Conjuring up new technology – using magic objects in co-ideation with stroke survivors

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Abstract. Ideation means to generate ideas, and when involving non-designers in these activities they need to be informed about the scope of the possibilities without limiting their imagination. This is a general challenge, which becomes particularly important when it comes to advanced technology ideation together with participants that may not have in-depth knowledge of technological designs and solutions. In this study, we supported the ideation process by presenting a kit of *magic objects* (consisting of cards and physical props) to stroke survivors participating in a co-design workshop carried out within the STARR EU project. The kit was seen to generally work well, but improvements are suggested for the introduction, the design of the cards and the number of objects used.

Keywords. Ideation, co-design, participation, stroke, magic, health, risk reduction

1. Introduction

Fitness and health apps are in almost every smart phone, and it is possible to measure a large variety of health-related data. With the help of smart wristbands, GPS and other combinations of sensors it is possible to measure steps walked, distance covered, sleep patterns, heart rate and time spent not moving, for example. The interest in health and fitness apps by the general public is a growing market of great importance. According to (research2guidance, 2016), there were about 259.000 health and fitness apps available on the major app stores in 2016. Health and fitness apps are used by 33% of the consumers and wearable technology by 21% of the consumers (Safavi, Ratli, Webb, & MacCracken, 2016). Users of health apps and wristbands explicitly state that they use the apps to keep better track of their condition or keep them healthy, and the most used app types relate to fitness and nutrition/diet.

For persons who have survived a stroke, making conscious changes in their life-style (to avoid further strokes) is even more important on an individual, as well as societal level. There are risk factors connected to stroke incidence (c.f. (Wolf, D'Agostino, Belanger, & Kannel, 1991)) that have to do with hypertension, blood pressure, diabetes, smoking and cardiovascular disease. Many of these factors can be improved by adopting a healthier life style, including regular exercise and healthy eating. Although there are many health apps, most of them relate to fitness and may not be tailored to stroke survivors' needs. For example, the pre-set goals for daily steps may not be appropriate. Using a wrist band may not be the most effective way of measuring steps, as many stroke survivors have partial hemiplegia and balance problems. As stroke survivors are often

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older, and cognitive problems are a common side-effect of a stroke, the mainstream apps might be too hard to use. Furthermore, smart phones can be difficult to use for the target group in general (Rassmus-Gröhn & Magnusson, 2014).

Thus, there is a need for investigating user requirements in a broad sense for health-related applications that are targeted to stroke survivors. Such applications can involve mobile apps and mainstream wearables, but alternative custom designs and devices should also be investigated. The capture of requirements needs a palette of activities, and presented below is a participatory design method with high user involvement that has the potential of feeding both novel application ideas and user requirements into a design process.

2. Related work

Since the 1970's, the democratization of design and innovation processes, such as those expressed in user-driven innovation (von Hippel, 2005) and participatory design (Simonsen & Robertson, 2012), has gradually increased the discussion of the importance of user involvement in development processes. Even in agile processes (Shore & Warden, 2008), the role of the customer (user) is explicitly defined as being key to a successful product. But how do you successfully involve users? And when? As Kulaja states (Kujala, 2003), user involvement is a vague concept and it is not entirely clear how one captures the user's implicit needs and requirements. Potentially, there are many opportunities and methods to involve users (Kriner, 2012; Magnusson, Rassmus-Gröhn, & Deaner, 2009; Muller & Kuhn, 1993), and in (Russo-Spena & Mele, 2012) five stages are identified in co-development with users: co-ideation (co-generation of ideas), co-evaluation, co-design, co-test and co-launch.

In (Russo-Spena & Mele, 2012), co-development stages are primarily discussed from a service-design context, and the article presents examples for all stages in the process. In technological development, however, co-ideation and co-design may be more difficult because people could be too restricted by the technology they are familiar with. To overcome this, Iacucci et al. (Iacucci, Iacucci, & Kuutti, 2002), devised the *magic thing*, a simple mock-up for people to carry around and imagine things to do with it in their everyday life, and thus come up with ideas for new functions and services. The reference to the relationship between *magic* and *technology* is attributed to Sir Arthur C. Clarke, who formulated a law (Clarke, 1962):

> *Any sufficiently advanced technology is indistinguishable from magic.*

Thus, magic as a concept has been used in ideation and design as a means to simplify the understanding of technology, but also as an explicit cue to unleash the imagination in idea generation, which is further exemplified by (Andersen & Wilde, 2012; Grufberg & Holmquist, 2011; Iacucci et al., 2002).

Co-design with older users has been carried out previously but has largely involved able-bodied people. As stated already, one challenge in co-design is knowledge about technology, and in (Bjørkquist, Ramsdal, & Ramsdal, 2015) they found that older senior users (65 years or older) had more problems relating to the technology and services than younger users. Simple scenarios in the form of comic strips were used to make services understandable to stroke survivors in (Rassmus-Gröhn, Magnusson, & Hedlund, 2015),

and physical objects and props were found to be useful when involving persons with speech impairments in a design process (Wilson et al., 2015). Physical and cognitive changes of ageing can add challenges to a co-design process, and it can be important to make adaptions to methods. Participants may have less stamina and trouble hearing, for example, which puts limits on duration of exercise and group sizes, c.f. (Quine & Cameron, 1995).

3. Method

A co-design workshop was carried out together with the Stroke Association (UK). The workshop participants were stroke survivors and their carers, and the aim of the workshop was to capture a variety of ideas for health-related applications (not only limited to mobile apps). The workshop took place at the Life After Stroke Centre, Bromsgrove, UK. Eighteen (18) participants took part in the workshop of which fifteen (15) were stroke survivors (9 female and 6 male), and three (3) carers (2 female and 1 male). Aside from generating and capturing ideas, there was an implicit goal to gain insight into stroke survivors' lives, their current management of their risk factors, their views and use of technology, as well as their priorities and wishes for the future.

To provide a way to make technological possibilities graspable, but not limiting the thoughts of the participants, a kit of *magic objects* was created. The *magic objects* were related to the *magic thing* (Iacucci et al., 2002) described above, but instead of being general in a way that can make it hard to imagine what to use them for, they had identifiable qualities that related to technological possibilities. The similarity between the *thing* and the *objects* was such that they encouraged the user to think about **what** the technology should do rather than **how** it should do it. Each object was symbolized by several information pieces: a short *text description* on a large (A4) card with suggestions to what it could do, an *image* on the same card, and a *physical prop* (object). The *magic objects* created were: **a magic advisor, a magic bracelet, magic soles, magic glasses, a magic screen, a magic (generic) object, a magic camera, a magic pillow, a magic elastic, a magic phone and a magic robot.**

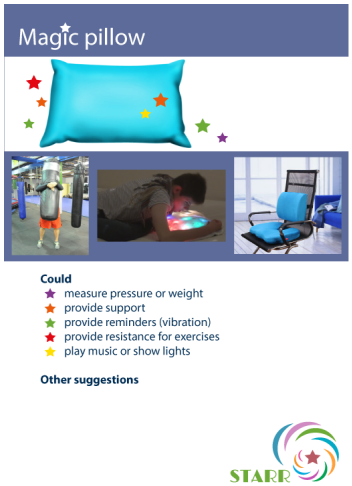

Figure 1. One example of the magic cards

The participants were first introduced to the ideas behind the project in which the workshop was a part, after which they were informed about mainstream solutions for improving health with the aid of technology. This was done through a presentation made by an expert user who uses technology to monitor risk factors and increase physical activity after a heart attack, with the help of an activity bracelet (Fitbit Blaze), Video games (Microsoft Kinect) and Pokémon Go.

After the initial presentations, the eighteen participants were split into four groups, with one moderator in each. Every group had access to a kit of *magic objects* to inspire their discussion. To prevent fatigue, the time allotted for the group exercise was limited to 35 minutes. As a concluding activity, each of the groups presented some of their findings to all workshop participants, who were encouraged to comment and discuss the presented ideas.

The four design exercise sessions and the reporting and discussion afterwards, were all audio recorded with dedicated recording devices. The audio recordings were later transcribed and analyzed using qualitative content analysis, in which eight topics of discussion were identified (topics in bold the main focus of this article):

- Stroke consequences
- Other medical issues
- Recovery
- **Exercise**
- **Motivation**
- Information sharing
- **Design suggestions**
- Design considerations

All participants gave their written informed consent to participate and to be audio recorded and photographed during the workshop. No information regarding the participants' personal data were collected, and they are anonymous to the researchers making the analysis and reporting.

4. Results

During the design exercise, participants were seen actively manipulating the props and looking at the cards while different subjects of discussion were brought up. When manipulating and discussing the *magic objects* and their potential use, the participants often told the group about the impact of their stroke on their daily lives. It was also evident that many of the participants knew each other and could relate to the problems they had in common.

During the workshop, some participants talked about medical issues other than stroke. Some of these were related to risk factors, such as high blood pressure, alcohol, smoking and sleep apnea. Several participants had pacemakers, something that was discussed in relation to the placement and use of technology, eg. activity bracelets and smartphones, in order to avoid affecting the pacemaker.

When talking about life after stroke, some participants mentioned ways they had recovered and regained functions since the stroke. Many times, the participants attributed their success to exercises they had performed that had resulted in walking better with less hobbling, improved dexterity, or learning to sit safely again three months after the stroke.

The participants talked a lot about different types of exercises that they had engaged in to get better, had heard about or wanted to start doing. They mentioned for example gait training in order to stop hobbling, exercises to lengthen their stride, filming themselves to see what to correct in their movements etc.

Participants also spoke about motivation in different ways. Some related to extrinsic motivation:

I just need someone to nag me and say:
Get off your back side and do something!

Others talked about lacking intrinsic motivation – if it was long since they had their last stroke, for example, or if they couldn't see what the benefit was. Part of this discussion was about setting goals and reaching them, and it was pointed out that goals needed to be personalized. Furthermore, participants identified a need for balancing realistic goals to challenges to perform better, so that the goals were realistic and reachable, but at the same time not too easy to fulfill.

Figure 2. Collage of images from the workshop

As the *magic objects* cards already contained some suggestions for use, part of the aim was to find out which of these suggestions appealed to the stroke survivors and their carers, and part aimed to generate new ideas. Below, we present those ideas that particularly target stroke survivors, and were considered as novel or particularly important. The design ideas that resulted from the workshop concerned four different aspects of the designs (activity, function, interface and placement). Not all are related to physical exercise and risk reduction, but also other aspects of life after stroke, such as speech training. And just because a person expressed a need or a problem resulting from the stroke, he or she didn't necessarily see technology as the solution. One person was scared of losing the memory functions she had fought so hard to regain, if she was to rely on technology based reminders instead of her own memory.

4.1. Activity (what is the user supposed to do?)

The magic cards already contained some suggestions to what each of the magic objects could possibly do. The imagined activities are, however, not explicitly tied to an object, but more general, high-level activities that users find the magic objects could help with.

- Sitting- sitting straight, not leaning to one side
- Walking - improve movement, lengthening stride, keeping pace
- Keeping your balance and weight distribution
- Using your hands
- Speaking - take part in communication
- Remember what you have done and what you are going to do
- Resting with good conscience (knowing that you have exercised/managed your risk factors)
- Stress reduction

4.2. Functions (what does the magic object do?)

Of the total 19 different functions that were collected, 13 were novel in the sense that they were not already suggested in the magic cards. Some of the most relevant are listed below:

- Dexterity practice – help you do things with one hand or both
- Help you finding things in the real world (with GPS or clues)
- Voice recognition - sense your emotional state/typing/interpreting
- Interpret or predict what you want to say and help you speak
- Feedback (visual or sensory) to encourage you to place your foot in the correct pattern on the floor, in the correct sequence
- Auditory feedback when you are walking (music)
- Specific physical exercises for people who have had a stroke
- Send data to other people (such as your physician) or devices (so you can find it on your computer)
- Register if you have got a TIA (transcient ischemic attack)
- Display rewards for completing an activity

4.3. User interface

The magic objects in themselves suggested some ways to interact with them, but from a total of 13 interface ideas, 8 were in part or entirely new, some of which are listed below.

- Stationary bike or treadmill + screen with interesting scenery
- Treasure map with clues
- Camera that looks at your mouth and microphone listening to your voice + context awareness: registering the shapes of your mouth and the sounds you are making order to predict what you are going to say.
- Combination of soles and screen - give information on stride and balance
- Piece of technology integrated in the fabric of a belt
- Magic robot that shakes your hand and automatically gets your sensor data

4.4. Placement

The placement of magic objects was also discussed, depending on the use and context of the magic object. There were different positions on the body that were suggested, for example: on wrist, around ankle, close to mouth, in hand, on head, on shoulder and around waist. Placement in clothing and apparel were also suggested, like in the trouser legs or on the glasses (also in peripheral vision). Objects were also suggested to be placed in the home (in living room, on desk).

5. Discussion and conclusions

Based on the concrete ideas and the discussion climate, the magic objects were seen to work as intended. Participants did not spend much time thinking or wondering how the technology worked, but were focused on what could be done with the magic objects. Previously, Grufberg and Holmquist (Grufberg & Holmquist, 2011) demonstrated that similar objects work well for designers, and (Iacucci et al., 2002) used a single object in ideation. The number of magic objects in this workshop was quite large (11) compared to (Grufberg & Holmquist, 2011), in which they appear to have had 3 objects. The participants were told that they need not come up with ideas for all the props and cards, but just use them for inspiration. The multitude could be an advantage in many cases, but it was observed that the number of magic objects might be too large for the group with aphasia. They seemed to become overwhelmed by the number of objects, when for others the variety spurred their imagination and spontaneity.

Although the cards contained some suggestion for how to use the magic objects, variations on the ideas and new ideas not already suggested were formed. Potentially, some of the suggested ideas on the cards were unnecessary – they might hinder participants' imagination or forestall the ideas that participants would have – leaving them to think that they did not contribute as much as they would want or expect. Furthermore, the introduction with an expert user could also have influenced the participants when it came to generating ideas. For example, the treasure map with clues (User Interface idea) could very well be a variant of Pokemon Go, which was introduced and explained by the expert user. Therefore, as a comparison, it would be interesting to modify the magic objects somewhat providing less or no suggestions. It would also be relevant to investigate how a workshop would turn out without a detailed introduction by an expert user.

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