Industrial Design meets Mental Healthcare
Designing Products Involving Game-Elements for Mental Healthcare Therapy - Three Case Studies.

V. T. Visch
Industrial Design Department
Technical University Delft
Delft, The Netherlands
v.t.visch@tudelft.nl

L. Dinh
Industrial Design Department
Technical University Delft
Delft, The Netherlands

M. Melles
Industrial Design Department
Technical University Delft
Delft, The Netherlands

M. de Wit
Industrial Design Department
Technical University Delft
Delft, The Netherlands

D. van den Brule
Industrial Design Department
Technical University Delft
Delft, The Netherlands

M. H. Sonneveld
Industrial Design Department
Technical University Delft
Delft, The Netherlands

Abstract—Industrial Design originally focused on product development. However, since a decade the attention has extended from design for products to design for users, design for experiences and design for emotions. Recently, several projects have been initiated to design products to be used in the application area of mental healthcare - ultimately aiming at an improvement of the patient’s Quality of Life by improving their emotion regulation. All these projects involve specific game elements but the designed products are not necessarily digitally. The projects share a design strategy that involves input from clinical practitioners and patients. This paper presents an overview of three projects. The first project has the aftercare of cancer patients as its topic. After breast cancer treatment, a large population of patients suffers from severe fatigue obstructing them to pick up their old life. A product was developed using the game elements tangible interaction and challenge to increase their energy management. The second project has a clinical group of soft-drugs addicted youth as its target group. The developed product aimed to increase their therapy adherence using game elements social coherence and tangible interaction. The third project has burn-out patients as a target group. The prototype consists of an online-game that aims to improve the patient's self-esteem and behavior. The used game-element is virtuality and amount of control. Gradually the game transgresses from low-interaction abstract games to high-interactive realistic role-playing. All projects have been evaluated by the respective patient groups.

Keywords-game-elements; mental healthcare; industrial design; emotion regulation

I. INTRODUCTION: INDUSTRIAL DESIGN, SERIOUS GAMING AND MENTAL HEALTH THERAPY

Traditionally industrial designers were good at developing functional products ranging from chairs to telephones. However, in the eighties designers began to wonder about the role of the user in the design process [1]. When you built a telephone that worked but that people did not understand, something had gone wrong in the design process. This expanded the design process from a functional understanding to a user centered understanding. Recognizing the importance of the user in the design process opened the way to several user-related components that should be taken care of when designing a product. Main components are its ergonomics, the understanding of the product, but also the experiences that the product might enhance in a user [2]. Part of the experience design is to think about the emotions a product can give to a user. Some products may facilitate joyful emotions, such as Alessi products, and others more aggressive emotions such as BMW. Moreover, it turned out that subjects based their choice for a specific product not only on its price or function but also on the emotion that is expressed by the product [3].

Within emotion psychology, there have been numerous experiments on the expression [4] and attribution [5] of emotions to stimuli. It is relatively easy to have people attribute an emotion to any kind of non-living stimulus, such as to an animation film or a car. But attributing emotions to products not always influences their emotional experience. People do possess a strong emotional regulation system [6] that controls the emotional experience: a comic film may make a sad person smile but not happy. If you want to alter the emotional state of a user/person, it is crucial that this person is motivated to change. The projects presented in this paper have in common that products are developed to for specific emotional needs or desired behavioral changes of the user. These products are developed for people who are motivated to undergo an emotional or a behavioral change. Subjects where this need is most overt can be found in the mental health care domain.

When you develop a product for emotional/behavioral emotional change such as a burn-out, this product will not directly remove burn-out. The product will involve a user product interaction that will in the end generate a desired result on an emotional/behavioral level. Crucially in this interaction is that people will continue the interaction. For instance, the process of drug rehabilitation is hard to endure...
but the patients have to do this in order to increase the chances of a long-lasting effect of the therapy. It is exactly at this point that game elements can be of use. Game elements (cf. challenge, social relatedness, tangible interaction, virtuality, competition [7]) may on the one hand motivate the user to continue an interaction – continue playing – but may also result in the motivation to achieve goals that are not directly apparent in the game - such as learning goals, training goals, behavioral goals or emotion regulation goals [8].

For the following paper three industrial design projects were selected that all have a distinct aim in the application area of the mental health care. The first project aims at increasing energy management of cancer patients, the second at increasing therapy adherence of drug addicts, and the third at increasing self-esteem and social behavior of burnout patients. All three projects were individual graduation projects by the 2nd to resp. 4th author at the industrial design faculty of the technical university Delft.

Distinctive of all projects is the involvement of the user group during the process on design. Collaborations were set up with distinctive user groups and mental healthcare institutions. After a first phase of literature research on game elements, motivation, the specific healthcare problem and therapy, a second phase started. This consisted of a user study with interviews and generative sessions (cf. context mapping [9]) of patients and therapists in order to explicate the needs, goals, wishes, and behavior of the target user. This process did not only inspire the designer in setting the borders and main elements of the design space but also connected the users actively to the development of the product. On the basis of this user field study, a design vision was formed that included the design aims and means. This was the basis for the prototype that was built and evaluated.

II. CASE 1: ENERGY MANAGEMENT FOR CANCER PATIENTS

Since the early days of manhood, cancer has been a life threatening disease worldwide. It is found in mumified bodies from Egypt (4000 BC) as well as in Peru (400 AD) [10]. Due to the increase in life expectancy, cancer has grown to be one of the most death causes worldwide, responsible for 15% of the deaths. Although cancer can invade any part of the body, breast cancer affect one out eight women during their life in the Netherlands [11]. Luckily cancer treatment is developing fast but due to the nature of the disease this form of disease is still hardly curable with a guarantee that it won’t reoccur. However, major advances have been made in temporarily cure and stabilizing the effects of the disease. This results in a growing population of cancer survivors.

The effects of a disease treatment is traditionally measured by the curing: ‘is the patient disease free’. Another measurements is however on the stabilization of the disease: ‘are the effect of the disease under control and will they not accelerate’. Since a decade these two outcome measures are added by a third: Quality of Life reflecting issues to the patient’s experienced well-being [12]. Given impact of chemotherapy during cancer treatment of the whole body, QoL is a measurement that deserves attention during and after the treatment. With regard to breast cancer treatment, chemo-therapy affects the body to the extent that fatigue emerged as a major side-effect of the treatment decreasing the patient’s QoL [13].

To enhance the QoL of breast cancer patients, this project developed a product that learned cancer survivors to cope with the fatigue by increasing their own energy management. User studies with breast cancer survivors and context mapping techniques (N = 7) showed that patients often mentioned the life invading negative consequences of cancer (“cancer is all that matters”; “I dare not to think about the future”; “cancer gave my life a set-back”) that prevented the patients to pick up their old life after the treatment which is also expected from their social environment (“Together with the newness of my illness the empathic understanding of others faded”; “since I do not look like a cancer patient anymore, people think I’m totally recovered”). In concordance with the cancer fatigue literature “Lack of Energy” was mentioned as a common cause for these consequences. Based on this user research a design vision for a prototype was developed with the aim to increase the energy management of the patients. Based on this vision the “Beaded” prototype was built.

Beaded (Fig. 1) is wooden box that comprises differently shaped beads, a wire, software, and instructions. The intended use of the product is right after the cancer treatment. The user has to attribute a specific daily activity to each of the beads. For instance, the pyramid shaped bead will be linked to dressing and washing, another one to breakfast, to shopping, to seeing a friend etc. In the morning the user has to select the activities for the coming day and thread them on the wire. When they are wired, the user has to adjust the expected amount of energy for each bead/activity on their smartphone/computer with the installed software. This amount of energy will be represented by the light intensity of the bead. When the user thinks that an activity will cost little energy, she will put the slider on the device low, which will make the linked bead glow a little – the wooden beads can be treading for activities that generate energy (e.g. taking a nap). Together with the energy expectation, the user has to give an expected emotional valence to each activity that is represented by the color of the bead (blue is negative, pink is positive). When the user has set her expectations of the energy and emotional valence for each of the daily activities, she can start performing them during the day. After each activity, or at the end of the day, the user evaluates her expectations made in the morning. The match between the expectations before the activities and the evaluations after the activities will learn the user to control and cope with their energy.

A small user study was performed with cancer patients (N=2) and cancer after care professionals (N=2). Both groups were very positive about the effect, the use and possibilities. More specifically, they recognized the main aspects of the design vision: the product being inviting (“what a nice product”), providing support (“I do have a better overview of my activities and energy”), communicative use (energy management became clear to the user and the user could also show it to her social environment to communicate her energy level), and challenging (dividing the amount of energy across of activities is challenging). It is this game element of
challenge between the perfect match between expected energy/emotion and experienced energy/emotion that forms the core of the learning process to increase energy managements.

Fig.1. Beaded, an energy management tool for breast cancer patients for breast cancer patients suffering from fatigue. In addition, the tangible interaction motivated the user to use the device.

III. CASE 2: THERAPY ADHERENCE FOR DRUG ADDICTS

The second case has soft drug addicts as its target group. In collaboration with Parnassia Bavo, a large mental healthcare organization in the Netherlands employing 8000 caregivers, a product was designed that motivates patients to endure the therapy increasing their therapy adherence.

Soft drugs (e.g., alcohol, cannabis, hashish, GHB) are defined by the Dutch Government as those drug that contain an acceptable risk to user in terms of his healthcare. Soft drugs are contrasted to hard drugs (cf. heroin, cocaine) containing a very strong risk to the user. Despite this low risk factor of soft drugs, they can still lead to severe addiction including strong interference in the patient’s life and drug dependency on a mental and physical level. The Mistral clinic, part of the Parnassia Bavo group, treats youngsters between the ages of 12 and 21, with severe drug addiction. The patients are expected to live in the clinic for the duration of the therapy (6 to 9 months). The therapy is mainly oriented to cognitive behavioral- and system-therapy involving the social network of the patient. The therapy involves individual- as well as group-sessions. Essential for the success of the therapy is that the patients are motivated to complete the full therapy program and stay clean from drugs the whole period. To design a product that increases the therapy adherence was the aim of this project.

A field study with the Mistral clients (N = 6) and care professionals was set up to get insight in the therapy itself, the user experience of the therapy, and the moment of design intervention in the therapy. The field study consisted of natural observational research, interviews, and context mapping. Analysis of the field study showed that all patients were characterized by a troubled past, that their main motivation problems occurred during the first weeks, and that were strongly influenced by their living group. The youngster lived together in groups of 14 during their therapy. This group helped them but also led to frustrations. Part of the existing therapy was a regular session in which the social frustrations were discussed within the group. These discussions were experienced as confronting and healing. Based on the field study a design vision was formulated stating to make a product that would help the patients to release their negative emotions and to use this as input for social coherence. Social relatedness was taken as the main game element.

The constructed prototype was strongly inspired by Native American’s totem poles. Totems poles display the social coherence of a group and their visual representations of mythical figures aligned to the interest of the patients. Also, totems use narrative structures to enhance the social coherence [24]. With regard to our target group, two aspects of narration are used: the diegetic narrative world that will ease the interaction of real-world problems to the target (cf. virtuality) and the time process of narration that can align to the duration of the therapy. The built prototype is shown in Figure 2. Firstly each patient gets a wooden box that fits in the totem. The patients can stick a personal avatar representing who they are, who they wish to be or what kind of supernatural powers they want to own. Secondly, inside the box they put an object of personal value that help them remembering their motivations to follow the therapy. When the patients experience negative emotions they can express these emotions in clay – humps of clay are provided by the lowest totem. The expressions of the clay are
then put in their own box and (voluntary) taken out to discuss during the next group session.

Fourteen patients took part in the evaluation study that lasted a week. Although some found it difficult to express their emotions in clay, the project was received successfully by both the participants and the care professionals – right now the totem is still in use. The main used game-elements are social coherence as an effect of the play, and fantasy enhancing motivation and facilitating social communication.

Fig.2. Totem Pole for therapy adherence for addictive youth.

IV. CASE 3: SELF-ESTEEM FOR BURN-OUT PATIENTS

The third project has the development of a game for online burn-out therapy as a focus. The project is carried out in collaboration with Interapy, the Netherlands’ largest professional online therapy centre for mental healthcare. Interapy was founded in 1999, has 50 employees and solely communicates with their patients via the internet [cf. the successful use of computer-aided cognitive behavioral therapy [15]]. Interapy thus lowers the threshold for patients to seek help for their psychological problems. Their clients mainly seek help for depression, eating disorders, and burn-out. Cognitive behavioral therapy is the main treatment paradigm.

Burn-out is a work-related mental disease which growth in number can be attributed to the societal shift in the Western world from physical labor to intellectual labor causing an increase in cognitive and social demands of employees. Stress and work pressure are responsible for 33% of the Dutch sickness absence of which 10% is directly caused by burn-out [16]. Burn-out can be defined as a prolonged response to chronic emotional and interpersonal stressors on the job, and is defined by exhaustion, cynicism, and inefficacy [17]. Aside from the physical symptoms of burn-out such as headache, neck-/back-complaints, high blood pressure, sleeping problems, patients suffer from psychological complaints. One of the main complaints are a low self-esteem preventing them to set their own borders in response to the demands of their job (they have difficulty in saying ‘no’ to job related demands which will increase their work pressure even more).

A prominent game element is virtuality. This will cause a bifurcation between the reality of daily life of the player and reality of the game. Game reality presents the player with less consequences of his behavior than reality of daily life does (in a racing game you may crash your car and loose one of your five lives, in reality you may end in hospital or worse). This game element of virtuality thus motivates players to behave more freely than they would do in daily life[18]. [19] showed that this virtuality enhances the communication in therapy between patient and therapist in depression patients. For the current project we used this virtuality as main motivational element for gameplay of the patient to learn to increase their self-esteem. In the game we intended to gradually decrease the virtuality in order to increase real-life behavior learning.

Before starting the design of the prototype user research was conducted with therapists (N = 4) and ex-burn-out patients (N = 3). The therapists mentioned the motivation of the patients and increasing self-confidence of the patients as major aim. These two aspects inspired the prototype. The ex-patients all mentioned that part of the success of their recovery was the amount of positive feedback received from their family, work and therapist. The user test inspired the design vision aiming at (a) improving self-confidence in social interaction, (b) including game levels declining from a virtual to a real-life level, and (c) giving positive feedback to the patient.

The prototype for burn-out consisted of a game involving four levels – see figure 3 – gradually increasing from an anonymous game involving low personal interaction to a realistic role playing game. All levels aim to teach the patient to increase his self-esteem and behave accordingly. The first level is a matching game in which the patient has to match negative thoughts to positive thoughts by dragging them into two containers. For instance negative thought “my colleague pretends she doesn’t notice me. She doesn’t like me” should be matched with “my colleague isn’t very communicative,
which isn’t caused by me”. The second level increases the interaction. In this level, the patient has to shoot a negative thought with a positive thought that is selected from a choice of three. By correct selection and hitting the user gains points. In the third level the patient sees an animated dialogue about a work related stress scene. Suddenly a negative thought appears which the patient has to shoot. Subsequently, positive thoughts move through the screen. The patient has to select the right positive response for the dialogue. The last level shows a video of an actor playing a boss who is criticizing the player/patient on his behavior in his (virtual) company. After his monologue, the participant has to come up with an answer which is directly captured by the webcam of the patient’s computer. After his reaction the patient can review his reaction on video, evaluate it, and eventually sent it to his therapist. The prototype of this game is positively evaluated by Interapy therapists and a small group of patients. A larger scale effect study has been planned for the coming months. The first used game elements are amount of control or richness of the interaction, the low amount of the first levels motivates the user to start the game, the high amount in the last levels motivates the user to finish the game. The second used game-element is virtuality of content, the content is anonymous in the beginning and becomes personal at the end.

V. DISCUSSION

The three described cases showed how industrial design research can contribute to the development of products to be used in the domain of mental healthcare. Essential for our approach is the user-oriented perspective in which we involve user (patients and medical staff) in the design process. Based on this user research a design vision is formulated in terms of general aims and interaction. The design vision puts forth a prototype that is evaluated by the user group. The approach as well as the prototypes did receive positive evaluations for all three cases. The cases provided products that will be added to the existing mental care programs. Mostly these programs consist of cognitive behavioral therapy. Although the therapy is already successful, extending it by interactive products is likely to enhance its effect. Since the therapies ultimately aim to change behavior and emotional regulation processes of the patient, the therapies still can benefit from products that enhance the motivation for interaction. By adding specific game elements such as tangible interaction, challenge (case
1), social coherence, tangible interaction (case 2), and virtuality, amount of control (case 3) the motivation for the therapy as well as the motivation for the behavioral change will be enhanced as our research showed. Interestingly, the cases showed that the motivation effect of the game elements is not restricted to digital products. By placing the development of the prototype at the end of the design process, the most appropriate medium (digital (case 3), digital/tangible combination (case 1), tangible (case 2)) is chosen.

The effect of the use of game elements in innovative products within the mental health domain has been shown in diverse case studies. However, empirical experimental research on the motivational effects of distinct game elements is still lacking in the area of serious game research. The area of serious gaming is, although rapidly developing, still young in comparison to other scientific areas such as experimental psychology. Serious game research seems to split to research devoted to the development of serious games in diverse application areas, and research devoted to the theoretical description of games. Given the promising results of these research branches makes it possible to start orienting towards a more fundamental area of research on the generic effect of game elements. Although we will still maintain to develop case specific prototypes, we hope to contribute together with psychologists to more generic research on the effect of game-elements.

ACKNOWLEDGMENT

The authors wish express their deepest gratitude to all the volunteers, patients, clients, caregivers, and therapists who participated in the studies.

REFERENCES