



“Always a Tall Order”: Values and Practices of Professional Game Designers of Serious Games for Health

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ABSTRACT

Serious games for health utilize game media to help players attain health-related goals. Game designers play a crucial role in this growing game genre; they focus on particularly challenging design problems that are not well represented in the literature. In this study, we interviewed 11 professional game designers focused on games for health to explore how they perceived and approached their work. Our findings revealed how our participants considered “success” and the challenges of designing games for health; we also identified various methods and tools used in their practice. Additionally, we found that our participants were very user-centric and tended to focus almost equally on the problem and the solution spaces when approaching game design. The insights presented in this study will be of interest to games for health researchers and designers. This work also contributes to bridging the research-practice gap in the community exploring games as purposeful media.

Author Keywords

Game designer; design practice; game design; games for health; serious game.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

In this study, we explored how game designers who focus on serious games for health perceive and approach designing games. Serious games are those designed to “deliver a message, teach a lesson, or provide an experience” [25]; they aim to convey a purposeful goal in addition to entertainment. Serious games for health (or simply games for health, or health games) are a thriving area that targets various types of health related goals. Games in this genre have included games designed to: (1) promote a healthy behavior such as healthy eating or

smoking cessation [19,42,43], (2) encourage physical activities (sometimes called exergames) [24,30,38], (3) support rehabilitation activities involved in a therapy [1,8,12], and (4) improve health and wellbeing of elderly populations [16,28]. Accordingly, target audiences for health games are also diverse, including children, elderly adults, people who have health conditions, caregivers, and the general public.

The field of games for health has experienced a rapid growth in the past 30 years [29]; as of this writing, practitioners have created more than 400 published health-related games [11]. This growth has also inspired (and is expedited by) professional and research communities such as the Games for Health Project [31] and the Games for Health Journal [2]. Currently, games for health is an active and flourishing area that attracts diverse professionals including designers, researchers, and medical and healthcare experts.

Game designers play a crucial role in the development of games for health. In their day-to-day practice, they communicate with various stakeholders, research subject matter, interact with target players, and strive to create an engaging experience to convey the purposeful goal. Different from other types of serious games, games for health are often aimed at players with special needs, such as elderly populations and/or people with disabilities. Therefore, games for health designers often face unique and significant challenges to making their end products accessible and engaging to target players while delivering the intended objectives. However, there is little research examining how these designers perceive and overcome these challenges. Game designers have often shared their insights through postmortems (i.e. reflections on a particular game project) and in other venues such as talks in game development conferences [18]. In the field of games for health, however, this type of information sharing is not common, with only a few exceptions (e.g. [7,20,31]). Further, no work has been done to synthesize the knowledge and experiences of this group of game designers.

In this paper, we bridge this gap by accumulating insights from professional game designers who focus on games for health through in-depth interviews. In particular, we were interested in understanding: (1) how the designers judge and perceive success of games for health projects; (2) how

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they think about and act on the challenges in their work; (3) how they acquired domain knowledge and assessed their games; and (4) what “tools” they used to support their work. For the last point, we adopted Stolterman et al.’s concept of *Designerly Tools* that include concepts, theories, and artifacts that supported design activity [40].

Our work acknowledges a focus in recent Human-Computer Interaction (HCI) research aimed at understanding designers as professional practitioners and exploring the processes and tools that designers use and value in their practice [13,27,41]. A rationale for this approach is that an emphasis on professional designers’ experience, including an understanding of their distinctive approach to creative work, will help bridge the research-practice gap in the HCI community and support design education. As such, we argue that understanding the values and practices of game design professionals is a needed first step to explore important Player-Computer Interaction factors such as (a) adaptation of Games User Research methods in serious game design and (b) methods and tools that can better support serious game designers.

Understanding how games for health designers think and act in their work is important for two additional reasons. First, designers of games for health focus on particularly challenging design areas that are not well represented in the literature. As such, we believe that insights obtained from this group of designers can also inform research on serious game design in other areas. Second, cases cited in the literature have identified that game designers’ expertise and skills are not always sufficiently stressed in the design of games for health [7,20]. In other words, there has often been a stronger emphasis on meeting the health-related goals than on designing an engaging game experience; this could be a reason why many games for health projects have not been considered successful [6]. As the field matures, emphasizing and understanding game designers’ role will become increasingly imperative for the creation of successful games for health.

RELATED WORK

This study is grounded in work related to: (1) games for health research concerned with the balance between player engagement and the game’s effectiveness; and (2) research about design practitioners, especially those involving interaction designers and game designers.

Games for Health

Research in games for health has focused on subjects including: (1) healthy behavior [19,42,43], (2) physical activities [24,30,38], (3) rehabilitation [1,8,12], and (4) elderly wellbeing [16,28]. While much of the work in this area is aimed at evaluating the game’s effectiveness at addressing the health-related goals, researchers have also investigated player engagement in recent literature. For example, Alankus et al. [1] created nine adjustable games for upper body rehabilitation of patients who have had a stroke; in user studies of these games, they emphasized players’ motivation and engagement in addition to the

games’ accessibility and efficacy. In another example focused on encouraging physical activity of elementary school children, Penko and Barkley [30] found that a motion-based Wii game generated significantly better physiological outcomes and were preferred by both lean and overweight children when compared to either (1) a traditional “sedentary” Nintendo game with the same theme and (2) physical exercises.

Researchers have also generated design guidelines aimed at increasing game engagement in health games. For example, Flores et al. [12] generated a list of design criteria for stroke rehabilitation games for people who were elderly; the list included criteria focused on entertainment. A stronger focus on engagement has led to the understanding that an effective collaboration between subject matter experts and game designers is important for creating successful games for health [6,12]. For example, Thompson et al. [42] reported a case study of how a close collaboration between game designers and behavioral scientists led to the creation of a promising game that focused on preventing Type 2 diabetes and obesity among youths. Built upon the related literature about the balance between player engagement and the game’s effectiveness in games for health, this work is particularly focused on the role of game designers.

Understanding Design Practitioners

Based on studies with practitioners from various areas (e.g. architects and psychotherapists), Schön [37] proposed common characteristics of expert practitioners: (1) expert practitioners consider each practice situation as a unique and undetermined case; and (2) they frequently reframe this situation through “reflection-in-action” (i.e., reflective conversations during practice that is aimed at assessing and adjusting actions in an unfolding situation). Echoing this view, Cross [27] argued that design expertise requires the abilities to solve ill-defined problems and adopt solution-focused strategies. He called for exploring “deep, underlying patterns of how designers think and act.” In this study, we aimed to understand how designers of games for health think and act (based on their reflection) to meet the unique and unfamiliar challenges in their work. In the following sections, we review literature aimed at understanding interaction designers and game designers.

Understanding Interaction Designers

The HCI community has explored the HCI/UX practitioners’ perceptions and practices since the field is inaugurated (e.g. [14,33]). In a seminal paper, Gould and Lewis [14] outlined three principles that defined a “user-centered” approach: (a) early focus on the user, (b) empirical measurement, and (c) iterative design. Aiming to explore how professional practitioners considered these principles, they asked the attendees of a HCI conference to describe the major steps they regard as good practice in their work. Only a small fraction of their participants mentioned the three principles [14].

As the interaction design profession matures, more recent related research has focused on stressing the role of

designers and acknowledging their experience and skills [13,32,39–41,46]. A rationale for this approach is that knowledge about designers' values and practices will help bridge the HCI research-practice gap and support design education. For example, Goodman et al. discussed the gap between HCI research and interaction design practice; they proposed a shift in which "HCI researchers turn their attention to producing theories of interaction design practice that resonate with practitioners themselves" [13]. Stolterman et al. also proposed the concept of *Designerly Tools* aimed at exploring "methods, tools, techniques, and approaches that support design activity in a way that is appreciated by practicing designers" [40]. In an exploratory study, the authors found that designers framed tools as having two different purposes: supporting design thinking and supporting creation of an artifact. In addition, designers considered physical or digital tools and conceptual tools (theories and approaches) in the same manner [40]. These insights informed the interview questions in our study.

Understanding Game Designers

How game designers think and work has also been a topic of recent research [4,15,23]. For example, Hagen [15] interviewed six game designers from major game development studios in Sweden to understand how they considered and captured player experience in their work. He found that while all participants considered player experience as an important focus in design, most adopted an "autobiographical design" approach when capturing player experience; i.e., the designers they interviewed mainly relied on their personal and professional experiences when approaching design and rarely leveraged user research methods to understand their target players and assess their games [15]. Related, Manker and Arvola [23] interviewed 27 game designers to understand how they perceived and practiced prototyping to support their design. They found that prototyping helped designers set and clarify the design goals and communicate design ideas to stakeholders.

There are very few studies focused on designers of serious games; many have focused on games for learning (e.g. [17,34]). For example, Isbister et al. [17] interviewed 17 game designers within and beyond the games for learning field to explore how they considered the challenges and best practices in educational game design. Their participants claimed that serious games must be fun first and the serious contents need to be deeply integrated in the game mechanics and goals. Interviewees also expressed concerns about sparse resources (e.g. budget and time) that reduced the designers' abilities to polish their games to a higher level. Delving into the issue of how designers integrate serious contents into gameplay, Ryan and Charsky [34] interviewed 11 serious game practitioners. They identified several factors that influenced the success of this integration; factors included sufficient evaluation, adequate resources, and client collaboration and understanding. Related to games for health, Mueller and Isbister [18,26] collected game design experts' feedback about design

guidelines they had created for movement-based games; the authors asked their participants to evaluate their guidelines' appropriateness, accuracy, and the communicative value. In our literature review, we were unable to find work that directly targeted understanding games for health designers. Our work thus contributes to the literature by focusing on this unique and challenging design terrain.

METHODS

We conducted semi-structured interviews with 11 professional game designers who are currently working in the games for health field. In the following sections, we discuss our recruitment process and participants, our interview protocol, and our data analysis procedure. This study was approved by the Institutional Review Boards at DePaul University to ensure ethical conduct.

Participants

We began the recruitment process by identifying authors or presenters from the Games for Health Journal (22 issues from February 2012 to August 2015) and the Games for Health Conference (2013 and 2014) who were associated with a professional game design studio. We then followed each studio's website and collected names and contact information (if available) of the game designers in the studio. Among the 48 game designers we identified, we were able to obtain an email address contact for 30 designers. We sent recruitment emails to those 30 designers; 11 responded and completed the interview.

Among the 11 participants we interviewed, nine were from the United States (from five states including Illinois, Wisconsin, Pennsylvania, Texas, and California), one was from the Netherlands, and one was from the UK; four out of the 11 designers were female. All participants had a job title that included "designer" or "creative director" and considered game design as their main responsibility. Their professional experience as game designers varied between 3 and 23 years. All participants had actively worked on games for health projects during the past three years; many were designing a game for health at the time of our interview. All but one participant had also worked on game projects beyond games for health, including commercial entertainment games and games for learning. Table 1 summarizes professional experiences of our participants.

While most participants focused on digital games ($N = 8$), two had exclusively worked on tabletop games and the remaining one focused on active games that are played in a real-world space. The health goals participants had considered included promoting a healthy behavior ($N = 5$), addressing a mental health issue (e.g. anxiety) ($N = 4$), increasing awareness or empathy of a health condition (e.g. depression) ($N = 2$), supporting conversations around health related issues (e.g. sex and sexuality among teens) ($N = 2$), and promoting physical exercise ($N = 2$).

Interviews

We conducted the interviews between October and December 2015. All but one interview was conducted via

ID	Job title	Years as game designer	# of games for health designed	% of games for health in all projects
P1	Creative Director	8	7	66%
P2	Head of Game Design	23	3	10%
P3	Senior Game Designer	10	3	20%
P4	Creative Director	15	3	20%
P5	Lead Designer	20	25	80%
P6	Lead Designer	5	2	50%
P7	VP of Design	13	10	50%
P8	Art Director	8	4	25%
P9	Game Designer	9	10	50%
P10	Lead Designer	8	2	30%
P11	Game Designer	3	10	100%

Table 1. Summary of participants' professional experiences (all data were collected at the time of the interview)

phone calls or VoIP; the remaining one was conducted in-person. During the interviews, we asked participants about many aspects as to how they think and act in practice, including: (1) processes they followed to design games for health; (2) their most and least successful games for health projects and their accounts related to successfulness; (3) methods they used to acquire domain knowledge and to explore the needs of their target players; (4) methods they used to evaluate their games; (5) the biggest challenges they considered in games for health design; and (6) the tools they used for designing games for health. Each interview took between 30 and 45 minutes; interviews were audio-recorded and later fully transcribed.

Data Analysis

We adopted a grounded theory approach [9] and followed four steps in analyzing the transcribed interviews.

1. One author conducted structural coding [35] of the interviews to identify the major topics and the corresponding text segments. The topics identified in this step included (1) general approach, (2) success, (3) challenge, (4) domain research and game evaluation, and (5) tools used.
2. Two authors independently analyzed the interviews and inductively coded for salient themes in each structural topic identified in step 1.
3. The two authors discussed their codes and reached an agreement on the themes they identified. They then co-wrote a codebook to describe how to identify those themes; in the codebook, each theme was associated with one or more structural topics.
4. A third author who did not involve in the interviews and the codebook creation process (i.e. a blind coder) used the codebook and deductively coded the interviews. We then calculated inter-rater reliability using Cohen's kappa through binary agreement with the blind coder (i.e. if a theme was identified at least

once within a structural topic in the interview, we coded it "Yes").

FINDINGS

Among all the themes included in our codebook, the average inter-rater reliability based on Cohen's kappa was 0.68 ($SD = 0.27$); a kappa statistic between 0.60 and 0.80 is considered a "substantial" agreement [22]. In the following sections, we only report on themes in which inter-rater reliability was considered substantial or better (Cohen's kappa is 0.60 or greater) and at least three participants mentioned the theme. Those themes were categorized into the four overarching topics based on the structural coding: (1) success, (2) challenge, (3) domain research and game evaluation methods, and (4) tools used in design.

Success

We asked participants to describe their most and least successful games for health projects and reflect on why they felt the games were successful or unsuccessful. When discussing this topic, participants mentioned two top-level themes: (1) specifics about *criteria* they considered when determining the success of a game for health and (2) specifics about *factors* that contributed to the successfulness or unsuccessfulness of a game for health. When coding these themes, we consolidated the designers' opinions and reflections on both successful and unsuccessful projects; i.e. similar criteria or factors were discussed in both successful and unsuccessful projects.

Success Criteria

When discussing how they judged the success of a game for health project, participants mentioned standards and criteria that fell into one of the three categories: (a) the game's effectiveness at addressing the targeted health goals, (b) a balance between engagement and efficacy, and (c) adoption and/or publicity of the game.

(a) Eight of our participants considered meeting the game's serious objectives (i.e. the health goals) as a criterion of success. For example, P5 explicitly mentioned that he would generally regard efficacy and effectiveness as the top success measure:

"The measure of success is whether your hypothesis turns out to be true. You know, I could measure success based on unit sales. But you are very limited on that. I would really measure it on efficacy and on effectiveness."

When considering a game designed to support children with an attention deficit hyperactivity disorder (ADHD), P9 discussed its success around clinical tests and meeting the serious goals:

"That is a rare thing – that is it was really tested clinically and validated. ... I think in that case. It was really successful. And I think it really provided the users with all the goals they needed to have with the game."

(b) Five participants also explicitly discussed player experience and considered achieving a balance between player engagement and goal efficacy as a success criterion.

For example, when talking about the same game supporting children with ADHD, P9 also stressed the importance of balancing efficacy with engaging gameplay; he mentioned that this consideration is more associated with his own perspective as a game designer:

“If I look at that project, I think it was one of my biggest successes in terms of how to make a real game that also has these serious elements in it. ... That’s always a delicate balance between how serious something gets and how fun it is to play. ... So from my point of view as a designer, it was a really successful game.”

P2, a veteran commercial game designer who recently entered the games for health area, discussed the differences between success of a commercial game and a game for health; he emphasized the importance of embedding engagement into the game to support the serious contents:

“We can’t typically design a game like you would in entertainment. You would have to look at the learning and health goals, talk with subject matter experts, and come up with very unique ways in order to add that fun factor or engagement in the game. That really is embedded in how those goals come across.”

(c) Seven participants mentioned that they considered a wide adoption and/or a considerable publicity as a measure of success. For example, P4 considered a game aimed at helping youths understand medical knowledge as successful because it had “won some awards.” P8 also mentioned a wide adoption when talking about the success of a unique game that leveraged biofeedback mechanisms for young people to understand and manage anxiety; in addition to the standard mouse and keyboard control, the game reacts to changes in players’ physiological state such as pulse and sweat monitored using biofeedback hardware:

“This game has been used in a variety of environments and it’s our most requested game. So in that respect, that made it a uniquely successful product for us.”

While P9 considered the game for children with ADHD as successful in terms of effectiveness and a balance between player engagement and goal efficacy, he lamented about the low adoption of the game:

“But unfortunately, it wasn’t really a success with the rollout. I think not a lot of people actually played the game. ... That’s a bit sad.”

Success Factors

Participants discussed various factors that contributed to the success of their games. We categorized the factors into four groups: (a) direct interaction with target players, (b) stakeholder communication and cooperation, (c) successful game design elements and design choices, and (d) iteration.

(a) Seven of our participants considered direct interaction with target players as an important factor to achieve success. Many mentioned that including target players in a participatory design process or during playtest sessions had

helped them understand the characteristics and needs of their players and/or had provided insightful information for designing the games. For example, when talking about a game to promote healthy behavior for patients who have had a heart failure, P7 mentioned that insights gained from interviews with target players had motivated him to adopt a minimalist game design style that had contributed to the success of the game:

“What we found in our interviews with patients at the beginning of our design process was that even the basic literacy level of many of the patients is super low. ... And people’s scientific literacy and medical literacy was even lower. So we really, really simplified it.”

(b) Six participants considered the quality of the partnership with other stakeholders (e.g. the client or subject matter experts) and the support they acquired from the stakeholders as a factor contributing to the games’ success. For example, P7 mentioned a good partnership with other team members had allowed the designer to embrace his minimalist game design style:

“Luckily we had a team that trusted us and I had a lot of support from the folks we were working with. So we were able to say, ‘we are really going to focus on these complete really basic ideas.’”

Some participants also valued the domain and user information provided by the subject matter experts (i.e. medical and healthcare experts) that helped achieve success of the game. For example, P9 emphasized the support he acquired from the client and the subject matter experts:

“We had a team of researchers at our disposal that was really involved in the whole process. ... They knew everything about the subject and we could iterate with them on how we should implement that in the game.”

Poor partnership with stakeholders would also negatively affect the game’s success. When talking about an unsuccessful game, P9 considered a scenario in which an assertive client can impede a designer’s effort to achieve a balance between player engagement and goal efficacy:

“Especially if the client is really pushing its vision on the game through, then you have a game that the client think is great but the users are not that interested about it – players are just not engaged and they don’t like to play the game. Then basically it fails to meet the goals that you set for the project.”

(c) Seven participants mentioned general game design elements (e.g. narratives, challenge, etc.) or specific design choices when discussing factors contributed to the success of a game. For example, P3 designed an iPad game aimed at supporting youths at risk of sexually transmitted diseases; she mentioned that focusing on narratives and delivering an authentic experience helped to make the game successful:

“We focused on narrative and making important decisions and seeing the outcome of the decisions. ... We

also focused on trying to capture the narrative quality of stories that these players would see in their everyday life, trying to make it feel authentic so that they would be interested – kind of like they were interested in what's happening to themselves and their peers.”

P8 also emphasized game narratives in a game for anxiety management; he strived for combining novel technology and narratives to create a unique player experience:

“There is the novel aspect of it: We merged clinical techniques and eastern techniques [of anxiety management] into our own mythic world. So it has a very unique narrative. Also, it's a game that works with the biofeedback device, which a lot of people are not doing.”

(d) Three participants explicitly mentioned that design iteration is a key to create successful games. For example, P2 provided an insightful summary of his design philosophy, in which he valued the combination of subject matter expert support, direct interaction with target players, and iteration:

“I got up with that whole idea of, you know, more time with subject matter experts and more time with focus-testing and iterating on design, the better the game would be. I think that's the key in any game for impact.”

Challenge

We identified six themes in participants' consideration of the major challenges in games for health design: (a) combining engagement and the serious game goals, (b) consolidating interests of subject matter experts and game designers, (c) evaluating efficacy, (d) working with limited resources, (e) achieving lasting impact and interest, and (f) overcoming stereotypes associated with gaming.

(a) Six participants felt a major challenge in games for health design is to achieve a balance between player engagement and the game's effectiveness at addressing the health goals. On one hand, participants regarded achieving the health goal via an engaging game as challenging. For example, P3 said:

“The biggest challenge is that it's always a tall order. It's not just about designing an engaging game. But you have to really be aware of the research, you have to really investigate the problem, and you have other metrics for success in addition to the game is engaging – you also have to achieve the purpose. So I think there is just a lot more requirements for this kind of game.”

On the other hand, many participants also emphasized the difficulty of achieving player engagement in games for health and lamented on the lack of engagement in many current games. For example, P2 mentioned:

“The biggest challenge is making it still feel like a game. It's ultimately its name, you know, a ‘game for health’, versus a ‘task for health’. There are a lot of games out there that are just tasks. So the challenge is trying to

embed that goal in a very playful way ... so it should come across very naturally.”

(b) Four participants mentioned that it is often challenging to consolidate the different mindsets, interests, and motivations between the subject matter experts and the designers. For example, P2 talked about the conflicts they often meet and the compromise they often have to make when working with subject matter experts:

“On almost every project we come to this point of compromise, where as game designers, we are trying to add very game-like motivations and trying to embed and hide the serious goals in there, and then the PIs or the subject matter experts are scientists and they are looking at it from science. So they tend to want to just see the serious goals in every interface. So what usually ended up happening is we strip out what we call the fun and engagement part of it and we end up putting in like ‘look what you are getting’ in your face – because that makes them feel better.”

P4 discussed the same issue and felt the severity of the issue “depends on how well the subject experts understand games.” P5 also emphasized the difficulty to communicate with subject matter experts because of this difference on mindsets and focuses:

“One of the barriers to serious game development is the disconnect between game developers and the serious content providers. They often do not speak the same language or understand each other's areas. ... Especially in healthcare, many of the subject experts are not game players. ... So when talking about games they may understand the words but not be able to relate it to an experience in their own fund of knowledge.”

(c) Three participants considered measuring the efficacy of games for health as a major challenge. Participants mentioned various reasons for the difficulty of measuring efficacy. First, it is sometimes difficult to define the proper metrics for efficacy in games for health. Second, a proper measurement requires resources such as time and committed partners that are often limited in games for health projects. Third, a proper evaluation on efficacy is usually done when the game is finished and it has little value to feedback to the design iterations. Mentioning all three reasons, P7 said:

“I think the biggest challenge is measurement – to actually do a pilot and get a scientifically rigorous assessment about whether or not the intervention is successful. The problem we face is also that it takes a long time. It takes a really committed partner. And it's really hard to iterate when you have to wait for six months or a year to get data from a study like that.”

(d) Three participants also emphasized that games for health projects usually have to work around limited resources such as time and budget, which poses a considerable challenge. For example, P3 considered limited

budget is one reason that constrained the quality of some games for health projects:

“I think one of the biggest challenges is that we have to do more with less. The projects are usually underfunded. ... The typically funded, they are in smaller amounts as compared to traditional entertainment games. ... I think that is one of the reasons why some of these games struggle with quality.”

(e) Three participants mentioned that it is often challenging for games for health to achieve sustainable impacts and maintain lasting player interest. P1 also associated this challenge of sustainability with limited budget:

“I think the biggest challenge is promoting lasting change and having a sustainable experience. There is a novelty value to every game – people play it for a while ... and often you come to know that over time this novelty wears off very quickly. ... Since we don't have much money to create a huge game for health, it is a problem using one or two intervention and then people play it for an hour and you are done. So being able to milk that positive benefit of games for a longer amount of time is a huge challenge.”

(f) Three participants considered a challenge for games for health is to handle stereotypes associated with gaming. For example, P6 designed a board game aimed at supporting communication around end of life topics; a big challenge he experienced when promoting this game was a stereotype that people think games are not serious:

“Especially at the beginning when we were starting the design of the game and trying to get people interested in it, particularly because this is a very serious topic, people don't think games are appropriate for this kind of thing. ... A few weeks ago, there was a big event where people play the game and afterwards several people came up and said, ‘I really enjoyed it. We had a lot of fun. But don't call it a game.’ And I think there is a disconnection about what a game is.”

Domain Research and Game Evaluation Methods

We asked participants to describe methods they had used to understand the domain and the target players and methods they had used to evaluate their games. We organized these methods into two top-level themes: (1) before-prototype methods and (2) after-prototype methods.

Before-Prototype Methods

Before creating a game prototype, participants mentioned use of various methods to understand the subject matter topic, explore the characteristics and needs of targeted players, and refine the game's objectives. We grouped the before-prototype methods into three major types: (a) get support from subject matter experts, (b) directly interact with target players, and (c) read materials about the domain. These methods eventually supported the designers in brainstorming and prototyping.

(a) All 11 participants acquired some kind of support from subject matter experts before prototyping starts in at least one of their games for health projects. However, the level and the form of subject matter experts' involvement varied.

Some participants gained subject matter experts' help from informal conversations. For example, P1 mentioned that she regularly talked with a medical school professor who focused on the treatment of anxiety disorders to acquire knowledge about this subject.

In contrast, some games for health projects were led by or partnered with a research group focused on the subject matter. For example, P7 mentioned that he usually get subject matter experts' support from this kind of partnership:

“We start with our client and our partner. They often have subject matter experts. So we start there to learn what they believe the context would be. They are not our players – they are not our end audience. But they do inform the criteria for success and what they believe to be the correct objectives.”

In some cases, game development studios had hired subject matter experts to support their design. For example, P8 discussed how they hired different types of experts throughout the design process:

“We usually have two levels of experts. We have people who are generalists. They come in early and set the table for the domain. ... We sometimes call them ‘storytellers.’ They help the whole team get familiar with and start understanding the domain. Then once we drill in, and we start knowing what we are going to focus. We bring in content experts. They really know a lot about specific things. We work with them to make sure what we are doing is accurate.”

(b) Seven participants mentioned that they had directly interacted with target players (via e.g. interviews, focus groups, and/or informal conversations) prior to creating a prototype to understand the domain and player needs. For example, P7 stated that he usually conducted interviews with target players before creating a prototype:

“We generally follow a player-centric design process, where we try to do interviews with our target audience up front. ... When we talk to representative players, we were really looking for ‘What's their baseline?’ You know. ‘What are their attitude about the content? What do they know? What don't they know? What do they want to know more about?’ We also have general questions about games: ‘Do they play games? What kind of games? How do they feel about games?’”

(c) Four participants also mentioned that they read materials such as research papers or books to understand the domain and the target players. For example, when designing a game aimed at supporting youths at risk for sexually transmitted diseases, P3 mentioned that after interacting with subject

matter experts they further explored the domain through research materials:

"[After subject experts focus groups,] we then drew from the body of research around behavior change that is long-standing. So we were looking at that research."

After-Prototype Methods

Participants adopted several methods to help evaluate and iterate the prototypes they created. These methods fell into one of the two major categories: (a) playtests that are conducted by the designers themselves and (b) formal research studies that are usually conducted with the support of subject matter experts and focused on game efficacy.

(a) All 11 participants have conducted playtests with target players to help explore the effectiveness, the gameplay, and/or other aspects such as narratives and artwork of their prototypes. The methods participants used in playtests included observations of player behavior ($N = 6$), interviews or focus groups with the players ($N = 5$), surveys during or after playtest sessions ($N = 4$), and remote tests leveraging telemetry data or player diaries ($N = 3$). P9 mentioned all four playtest methods by saying:

"So when you can actually observe it, it gives you the most insight. But we can't always be there. So sometimes we just provide them with the game and they can test it at home. Then they can fill in, for example, surveys online and provide us with feedback. We recently tested a game and let players play it at home. We then had a telephone survey – we call them and ask them how they were doing and how it was the gameplay. So that's a media between seeing it and just letting them fill in the questionnaire."

Participants also expressed concerns with three factors about how to conduct playtest:

1. *Early and often.* Eight of our participants mentioned that they tended to conduct playtests early and often in the development cycle. For example, P7 mentioned: *"As soon as we had something built, usually our first prototype, we do playtesting with representative players and collect data from it. These then inform our iterative development process. We playtest as much as we can in the course of the development."*
2. *Obscuring the purposeful goal.* Four participants mentioned that they intentionally obscured the purposeful goals of the game from the players during playtests to see if the goal emerges from play. For example, when talking about playtesting a game that aimed at promoting awareness and empathy about people who are living with depression, P1 mentioned: *"In the beginning we didn't tell them because I wanted to see whether the experience came across without their knowing what it was about – did we really capture, with the mechanisms and the game structure alone, that feeling of helplessness of loss and frustration – because that was the point."*

3. *Group/social testing.* Four participants mentioned that they included multiple participants in a same playtest session to encourage feedback. For example, when talking about playtesting a game aimed at helping children understand medical knowledge, P4 said, *"Often we will have kids paired up and you want to get them talk to each other. ... And also, it can be helpful for keeping them honest."*

(b) Three participants mentioned that they collaborated with subject matter experts to conduct formal research studies to evaluate the game's effectiveness at addressing the serious goals. For example, P6 mentioned that a research team they were collaborating with was actively evaluating the game for end of life communication:

"The research team is actually the one that's doing much more in-depth studies of how people play the game. They actually do audio and video recording of every game. And then they have a methodology called the Multiple Goals Framework to assess communication qualities."

Tools Used in Design

We asked participants to discuss tools they had used that supported their design of games for health; we explicitly asked them to consider "physical, digital, and conceptual tools." Participants considered several types of tools that included (a) theoretical frameworks, (b) design philosophy or design process, and (c) early prototyping methods. Very few participants mentioned physical and digital tools.

(a) Seven of our participants mentioned that they have used theoretical frameworks that are either published or internal to the participant's organization to support their design; those frameworks included (1) theories about the domain or the subject matter ($N = 3$), (2) works about game design in general (such as Jesse Schell's game design lenses [36], $N = 3$), and (3) frameworks about serious game design ($N = 2$). For example, P7 mentioned that he had used both published and internal frameworks to support his work:

"We leverage Bloom's taxonomy to think about the learning and behavior change objectives. ... We also developed internally in our studio a model of elements of game for behavior change. And that model certainly informs how we approach the design of a game."

(b) Four participants considered a certain design philosophy or a certain aspect of their design process as a "tool." For example, P7 considered a design process of determining the game's objectives up front as a tool:

"I would say that a tool is really our design process, particularly in the very beginning. ... I mentioned the idea of determining learning objectives and behavior objectives up front. ... That really helps us drive the focus early in the project."

Several participants also mentioned using other existing games as a tool to support inspiration or communication. For example, P2 said:

“When working with the PIs and the researchers, one of the tools is playing other games. ... Because a lot of times the people we were working with aren't gamers. So I think games themselves become tools that helped the communication and design.”

(c) Three participants considered early prototyping methods (e.g. using pencil and paper or board game pieces) as tools to support design. For example, P8 considered paper prototyping as a tool to design a digital game:

“A tool is really paper prototyping. Sometimes we even first do it as a board game or a card game.”

DISCUSSION

In this study, we explored how game designers who focused on games for health perceived and approached designing games. We argue that the insights presented in this study bridges a current gap between research and practice in the Player-Computer Interaction (PCI) community; that is, our work exposes current values and practices of game design professionals in the context of games for health, which is a needed first step for discussing (1) adaptation of Games User Research (GUR) methods in serious game design and (2) methods and tools that can better support serious game designers. These insights will be of interest not only to games for health researchers and practitioners, but also contribute to understanding about the design of games as purposeful media. In the following sections we discuss the major implications of our study.

Games for Health Designers Are Very User-Centric

In our interviews, we found that most games for health designers valued and practiced Gould and Lewis's three principles of user-centered design, i.e. early focus on the user, empirical measurement, and iterative design [14]. Further, most participants mentioned interviews or focus groups with target players as one of their first steps approaching a game for health project; many also regarded direct user involvement as an important factor that contributed to the success of their games. These findings suggested that games for health designers tend to put a lot of emphasis on early user involvement and user research.

Notably, our finding is inconsistent with Hagen's discoveries about the practice of some commercial entertainment game designers; while limited on sample size, Hagen [15] found that his entertainment-focused game designer participants tended not to leverage early user research in their work. We speculate that the nature of the game projects may have influenced the approaches of the health and entertainment game designers. Target players of games for health often have special health-related attributes that are not familiar to the designers. In addition, many of the user attributes essential to game design (e.g. target users' play preferences) are also unique to the user group (e.g. an elderly population). As a result, it is crucial for the games for health designers to pay special attention to their target players and conduct user research themselves to understand the player attributes.

Our participants also mentioned that they have adapted common GUR methods to fit in the unique context of games for health design. For example, participants told us that they often obscured the health goals in playtesting sessions to see if those goals were embedded in play. Interviewees also discussed how playtesting methods were limited in establishing the efficacy of the game at meeting health goals; as a result, many of our participants resorted to more formal research studies. These insights indicated that adaptation of traditional GUR methods in serious game design is an important area to explore.

Problem-Focused vs. Solution-Focused

Nigel Cross [27] argued that, unlike problem-focused professionals (e.g. scientists), designers usually adopt a solution-focused strategy when approaching a design problem. According to Cross, designers are often faced with ill-defined and ill-structured problems; as a result, they prefer to approach a problem by synthesizing lessons learned from “planning, inventing, making and doing” to create a satisfactory solution. While we found that games for health designers are also generally solution-focused, many participants in our interviews approached game design by exploring both the problem and the solution spaces somewhat equally.

On one hand, all of our participants were committed to iterative prototyping and playtesting when approaching game design. Participants also relied on this iterative process to refine their understanding of the domain and the target users (i.e. the problem space). On the other hand, we also found that many of our participants put a lot of emphasis on before-prototype methods. Many participants devoted considerable effort to explore the subject matter and the needs of the target players even before creating the first prototype. Additionally, we found that some participants put more emphasis on before-prototype methods than others; i.e. there was a spectrum of problem-focused tendency among our participants. In particular, some of our participants mentioned that they strived to clearly define the serious objectives and the efficacy measures of a proposed game before approaching design.

We feel this tendency of approaching design from the problem and the solution spaces somewhat equally is unique to serious game designers; Vasalou et al. [44] also emphasized pre-prototyping efforts when developing an educational game. We speculate that this tendency among games for health designers has two originating sources. First, games for health designers are facing complex problems that are often unfamiliar to them. As such, they often have to acquire a great amount of domain knowledge in order to approach the initial design; this is also associated with their early user focus tendency. Second, games for health designers often work closely with subject matter experts and other stakeholders who are more accustomed to problem-focused approaches. For example, some of the game projects discussed in the interviews were initiated or funded through a research project led by medical

professionals. As a result, designers often need to adjust their approaches to maintain effective collaboration and communication with these stakeholders.

Games for Health Design Is a Challenging Area

Entertainment and serious game designers all face significant challenges when considering the design of engaging experiences; however the latter group also have to steer player experience to deliver a purposeful goal. Some of our findings about games for health designers' account for challenges were in agreement with the literature focused on other groups of serious game designers. For example, our findings supported that embedding serious content into an engaging gameplay experience is a crucial but difficult aspect [5,7,34]; in addition, maintaining successful stakeholder collaboration is also important but challenging in serious game projects [6,20].

We have also identified several challenges that are particularly important for games for health designers. For example, when compared to educational games, which are usually focused on delivering specific knowledge or skill, games for health often focus on more subtle (e.g. behavior change) or long-term (e.g. rehabilitation) effects. As such, our participants considered establishing efficacy of the games as a significant challenge. In addition, games for health players are diverse; in some areas (e.g. games for elderly adults), the target users are not typically familiar with the game media. So dealing with stereotypes (and sometimes stigmas) associated with gaming was perceived as a challenging aspect by some of our participants.

When addressing those challenges, our interviewees tended to be more problem-oriented and very user-centric in their practice. However, their user-centered efforts did not always help with some of the prominent challenges such as communicating with subject matter experts and achieving lasting player experiences. These findings indicated that more research is needed to help support games for health designers overcome the challenges interviewees discussed.

Success of Games for Health Is a Complex Issue

While delivering an engaging player experience is usually the success criteria of most entertainment games, our interviewees discussed the success of their games for health projects in more complex ways. When we asked our participants to describe their successful and unsuccessful games, they usually started by qualifying the definition of success and continued in discussing multiple aspects of the project, indicating that they did not consider success as a one-dimensional phenomenon. We speculate that this multi-dimensional and sometimes context-based view of success is associated with the challenges designers meet in their work. For example, designers need to balance the needs of various stakeholders including subject matter experts, clients, players, and/or caregivers when approaching their design vision.

In research that has explored factors contributing to the success of serious games, many have proposed game design

elements, such as appropriate challenge and meaningful feedback, as success factors (e.g. [3,21,45]). In our study, however, participants valued process and methodological issues (e.g. interaction with target players, stakeholder communication) over specific game design elements when considering factors leading to success. While we acknowledge game design elements are important components, we call for more research on methodologies and approaches from the games for health and serious game communities.

Tools Are Mostly Theoretical and Conceptual

When discussing tools used to support design, we found that participants took account of major consideration on theoretical frameworks and conceptual approaches. This consideration of theoretical and conceptual tools supports Stolterman et al.'s concept of *Designerly Tools* [40]; i.e. designers value artifacts, methods, and theories similarly as tools. It also resonates with the recent efforts in related literature that explored game designers' accounts of theoretical and conceptual tools [15,18,23]. For example, echoing with Manker and Arvola [23], our participants also considered early prototyping methods as tools to support generating and communicating design ideas. We argue that the designers' emphasis on theoretical and conceptual tools provides insights for both researchers and educators concerned with games for health; i.e. the need to emphasize investigation and teaching about these tools.

Further, very few of our participants mentioned the use of physical or digital tools to support their design. Some participants also expressed dissatisfaction about the lack of design tools. Specifically, our interviewees voiced a need for information tools to help them understand the subject matter and communicate with other stakeholders. We feel that investigating information tools for serious game designers is a valuable future area to explore.

LIMITATIONS AND FUTURE WORK

In this study, we relied on practitioners' reflection on past experiences to explore their values and practices. We recognize that this approach is limited in its ability to understand how designers work "in-action." A longitudinal contextual inquiry would provide supplemental information to this study. In addition, while we aimed to include diverse participants to understand the common themes in their perspectives, exploring how different experience and background can affect designers' perspectives would be compelling future work. In the future, we also plan to examine how theoretical and conceptual tools can support games for health designers. In particular, we are exploring how therapy-centered game design patterns can serve as a tool to support designers focused on games for brain injury rehabilitation [10].

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