Empathy & Information: Ingredients for a Children's Game on Diabetes

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***Abstract*—Type 1 diabetes patients have to control their blood insulin throughout their lives. Mastering this process increases one's quality of life as well as one's life expectancy. Since the 1990s, video games have been successfully informing diabetic children about the impacts of dietary habits or providing assistance by logging, visualising and rewarding a balanced insulin level. In the long list of diabetes-related games, some design choices frequently re-occur: (1) The player's identification with the game's protagonist whose metabolism needs to be balanced, (2) the aforementioned log-and-reward mechanism that rewards the player's own compliance with insulin medication and proper diet with game-related bonuses, and (3) a focus on the biochemical basics of the disease. We have investigated numerous game titles and several reviews on diabetes-related games, but could not identify a single game that incorporated all three core mechanics. For this reason, we propose a game design concept that merges these mechanics but, despite these interwoven goals, remains accessible for kids.**

I. State-of-the-Art

There are diabetes-related games where the player plays in 1st or 3rd person. 1st person games are typically adventure-style games, whereas 3rd person games often adapt common jump and run-mechanics with efforts to avoiding unhealthy treats and collecting the right items at the right time to stay "fit". I got this: An Interactive Story (University of California, 2015) is a hand-drawn adventure game in 1st person view that explains the life-changing aspects of Type 2 diabetes, including physical limitations but also social impacts. In Diabetes 360 (Human Games, 2019), the player assumes the role of a diabetes patient (1st person view), navigates and interacts with a clean 3D environment. Physical exercise, eating and medication affect the glucose level of the player and thus his health. In terms of 3rd person perspectives, in [1] a study showed that playing the video game Packy & Marlon game could improve the communication about diabetes between affected kids and their parents, the children's self-care behaviours and the number of emergencies. Like in Captain Novolin [2], Pandabetic (M1Play, 2017) or Balance [3], the player takes the role of a jump and run-character who monitors blood glucose, takes insulin injections, and chooses foods, while setting out to save a diabetes summer camp from supply-stealing rodents. The jump and run mechanics also apply to Huima Hiilari (HUS-kuntayhtm, 2017), an endless runner to instil the right behavioural choices to diabetes patients. Beyond jumping and running, other games promote special abilities when keeping the right sugar/insulin levels as in Magi, where a sorcerer uses magic against evil robot armies, or in Detective where a criminal is hunted [4]. Instead of playing the main character, players may also feed and treat them with food or drugs, e.g. Jerry the Bear (Sproutel Inc., 2019) or Dex: Your Virtual Pet (Augusta University, 2016). In some games, the player's self-care activities reflect positively on the virtual companion, e.g. in Diapets (Giancarlo Cavalcante, 2016) a little baby dragon character will maintain health and happiness. The game uses notifications and ties in with Apple's HealthKit framework to retrieve data about the player's activities and to support self-care. Other games link biochemcial facts (such as carbohydrate contents in various foods) and interactions (e.g. the impact on the blood sugar level) to arbitrary game mechanics – from puzzlers to arcade games. Seeking and mining life-saving insulin(um) is at the core of the 2D space ship game Commander Gage: T-1 Space Rangers (Fletcher/Rosen Interactive, 2016). Diabetic's Diner (iWOO Health, 2016) reduces the instilment of dietary challenges to an arcade game where healthy food items have to be picked up by means of a simple touch-gesture, before they fall on the ground. In BuildupBlocks and CarboBuster the player solves quizzes to unlock block-based puzzles [4] (Mahalo Health Inc., 2019). In [5] the player estimates the carbohydrate contents of different food items that are augmented onto the video feed of a real dish. In Monster Manor [6], the log-and-reward mechanic is realised by coins that can be spent on various in-game items that are essential for progression through the game. Social games like HealthSeeker also support self-care routines, encouraging players to share their achievements. HealthSeeker is social game staged on Facebook [4]. In Diabattle (N8 Solucoes Inteligentes, Ltda., 2019), each player receives credits based on the reported frequency and regularity of measures by other players he follows. Strong groups can form and reinforce each other's compliance. The collected credits can be spent on one-on-one battleship matches.

II. Design Concept

As stated in the abstract, we aim at creating a game for children suffering from type 1 diabetes that combines the means to (1) identify oneself with the game's main character, (2) report/support the player's self-care and (3) provide information about the underlying biochemical mechanisms that trigger the symptoms of the disease and provide the rationale for healthy behaviour. These criteria were not only motivated by the state-of-the-art but were also specific demands expressed by a diabetes expert that we interviewed at the beginning of the project. According to his feedback, point (3) should be the first to be addressed as the mechanical explanations of the disease mitigate potential fears the children might have. Despite the existing diabetes-related games for children, the expert reported that there is still great demand, frequently expressed by the children's parents. Of points (1) and (2), the doctor emphasised the identification with the main character as a key factor to a successful game. Based on our survey

and the expert's feedback, we have arrived at the following design concept. The main character has simple, colourful, anthropomorphic looks and demeanour (Fig. 1). Simplicity in its geometric model would contribute to a broader adaption to other potential applications, media or contexts, and thus render it more accessible. Different form the games we have researched, the player should be able to choose a character and have him as a companion. In this way, there would be a strong bond between the game and the player, like in "Tamagochi"-like games but the character would also serve as a link to explore the game's virtual universe. As a mediator between worlds, the character can address the player directly and naturally provide the necessary information about the game, the biomedical mechanics, etc. Different from preceding games, our main character should be able to react to simple voice commands, assist in logging data about the player's self-care activities, such as sports, eating/drinking or medication, and if necessary, approach the player to inquire about his current state. If permitted by the parents and accepted by the player, the reported data could be made available to the doctor to optimise his treatment and advice. In terms of concrete game mechanics, the player is offered several sections that support his interest. One section explains the basics about type 1 diabetes. Here, the player can feed a child by dragging and dropping various food items on his mouth to actually see their digestion and how their molecules can be utilised by the cells depending on the current insulin levels (Fig. 2). Metabolic imbalances should yield the corresponding effects on the child, further interactions could help to set things right again. A simple agent-based approach should suffice for an according qualitative simulation. Shaking, swiping and other gestures could accelerate the digestive processes to increase the player's engagement. In a second section, the player can explore different planets that host different food categories such as meats and fish, drinks, backed goods, fruits and vegetables, etc. (Fig. 3). Learning the exact carbohydrate units could be hidden in the need to replenish the space ship with energy. A third section would focus on hyperglycaemia, provide animations of various symptoms and allow the player to check his own state talking to his companion or entering rough estimates using sliders.

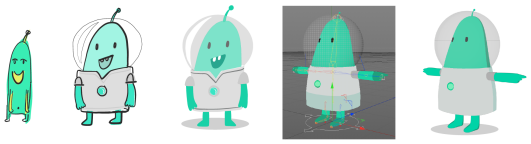

Fig. 1: Final touches of the first character study.

III. Conclusion

Based on literature and expert feedback, we developed a game concept that (1) involves an empathetic companion, (2) allows to report on self-care activities and states, and (3) informs about the biomechanical principles of type 1 diabetes. We propose a virtual world that allows the player to explore information that is interesting to the player or just use the companionship for logging self-care states. For the implementation we will deploy ready-to-use solutions provided by environments like Unity (including speech recognition). We hope to instigate fruitful discussions and in the medium term to motivate a successful adoption of the game.

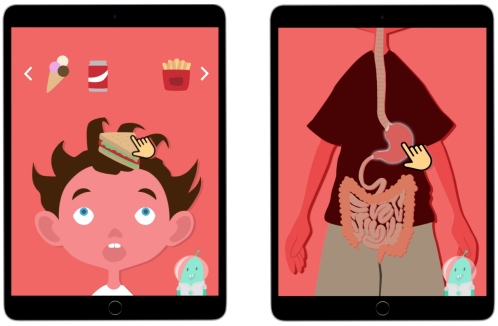

Fig. 2: Interactive exploration of the basics of diabetes.

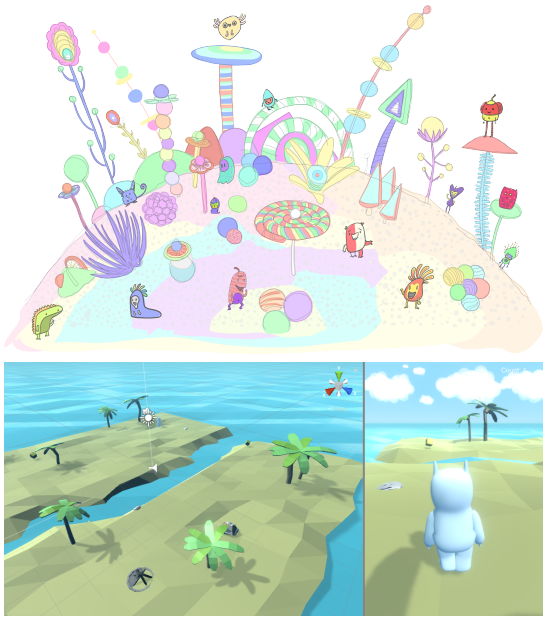

Fig. 3: Top: Food planet concept art. Bottom: Testing planetary exploration.

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