

Using a Co-Design Methodology for Research on Environmental Gerontology

Morales E*, Rousseau J and Passini R

Researcher & Adjunct Professor Centre interdisciplinaire de recherche en réadaptation et intégration social, Université Laval, Québec, Canada

Introduction and Literature Review

Environmental gerontology has addressed the description, explanation, and modification or optimization of the relationship between seniors and their environment [1-3]. In all likelihood it seems imperative to have a serious understanding of this relationship and yet, imagining other people's experiences (seniors, children or adults) is one of the most difficult tasks one can undertake. This is probably why, in the past few decades, a few designers have moved closer to the needs and aspirations of future users [4]. In the 1970s in Norway, Sweden and Denmark, a "Collective Resources Approach" (CRA) was born as a result of trying to increase the value of industrial production. The CRA attempted to empower trade unions and workers at the local level by exploiting the needs of the highly integrated Scandinavian economies to constantly improve their technology using the workers experience to do so [5]. This "democratization of design," as some authors call it [6], considered the workers (users) of the machinery as "experts," who provided significant input into the design procedure. This idea of including users in the process of designing an object was soon adopted as a marketing strategy for product development and enjoyed significant success [7].

By the 1980s, two approaches with similar characteristics were established in parallel in Northern Europe and in the United States. The user-centered design approach [8], applied mainly in the United States, takes the user as a "subject" who is observed and interviewed by trained researchers. User involvement is limited to developing specific tasks and/or providing their point of view of a particular product or concept. The participative design approach [9] sees the user as a "partner" who provides expertise and participates actively in the early phases of the design process [10-12]. Today, several authors [4,6,13] in the participative design domain have redefined and extended the limits of this approach and promoted new processes known as co-creation and co-design. Co-creation refers to the act of collective creativity shared by two or more people, and co-design to the creative process in the design field exclusively, which is only one part of co-creation.

The user is slowly beginning to be included by both design practice and design teaching at universities. Most examples of the application of co-design can be found in the fiercely competitive environments of the software design, high-technology and telecommunications industries, due to the ephemeral nature of the value of "new features" in new products in these fields. Little work has been done in the conception of spaces with these methods in the field of architecture, except for some isolated examples Ivey and Sanders [7] and Sanoff [10].

Elizabeth Sanders has devoted the last 15 years of her career to promoting and developing research tools and strategies for design research within the co-design approach. The purpose of these tools (e.g., collages, diaries with everyday life experiences, etc.) is to focus on the user's experience in order to better grasp the problems to be solved and then to use that experience to generate new ideas with the user's participation. Back in 2001, Sanders proposed a methodological framework to explore users' experiences, harness their creativity and help them to express that creativity. It consists in four steps developed in several sessions: the Immersion step (1), where the participant

is introduced to the phenomenon that is being investigated and has to think about it; the Activation of feelings and memories (2), which explores the participant's thoughts, feelings, and ideas about the experience being investigated (through documented self-observation, written or photographed); the Dreaming step (3), in which the participant imagines the ideal experience regarding the phenomenon investigated; and finally, the Expression step (4), aimed at imagining future scenarios and communicating them. In addition, Sanders suggests a number of research tools to be used during these steps to evoke participants' memories and help them express their ideas. The research tools are predominantly visual, such as carefully selected drawings or photographs that might be used in techniques such as "collage" for purposes of expression [7].

The long-drawn-out process of integrating and disseminating co-design/participatory design methods throughout the design community has been a difficult one, mainly for the following reasons:

1. The belief that all people are creative is not commonly accepted [14,15].
2. There is a common idea that participative design research is more related to academic endeavor and has little to do with industrial competitiveness.
3. Co-design research is looked at as an "expensive step" in the design process that only a few clients are willing to pay for [4]. This is because it requires several sessions.
4. Co-design has been criticized for its lack of formalization, making it complex to implement. The creative process is very complex and seems to work differently in each individual; thus it is difficult to adopt the steps proposed.
5. Co-design has been attacked for focusing on the early design phases while putting less emphasis on the later stages of the design process [16].
6. Another difficulty associated with this method is reaching a consensus in the democratic process, taking place in a series of sessions, which "jeopardizes" its efficiency [4,17].

In the design and application of the methodology presented in this paper, there was an effort to attend some of these aspects, particularly by simplifying the whole process while trying to improve its efficiency.

***Corresponding author:** Ernesto Morales, Arch., Ph.D, Researcher & Adjunct Professor Centre interdisciplinaire de recherche en réadaptation et intégration social, Université Laval, Québec, Canada, Tel: 418-529- 9141 #6030; E-mail: ernesto.morales@cirris.ulaval.ca

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Although every step of the methodology presented in this paper will be explained later in this document, Table 1 succinctly elucidates the main differences between Sanders' framework and the methodology suggested in this paper.

The adaptation of Sanders' framework to the methodology proposed in this paper involved merging some of the steps she proposes and adding new ones. The main differences are:

1. The process in Sanders' framework seems to demand several sessions. In the methodology presented in this paper, the "immersion," "activation of feelings and memories" and "dreaming" steps become one single step. This simplification responds to the main criticisms of co-design as being an expensive method that lacks formalization and is complex to implement, jeopardizing its efficiency. Merging the first three steps of Sanders' framework not only helps the user to acquire a better understanding of the whole phenomenon at once but also saves money and optimizes time and energy invested in data collection.
2. While Sanders' framework focuses exclusively on the promotion of creative thinking and its expression, this is just one part of the methodology presented in this paper.
3. There is a clear differentiation between researcher and designer in most of Sanders' publications. However, the methodology suggested in this paper is mostly oriented toward architects and designers willing to make innovative solutions based on in-depth research with the active involvement of key participants; thus, the roles of researcher and designer are merged into one. The role of the researcher/designer is explained in more detail in step 2 of the methodology in this paper.

Main Objective

The objective was to propose a comprehensive co-design methodology for environmental gerontology intended to rethink objects and spaces. This methodology includes four steps: Exploration, Co-Design, Validation and Development. Each step is illustrated in a research project using this methodology that aimed to rethink bathrooms for seniors with mobility problems. A few examples of the results obtained by using this methodology are included.

Co-design Methodology

Qualitative research seems to favor a more in-depth understanding of seniors' needs and their interactions with their environment when

designing and building new objects and/or physical environments [18]. The main emphasis is placed on the characteristics of individuals, objects, processes, experiences or meanings given, which are not experimentally examined or measured in any way [19]. In qualitative research, there is an intimate relationship between the researcher and what is being studied. The co-design methodology suggested in this paper is a good example of the intimate relationship or involvement of the researcher/designer with the object of study in order to come up with solutions in the environmental gerontology realm. The following paragraphs will explain in more detail each step of the methodology suggested.

Exploration

It could be said that this first step uses an "experience-centered approach," explained in the introduction of this article. Most of all because the expression of the participant's lived experience is the most relevant aspect in this step and it can include all the actors who have something to do with the phenomenon being investigated.

Objective: Better grasp the research problem/situation and the participant's experience. There are three fundamental aspects to take into consideration:

Generate awareness of the investigated phenomenon in the participant. This is the necessary first step in environmental gerontology – the trigger to start thinking about the problem. The explanation of the problem has to be clear and understandable for everybody, regardless of their background; it may include graphic material to enhance the impact on the participant. The activation of feelings and memories, along with reasoning and questioning, begins the moment the participant is introduced to this information through associations with her or his personal experience.

Identify the participant's needs and problems concerning the phenomenon in question. Determine the resources and facilitators as well as the problems.

Understand the participant's personal experience in relation to the phenomenon that is being investigated.

Dissect the vast concept of experience into elements that conform to experience itself, such as:

- Knowledge (what they understand about the phenomenon)
- Feelings and sensations: The feelings involved (fear, relief, hate, love, passion, anguish, indifference, etc.), and sensory features

SANDERS' METHOD	ADJUSTED METHOD Each step is explained in detail in this document
1. The Immersion step, where the participant is introduced to the phenomenon that is being investigated and has to think about it.	1. Exploration (Steps 1, 2 and 3 in one session) This step aims to gain a clear understanding of the problem by exploring the participant's (user's) feelings and experiences. It is also intended to generate in the participant a certain degree of awareness, and therefore reflexive thinking, about the research problem.
2. The Activation of feelings and memories, which explores the participant's thoughts, feelings, and ideas about the experience being investigated (perhaps through documented self-observation).	
3. The Dreaming step, in which the participant imagines the ideal experience regarding the phenomenon investigated.	2. Co-Design Active collaboration between the participant and researcher/designer to come up with new ideas for possible design solutions to solve the user's problems.
4. The Expression step, aimed at imagining future scenarios and communicating them.	3. Validation Focus groups with specialists to evaluate the pertinence of the ideas generated in the previous step.
	4. Development Translation of the validated ideas into prototypes for testing and production/construction.

Table 1: Sanders' framework and the one proposed in this paper.

(warm, painful, hot, cold, pleasant, rough, soft, etc.) are the hallmark of the concept of experience [20].

- Expectations (what they think the experience should be). The participant's understanding of what he or she expects from the phenomenon seems to be filtered by the culture in which the individual lives [21].

All these elements can be studied by interpreting the personal expressions of the participant who lived through the experience [22] by means of representation of the experience orally, written or graphic [23].

Tools & Methods: The exploration session can make use of different methods such as structured or semi-structured interviews, questionnaires, focus groups, etc. Semi-structured interviews seem to provide a greater breadth and depth in understanding the participant's experience and it includes a number of open-ended (in-depth) questions that allow participants to express their responses more freely.

Challengers/Things to Look for: The challenging aspect of working with the concept of experience is that it is personal – it is perceived from the point of view of the individual. As it is “personal,” the researcher might find that some people might have difficulty expressing themselves freely, as can happen in any research methodology including interviews. It takes time and energy from the interviewer before the participants start to talk openly. Once participants are able to “share” their experiences, they might answer questions and provide details or apparently irrelevant information that might not seem to have a clear relationship with the subject matter being investigated. It is important to consider this type of information as it often supplies the unexplored angle for a design proposal.

The most advisable location for the exploration step to take place seems to be where the phenomenon occurs (i.e., interaction with a particular built environment). The participant will remember problems and/or experiences more easily if the built environment is in front of him or her.

Co-Design

Objective: Promote creative thinking so participants and researcher/designer can work together to design possible solutions to improve the phenomenon being studied.

Role of the researcher/designer: The researcher/designer has two main tasks to develop during this step. The first is to understand, clarify and even translate what the participant is expressing, indicating patterns or other elements that can help to determine the idea [5]. In doing so, the researcher/designer has to draw the description of the participant's idea and corroborate whether it corresponds with what the participant was thinking. The second task goes hand in hand with the first one; it is to help “fill the blanks.” Due to their training, designers have the ability to give graphic forms to oral words, and this skill is what applies an interesting shift to this methodology in environmental gerontology. This is collaborative work and the designer has to help shape the ideas that come from the participant's experience.

Tools & methods: Elaborate on previously designed exercises that might include “tools” for the participant. Ideas, related memories, feelings and creative thinking are expressed in the form of oral expressions, written texts, drawings, collages and models. The criteria for the creation of a tool include some of the following suggestions:

- Visual tools are the most appropriate as they are clear to the

eye and so new ideas can arise more easily based on the images shown. Use graphic examples of the activities developed, sensations experienced and feelings related to the phenomenon in question.

- Create an “individual brainstorming session” with images showing significant differences or opposite examples of the phenomenon being studied or elements related to it.

Including other users in environmental gerontology (e.g., nurses, doctors, caregivers, etc.) in addition to the main one (e.g., the patient, senior, etc.) is fundamental. Assuming that all human beings are creative, one can easily think that, during these people's everyday life experiences and interaction with the phenomenon being studied, several ideas may have crossed their minds about how to facilitate their interaction with their physical environment. Allowing participants to be part of the design process gives the designer an opportunity to gain a better understanding of their experiences and therefore arrive at a more appropriate solution with them.

Challengers/Things to look for: The main obstacle in any co-design methodology is the lack of stimulation, motivation or input among participants who do not feel themselves to be creative enough to find a solution and therefore refuse to invest much time or energy in the project [24]. The recruiting process needs to anticipate this situation by carefully studying prospective participants' reaction when the project is presented.

Validation

What is called “validation” in this paper is the presentation, confrontation and/or corroboration of the ideas from the co-design sessions during consultation with experts in particular fields (e.g., doctors, occupational therapists, manufacturers, building managers, etc.).

Objective

- Evaluate the pertinence and feasibility of the ideas from the previous step.
- Enhance those ideas that are worth exploring.

The user's experience is greatly shaped by his or her interaction with the physical environment, which is shaped by many actors, including designers, manufacturers, and construction managers. Each of these key actors has a say in how they experience a design solution and what it should be like, according to their personal and professional point of view. The richness of our methodology in environmental gerontology is precisely that it gathers different points of view regarding a particular phenomenon in order to better grasp all the elements that must be taken into consideration in the design process. Validation, in this case, becomes a filter, a research strategy to exclude designs that pose more problems than solutions and retain those with more potential.

Tools & methods: Focus groups or semi-structured interviews [25] with key participants seem to be appropriate methods for establishing parameters for the unlimited process of creation in order to reach realistic, viable and sensible solutions.

Challengers/Things to look for: Gathering the right people: it is important to search for key actors who will contribute significantly to nurturing the project.

Development

This step is the necessary translation of the “validated ideas”

into plans or layouts that will result in the eventual fabrication of a prototype (for testing purposes and then production) or building of a physical environment (e.g., household, park, hospital, etc.).

Objective: Translate the results of the research and the information gathered into an object or a built environment. It is possible to identify at least two or three phases in this step: translation, implementation and testing. The translation phase includes the laborious process of solving all the technical problems (materials, systems, joints, parts, molds, etc.), along with functional and safety aspects. The implementation phase means finishing the construction plans for the project and building a prototype for testing purposes.

Throughout this step, it is important to continue the participants' involvement in the study as they can contribute different perspectives and ideas throughout the process of solving every small problem and defining every detail of the project. Economic resources contribute one of the most important elements in this final step, and participants in this field can provide the expertise to achieve feasible solutions and even help to build them.

Tools & methods: Create construction plans and layouts and present them to focus groups or specific key participants.

Challengers/Things to look for: Although the methodology presented in this paper promises appropriate results due to the participation and intervention of all the possible actors, testing is mandatory. Ideally, the prototype or solution should be tested and modified for the final design; however, this depends entirely on the characteristics of the project. A major challenge in this step is the fact that building a prototype or a physical environment requires a significant amount of time, energy and, most of all, money.

This is probably one of the most difficult and challenging steps of all, due to its complexity. Still, being able to transform the research into action – into something tangible – is the ultimate aim of research and design.

Application of Co-Design Methodology

The research project in which this method was applied was developed in Montreal, Canada, and had the goal of rethinking bathrooms for seniors with mobility problems, mainly because many authors consider the bathroom to be the most difficult space at home for adults with impaired mobility [26-28],[30]. Moreover, functionality and security seem to be some of the ruling features of the many design solutions on the market to adapt bathrooms for this particular population; comfort, on the other hand, seems to be neglected. Following this stream of thought, the main objectives of this study were to explore the experiences of seniors with mobility problems in their bathrooms; and to develop conceptual ideas on how to rethink the bathroom not only in terms of functionality and security but to promote comfort as well.

The target population was elderly individuals (aged 65 and over) with motor disabilities who use different types of aiding devices to move from one place to another. Eight individuals with different characteristics were recruited in order to address different interactions with the built environment: a man and a woman who used a wheelchair; a man and a woman who used a walker; a man and a woman who needed to use both wheelchair and walker alternately, depending on the situation; and finally, two caregivers (aged 18 and over) responsible for assisting seniors with their hygiene. These were formal caregivers recruited from the same retirement residence for autonomous and semi-autonomous seniors. The recruitment criteria were their skills

and experience in helping with the bathroom activities along with not assisting any of the participants in this research at the moment of the study. Seniors with cognitive problems or severe hearing or visual impairments were excluded from this study.

Half of the participants were recruited at a private retirement residence with autonomous and semi-autonomous seniors who live in small apartments, and the other half in a clinic for seniors, among the patients of the occupational therapists (OTs) working at this clinic. Each participant was visited by the researcher in his or her home or retirement residence once a week for three weeks. The mean length of each visit or session was 35 minutes. All sessions were tape-recorded and photographs were taken of the bathrooms.

Exploration

The exploration step took one session with each participant and it aimed to generate awareness of the senior's situation in their bathroom; identify their problems of accessibility and usability in their bathroom; and understand the participants' limitations and procedure of their activities in the bathroom.

Generate awareness of the investigated phenomenon in the participant: The first author read out loud to each participant a text in which the project was clearly explained. In addition, all the comments and questions regarding the pertinence, procedure and main objectives of the project were answered and discussed with each participant. The document was left with the participant so she or he could read it again.

Identify the participant's needs and problems concerning the phenomenon in question: During the first meeting, the first group of questions sought general information such as age, number of people living in the house, number of bathrooms in the house, pathology; how the participants used and circulated in the bathroom from the moment they woke up in the morning; what problems they faced in the bathroom and how they solved them, etc.

Understand the participant's personal experience in relation to the phenomenon that is being investigated: The second group of questions explored the participants' problems and current experiences (do, feel, think, etc.) in the bathroom. For example, we were interested in learning how the use of a wheelchair or walker had changed their everyday life in their homes; the characteristics of their different experiences in their bathroom before they had the motor disability and after; what they liked the most and what they disliked the most about their bathroom. In addition, we asked about their use of the space before they had their mobility problem. This question was intended to guide the participants to compare their past experiences in this space with their current ones. Other questions elicited a description of the feeling of being clean after using the bathroom and addressed the relevance of privacy in the bathroom (are there some activities that require more privacy than others?).

All of the participants' bathrooms had a seat in the bathtub that is placed over the side of the tub's outside edge. This solution allows users to sit down and move their legs into the bathtub so they can take a shower. Regarding the use of the bathtub, the following quotations illustrate the nature of the participants' difficulties and frustrations due to their limitations.

"If I could have something to help me get into the bath and get me out of the bath, if I could have a bath now, that would be a dream come true. Imagine, it's been more than 10 years that I don't have a bath!"

An 81-year-old woman, who broke her hip seven months before this interview, expressed the difficulties she experienced in her bathroom:

"It's not easy! It's hell on earth! Because it's difficult to move, to change from one position to another... and also because it's too small, you cannot put the walker with the wheelchair at the same time, it makes me feel... cramped and not comfortable... it produces anguish and fear. There's nothing worse than a fall in the bathroom, you can break all kinds of things."

Here is a 98-year-old man who uses a walker to move from one place to another. He moves at a slow pace and does not show more severe problems:

"I slipped in the bathroom and I couldn't get up, couldn't lift myself up, my wife called emergency downstairs, and two people came to pick me up."

The quote below is from a caregiver who expresses a similar fear of falling along with her patient

"Most of the time I have to ask for help... he [her patient] sometimes falls because his good hand is weak when he grabs the bar, and then my girlfriend and I have to pull him out of the bathtub and try to get him on the chair, it's hard and sometimes he doesn't help."

At the end of the interview, a notebook, a pencil and an eraser were provided to the participant, who was left with some "homework." Participants were asked to think about possible ways of solving their problems and/or promoting more comfortable experiences in the bathroom and to write down or draw their ideas in the notebook for the next meeting the following week: "let's say you have thousands of dollars and you want to renovate your bathroom to make it more comfortable. How would you do it?"

Co-design

Objective: Promote creative thinking so participants and researcher/designer can work together to design possible solutions to improve the phenomenon being studied.

The co-design sessions took place in the weeks following the exploration session. As mentioned before all sessions were recorded. The immediate action was to validate the data with each participant in order to confirm the exact meaning of the information provided in the previous session. Thus, the researcher would review the main aspects that came out during the previous interview. Once this was verified, a graphic tool was presented to give the user some references and let him or her come up with new ideas. The graphic tool consisted of a PowerPoint presentation showing images of bathroom solutions for seniors with motor disabilities contrasted with images of spa-like bathrooms. It began with the sink to illustrate all the activities done in this area and the "sliding panels solution" provided by Abir Mullick from the University of Buffalo [29] Figure 1 and Figure 2.

Then the presentation showed some examples of solutions for the toilet such as Figure 1, contrasting with the image of the "Toilet-bidet model from Toto." The main objective of displaying the "raised seat" model shown in Figure 1 was to emphasize the fact that, despite the functionality of the solution, the aesthetics of the space is evidently altered Figure 3.

In addition, other images were presented in relation to "accessible solutions" for the shower and bathtub in contrast with spa-like images of sophisticated bathtubs Figures 2 and 3. The aim of these images was to encourage the participants to generate mixed emotions about the

space, and how it seems to be "unfair" to deny them access to more comfortable and more aesthetically appealing spaces. This reaction was achieved in almost all participants.

The participants were then asked to show their "homework" and discuss their ideas with the interviewer. Participants described their ideas while the interviewer simultaneously drew them in a sketchbook, based on the participant's description. At the end of the session, the participant was asked to keep the sketchbook with all the drawings and to think about refining the solutions and write or draw new ideas in the book for the next and final session. The last session consisted in the development of the basic features (color, materials, installation, cleaning) of the design solutions from the previous session Figure 4. Since the ideas drawn were based on the participant's description

Along with some input from the lead researcher, the graphic data was validated at the same time. Three examples of ideas generated in this way are presented below Figure 5.

Magic Cube

- This is a more sophisticated version of the walk-in bath. There is no step from the outside to get inside.
- It has a sliding door that is much easier to open and close.
- The back can be lowered so the user can lie down as comfortably as in a bathtub.



Figure 1: High seat.



Figure 2: Bathroom solution for seniors with motor disabilities.



Figure 3:

- It allows the option of including a Jacuzzi and has grab bars on every side of the tub.
- It can be used as a regular shower, as everything is pliable into a cube, set up next to the shower Figure 5.

Standup Toilet

Some of the participants had difficulties sitting down on and standing up from the toilet. This idea came from a man who had suffered a stroke and wanted to facilitate the use of the toilet.

- The goal is to have a higher toilet bowl for people who have problems lifting themselves up from the toilet bowl. It can include grab bars on each side Figure 5.

Support Bars

- These are movable support bars allowing users to recline or support their weight completely and thus maintain a steady and secure position, helping caregivers to wash them properly and easily, and without getting wet.
- The goal is to create support solutions for users with motor disabilities to help them feel secure and to facilitate the hygiene task for caregivers.

Validation

Objective: Evaluate the pertinence and feasibility of the ideas from the previous step.

Enhance those ideas that are worth exploring: In order to validate the graphic data, a focus group with OTs was organized to determine the viability and pertinence of each solution. Three OTs who specialized in home adaptation, had more than five years of experience and did not work together in the same clinic were contacted. Twelve solutions were presented for analysis. The criteria for choosing the 12 solutions were originality, not already being on the market, and clarity.

The focus group served as a filter to discriminate the solutions that best fitted the seniors' needs. According to the OTs' comments, some of the ideas had to be excluded because they were not pertinent, others could be reworked and/or blended with other ones, and a few of them were very good the way they were. The same three examples are presented here to illustrate the results of the Validation step.

Occupational therapists' comments on Magic Cube solution

The shower has to be closer to the user for easy access and control, and there have to be vertical grab bars to help the user to stand up Figure 7. The seat should move in relation to the back so that the person will not slip when the back is reclined. A lever has to be incorporated into the design to give full control over the inclination of the seat. It also needs a support for the feet. The door is fine because it is big and allows users to have someone to help them. The cleaning of the space is something to take into consideration, especially with the sliding door and the floor.

Occupational therapists' comments on Standup Toilet solution

This idea could create major difficulties for people with balance problems Figure 8. Grab bars on each side need to be included, but the main problem is the lack of adjustability; thus, not many people may be able to use this solution. Moreover, the best position for elimination activities is squatting, so this idea might cause some performance difficulties.

Occupational therapists' comments on Support Bars solution

This idea could be feasible but needs further exploration Figure 9. The main concern is the senior losing his or her balance and falling backwards. The idea of putting the whole weight on the upper bar could help the caregiver's work, but is not necessarily a good thing for seniors.

Development

Building prototypes is expensive, and it is even more expensive to build the molds and necessary equipment for the production. For this reason, the Development step has not been completed yet. A grant application to obtain the funds necessary to complete this step is currently being completed along with meetings with private companies. If the results of these funding opportunities are favorable, bathroom-fixture manufacturers and construction managers will need to be actively involved in this process. In addition, recycled materials and sustainability are a priority in the development of this project in order to solve more problems and not create new ones. One challenging aspect, currently being investigated, is cost reduction, in order to make

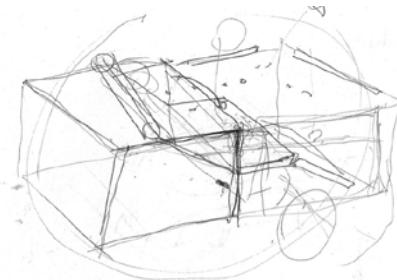


Figure 4.1: First draft of the Magic Cube.

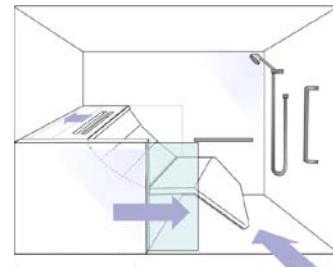


Figure 4: Magic Cube.



Figure 5: First draft of the Standup Toilet.



Figure 6: First draft of the Support Bars.

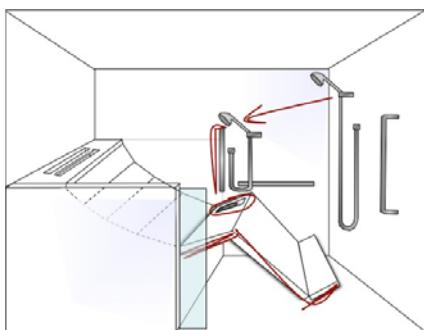


Figure 7: Magic Cube with O.T.'s observations.



Figure 8: Standup Toilet, without modifications.

the propositions as affordable as possible and meet the needs of a larger segment of the population.

Discussion

The work developed by co-design authors such as Sleeswijk Visser et al. [13], Stappers [4] and others, but specially Sanders (from 2001 on), has to be acknowledged as a turning point for the traditional design process. The methodology presented in this paper aimed to shed light on existing co-design methodologies with a rather simple way to follow up the design process. It also envisions its application to the field of environmental gerontology and health-related problems where an appropriate design solution can make a significant difference to seniors. Probably the main problem with Sanders' proposal is the time invested in several sessions for its development. Merging the "immersion," "activation of feelings and memories" and "dreaming"

steps of [8] framework into a single step to be developed in one session can help co-design to be more efficient and less expensive.

A different kind of "merging" happens to the role of the person doing the research and the designer, who are one and the same. This again follows the same logic of simplifying procedures, aimed at architects and designers who are willing to make innovative solutions based on in-depth research with the active involvement of key participants. For most designers, the translation into forms and shapes of what the participant is expressing orally or through notes and drawings comes more or less naturally. While the researcher/designer is corroborating the description with the participant, it becomes a brainstorming session for both of them; in the end, they are able to more efficiently achieve a higher degree of definition and development of the original idea.

"Consultation with experts" seems to be a very fruitful experience in the design process. Following this stream of thought, the validation of the ideas suggested by the users seemed to be the next logical step. On the down side, co-design methods have been criticized for their complexity; thus, adding an additional step (Validation) to an already complex methodology seemed a difficult task. Nevertheless, the validation step proposed in this paper is intended to be developed in the simplest way possible through small focus group(s), as shown in the application of the methodology.

There are other aspects in any co-design methodology that play an important role in their development, such as selecting the "right" participants who will provide valuable input to the project. Another element is imagining a physical environment when working with participants who are unfamiliar with the design and architectural domains seems like another challenge. In the particular case of the application of the methodology to rethinking the bathroom, the characteristics of the space and the users' familiarity with it made it easier for the participants to imagine.

In exploring more comfortable and more aesthetically appealing bathrooms for seniors with motor disabilities, our findings suggest that comfort in the bathroom is a rather modern concept that most of the participants in this research were not necessarily familiar with, as they used their bathrooms in a utilitarian way. Furthermore, living in a situation in which health and autonomy have been affected has an impact on an individual's priorities, and makes comfort in the bathroom appear rather unimportant compared to safety. Most participants expressed a genuine fear of falling in the bathroom; in fact, one participant had already fallen, while the rest feared doing so. In the eyes of the participants in this research, the contemporary bathroom,

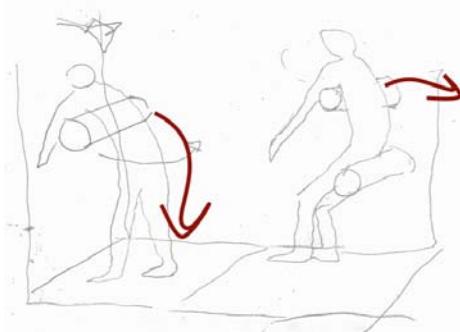


Figure 9: Support Bars with O.T.'s observations.

despite some adaptations such as grab bars and shower seats, is far from being a comfortable space as it primarily induces stress and fear [31].

Lessons Learned: The researcher/designer's experience in this research project was very enriching, as astonishing ideas emerged throughout the data collection process. The ideas proposed by the participants seem very promising, especially because of the participation of the caregivers and the intervention of the OTs. In the particular case of the standup toilet, for example, it seemed to be a good idea at first glance, and yet it was unanimously rejected by the OTs. As for the Magic Cube and the support bars, both presented some problems but were found to have some good qualities as well. Some problems seemed to be solved after the meeting with the OTs, which served as the basis of some of the solutions to be developed in the next step. Therefore, the relevance of including a clinical point of view in the development of a co-design methodology in environmental gerontology seems mandatory in order to provide a more accurate solution.

The tools for expression were simple. The participants would write or draw their ideas without any special techniques. Both caregivers provided very important input into the graphic data with their drawings and their proactive attitude to the whole process of co-designing. Most of the senior participants preferred to make notes to remember their ideas for the second and third sessions. The fact that the first author was able to draw the senior participants' ideas based on their descriptions was a valuable asset for this research. In the fields of architecture and design, being able to draw and represent a space or object on paper is almost mandatory; thus, this should not be a problem for future applications of this methodology by designers/architects willing to do research in their domain.

Conclusions

It can be said that the application of the co-design methodology presented in this paper remains "incomplete" as no prototypes of bathroom solutions have been tested nor have any potential fabricators been involved yet. Still, this is not to say that valuable conclusions cannot be drawn from it. In the qualitative research presented above, users as "subjects of study" were observed and interviewed in session 1 (user-centered approach) and became "partners" (participatory design/co-design) in the creation of new ideas for the bathroom in sessions 2 and 3. The future step of Development (prototyping the idea) needs to include a test phase and revert to the "subject of study" approach. In order to make the pertinent modifications based on what was observed in the tests, it would be sensible to listen to users' comments and ask them how they would improve the design, returning again to the "user as partner" approach. This "back and forth" between methods suggests that, despite the example of the Collective Resources Approach from 30 years ago, and the significant developments of co-design authors such as Sanders, this particular type of research in architecture and design is, to some extent, still in its infancy and thus in constant evolution.

The research of the Bathroom has indeed several limitations such as the sample size. However, it can be argued that it does illustrate the application of the methodology, as the aim of this article is to provide the reader with a comprehensive Co-design methodology in the field of environmental gerontology.

The contribution of this paper resides in the combination of existing methods and procedures to suggest a simple methodology, in response to some of the criticisms that have been made about co-design and applied it to the field of environmental gerontology. Probably the most attractive feature of the proposed methodology is the effort to clarify users' roles and participation, along with the analysis and validation of

the graphic data. Moreover, the role played by the researcher/designer seems to be of utmost importance as the input added to the ideas and the interaction with each participant significantly enriched the innovative solutions.

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