"On the Top of High Towers..." Discussing Locations in a Mobile Health Game for Diabetics

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Abstract

The potential role of digital “games for health” for education and within healthcare is addressed by an increasing number of research projects. Games, running on mobile devices, with attached biosensors and Internet access, may unfold an extended influence on personal health related behavior. In particular for management of chronic diseases, game designers explore a wide range of Ubiquitous Technologies. As mobile health games are played within user’s everyday life, they find their way into our cities: parks, schools, offices or shopping centers are their potential playgrounds. This article discusses three concepts of a mobile health game for children with diabetes. Its focus lies on the different effects arising from locations and participants involved. Early prototypes have been “playtested” by a group of patients at the Olgahospital in Stuttgart, Germany. Participants’ comments, presented in this article, point to distinctive design challenges. Various locations, it is argued, do not only implicate technical and spatial aspects, but also reveal social issues regarding interactive design.

Keywords: mobile health games, ubiquitous technology, urban design, diabetes management, and participatory design.
Introduction

Current research projects on health games aim to combine well-known principles of learning and health behavior change with current game design strategies (Health Games Research, 2009). Serious games seek to be pleasurable and to support, educate or train users in their real life. With the rise of Ubiquitous Computing, mobile serious games stress an important aspect, since they address the boundaries between user's game experience and daily routines. As B.J. Fogg has pointed out: "When interactive computing systems are embedded in everyday objects and environments, they can intervene at precisely the right time and place, giving them greater persuasive power" (Fogg, 2003, p. 10). A growing number of "persuasive technologies" attempt to motivate users for a certain health, safety, and eco friendly behavior. So far, health games largely run on consoles or desktop computers. Nintendo’s bestselling Wii Fit for instance, is predominantly played in distinctive places, such as the domestic living room. As one example of several “exergames” - seeking to encourage physical activity in their players - it may illustrate that social environment, however, is crucial to get users involved as well sustaining their motivation. So far, as Ian Bogost states, game designers would merely borrow “ritual practices” from other domains and implant them to private locations: "When we play Wii Sports with one or two friends or family members, we create a micro-environment that mimic the golf course or the bowling alley“ (Bogost, 2007).

In contrast to that, mobile health games potentially can be played everywhere and at anytime. The research project "Mindless Eating Challenge" by Cornell University currently investigates “persuasive mechanisms in mobile health games“ (Health Games Research, 2009). In their case study, health related behavior and food choices are rewarded by the game play. It involves eating tips, mobile phone snapshots and “nurturing” of a virtual character. Mindless Eating Challenge can be played at home, in schools or in restaurants, since the game platform, a mobile device, can be taken anywhere. This shift from gaming for health in private spaces to
playing a mobile health game potentially everywhere, including public spaces, raises several questions: How can the social micro-environment of a game unfold in different real world locations? How can it possibly interact with the city and its architecture? Merely technological aspects may deal with the interplay between digital media and diverse potential locations. However, virtual game environments as well as the city landscape are strongly intertwined with social aspects regarding interactive design. On the one hand, mobile health games seem to promise an increased potential for learning and motivation. On the other hand, they implicate certain issues regarding security and privacy, which need to be addressed by further research. This article presents the work in progress at University of Stuttgart, looking at mobile health games from an urban design and research perspective.

Related work: A mobile health game for Diabetics

Diabetes is a chronic disease likely becoming a major epidemic in the developed countries. Today more than 220 million people live with the disease and this number is likely to more than double by 2030 (World Health Organization, 2009). Type-2-diabetes that comprises 90 % of the diabetes cases, has multiple causes, but seems closely related to excess body weight and physical inactivity. Moderate changes in lifestyle such as an adequate diet; more physical activity and loss of weight positively influence the disease management of typ-1 and type-2-diabetes. Taking record of all relevant factors including blood sugar levels, insulin dosing, meals and physical exercise is an essential part of diabetes management and education. On its basis patients and doctors can point to potential therapy improvements.

Therefore, insulin-dependent diabetics, largely type-1, log their data in so-called “diabetes diaries”. So far, they usually consist of hand-written logbooks. A variety of diabetes management software has become available on the market, being increasingly developed for mobile devices. Yet, these applications seem to get slowly accepted by a broader range of diabetics. They still seem to face several evaluative,
development, technical, policy and ethical issues, to be addressed by further research (Demiris et al., 2008, p.12). However, it is of particular importance to combine an active lifestyle with a well-adjusted diabetes treatment at a young age in order to avoid the various long-term complications of the disease.

Most digital games dealing with diabetes self-management run on desktop computers. “Packy & Marlon” (Wave Quest, 1995), an educational game for diabetic children and adolescents, has pioneered this field in 1995, when its was launched for Nintendo’s console Super NES. Its capacity to provide diabetes relevant knowledge, to increase its users’ motivation and to foster communication about the disease has been evaluated in clinical trials (Brown et al., 1997). Since then numerous video games dealing with diabetes education have been developed for various platforms. The health games research project gives a useful overview on its website’s database (Health Games Research, 2009a). More recently, an attempt to combine diabetes management with mobile gaming has been launched with Bayer’s glucose meter system Didget. The device can be attached to Nintendo’s portable gaming platforms DS, where blood sugar levels and testing habits are rewarded within the game play (Bayer HealthCare, 2009). So far, no evaluation has been published regarding the long-term impact on players’ testing habits. For the context of mobile health games, an investigation on the impact of using mobile devices in contrast to console platforms seems to be of particular interest. The potential of location based and location sensitive games within diabetes education appears scarcely explored yet.

DiabetesCity therefore aims to develop a game concept, which playfully motivates children with diabetes to document their diabetes relevant data. Exploring potential synergies between available mobile technologies and game design strategies has led to three conception prototypes. This article presents and discusses them in the following with a particular emphasis given to locations and social interaction that might result by different kinds of game play.
Developing Ideas of Game Play

DiabetesCity suggests the “serious” goal to collect as much data as possible for the game period. Eventually, records may serve as a therapy tool, indicating therapy improvements. This section presents three possible kinds of game play. Each version has been developed according to the same object, but differ significantly in their implementation of a) locations and b) potential participants (See figure 1). All concepts are developed to run on a mobile platform for a test period of one week.

Version I: Candy Castle

In Candy Castle, children team up with their parents in order to take on the role of creative builders. Both jointly document a part of their daily routines such as meals, physical activity or blood sugar levels. The data is gained in real world locations, for instance, in school or in the office and then transferred to the game environment. Thus, while the game is progressing, a virtual landscape is built up on the screen. As explored in the Mixed Reality Game “’Ere Be Dragons” (Boyd Davis et al., 2007, p. 200), this on screen landscape partly corresponds to the real space, players walk, eat, study or live in. Moreover, it responds to players’ particular physiological data. By using GPS, the game environment, “mapping” its players’ diabetes relevant data is tied to certain locations in real life. Its shape and look corresponds to players’ measured glucose levels. Succeeding, the cartoon like world of Candy Castle consists of secret gardens, buildings, towers, and dungeons.

Version II: “Capture the Flag“
In Capture the Flag, the player and up to three friends form a “gang of journalists“. They film, photograph and report on stories from their everyday life in school. By reporting to other players, each gang captures various locations throughout the school area. Reports may contain the latest school gossip along with tested blood sugar levels. Players may mark several locations with “Capture the Flag“ stickers, incorporating Near Field Communication (NFC) tags. Having spotted these locations, players can read and upload new reports by holding the mobile device close to the NFC tag. Teams therefore start to compete about the most popular reports in order to gain the biggest area during the challenge.

**Version III: “Sugar Pet“**

Sugar Pet is a single player version of DiabetesCity. In contrast to the first two concepts, users play with a virtual pet by “nurturing” it with information. Entering his or her test results, players begin to create and taking care of its virtual companion. The latter develops from a simple cell to a complex character as it does, for instance, in the computer game “Spore” (Wright, 2008). Eventually, the character begins to mirror therapeutic actions, for instance doing strange and entertaining gestures, like for instance, scratching his neck, when the player tests his sugar levels. The more parameters players enter, the more the virtual pet develops. As it turns out, Sugar Pet has been diagnosed with diabetes as well and could definitely need a helping hand.

**Playtesting a concept?**

In this section several methods for participatory, user-centered design processes are presented. Initially, we produced one-page design treatments, from which we have retrieved the short passages shown above. We started to play around with different forms of game play, storytelling, motivation and technical set ups. Eventually, we
focused on three versions, which became an important part of theory development, as will be discussed in more detail below. Short descriptions of formal and dramaturgical elements were helpful to outline several Do’s and Don’ts by sending them to the doctors in very early design stages. Moreover, we used “visual brainstorming,” initiating a correspondence via conceptual sketches with befriended game designers. As a result, roughly sketched conceptual drawings, depicted first impressions about emotions, characters, and the mood of DiabetesCity.

As a design instrument for mobile games, the three-dimensional board game gives an impression of spatiality and travel time in the game: “In addition to being a demonstration tool, a board game prototype provides a world-in-miniature that allows game play to be easily tested” (Ballagas & Walz, 2007, p. 268). Building numerous working models and board game prototypes has proven to be extremely useful: not only to communicate with the doctors and patients, but as well to develop our ideas.

<table>
<thead>
<tr>
<th>Gameplay Version of DiabetesCity:</th>
<th>Candy Castle</th>
<th>Capture the Flag</th>
<th>Sugar Pet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants involved:</td>
<td>Parents</td>
<td>Peers</td>
<td>Single Player / Virtual Character</td>
</tr>
<tr>
<td>Locations involved:</td>
<td>Everywhere (Data transferred to virtual world)</td>
<td>Restricted Area (School)</td>
<td>Everywhere</td>
</tr>
</tbody>
</table>

Figure 1: Different versions of DiabetesCity and their involvement of locations and participants.

Users’ comments on locations and participants

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2 The website www.intothepixel.com provides an overview of the art of conceptual sketches within computer games.
We presented these early working models and board game prototypes to a group of patients and doctors from the Diabetes Centre in the Olgahospital, Stuttgart. We had the chance to speak to twelve children, two girls and ten boys, aged between eight to thirteen years, diagnosed with type-1-diabetes. If not marked otherwise, the following quotations represent answers given by participants in their own words, respectively by choosing from multiple options at various stages of each session.3 The following section discusses the results of our survey and presents users’ comments on locations and participants. Design challenges stressed within DiabetesCity are associated here to relevant keywords of game design theory in general.

Social Interaction

According to Salen & Zimmermann, actions within the game play such as following ore breaking social codes exert “a tremendous influence on the overall experience of play“ (Salen & Zimmermann, 2004, p. 464 ff). Social interactions consist of a so-called “metagame”, which derives its rules from the relationship “between the game and outside elements, including everything from player attitudes and play styles to social reputations and social contexts in which the game is played“ (Salen & Zimmermann, 2004, p. 481ff). Even if a direct influence by game design on these correlations remains questionable, the observation of players’ interactions may well contribute to a broader understanding of mobile health games. Social interaction appears to be one of the key points to long-term motivation in mobile games. Regarding both multi-player versions, Candy Castle and Capture the Flag, we pitched the contest between several teams, including the cooperation between teammates. Two questions regarding social interaction arise from this setting: First, with whom would patients like to play?

3 Interviews had been conducted in the “Centre for Diabetes Care and Education” in the Olgahospital Stuttgart in April 2009. Any proceedings were held in German language and have been translated by the author for this publication.
In Candy Castle, parents are integrated into the game play concept. Parental “monitoring” of a diabetic child seems to be a problematical issue for everyday live within families concerned. We decided to address this aspect as one possible feature of an interactive game. We assumed children might like the idea that their parents would log their own data, too, and eventually would build up the virtual landscape of Candy Castle jointly. However, in the survey eight out of twelve patients ticked on the answer “I would like to play DiabetesCity with my friends.” Three patients indicated “with other diabetics”, further three stated “with my parents” and two children preferred to play “on my own.” It is important to note that none of the four children, who had specified earlier that their parents log their diabetes data, favored playing DiabetesCity “with their parents”. Even though two of them generally liked the concept of Candy Castle. On the one hand, it may be a common place that children prefer to play with their peers. On the other hand, this result underlines that transforming social codes is an essential attraction of any game situation. Escaping from parental monitoring may have a particular attraction within a game that aims on disease management for minors.

A key question that arises from this point is how to involve non-diabetics into the game play of DiabetesCity? To include actions such as measuring blood sugar levels for non-diabetic players appears plausible. However, it is supposed to loose its fascination after first initial attempts and may entail certain issues for untrained users. Patient’s friends may be curious about diabetes, about its therapy and the medical gadgets involved in diabetes management. Debra Lieberman has shown that educational video games can be a springboard for a conversation about disease with friends, family members, and caregivers (Lieberman, 1997, p. 114). A suitable idea therefore might have been to implement a quiz-module, in which diabetics and their peers would solve questions jointly. It remains questionable whether the quiz-feature would work in a mobile game context, though. Moreover, diabetics and non-diabetics may be interested in documenting and sharing their experiences, as the success of the various social networking websites suggests. The particular challenge remains, how to implement the very personal need of documenting and sharing medical data.
into a game play that would be interesting to the whole group. We addressed this issue within Capture the Flag, in which the diabetic player teams up with his or her friends. The “reported” stories within the game play would be experienced by the whole team and may include relevant data such as testing results. In Capture the Flag, however, the shared motivation for players would be to gain the biggest area on the school ground, by posting reports of various - medical and non-medical - content.

**Storytelling/Educative Features/Immersion**

For all three versions storytelling is an essential feature. Especially in a health context, it seems important to provide a different, playful perspective onto the serious topic. Transferring the scientific and medical notion of disease management into a softer and more entertaining concept is one key point of developing a health game. Furthermore, storytelling is considered as powerful technology of immersion in serious games. Especially Sugar Pet may illustrate how storytelling may be used as an education and therapy tool. Its psychological trick is widely used by digital pets: The virtual character is diagnosed as diabetic as well, and appears to have similar daily struggles to players. It suggests to motivate players for certain diabetes related behavior by switching their role from being a patient to being a “mentor”. Diabetes educators have appreciated this feature in particular. Incidentally as well as patients: Eight of twelve patients claimed that they “favor the version Sugar Pet the most.”

**Spectators**

Every game has its spectators, which is an important aspect of the social and spatial interaction it may engage. This becomes particular apparent in mobile games, not least because their playgrounds include public spaces. Since the game play of DiabetesCity could involve intimate actions like measuring blood sugar or injecting insulin, the game design would have to consider who could and who may be
watching the game. We therefore asked patients: “[...] Which persons can be aware of you playing DiabetesCity?” Seven out of twelve patients ticked on the answer “friends”; five children added “parents” and two stated “other diabetics”. Four out of twelve answered that “no one” should be able to watch the game, contrasting this eight-year-old boy, who seemed not to seek for any restriction at all, saying: “anyone, who cares!”

Figure 2. “Playtesting“ early prototypes of DiabetesCity at Diabetes Centre in the Olgahospital Stuttgart.

On and Off Playgrounds

In considering the playgrounds of mobile health games, it is important to note that locations are intertwined with the people, who frequently use or are expected to use certain spaces. The strong interconnection can be sensed in the patients’ responds asking them to relate distinctive locations to their diabetes management. In order to see whether there would be any difference between an imagined game situation and an imagined everyday routine, we distinguished between a) “Where would you not like to play DiabetesCity” and b) ”Where would you not like to test your blood sugar“?

For each case, seven out of twelve patients did not state any locations. Interestingly, those five responding with locations to question about the game situation were not identical to these five persons, referring to diabetes management in general. The
following quotes on user’s “non-locations“ point to several design challenges, addressing technical and social aspects. This 8-year-old boy for instance stated: “I would not like to play DiabetesCity in school or on excursions. During school lessons, one is not allowed to play and on excursions one must not bring mobile phones.” His remark clearly indicates that certain potential playgrounds may have their own house rules, which game designers would have to deal with. This girl, 11, contrasted the rather technical argument with the statement: “I would not like to play DiabetesCity in school. Because it’ll make me feel uncomfortable.“ She preferred the single-player version of DiabetesCity, described above as Sugar Pet.

All three game play versions involve measuring blood sugar, as it is an essential part of diabetes management. We asked therefore: “Are there locations, where you would not like to test your blood sugar?” Answers seem to mirror the mixture of social and technical connotations, mentioned above. This 8-year-old boy claimed for instance: “I wouldn’t test my blood sugar on a party, because there are lots of people.” This strong link between locations and potential spectators is clarified by the following remark of a 13-year-old boy: “I wouldn’t test my blood sugar on a stage or during presentations. [It would be] embarrassing.” In contrast to that, this 12-year-old-boy pointed to a different aspect: “I wouldn’t test my blood sugar on the bus. One would miss the bus stop, if it took you too long.” Involving actions of diabetes management into a game play requires to think of the way we use locations usually: How much time do we spend there? Are we in a hurry? Do we move there fast or slowly? And do we feel secure? Hearing what the users have to say about potential locations more than often reveals unexpected aspects. This article has borrowed its title from the following statement of an 11-year-old girl within the survey. The two locations she refers to, appear to be rather extreme for both activities, she imagined- testing your blood sugar or playing a mobile health game. Nevertheless, her remark points to the importance of considering very pragmatic factors such as comfort and safety within the game play mobile health games. She stated: “I wouldn’t test my blood sugar on high towers and on big ships. There, parts of your equipment can get lost.”
Conclusion

It is important to note that the discussion presented above is intended to be a generator of future research keywords rather than a “scientific” survey. As urban researcher, the author has explored methods of sociological and psychological investigation in order to raise questions and ideas on mobile health games in the perspective of his own academic discipline. Therefore, it claims to be seen as an approach to contribute to an interdisciplinary discourse, which is currently emerging. The development of mobile health games, potentially being played everywhere, next to (immobile) health games, played in private spaces, emphasizes the role of locations within digital services. Facing the complex of potentials and challenges that come along with mobile health games, a transparent, participatory and user-centered design process appears to be essential. As shown above, playtesting very early stages of DiabetesCity in the form of conceptual prototypes and board game models has helped to set a group of 8 to 13-year-old patients into the position to point to several design challenges in their own perspective. Their comments on locations and potential participants, presented in this article, have shown that social and technical aspects are closely related in interactive design. This may be particularly true within a health related context. Involving users in initial stages has led to several insights to this new and evolving topic, and has revealed a variety of unexpected impulses and research questions. This may render a participatory design approach as encouraging for further exploration.
Acknowledgement

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Books


Journals


Websites


Games


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