I-space: Designing for and with Citizens with Special Needs

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ABSTRACT

This paper presents *I-Space*. The purpose of this project is to improve the wellbeing and life quality of mentally impaired citizens through the development of new technologies, which could enhance learning and motivation. The project is used as reference to a discussion on structures within design and innovation processes.

General Terms

Design, Theory, Innovation, users with special needs

1. INTRODUCTION -

1.1 Designing in Complex Settings

I-Space [1] is a research and development project designed and conducted in a partnership of two higher education institutions (HEI), four small and medium-sized enterprises (SME), two municipalities, and a non-governmental organization (NGO). University of Southern Denmark (SDU) is lead partner.

In the project *I-Space*, we have tried to cope with a number of challenges in developing devices for citizens (adult and children) with special needs. The overall idea was to use the potentials in games, interactive playgrounds and systems for documentation to develop a training environment, which was motivating, enabling learning and mastering and then also had the option of being able to document the progress the individual achieved using this system. To ensure adaption to the needs of the users we furthermore wanted to have different users mobilized as active co-developers.

To sum up, this means that the development process could be defined and characterized as a set of interacting complex processes. Different stakeholders and user-perspectives should not only be handled but also mobilized in the processes.

To cope with this we needed to develop a design model which was 1) solid 2) flexible 3) user involving. We came up with an understandable yet structured model, which combined observation and participation. The model we have labeled "The Quadrant Model". It has the overall purpose of generating a dynamic and structured approach to the development.

Thus it should be a kind of meta-model. In the model, we have tried to combine different traditions within theoretical and practical understandings of design and user-driven innovation into a more generic and comprehensive model.
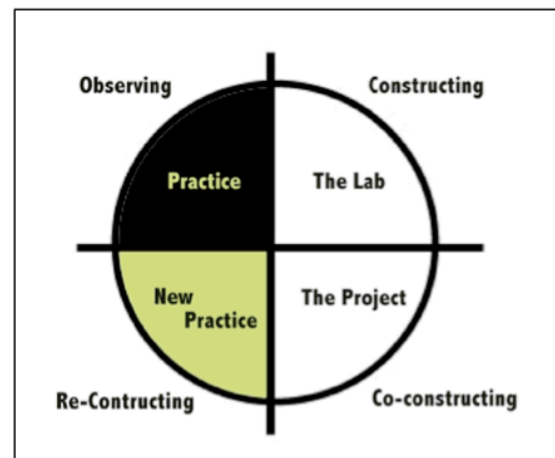

Fig 1. The Quadrant-Model

2. THE QUADRANT MODEL

2.1 A Stage Model

The Quadrant Model (Figure 1) illustrates four stages in a design process in complex settings. The model should overall be understood clockwise starting in the upper left section. The four stages represent a development in time, knowledge and (hopefully) fulfilment of the projects objectives. At each stage however iterative processes will and might occur and iterations may also take place across quadrants.

2.1.1 Quadrant I—Observation

This quadrant is characterized by initial observations on the present practice. This is about understanding the "field". The actual research was based on articulated assumptions about the practice here. These assumptions could be summarized in the following way: The users would be the users of institutional settings such as mentally impaired citizens and also the staff mainly different kinds of social workers. The work of the ladder would be to enable and develop institutional life which on the hand should enable a life with good life quality and on the other hand ensure that legislative and administrative regulations where fulfilled as well as made meaningful for the users [2]. The developed system should be meaningful in supporting and redeveloping the staff's efforts and it should also be meaningful for the users. In the actual case, this was a question of interviews, short initial workshops and video observations. This quadrant so to say directs attention towards the daily practices including local sense makings and rationalities. This initial description was not "thick" description [3] but rather sketchy. This was a deliberate choice because this description should not be valid from a scientific point of view but rather generate input and inspiration for the initial development of a prototype.

2.1.2 Quadrant II—Constructing

This quadrant delimits the process of actual proto-typing of new technologies developed with inspirations from the initial findings in Quadrant I. In the actual case, the input from the initial research was matched with an interactive playground "Jungle Gym" that one of the participating companies had developed and was selling to schools and municipalities.

Fig 2. Children playing with the interactive Jungle Gym

This so-called "Octopus" was initially developed to use the potentials of children's fascination for computer gaming with physical activities. This should re-introduce children to playing physically, and to play across age barriers and thereby enable inclusion and better fitness. The intelligent part here is 18 satellites, touch sensitive, with light and sound. The children use them to play different embedded games.

This jungle gym was downsized and made more mobile so it could be moved around and be part of a research setup in different contexts – This device was name "The dog".

Fig 3. Initial Prototype: "The Dog"

2.1.3 Quadrant III—Co-Construction

This quadrant involves application of the prototypes and therefore competencies and skills in a new way. The purpose is to use the prototypes to develop new forms of practice and at the same time to generate feedback to the developers for further development of the application. We took the device – "The Dog" - back to the institutional settings and tried it together with different user groups. The basic setup was groups with end-users, social workers, consultants from the participating university of applied science and developers from one of the participating private companies (the producers of intelligent playgrounds).

This first iteration with users and device generated the following outputs:

- The system should be much more flexible allowing users with a variety of physical and mental disabilities to us it

- The social part of the use was very important – it was important to develop social games and activities

- The game element seemed very motivating also for users with severe disabilities. Game elements and the physical set up such allow for adoption and compensation for disabilities.

- The sound design which in this initial prototype was a rather metallic arcade game type should be maintained for some users but it was scaring for others and even potential harmful for users with tendencies towards epileptic seizure.

Furthermore, we realized that there was a need for a kind of translators between the users and the developers. In the project, we were also asked to develop educational designs, which should secure that results generated within the project were implemented in basic education for social workers. We decided to combine our observation about "translators" and the goal of developing educational designs in the second iteration of "co-construction"

This second iteration was based on a re-developed prototype, which allowed for a much higher degree of flexibility. The satellites were now connected through a wifi local network. They had there own power supply. This enabled a great number of physical configurations (inside and outside) up to a distance of sixty meters. The satellites were placed in a suitcase were they

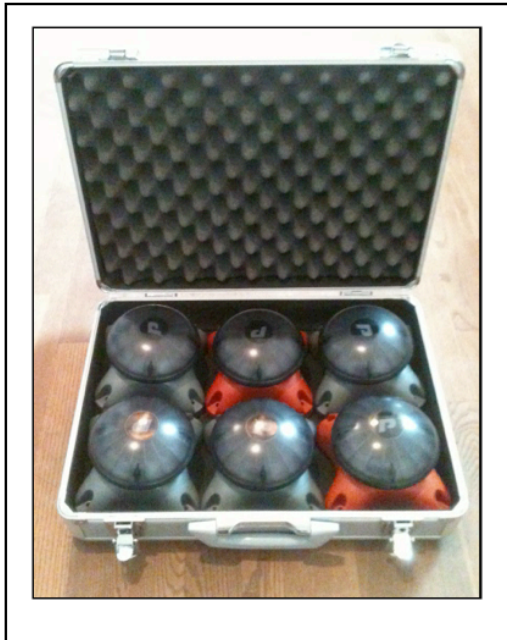could be re-loaded with electricity. – And a magnetic socket gave the option of placing them in different ways.

Fig 4. Second Prototype: The Suitcase Concept

This option of placing satellites in different configurations turned out to be very useful. Some users only used one or two satellites – others participated in set-ups where they made a kind of field courts and also treasure hunts. The technical set up was solid stable and also flexible

- The set up was easy to use for end-users and staff
- There was a need for more explicit didactic designs and game designs.
- What was useful and beneficial and for whom?

The "translators" took up the ladder point. They were young students from different educations (social workers, occupational therapists and physiotherapists). They were recruited by application to a cross disciplinary Master class, given an initial training in research and development work and then working in cross disciplinary teams together with staff and especially with the end users. Their findings were then presented to the researchers and developers not as student works but as authentic input and inspiration for the further development process.

The reciprocal acknowledgement of these young developers cum researchers and the end-users has been very beneficial for the process. In short, they have done a great work: Coming out not as a kind of internship but as authentic participants enabled them to have a valued position and opened up for a lot of input from the end-users. They were the real experts not only on themselves but also especially on their not so articulated peers.

The generated outcome of these processes were documented in a report which has been part of the input for the continuing development process – and it was also demonstrated and had feed back from developers, researchers, staff from the institutions on a conference organized by the project.
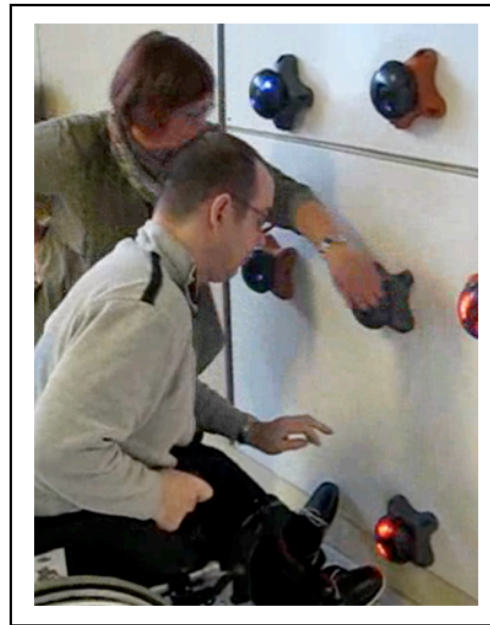

Fig 5. Social Worker and End-user testing the new Prototype

2.1.4 Quadrant IV—Re-Construction
This quadrant brings the focus to the long-term implications of sustainable innovation. Whereas, the three first quadrants are somehow outside daily practice with a focus on novelty the focus here is on how this novelty becomes un-novel, how it becomes part of a daily practice. In the present project, we have not reached this part yet, but it will involve more that just how to use the application. In general, this part is about changing processes and structure within practice.

3. PROCESS
The project is interesting because it highlights a number of challenges in design and innovation processes. It is complex and involves a number of different actors, which then again calls for a structured process. This process was (and is structured) with the so-called Quadrant-Model. This being a kind of meta-design model enabling different rationalities to interplay.

The model tried to combine different traditions within theoretical and practical understandings of user-driven innovation and design into a more generic and comprehensive model.

Learning's from the development has been:

- The Quadrant-Model has been an useful and inspiring model for the different actors in the project
- Such a model enables a demarcation of the different roles of different actors, their competences with the project
- This demarcation enables dialogue across different rationalities
- The use of prototyping is essential to the process

- Students can become important contributors to such processes if their role is authentic and appreciated.

Let us elaborate on the two last bullet points.

3.1 The role of prototypes

Prototypes are often seen as important vehicles in design – and development processes. When developing collaboratively there is a need for mediating artefacts. They open up for articulation – Thereby they become the language of the users who through the artefacts can reflect on their practice and needs. This is very important especially when you collaborate with children or adults with special needs. The artefacts are also a way to generate a common understanding of the project when you have a partnership with very different both competences and underlying rationalities in such a project. – When we try to understand practice from a learning perspective we often use Lave and Wengers (1991) notion of "Communities of Practice" according to this theory we learn by becoming part of a community, and that this becoming is a dual process of reification and participation. We do not use reifications to tell us what to do, but as ways of understanding [4]. When we then move into temporal communities of innovation, they are unstable and the reifications change and become different both through our changing interpretation of them and through the actual development of the externalization. These innovative temporal settings or "Communities of Interest" in the words of Fisher (2001) are defined by a shared interest in innovating something – and inclusion is a question of being able to offer different contributions or competences meaning that we develop communities of interest through difference not through sameness - as it is the case in Communities of practice. Therefore the externalizations become important as shared not identical reference points [5].

3.2 Students in collaborative design processes

If we follow the line suggested above we also can use his understanding as a way to understand the role of the student-researchers in the project. In participating in this project, they we defined not as novices or as Lave and Wenger call newcomers in a practice legitimate peripheral participates meaning that they are becoming part of a community through developing an understanding of values and ways of doing things. In this innovative setup, they were defined as experts. They knew about the subject matter of social work, they had the ability to establish dialogue with the users thereby they became part of the innovative community as authentic contributors and the also had these contributions evaluated not "as if student work" – but as what was relevant input to the development process.
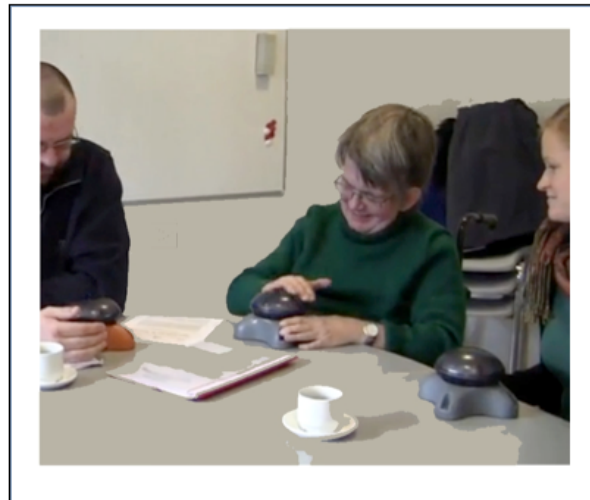

Fig 6. Collaborative Design Processes between Student-Researchers and Users

4. THE USER

The i-Space-project builds on the idea of user-driven innovation. At the same time, this very project demonstrates the complexity in speaking about users and involving users. The end-user would be the mentally impaired citizen, and it is of course important that he or she uses the application. Our research documented that two factors are at play. The application should be available for them and it should be fun to use. The availability then introduces two other user categories: The professional staff and authorities. If the professional staff, typically social workers and physiotherapists, should use and introduce this application, the results from the project seem to emphasize two important features: The application should be easy to use. In general, the staffs are not very technical or ICT-competent. Additionally, they are orientated towards what they call human values, and these values are perceived as being incompatible with technology. Therefore, the application should be understood as a pedagogical tool, and not as a technical device.

This leads to the second observation in this relation, namely that the application should enable developments and learning for the users. The availability is also a question of economic funding which then again means that we have a third user category: The funding and administrative authorities. They will fund such an application only if they are convinced that that progress among the users can be proven. Moreover, very often the funding would also be a question of whether this investment would or would not reduce staff cost. Of course this is not necessarily consistent with the interests of the social workers. Further user groups could be added like relatives.

The end-user is not a category. It is an individual and even though we make a rough category such as *mentally impaired citizens* we have to take into account that within this group we had a very complex variety of social, physical, and social characteristics. Therefore, on the one hand the application should be highly flexible and on the other hand easy and transparent to use, functionalities that very seldom are compliant.

The critical factor in the professional use is whether or not this application readily is made operational, and furthermore whether it enables the social worker to handle the dilemmas in daily life between the mentally impaired citizens' idea of the "good life" and society's concept of the good life. The social workers have a dual role. On the one hand, they are representatives of the society as such on the other hand they are enabling and advocating the citizen. The qualified social worker is a professional and capable of handling these dilemmas. And if she should use such applications they mediate these dilemmas. In the case of *i-Space,* this means that apart from playfulness the application should also offer potentials for physical (and social) progress. The embedded training program reflects this. The operationally is guaranteed by an easy way of distributing the touch sensitive satellites. Another issue here has been the fact that such items have a tendency to get lost in institutional settings. The development of a suitcase where the satellites were kept when not used solved this problem and at the same time this gave the option of having a place for recharging them.

The need for documentation was achieved by combining the physical set up with the administrative system. This meant that the system could be used as the interface for configuring the actual set-up by means of a number of templates, providing flexibility. The actual actions then again provided data that was feed back to the system. This enabled the user to get an idea of the actual development and provided documentation of the time spent on the activities and on the progress achieved through these activities.

Obviously, the "user" is always construed from a particular point of view, and as suggested we have to speak of different users. Even if one particular user or aspect is emphasized, users are still multi-dimensional.

The user becomes the negotiating point of the process and the application becomes its material transformation. The discussions are delegated in the physical devise and thereby the notion of user re-enters the process in an iterative process. Triple Helix Models are dynamic and in order to stabilize them reifications – and concepts are important. Because we do not have a stable code for the cooperation and interaction, we need an ongoing stabilizer, which continually is under construction. This is generating the cohesiveness of temporary settings.

The Quadrant-Model has scaffolded the process. The model helps the actors in the project delimit different rationalities in different phases of the project. It gives the different groups participating in the project the necessary space for shifting between open and closed processes. Open processes where the participants share knowledge through discussions on findings, prototype and, as mentioned above, user concepts; – and closed processes where they go deeper into the part that is relevant to disciplinary competence. At least in this case, innovation is a product of multi-disciplinary collaboration where different rationalities and competences become articulated through the process and where the affordances and the constraints of shared models such as the Quadrant-Model scaffold that process.

5. ACKNOWLEDGMENTS

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