The Tavern: Connecting Stroke Patients through a Social and Playful Interface

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Abstract
The motor and speech impairments of many stroke patients makes interacting with screen interfaces a challenging activity. They might consequently be excluded of the possibilities of social contact and entertainment provided by technology. Inspired by the movie ”The Diving Bell and the Butterfly”, in which a man has his life completely changed after losing all body movements, except for his eyes, we designed ”The Tavern”. It is a screen interface controlled by speech or gesture, where patients can talk with each other and play games together, the way it was in taverns and traditional bars. Our goal is to help them by giving new interactive ways to enjoy positive social experiences during their recovery.

Author Keywords
assistive technology; social games; gesture based interaction; speech based interaction.

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous

Introduction
During our first observation and bodystorming sessions [13] in a hospital in Stockholm (see Figure 1), we discussed many possible ideas for an Assistive Technology. We were

Figure 1: Observation in Danderyd Hospital, Stockholm

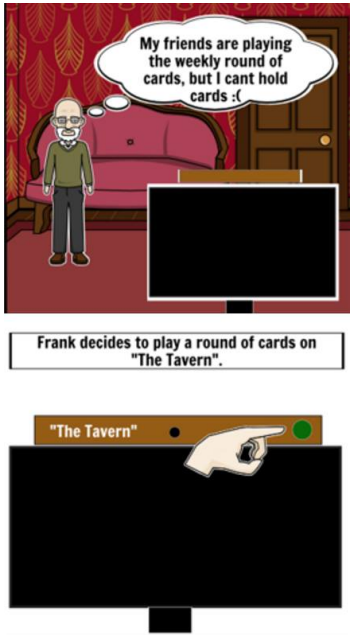

Figure 2: Scenario - part 1

particularly inspired by ”The Diving Bell and the Butterfly” movie [2], in which a man, after a massive stroke, lost all body movements except for his eyes. He feels trapped and it is hard for him to recover the joy of living. Therefore, we decided to build an Assistive Technology for people who are not able to interact with screen interfaces because parts of their bodies are paralysed.

According the the UK Stroke Association [16], a stroke is caused when the blood supply with oxygen and nutrients cannot reach to parts of the brain because it was suddenly blocked or cut off, leading to the death of brain cells. When the victim does not die, it can affect speech, vision, bladder and bowel control, spatial awareness, balance and movement coordination of limbs. Some stroke survivors can recover their condition, however, some might take years without seeing any improvement.

In numbers, the World Health Organization [17] estimated that 15 million people suffer a stroke worldwide each year. The statistics show that by the age of 75, 1 in 5 women and 1 in 6 men will have a stroke, being stroke one of the largest causes of disability and death, accounting for 11% of total deaths worldwide [15]. Of these, 4 million die and another 5 million are permanently disabled.

The life of the stroke patients who survive is not easy. Having to deal with the loss of independence and intense rehabilitation session, most of them struggle to re adapt. In the report of the UK Stroke Association [16], it is estimated that one third of stroke survivors develop post-stroke depression, whilst 73% of them lack confidence, 63% live in fear of another stroke and 56% feel friends and family treat them differently. The physical effects also affect the majority of them, 77% presenting upper limb weakness, 72% lower limb weakness and 50% slurred speech.

After a brief web research, we found some examples of applications aimed to help stroke patients. Most of them are concerned with speech and movement rehabilitation, proposing exercises and displaying daily progress, such as like Constant Therapy (https://itunes.apple.com/us/app/constant-therapy/) and Tactus (http://tactustherapy.com/). In addition, there are many mobile apps focused on helping patients to communicate during day to day activities, by translating text to voice messages for small talk situation (http://www.stroke.org/stroke-resources/). Moreover, some robust approaches were published by researchers, using augmented and virtual reality for rehabilitation [1, 9, 14].

However, there is still a lot that can be done by designers, developers and researchers. We noticed that many stroke patients report feeling lonely, anxious and fearful. Our goal was help them to rediscover the joy of living by creating the social space called ”The Tavern”: a place where patients can talk with each other and play games together, the way it was in the traditional taverns. We envisioned this social platform to be displayed in a television equipped with Kinect sensors [11], so that they can use gesture or speech to control the interface and to indirectly help them in the rehabilitation.

Design Process

Our design process was divided in four phases, one phase per week: brainstorming, building personas and scenarios, creating sketches and prototypes, and finally evaluating a prototype. Given that our work was also part of the Methodology for Interaction Design course, we counted with the guidelines provided by the professors Konrad Tollmar and Patric Dahlqvist in order to structure our design process. Also, after each phase we had the chance to present our progress to the classroom, which allowed us to receive fruitful feedback every week.

Figure 3: Scenario - part 2

First of all, we had some brainstorming sessions, using the the traditional method, the Six Thinking Hats method [7] and the bodystorming [13]. We had many different groups of people we would like to work with, however, we were particularly inspired by the movie "The Diving Bell and the Butterfly" [2]. In this movie, a locked-in syndrome patient, who could only move his eyes, felt trapped in his own condition. So, we wanted to create a digital device that could help paralysed patients to not feel excluded from the life around them.

Before continuing with this idea, we needed to reach these patients in order to found out what were their needs [3]. However, we came to know that this condition is rare to find and they are in very delicate conditions, so we decided to change our focus to partially paralyzed patients. It was also highly challenging to get direct access to them because we needed special approval in most cases. For this reason, we decided to reach these patients by using secondary data gathering techniques of surveys and interviews with subject matter experts [6].

Then, given that one of our group members was familiar with an online German stroke community, we posted a survey on their forum and we obtained 43 replies. The survey consisted of open and closed question concerning their conditions, frustrations and goals. To complete our investigation, we had an unstructured interview on Skype with two relatives of stroke patients and we performed an online research about this user group. Using the data collected we built two personas, Frank and Hiltrude, being Hiltrude the secondary one [6].

The Frank persona was a patient recovering from a stroke he had 4 years ago, mainly supported by his wife (like 55% of contestants) and living at home (as stated by 78% on the survey). He is driven to improve his own situation to be independent (such 70% of the replies). However, his main frustration is that he is incapable of fulfilling his needs for social contact (61% of respondents feel lonely sometimes). A recurrent thought on Frank's mind is a quote from one of patients interview: "I feel helpless and lonely. I would never have thought that the consequences of a stroke were so life-changing".

Besides the persona, we also developed a scenario [5] to illustrate a situation when Frank would use our device. The scenario was as follow: first, he would be at his house, getting a bit melancholic because he would like to play cards with his friends. Then he would turn on the television to start navigating through the "The Tavern", an interface for social games and communication. He sees that another stroke patient is online and they start playing a card game. Frank uses mainly hand gestures to control the game, because he still has trouble to speak perfectly. As a bonus, he notices that the game also helped with his rehab exercises. See Figures 2 and 3.

Sketches and Prototype

As we were collecting and consolidating the ideas of the brainstorming, we were moving from exploration to composition [10]. By the end of the previous phase, we had defined our artifact to be a speech and gesture recognition interface aimed at helping stroke patients to interact socially and to play games. However, we still needed to evaluate this concept with the real users. Based on the data analysis, personas and scenarios of the previous phase we developed sketches, and later on an interactive prototype to be used for evaluation.

First of all, we had a short discussion on the features to be included in the first prototype and how would they should be connected with each other. In order to visualize this

Figure 4: Sketch of the Welcome screen

Figure 5: Prototype of the Welcome screen

workflow, we draw a diagram with the sequence of screens. Then, we organized the items on the screen in a way that would make the interface easy to learn [12]. Finally, we created a sketch with an extensive tutorial to the users, because we wanted the users to have a good understand of how to use speech and gestures to interact with the interface.

As already mentioned by Houde et al. [8], choosing the right prototype for a design phase is not a trivial process, therefore, we had to carefully reflect on what was the main purpose of our prototype. Our design questions were focused on how the idea would be received by our users, if they would be interested in interacting on a social platform, if the styles of interaction were usable and what would be desirable features. So, we created a MS PowerPoint prototype, with a representation of the look and feel of the main functions without the underlying implementation.

In the process of constructing this prototype, we were paying a lot of attention to the possible issues that could arise during the interaction, given that we had a very complex user group. We had to pay attention to which gestures and which words would be the most intuitive for them to interact with the device. Also, we aimed at making the interaction flexible and easy to learn, so we provided both speech and gesture systems of interaction and we included detailed tutorials for novice users.

Moreover, the choice of the games for the prototype had to reflect the preference of the main age group of stroke patients, so we chose simple and well-known card games. In addition, as we focused on creating a social space to enhance personal connectedness, we added the possibility of challenging friends or other stroke patients for a game. Finally, we included the feature of chatting while playing a game, using video or voice, so that the patients could also practice the speech abilities.

In summary, the first prototype had: a welcome screen (menu) with visual elements bringing the metaphor of tavern; a help screen with instructions and tutorial; game list, featuring only the ”Gin Rummy” card game for this version; chat feature to offer the possibility to talk during a game or to simply chat without the game. Other features will be added in the next versions.

Evaluation

After building the interactive prototype, we were ready for the evaluation. Our main goal was measuring the role as well as use-oriented qualities of our solution, validating if it is useful and usable for stroke patients. We chose a participatory-based method, given that the results reflect the impressions of the people who will actually interact with the device [3]. We aimed at conducting on-site tests with the patients. However, due to time constraints as well as the complexity of reaching them in the hospitals, we performed our evaluations with three other representative users: an experienced stroke nurse and two stroke patients from Germany (acquaintances of one of our group members).

The evaluation methods used were Semi-structured Interviews followed by the participant-based Usability Testing. The interview were structured by the guidelines described by Bryman [4]. During the interviews, we were mainly interested in how the daily life of a stroke patient is, how they interact with other people, how the experience in the hospital was and what difficulties they faced or still face. We also wanted to know how the patients felt when socializing with others and what activities they usually do to entertain themselves.

The setup for the interview with the stroke nurse was in

Figure 6: Evaluation with stroke specialist

the hospital, using a laptop to display the PowerPoint, and controlling it with a Wizard-of-Oz technique [3] while she was pretending to control it using gestures (see Figure 6). She got a good first impression and stated that it was easy and intuitive. During the testing she pointed out that some patients can not move half of their body including one arm for gestures which gave us more insights on how to design gestures for one hand. Besides, she liked the idea chatting with stranger because some patients feel embarrassed to speak with them in real life. She also confirmed that most of the patients struggle while spending a lot of time alone.

For the remote evaluations, the setup for the Usability Testing was a shared screen video by Skype, with the prototype running and controlled via the interviewer. The mouse pointer was enlarged to reflect the spoken or physical activities of the patients on the screen. The patients stated that it was very useful to have different interaction styles, attending to patients' needs. Moreover, they suggested features to improve the playability such as more games options, single player games, customized gestures, a player profile to visualize progress and competitions between users. All these features seem to be technically feasible, but we still need to pursue further investigations.

Concerning the usability of our prototype, the users reported some issues to be improved in the next version. First, one of the patients pointed out that the gestures are not always clear. Also, the stroke nurse indicated that patients sometimes have difficulties to memorize all instructions, so she suggested to put gesture hints on every interaction element, and to include an icon in each screen to redirect to the tutorial page. Based on this feedback, we thought about making improvements in both the tutorial interface and include a practice mode for first time users.

The interface is not finished yet. After this evaluation phase we would need to discuss about the feedback collected from the users and create another version of the prototype, including more features and solving the usability issues. We would also like to involve more users in the next phases, not only remotely but also in real life. Finally, we would like to perform the next evaluations using the a television equipped with Kinect [11] instead of a laptop.

Conclusions

The journey of a stroke patient has many moments of struggle, anxiety, pain and loneliness. Our goal was to find a way to give them more possibilities to interact with each other, with their family and friends. They would be able to feel part of community of people who not only play together but also care about each other. We were glad to see that the users liked the idea and we also received many positive feedbacks during the whole project.

Overall, it was a very meaningful experience for us to understand a bit more about the delicate condition of partly paralysed patients. Just like these patients, there are many other user groups that could be immensely helped by Assistive Technologies. Therefore, we sincerely hope more designers feel called to be engaged in such projects and that these contribution add more meaning and joy to other patient's life.

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References

[1] Gilda Aparecida de Assis, Ana Grasielle Dionisio Correa, Maria Bernardete Rodrigues Martins, Wen-

del Goes Pedrozo, and Roseli de Deus Lopes. 2014. An augmented reality system for upper-limb post-stroke motor rehabilitation: a feasibility study. *Disability and Rehabilitation: Assistive Technology* (2014), 1–8. DOI: http://dx.doi.org/10.3109/17483107.2014.979330

[2] Jean-Dominique Bauby. 2007. *Le scaphandre et le papillon*. Julian Schnabel, Ronald Harwood.

[3] David Benyon, Phil Turner, and Susan Turner. 2005. *Designing interactive systems*. Addison-Wesley.

[4] Alan Bryman. 2008. *Social research methods*. Oxford University Press.

[5] J.M. Carroll. 2000. Five reasons for scenario-based design. *Interacting with Computers* 13, 1 (2000), 43–60. DOI: http://dx.doi.org/10.1016/s0953-5438(00)00023-0

[6] Alan Cooper and Robert Reimann. 2003. *About face 2.0*. Wiley.

[7] Edward De Bono. 1985. *Six thinking hats*. Little, Brown.

[8] Stephanie Houde and Charles Hill. 1997. *What do Prototypes Prototype?* (2 ed.). Elsevier B.V., 367–381.

[9] Dahlia Kairy, Mirella Veras, Philippe Archambault, Alejandro Hernandez, Johanne Higgins, Mindy F. Levin, Lise Poissant, Amir Raz, and Franceen Kaizer. 2016. Maximizing post-stroke upper limb rehabilitation using a novel telerehabilitation interactive virtual reality system in the patient's home: study protocol of a randomized clinical trial. *Contemporary Clinical Trials* 47 (2016), 49–53. DOI: http://dx.doi.org/10.1016/j.cct.2015.12.006

[10] Jonas Lowgren and Erik Stolterman. 2004. *Thoughtful interaction design*. MIT Press.

[11] Microsoft. 2016. Developing with Kinect for Windows. (2016). https://dev.windows.com/en-us/kinect/develop

[12] Jakob Nielsen. 2016. 10 Heuristics for User Interface Design: Article by Jakob Nielsen. (2016). https://www.nngroup.com/articles/ten-usability-heuristics/

[13] Antti Oulasvirta, Esko Kurvinen, and Tomi Kankainen. 2003. Understanding contexts by being there: case studies in bodystorming. *Personal and Ubiquitous Computing* 7, 2 (2003), 125–134. DOI: http://dx.doi.org/10.1007/s00779-003-0238-7

[14] Michael Sampson, Yio-wha Shau, and Marcus James king. 2012. Bilateral upper limb trainer with virtual reality for post-stroke rehabilitation: case series report. *Disability and Rehabilitation: Assistive Technology* 7, 1 (2012), 55–62. DOI: http://dx.doi.org/10.3109/17483107.2011.562959

[15] StrokeAssociation. 2016. About Stroke. (2016). http://www.strokeassociation.org/STROKEORG/AboutStroke/About-Stroke_UCM_308529_SubHomePage.jsp

[16] StrokeStatistics. 2016. StrokeStatistics. (2016). https://www.stroke.org.uk/

[17] WHO. 2016. WHO | Stroke, Cerebrovascular accident. (2016). http://www.who.int/topics/cerebrovascular_accident/en/