this view is that users are seen as experts on their work [5–8]. Hence their expertise is needed in the design in order to build such “participatory artifacts”. Design in PD becomes a collaborative process where both use expertise and technical expertise are necessary ingredients. This in turn affects how the design process is organized and carried out, making processes of mutual learning and co-construction essential [9].

This paper discusses how PD can be tailored to users who have limited capacities for participation as user representatives in organized participatory design activities due to their physical or socio-cultural conditions like illness, age, cognitive skills, education etc. We report from a PD project in which we succeeded in involving old people in active design: both mutual learning and co-construction. We discuss how the participation was organized and carried out in order to achieve a good result. Our story demonstrates how mutual learning combines analysis and design, and how design ideas co-constructed in PD collaboration include elements originating from both designers and users.

The paper is structured as follows: Sect. 2 presents the main characteristics of mutual learning and co-construction in PD and in Sect. 3 we give an overview of related work. Section 4 describes our empirical basis: a large PD project with old people, and Sect. 5 reports from one of the smaller PD sub-projects. In Sect. 6 we present our analysis of how PD with old users unfolds in practice. Based on this Sect. 7 ends the paper with a

discussion about how we managed to have our user group participate in designing artifacts that enhanced their space of action.

## 2 Mutual Learning

Seeing the design process as collaboration between two expert groups with little knowledge about each other's expertise suggests that they need to learn from each other. The first phase of PD is therefore "mutual learning" [9, 10]: designers need to learn about the use context and the users' activities, users need to learn about technology and technical possibilities. They both should learn enough to recognize the logic of the other expert group, so that they can recognize their professional reasoning about a design idea. The use expertise is demonstrated in their use practices; hence observation and interview of users *in situ* are necessary for understanding the use logic [10].

A successful mutual learning enables both groups to widen their imaginative capacity and to build on each other's ideas, hence designing really new artifacts. It is therefore important that the two groups spend time together as their knowledge about the other profession (as well as of their own) grows during the process [9, 10]. A description and analysis of the use context and users' activities can therefore not replace involving real users over time: both their imagination about design possibilities and their needs and wishes for artifact support will change [9, 10]. The users should have a voice as well as a say in the design process [11].

Mutual learning includes both analysis and design [9], and mixes the two: understanding more of a problem area gives a better basis for imagining possible solutions. A prototyping workshop could be used as a method for inquiry, while a study tour to see a similar artifact in use in its use setting could be used for evaluation. PD spends time on establishing a common problem definition based on input from both use and technology.

This view is based on Schön's conceptual framework on design [12, 13]. More specifically we see that users and designers collaborate on what Schön [13] calls sequences of "see – move – see": seeing the design possibilities, choosing one of them to try out, and then seeing /evaluating the result – continuing forward if the move is considered productive with respect to the design process goal, moving back and trying another move if not [4, 12, 13]. In co-construction processes both users and designers participate in creating choices or design ideas to choose from, they work together on making the move by means of various design and prototyping techniques, and they evaluate the result together. The co-construction process can be intertwined with mutual learning activities: trying to concretize a design idea can spur a discussion not only about the problem solution but also about its definition [4, 13, 14].

PD of new design ideas requires an open and trusting collaboration, acknowledging differences but treating them with respect and interest rather than as problems [4, 9, 10, 14]. PD trusts the users to act as co-designers of their own activities – the concretizing of the design (its form and function) should not be left to the designers alone. This also means that the artifact is seen just as an element of the final design: its habitual use in everyday activities is the objective and hence the unit of analysis and evaluation. Thus, PD is

organized with more time spent on mutual learning activities (learning both ways), more activities that involve both users and designers so that they share experiences and knowledge over time, more negotiations and building on each other's ideas, and including more contextual evaluations in all phases. The organization of PD puts a lot of claims on both designers and users, and in practice one has to make compromises as to how the collaboration can be facilitated.

A standard model of the PD process emphasizes that the development of a problem definition and solution goes hand in hand, and evolves together over time. Defining the problem typically involves fieldwork (interviews, observations on-site) and analysis of needs and their rationale and priority, while solving the problem typically involves various concretizing activities (design workshops, experiments, tests). Each move opens up for new ways of looking at both problems and solutions, hence the iterations can be very small [4, 9]. The full cycle typically involves a field study, needs identification, requirements specification, concretizing, experimental testing, and evaluation-in-use – sometimes collapsed into the same activity.

### 3 Related Work

Over last decade, the PD community has discussed ways to better organize PD processes with vulnerable users, among them elderly people. The selection of user participants when working with elderly people has been discussed [15–17]. The diversity of health conditions, contextual factors and daily activities of elderly people complicates the facilitation of PD. Grönvall and Kyng [18] explain how moving the PD process into a home environment affects the organization, participation and recruitment, especially when working with ill and fragile participants. Anderberg and Berglund [19] paint a very realistic picture of the everyday lives of elderly persons in their description of thoughts and perspectives of inhabitants receiving care in nurse homes. The contextual factors they emphasize have also been addressed by others. Scandurra and Sjölander [20] argue for the importance of bringing contextual considerations when co-designing with elderly. Similarly, Ballegaard et al. [21] discuss the design of the development process and how contextual considerations such as daily activities must be integrated as a part of the whole approach in order for the technology to sustain.

Ekdahl et al. [22] discuss elderly patients' needs and preferences when making decisions about care and medical treatment, discussing the limitations involved when engaging elderly participants. Aarhus et al. [15] point at a variety of challenges and roles of participation in their study of old people suffering from vertigo, and argue for involving users despite their limited capacity to participate: their users contributed significantly to the end result. Uzor et al. [17] involved elderly users with limited opportunity to participate in the early stages of PD to achieve better results. Hendriks et al. [23] contribute to this discussion by demonstrating the value of bringing in trust-worthy companions such as family members. They also stress the importance of being selective since many participants only participate “as a favor” rather than the desire to contribute to the design process. This is also seen in the case of [18] where half-day participation tired the participant totally and affected her for days. Grönvall and Kyng discuss how

providing the participants with a meaningful engagement would help in recruiting: they argue that elderly people with chronic illness needs a purpose in order to spend their few “good days” participating in a project. The danger of “overselling” the outcome of PD activities to such participants is also stressed. Lindsay et al. [24] argue for the importance of empathy when engaging elderly in order to provide meaningful engagements, and Yamauchi [25] share a similar view towards using empathic relations to better understand the participants.

The research literature also includes discussions on how we involve various stakeholders such as proxy-users in order to strengthen the design process. Clemensen et al. [26] use interdisciplinary teams as an approach to overcome practical challenges of involving elderly people related to medical issues, and Hultgren et al. [27] present a concept for community-based co-creation where the goal is to facilitate long-term collaboration with various stakeholders in a community-based environment. One of the PD concepts they emphasize is mutual learning. Their discussion on commitment and how to engage participants is relevant for some of the topics experienced in our empirical context.

Finally, a part of the discussion about the organization of PD concerns the diversity of senior citizens. The danger of seeing them as a homogeneous group can result in a group with too diverse participants, which may not result in optimal group dynamics. Aarhus et al. [15, 18] exemplify how similar-aged elderly have different attitudes and perspectives towards technology, and Vines et al. [28] choose to use the term eighty-something to describe the age group rather than old or oldest old. Hultgren et al. [27] discuss how age is not bound to our biological age, but rather to the individual perception of age. Malmberg et al. [29] discuss difficulties finding characteristics for elderly participants that are not grounded in age and at the same time avoid stigmatizing their self-image. Their studies suggest different approaches, e.g., the concept of “situated elderliness” as a way of addressing the elderly participants and simultaneously acknowledging context-specific challenges [30].

## 4 Collaboration with Old People: The Case

As part of a long-term collaboration with Oslo Municipality, one of the studies in the A3 project<sup>1</sup> was carried out in a residence for elderly people named Kampen care+. The building contains 92 apartments for elderly people – at the moment housing 104 persons with the average age 84 years (ranging from 74 to 101). The building includes a reception desk with 24/7 staffing (three people every day, one person during night), a café where the residents can buy dinner, a gym, an activity centre open to public etc. The building also has installed “welfare technology” mainly for increased safety: automatic energy regulation (light, heating), electrical sockets with timers, stove guard, motion sensors in all rooms (e.g., for night light), video calling and door lock (RFID). In addition, they have a tablet with an Internet connection for communication and information exchange (e.g., telephone, calendar and bulletin board). This public installation of welfare

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<sup>1</sup> A3: “Autonomy and Automation in an information society for all”, see: <http://a3.ifi.uio.no>.

technology is the largest in Europe, hence enabling a good basis for studying use practices on a larger scale. One apartment has been reserved for our project: it is equipped with the standard welfare technology solution and is used for experimenting with alternative designs and enhancing the existing solution.

The aim of the collaboration with Kampen care+ was to evaluate the practical application of the welfare technology solution, and suggest improvements and alternative solutions [31, 32]. The collaboration has involved approx. 70 people from Kampen care+: employees (4) and residents (52), as well as relatives, friends and volunteer workers. In addition, three faculty and three PhD students as well as 10–15 graduate students and 16 undergraduate student projects has spent time in Kampen care+ over the last two years. The project therefore was organized as a collection of separate but not independent smaller projects on top of a set of regular weekly activities (IT workshop every Thursday evening, IT course every Monday at noon, regular visits involving workshops or interviews and observations).

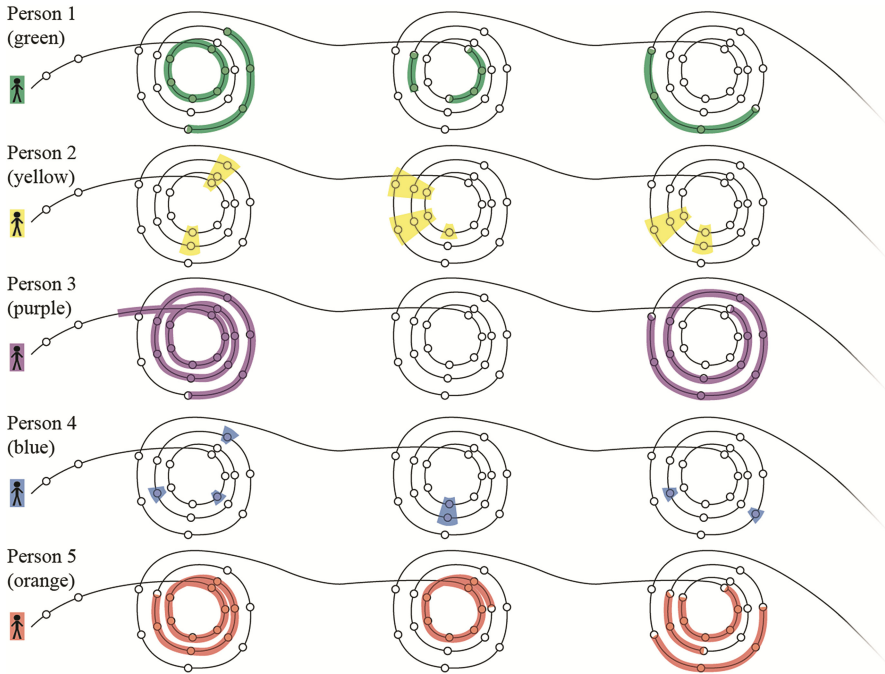
The Kampen care+ has a large common area beside the reception desk, which acts as a meeting point for the residents. Coffee is served there every day at 5 PM, and also during the day groups of residents sit there and talk and watch what happens (or the employees sit down and talk for a while). The area enables an overview of the entrance, the café, and the library meeting room where many of our workshops and interviews were carried out. When returning to the common area people always talked about what they had participated in. All the people from our department have been very well received – even often invited in for a coffee. The attention from researchers and students and from media (reporting on welfare technology) has over time “cultivated” a group of positive and enthusiastic – almost professional – users as well as a need to be realistic about what is hype and what is reality of welfare technology.

#### 4.1 Ageing Bodies in PD

Ageing changes the body in many and non-linear ways, and vary enormously [33]. Normal characteristics of the ageing body, like declining sensing (eye sight, hearing, taste), loss of strength and balance, and changes in skin texture, fine motor skills and tremors make many computer appliances difficult to use. Also decline of memory and the ability to understand abstractions (like maps) make many standard interaction mechanisms and symbolic representations difficult or impossible to use. Designing for ageing bodies therefore needs to pay attention to what the design presupposes that the user is able to do and adjust these to the skills that are present [8]. However, we also claim that one of the features of PD is that even if the loss of abilities tends to dominate the practical design challenges, the actual design process is based on the existing abilities, focusing on what the can do rather than what they cannot [33].

The PD process we carried out can be described as a combination of several iterations of smaller projects, where the old users participated in some parts of some projects over time, and that this long-term relationship enabled both us and them to develop a coherent PD process from it (see Fig. 1). The figure pictures three cycles of iterations. Each of the cycles includes several smaller activities [9]: interviews and observations (in their homes), brainstorming sessions, group discussions, workshops, and prototype evaluations. We had

different people participating in different activities depending on their abilities and interests. Below we use the participation lifecycle for five residents to illustrate how their participation varied, and how focusing on shorter and more frequent activities allowed participants to join even when they experienced to have limited capacity. Their health conditions led to practical difficulties concerned with participation, and we organized the process so that they still could participate.



**Fig. 1.** The participation activity for five of the participants throughout the project (Color figure online).

Person 1 (green in Fig. 1) was a gentleman who depended on having “a good day” in order to participate. His health conditions prevented him from scheduling activities beforehand: he had to wait until the very same day to determine whether he was able to participate or not. Participation required a great effort of him in preparing as he had to get up early, wash himself, and motivate himself to interact not only with us, but also with other residents. This introduced some unpredictability: his participation was a direct reflection of his daily capacity. The most important for him was not which activities he joined, but instead that he participated for as long as he could.

The second person (yellow) was very meticulous with which activities she would join. She did not want to participate in any activities involving “tasks” on devices such as demonstrative interviews or testing of prototypes; she was very self-aware and aware of her limited experience with technology and she did not feel comfortable using devices for the first time in front of others. She was only present for those activities that

(she felt) allowed her to learn and contribute, but she participated consistently in the activities she preferred. She was a very social person and seemed motivated by the social aspect of the participation: “It is nice to hear how I am not the only one struggling with this”.

The third person (purple) was a very motivated and energetic participant during the first cycle and one of our main contributors. She was present in all activities and seemed to be less affected by fatigue than the rest. However, she was hospitalized close to the end of the first cycle and stayed in the hospital during the whole second cycle; she did not return to Kampen Care + until the third cycle. Once she had fully recovered, she jumped straight back into the process and continued as before. As her attendance was very frequent when she was able to participate, she ended up having one of the highest overall attendances.

The fourth person (blue) was one of our most unpredictable participants. His participation was very sporadic and seemed to be independent of health condition. He was always invited, but only showed up once in a while. He explained his absence with “it was not a good time due to other commitments”. He participated consistently throughout the three cycles. His general health condition was good, but his endurance was limited. He could never participate in more than one activity, even when it only lasted half an hour.

The fifth person (orange) was very ambitious in the beginning and participated in all activities. However, in the middle of the first cycle she suddenly became sick, and was unable to participate for a long time. As she had little prior experience with such activities, she later said she was caught by a surprise of how exhausting participation can be, even in good company. She returned for the second cycle, but only participated in half of the activities compared to previous cycle, and managed to participate without any negative effects on her health. In the final round, she chose to participate in even shorter, but multiple, periods, as this allowed her to participate more throughout the cycle than if she were to do it all in one consecutive stretch.

These five life cycles demonstrate how we attempted to adapt the design process to the limitations of the elderly participants. The process of organizing the activities was very flexible from our side in order to recruit more participants and adapt the process to their opportunities to contribute.

We also saw how the participants learned about their own capacity to participate during the design process. The co-design experience was new to most of them, and they did not know how it would affect their endurance. Some were very careful with overcommitting, and had to complete several activities before they dared to participate more. Others contributed so much that they became ill, and had to reduce their commitment when they returned. All participants adapted their participation pattern based on their experiences from the first cycle. We observed that our organization of the design process gave participants more space: it allowed for flexibility in duration and frequency of participation, and it gave several opportunities to rejoin even after longer periods of absence. Some participants only wanted to participate together, and high frequency of activities allowed them to coordinate their participation in design with their other commitments.



## 5 Tangible Design for Simple Interaction

In this section we describe one of the smaller PD projects in which the old users were very active in both mutual learning and co-construction. The background for the project is that the government in Norway has decided to shift from frequency modulation (FM) to digital audio broadcasting (DAB) in 2017, hence the old radios will not work anymore. A modern DAB radio is a computer, and many of them make use of new interaction mechanisms, new metaphors and new interfaces, e.g., a small screen with frequency numbers or radio station name. Aiming to meet the problems before they arise, a small PD project was initiated and carried out aimed at designing a DAB radio that included what was thought to be useful functions and was easy to operate based on the skills of the participating users.

The PiRadio (see Fig. 2) was designed a usable radio based on a new DAB-radio equipped with the newest technology but with interaction mechanism and interface based on older interfaces with traditional interaction mechanisms [34]. The radio was co-constructed with some of the Kampen Care + residents: in total 25 of the residents participated in the mutual learning and co-construction of the radio.



**Fig. 2.** The PiRadio (left) and the prototypes for the knob (right).

The co-construction aimed at using rotary controls for operating the radio. In this way the interaction could make use of familiar gestures building on their habitual bodily skills [34, 35], the idea being that if they could not make sense of the interface intellectually, their body would remember how to turn on the radio by recognizing the button as a device for rotary movement (the “maximum grip” [35]).

The co-construction process involved designing a series of knobs and testing them to evaluate how easy they were to turn when used by old fingers. Ageing often implies loss of strength in hands and fingers, and several of our participants struggled with getting a proper grip on some of the prototypes. A smooth plastic surface was, for example, difficult to operate, in particular for fine-tuning the radio. The knob went through several iterations of redesign – co-design – where our old user-participants tried out knobs of different shapes, sizes and materials in the search for the best grip. At the end we arrived at a knob with a knurled and coarse surface that could compensate for reduced strength of their grip as well as reduced dexterity (reduced mobility and flexibility due to rheumatism or involuntary movements due to tremors). The testing aimed



at arriving at providing our old co-designers with a maximal grip (see Fig. 2). A second feature was the feedback of the knob when turned, i.e., its resistance and snap. The friction and snap into position was adjusted in cooperation with the participants in order to ensure that the feedback from the radio was familiar and immediately understood. The process made use of blindfolded testing to investigate how the touch between the hand and the knob by itself, i.e., without visual stimuli, was able to trigger the habitual understanding of the interaction based on their experiences: “I understood when I touched it”. The result selected by all participants was confirmed by a one-tailed t-test used to compare the efficiency and effectiveness, and results showed that tasks were completed faster and with fewer errors when tested against two standard off-the-shelf radio models (95 % CI) [34].

As the capacity to contribute in the design process weakened and they were forced to only participate in a few activities, some activities suddenly became much more popular. In particular, the blindfold testing and the material testing were very popular. They were both tests where we discussed future technology through non-digital artifacts. The blindfold testing was a social and entertaining activity in addition to being a way of discussing the design. Due to this, it also became popular among those who talked less during the workshops, and it seemed like they enjoyed the social setting more than the actual outcome of the design process. Thus, the reduced capacity of our old participants resulted in selective participation: they chose to participate in certain activities consistently over time, rather than participating more sporadically in whatever activity was available. Selective participation was also the case for other residents who wanted to only join certain activities. One participant for example wanted to only participate in a few activities per cycle as he felt that was enough for him. Organizing short and frequent activities allowed the residents to participate without disturbing other commitments.

## 6 Topics for Tailoring PD

Our analysis of the PD process and how we had to adjust the PD process to facilitate participation by our old users in mutual learning and co-construction, resulted in five topics: recruiting, timing, continuity, representativity and immediacy. Collaborating with the oldest old has been – and is – a pleasure. Their view on technology and quality of life differs from ours and represents a different logic that should be recognizable in the design result.

### 6.1 Recruiting

Recruiting participants for a particular activity proved to be easier than recruiting for long-term commitment. In our consent form we inform the participants that we will keep the recorded data until 2016, and we have several examples that the participants refused to sign – and to participate – because “*I might not even be alive then. This is not for me!*”. Many of the residents also did not want to engage in activities that were planned long time ahead. One reason is their determination to keep their promise and being

uncertain about their health condition: they were reluctant to promise something that depended on them having “*a good day*” but agreed to participate if they could give the final answer in the morning on the day of the activity. If this was not an option, they often did not want to commit to participating. Some also tried to avoid thinking too much about the future as “*I become sad when I think about how I will soon not be able to walk*”. The future is a sensitive subject, and many old people do not see themselves as old and in need – they design to help others [19].

After some time we managed to establish a group of eight committed participants, and we asked them to find other people who would be interested in participating during a week or two. This snowballing recruiting strategy proved more efficient than our direct one-to-one method. A particular side of working with old people is that they are vulnerable to illness and injuries, and two of our participants happened to get hospitalized during one of the iterations. They returned to the process when returning from the hospital. Two of our participants died – we think they appreciated the fact that they could be active to their final moment.

Most residents at Kampen Care + are women, and we wanted to recruit some men to our workshops. Therefore, we went after the weekly football game on TV, where the men were gathered in the reception area and were in a good mood. We easily recruited three men to a quick workshop in this situation. The strategy of making appointments for future activities had earlier proved to be difficult. This demonstrates a much more flexible strategy for recruiting people, spending more time with them and seizing the opportunity for recruiting people when the situation made it possible.

## 6.2 Timing

Linked to the previous theme is the duration of the participation. First of all, working with the users who inhabit the future use context means adjusting to that context. Working with old people in their homes means adjusting to their rhythms: their sleeping patterns (many sleep late) and regular appointments (e.g., with home care services), their everyday practical-and-social routines, like the long meal together around lunch time, and the regular coffee at 5 PM, in addition to occasional appointments with the doctor or a physiotherapist. Also the Kampen Care + organizes several activities during the week – all considered to be more important than our activities – and many of the old people had really full schedules. We had to look for open windows and opportunities for engagement in-between; hence we always needed to keep ourselves oriented about activities and happenings at Kampen Care + .

This made us change our plans from doing a few long sessions to planning for several shorter ones. This organization enabled more people to participate in more sessions as our activities became easier to fit to their schedules. An additional reason for shortening the sessions was the fact that old people get tired from long sessions. Some of our old participants could only manage a half hour, while some got a headache from looking at the screen for long.

More frequent and shorter sessions made our participants exposed to our themes more often. Most of the residents find technology to be difficult and strange, and do not meet IT much in their everyday life. Having frequent discussions with us exposed them

for the topics more often, reminding them about our topics and contributed to maintaining the continuity in the project. This was particularly helpful for those whose short-term memory is weak.

### 6.3 Continuity

A lesson from the two years spent at Kampen Care+ is the importance of creating continuity even though consistent commitment over time is not possible for most participants. We used several strategies for supporting the experience of continuity.

After some time we moved our workshops and meetings to the library-meeting room inside of the reception area, with windows facing the reception area. As mentioned before, this is the meeting point for everyone at Kampen care+. When our workshop participants left the room they were always encouraged to tell the curious spectators what happened – what they did, what we discussed, what they got to try out. The visibility of the project activities evoked curiosity and made recruitment easier. It also helped establishing continuity between the activities. The visible activities were positive reminders of our presence and of the project topics. One of our colleagues, Rune Rosse-land, has been arranging IT workshops every Thursday afternoon for those who want to join. Seeing him every week was also a reminder and has contributed to creating a feeling of continuity and confidence in our commitment. His regular presence gave him a different basis for contact than the less frequent visitors from our project.

In line with other PD projects we left things after our activities to enhance the learning and attention without our presence (similar to [25]). The active residents made use of papers, photos, prototypes etc. that we left behind. This “after learning” also worked to recruit new participants as the continuing discussion encouraged wider engagement. Above all, the discussions became less strange and not threatening.

The elderly residents took their appointments very seriously, and not keeping appointments threatened the trust we had built throughout the project. Sometimes the home care nurses were too busy and did not show up to scheduled design activities with the residents. This made us more determined to control the appointments ourselves – trust is a fragile relation that can easily be destroyed by only a few examples of breaking the contract [36].

### 6.4 Representativity

Old people are as different as everyone else – maybe even more. Ageing meets us in very different ways; hence the diversity is not easily represented through a few participants (see also [37]). Including employees and health care professionals in the project provides information about the variety and frequency of abilities and problems, and all the daytime employees have been part of workshops and interviews. This increases the feeling of trust and makes the participants relax because of their good personal relationships [36]. We take the participants to represent themselves rather than pre-defined groups of people.

Our strategy of recruiting ad hoc the people present in the reception area also resulted in recruiting people from the friends-of-Kampen care+ community. This has

proved very useful as they are close to the residents; they know them and their problems very well. They added to the discussion with experiences from living in their own homes rather than at Kampen care+. We have also included relatives in our workshops. They often participated as observers, but sometimes commented on challenges that the residents forget to mention. They definitively contributed to a richer picture of the problem area. We also find that not distinguishing between the people in the reception area, including guests and visitors, made the project more socially acceptable and interesting. The residents did not miss out of a social possibility, and including more people made the project activity a part of the social community hence adding to the reasons for joining in.

## 6.5 Immediacy

Reducing the threshold and “seriousness” of participating in project activities made it easier for everyone to participate. The division of activities into smaller units as well as addressing smaller elements of the project contributed to making participation in the project more accessible. A second strategy was to demonstrate that the project aimed at addressing problems that they experienced in their everyday lives. We were interested in hearing about their technology problems, and also offer help in solving (some of) them [32]. Their problems were often not difficult to solve (e.g., in the weekly Thursday evening workshop), and the concrete offers to help acted as a door opener for the project as a whole. More people became curious about participating. The difficult part was to have them understand the mutuality of the process where they learned something and we did as well. The “aha moment” demonstrating that learning had happened, often occurred when some concrete problem was solved: just talking about a technical feature did normally not result in increased understanding [33]. Problems and solutions needed to be concretized to contribute to the mutual learning.

As a way of increasing the old residents’ understanding of technology design we arranged “testing of materials”. An example is the co-construction of the radio buttons: we brought buttons with very different properties: form, size, material, color etc. and had them look and feel their way to a decision about the best solution. The pedagogy principle of “show, not tell” was also useful for understanding the interaction mechanisms as well as the possibilities for design options.

## 7 Fragments Making a Picture

PD is first and foremost characterized by its organization of work, distributing design work to users and learning to the designers [4, 9]. Organization of PD, like all organization of work, is concerned with the division of the work into tasks suitable for the available work resources as well as the coordination of these tasks to a coherent whole. PD with old people puts particular requirements to what kind of tasks can be carried out by the participating old people, and how the task performance is organized.

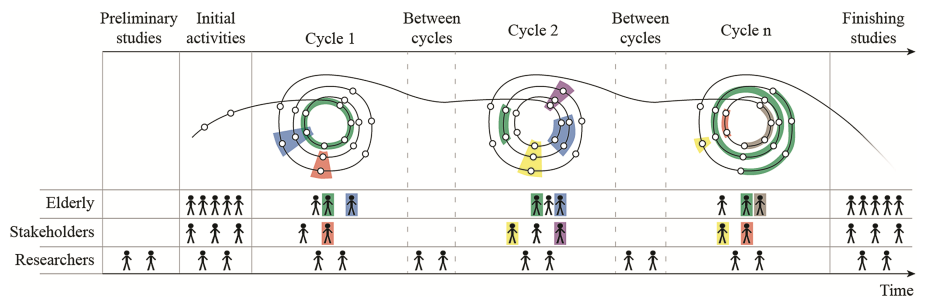
7.1 Time

When collaborating with old people time is crucial: the scope of the project, the planning horizon, the stamina of the participants, the maintenance of dialogue over time, and the everyday rhythms that structure the days at home. All the topics discussed in Sect. 6: recruiting, timing, continuity, representativity and immediacy, refer to how old people experience time differently – and as less time. The commonly experienced loss of short-term memory makes the immediate concrete activity more important: abstractions and representations beyond oneself in the here-and-now-communication is not engaging or even understandable. The topics of representativity and immediacy both concern the reluctance to deal with issues outside of the context or situation. Hence, the transferability of the PD results needs to build on more general knowledge about old bodies and old people’s habits, needs, and quality of life.

7.2 Assembling the Pieces

The design of small-enough work tasks for the participants’ competencies and abilities resulted in a complex collection of small PD projects that each contributed with a PD result. The larger PD project aimed at designing technical support for old people to live independently longer at home emerges from these bits and pieces of that support. However, participation in the larger PD project requires more resources than the average resident-participant has got.

In order to see the bigger picture, we put together the puzzle of participants and activities (see Fig. 3). In each of the three phases we have represented how our residents participated, giving an overview of the types as well as the amount of activity. We see that many residents only participated in one kind of activity (e.g., workshops) but for several iterations and in several phases. We see that some participated in a full iteration, and we see that some occur in all phases but in different ways.



**Fig. 3.** A description of the actual participation over time in the overall PD process (Color figure online).

The bigger picture also shows that the continuity of the larger PD project is the use context: the everyday living at Kampen Care+, and that there is a community of resident-participants. The community as a whole has more resources and capacities than any

individual participant. By utilizing the larger (use) context we can involve the community to participate in the larger PD project.

## 8 Tailoring PD to Old People

Our aim in this paper has been to discuss how PD can be tailored to users such as the old residents at Kampen Care + . We have argued that we needed to divide the PD work in smaller pieces that fitted the capacities of our resident-participants. Furthermore, by utilizing the use context as a frame for the larger PD project we made it possible for them to also influence the bigger picture emerging from the puzzle of the pieces. Cooperation in PD is based on mutual respect and trust, which in turn is based on knowledge about each other's perspectives and competencies. The careful timing of PD activities as well as the utilization of the use context to support the continuity in and between activities contributed to establishing the necessary common ground. Mutual learning is a fundamental characteristic of PD, and is not so easy to achieve in practice. Our resident-participants learned from small activity chunks, supported by reminders happening in regular patterns of activities (like the Thursday IT workshops) as well as from the activities that supported the continuity between activities. Our own learning happened as we discovered the practical and rather mundane problems that the old residents experienced, some very easily solved and some easily solvable with a better design [38].

PD often focuses on technology questions and hence looks for problems that can be solved by technology. This is alien to most of our old resident-participants, but characterizes most of the smaller projects organized around a problem or a solution (like most of the student projects). The most difficult part of the project was therefore to facilitate the resident-participants in getting enough time for reflection and for developing their own questions and wishes; resisting the urge to drive the process too fast and influence too much a technology focus. Coming closer to a process where their worldview decides the moves have led to different designs and priorities in design. Old peoples' lives are both more fragmented and have more continuity than the average (younger) designer's life. Assembling the pieces of PD into a larger context of mastery of technology hence resonates differently for the two groups. The patience to build a continuous account from smaller snippets of stories is the basis for critical thinking as well as alternative designs for old people.

PD emphasizes co-construction of solutions as well as of problems. Our project showed that activities that demonstrate that the knowledge of the user-participants is necessary for a successful design result are needed for co-construction of form and function to happen. The detailed co-construction of the radio button showed that a concrete design task was engaging while more abstract developments (e.g., navigation) needed to be concretized in order to facilitate participation. The many prototypes co-constructed in the project contributed to concretizing what technology can do, and acted as a basis for the resident-participants' imagination and evaluation in the design process.

PD is about participation, and working with the oldest old sets limits to the forms and level of participation in design. Getting to know the old residents over time certainly improved our abilities to facilitate their participation, but we also needed the

supplement of others who sometimes represented the interests of the residents better than they could do themselves. Our experience is, that redesigning PD methods to fit the capacities of the users, enabling them to participate, can result in really novel and innovative solutions.

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