# Usability and Fun of the INTERACCT Client

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**Abstract.** We present the INTERACCT system, a smartphone app and a Web page for fostering communication between young patients in aftercare after a stem cell transplantation. In this phase of rehabilitation, daily communication between the patients and their clinicians is key for detecting upcoming possibly deadly crises as early as possible. The app consists of a communication part, a gaming part, a module for daily medicine, and a daily story for further motivation. We describe the system as well as an evaluation of the app with several healthy children.

## 1 Introduction

Allogeneic hematopoietic stem cell transplantation (HSCT) is a medical treatment in the field of hemato-oncology, proven to be a cure for many diseases like leukaemia or red-cell disorders. Thanks to this life saving procedure, survival rates of more than 70% within the first two years after HSCT today are possible. However, long-term survivors carry a high burden of morbidity, including infections, treatment related organ toxicities, musculoskeletal disorders, endocrinopathies and immunological complications like graft versus host disease (GVHD) [3]. They usually affect multiple organs and tissues, resulting in multimorbidity and variable health developments [10]. In any case, early recognition is crucial, to initiate timely and suffcient treatment [8].

Currently, no adequate technological monitoring solutions are available, especially for young HSCT patients. The status-quo is a paper diary, where patients track their health data and present it to their aftercare physician once they visit the hospital, either during a scheduled visit or because the patient's condition has worsened. Prior examples of electronic diary solutions have proven to provide better integration into everyday routines.


K. Giokas et al. (Eds.): eHealth 2016, LNICST 181, pp. 156–163, 2017.
DOI: 10.1007/978-3-319-49655-9_21

In the project INTERACCT[1] we have developed a communication system for daily health reports from children after stem cell transplantation to their clinicians. In order to foster longterm motivation to keep up communication, INTERACCT includes various motivational features such as a game system and daily stories.

## 2 Related Work

In project INTERACCT one of the core challenges is to sustain long term engagement by using games as motivators. For the purpose of this project, engagement is defined as the first and lowest-level stage of immersion as opposed to engrossment and total immersion [4].

Serious games with health relation were researched by Primack et al. [9], where various positive aspects like education in health matters, motivation during difficult episodes, enhancing treatment compliance as well as therapy support through physical exercises were covered.

*Re-Mission* and its successor *Re-Mission 2*[2] are serious games where the player is fighting cancer cells inside an infected body.

Aiming at education of their patients' disease and treatments, Gansohr et al. [5] present a multimetdia entertainment system with game elements. The patients are children and adolescents of differentiating age groups, therefore the design process described, which involved methods of user-centered design, was particularly important for INTERACCT.

Prior examples of electronic diary solutions have proven to provide better integration into everyday routines [1]. Furthermore it was shown that electronic health monitoring technology potentially eases the interaction between young patients and their parents [11].

Gronvall et al. [6] propose that health care technology focuses on participative and collaborative approaches to doctor-patient communication.

A system for smart phones or tablets to support children with cancer to keep up with the curriculum of their school classes is presented by Barbosa et al. [2].

## 3 The INTERACCT Project

INTERACCT is an acronym standing for Integrating Entertainment and Reaction Assessment into Child Cancer Therapy, and denotes an Austrian research project funded nationally be the Austrian Research Promotion Agency FFG. Partners are the Research Group Entertainment Computing of the University of Vienna, the University of Applied Arts Vienna, Department Social Design, Arts as Urban Innovation, the St. Anna Children Cancer Research Institute and outpatient clinic, and the IT service provider T-Systems.

[1] http://interacct.at/.
[2] http://www.re-mission2.org/ (accessed May 7th 2015).

The St. Anna outpatient clinic takes care of children after a stem cell transplantation (which essentially wipes out the child's immune system and replaces it with a new one), who are sent home after some months to recover. Often, these children have to stay home all day for a period of between one and two years, being isolated from their friends and school mates, since the danger if contracting life threatening diseases is imminent. In this volatile phase, compliance to treatment is paramount, as is regular communication with the clinicians in order to quickly identify upcoming crises.

Therefore facilitating the communication process of the patient informing the physician about actual health data is key to a successful recovery. In the project INTERACCT we have developed a communication tool for children and adolescents for reporting their health status to their clinicians on a daily basis. The tool is basically a smartphone app that facilitates a module for entering health related data, a gaming system for keeping up fun and motivation, a medical system informing the patients about their daily medicine to be taken, and a daily story for keeping up spirits, taken from our story database comforting stories.

In order to design an appealing interface and gaming system we followed a participatory design process, conducting a three-stage methodological approach towards evaluating gaming preferences of children. These involved mainly exploratory design sessions, a quantitative survey and a proxy design approach based on drawing [7].

### 3.1 The Clinician Interface

INTERACCT provides a Web interface to involved cinicians who can assign patient profiles to their patients. For example, a kidney profile would involve all relevant parameters for monitoring patients with problematic kidneys. Such parameters would then include daily communication of the amount of water drunk, pain at the kidney, nausea, how often the patient urinated, etc. However, such profiles can be adapted and for each patient, parameters can be excluded or added as the clinicians see fit.

Communicated parameters can then be selected and shown stacked onto each other as time-value diagrams. This way, clinicians can visually correlate problematic episodes and therefore identify crises. Figure 1 shows such a stacking.

### 3.2 The INTERACCT Client

The INTERACCT app consists of various submodules designed for communication and motivation of young patients. The overview over the possible data categories that can be communicated are shown in Fig. 2. Only those categories that have been selected by the clinician will appear in the app.

One such category is how much water the child has drunk. This can be done every time a glass of water has been drunk, or in the evening to enter the total amount of drunk water (Fig. 3). Another category is pain. Here children can select the region of their body they feel pain at (Fig. 4). Other categories

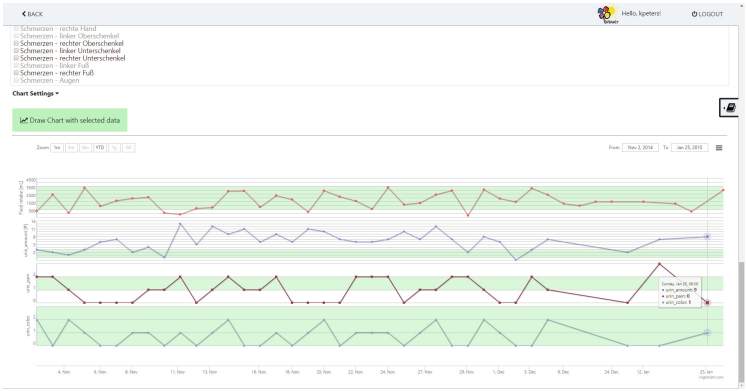

**Fig. 1.** Clinician Web interface


**Fig. 2.** Data entry.


**Fig. 3.** Drinking.

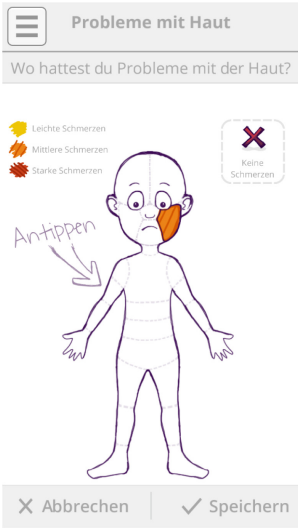


**Fig. 4.** Pain.

include defecation, mental wellbeing, physical activity, eating, pain in the mouth, nausea, throwing up, fever, and sleeping. When designing the data entries, care was taken to make the design child friendly and as non-verbal as possible, since our medical partner St. Anna Children's Hospital treats many children with non-German background.

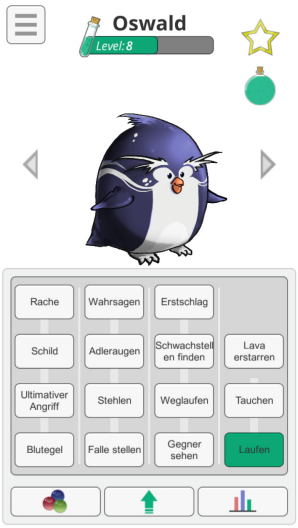


**Fig. 5.** Pet lab.


**Fig. 6.** Medication.

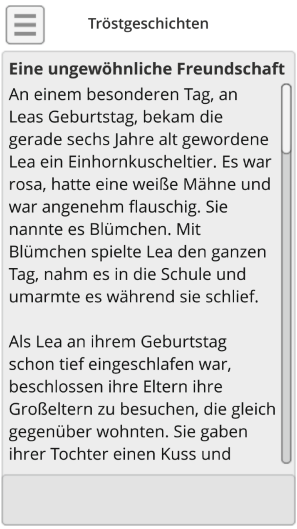


**Fig. 7.** Daily story.

Once all data has been provided, children are rewarded with research points, and can go into the lab and work on their pets (Fig. 5). Here they can buy new pets, or upgrade their current ones by buying new abilities like better fighting skills etc. Afterwards, they will find new islands daily on their island map, and can go to the newest one and roam the island, getting involved into fights, or discovering magic potions and treasures. An in-game screenshot of this is shown in Fig. 10.

The medicine module is shown in Fig. 6. Here children and their parents see all the medicine the child should take, as well as when they should take it. Furthermore, children can also send questions to their clinicians regarding the medicine, and even take fotos of the labels of unknown versions of medicine, which is more often than note some generic with unusual labels.

Furthermore, every day the app offers a new comforting story taken from our story database, which currently holds over 250 stories written by healthy children for ill children (Fig. 7).[3]

## 4 Evaluation

We asked 5 girls and 4 boys in the ages between 12 and 15 to participate in an experiment in order to collect their opinions in the INTERACCT client, here

[3] http://www.interacct.at/troestgeschichten/.

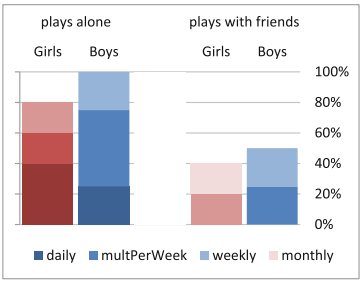


**Fig. 8.** Playing alone or with friends.

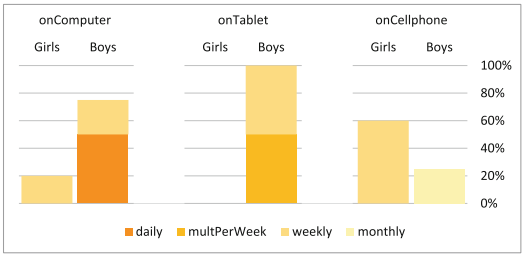


**Fig. 9.** Preferred platform.

testing for understandability of the process and accuracy of the exercise detection system.

The process was as follows: we first explained the purpose of the system, and showed the various parts of the app: data entry, pet laboratory, island gaming system, medicine module, and daily story. Then we gave them around 15 min for each of these parts to use them, play with them, and collect experiences. After about an hour we handed out the questionnaires and collected their opinions about the app.

The questionnaire has three parts. We first asked about their experiences and habits on playing computer games on various platforms. Figure 8 shows the distributions of the children on whether they prefer to play alone, or with friends, and Fig. 9 shows the distribution of preferred gaming platforms. Values are given for girls and boys separately. It can be seen that girls seem to prefer smaller smart phones, whereas boys prefer larger screens like tablets and PCs.

Figure 11 shows the results from the app questionnaire regarding the usability of the overall app. The green bars denote the more positive scores yes/fairly, while the orange bars show the no/marginally answers. Neutral answers have been omitted. The upper part of the diagram shows the categories where a positive answer is favourable, while the lower part shows the opposite. It can be seen that the results are quite satisfying and positive. Overall, using the app was regarded to be quite easy and unchallenging, which is of course important since the target audience consists mostly of very ill children with reduced cognitive skills.

Figure 12 shows the engagement felt in the game system. Here children reported again that the game is quiet easy and unchallenging, again something that we designed intentionally for ill children to be used. Generally the children felt anticipation for the app, which they regarded as being fun and useful.


**Fig. 10.** Ingame graphics

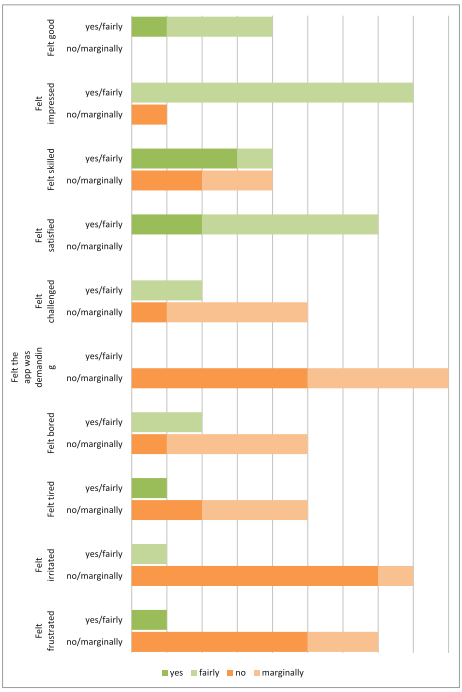


**Fig. 11.** Usability of app. (Color figure online)

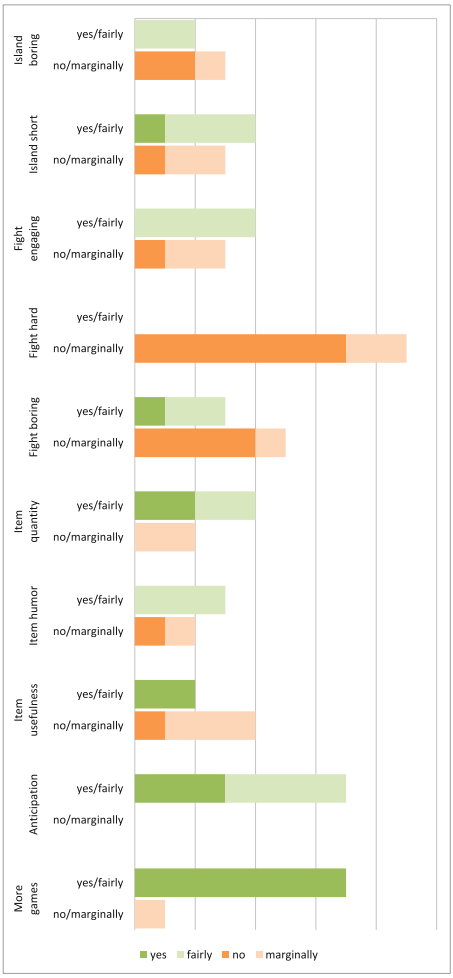


**Fig. 12.** Game engagement.

## 5 Conclusion

In the presented communication system INTERACCT we found good results in our evaluation with the intended age categories, but in our case only healthy children. While the design of the app and the game system per se was rated quite positive, healthy children are underchallenged by our game system, which has been designed for ill children with possibly severe cognitive and motoric restrictions. For example, the fight system is round based, there are generally no time-based challenges demanding fast moves.

However, since INTERACCT is more a game container rather than only one particular game, we intend to create a larger variety of games to be found on the islands, presenting more challenges for different skill sets.

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