Video games for mental health

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In recent years, mental illness has become recognized as a major disease burden globally. According to the World Health Organization, depression is the leading cause of disability around the globe [1]. But not everyone has access to care. This has created a need for innovative approaches to close the mental-health access gap, spurring interest in new digital tools that provide on-demand, scalable, and affordable care. One possible solution: video games, which offer several characteristics that are well suited to the context of mental health [2], including interactivity, aesthetics, and narrative. However, many open questions remain about the impact of game-based interventions, the effects of different game elements on efficacy and experience, and the implementation of video games in a clinical context.

As part of the CHI PLAY conference series, we have organized two workshops (2017 and 2018), inviting researchers and practitioners from communities such as HCI, mental health, and game development to discuss the opportunities and challenges of using video games for mental health.

For both workshops, we were interested in position papers and studies addressing contemporary topics in the field, such as innovative game design; technologies for promoting, assessing, or treating mental health; reflections on the development process of games for mental health; user-centered...
studies involving clients, stakeholders, or caregivers; and playful interaction design for the therapeutic context.

The workshop description, call for papers, and the contributions referred to in this article can be found at https://games4mh.wordpress.com/ for the 2017 workshop [3] and http://chiplaymhforum.wordpress.com for the 2018 workshop [4].

GAMES AS INTERVENTIONS

A common approach to building games for mental health interventions is to identify established intervention approaches, such as cognitive-behavioral therapy (CBT) or mindfulness, and then carefully translate them into a game context. Implementing an existing therapy as a game aims to increase user engagement and adherence in order to improve efficacy. Tying therapeutic praxis or theory-informed approaches to games is the most common strategy. There is also interest in exploring approaches that leverage game design to create game experiences that emulate mental health challenges (e.g., overcoming frustration) and creating training support for the cognitive challenges of mental health. A range of work was presented at the workshops, summarized in the following.

Coyle et al. (2017) gave an overview of the development and key lessons learned while deploying Pesky gNATs—a series of four custom-built, game-based CBT interventions to support face-to-face mental health interventions. The authors highlighted how applying games in a therapeutic context can help to mediate the sometimes challenging relationship between client and therapist; emphasized the need to focus on engaging qualities of games in the therapeutic process; and made clear that Pesky gNATs is intended only to support the therapeutic process and not to replace a therapist. Van der Meulen et al. (2018) contributed to the evaluation of Pesky gNATs by applying thematic analysis to survey data, investigating the expectations and experiences of therapists. Their work raised interesting questions about the advantages and pitfalls of using Pesky gNATs in support of face-to-face therapy.

Eilidh Macleod and Robin Sloan (2017) designed a phone/VR-based game that teaches mindfulness techniques to people recovering from PTSD. They drew upon contemporary game-design techniques and technologies as well as theoretically informed approaches to mental health recovery. In their design, they tied mindfulness practices to game elements: For example, a user must engage in deep breathing to pass certain obstacles. A number of similar design examples are described in their paper.

Marientina Gotsis (2017) designed a game to help people with rejection sensitivity. She underscored the need for technology interventions to go further than merely providing a patient with information about their condition (which mirrors non-digital approaches that Gotsis described as “death by pamphlet”). Gotsis focused on game mechanics as opportunities to repeatedly practice, and master, a skill or a response to a situation. She also discussed common pitfalls in designing serious games and games for mental health, such as overly didactic narratives and games that appear to the user as tedious or too much work.

GAME ELEMENTS

Video games offer a variety of mechanisms that can be explored in the context of mental health intervention. Game narratives offer the opportunity to convey information, to persuade, and to induce emotions. They can also function as a wrapper for other intervention formats, for example by sending the player on a treasure hunt that requires overcoming different challenges (e.g., enabling a reaction-time task). Aesthetic elements such as sounds or visual style contribute to the overall experience and are frequently manipulated to induce different experiences. However, there has been little research that systematically teases out positive or negative effects of game elements on mental health.

Jane Cocks (2017) explored interactive narratives, arguing that these have great potential to deliver health-relevant information leading to behavior change. Here, the importance is placed on aligning psychological, evidence-based frameworks and interactive narrative design. By acknowledging the responsibility of designers and researchers working on interventions, Cocks aimed to establish an evidence-based foundation to support decision making when designing for positive health outcomes.

Julia Bopp and Elisa Mekler (2017) discussed emotionally intense game experiences. The promise is that emotion-inducing games can, for example, generate frustration and anger as a result of randomly changing controls, and can be used in the lab for assessing and training emotion regulation. The authors discussed how the presence of an observer (e.g., researcher, therapist) potentially affects and biases emotionally intense experiences.

Katja Rogers (2018) investigated audio as a single component of game play and connected benefits for well-being to music listening. The author presented research supporting the notion that music is already used for mood regulation (e.g., heavy metal to vent anger), and argued that background music in games also has potential for regulating mood. Preliminary insights from a survey suggest a wide variety of different behaviors around music in games and implications of physiological and sensory distractions.

Huygelier et al. (2017) presented their exploration of ways in which therapeutic games addressing hemispatial neglect (i.e., reduced sensitivity to stimuli on one side of the field of vision caused by damage to one hemisphere of the brain) can adapt to the ongoing variation in individual users through dynamic difficulty adjustment, based on user models. The promise here is the ability of games to respond to differences in people’s individual needs for and responses to intervention. The authors are developing forms of individualized user models, which are informed by the user’s game use and health data.

INDIVIDUAL DIFFERENCES AND SPECIAL POPULATIONS

Video games and playful interactions are used almost universally, transcending societal divisions based on race, sexuality, age, or ability. Video games have the potential to reach users who otherwise might not reach out or benefit from traditional interventions. However, some games might need to be adapted, or the specific needs of a population might need to be characterized to avoid a mismatch between the design intent and the user needs.

Iacovides et al. (2017) studied Rainbow SPARX, an adaptation of the depression-management game
SPARX for young LGBT+ people. The promise is that a more relatable delivery method (i.e., the game adapted for its target audience) would improve the game’s reach. The authors provided insights into design challenges around the character-creation process for LGBT+ people and the potential of social support in online game groups. Intercultural differences between the U.K. and New Zealand in the acceptability of Rainbow SPARX were discussed.

McEwen et al. (2018) designed a game to support the mental well-being of young children (ages 3–5) with cystic fibrosis (CF) in a clinical context. The authors argue that playing games in difficult situations (e.g., long-term hospital stays) supports emotional coping and improves well-being. By applying contemporary motivational design strategies and following a design process involving domain experts and stakeholders, the authors aim to tailor their game design to a special user group, while maximizing psychological need satisfaction and creating an engaging experience.

Schaepen et al. (2017) presented a proposal to study older adults’ personality characteristics in regard to their attitudes to and the usability of head-mounted virtual reality (H-VR) devices. The promise is that better understanding of individual differences and attitudes of older adults regarding H-VR will lead to improved decisions in an applied clinical context. Details of the research design, such as instruments, technology choice, proposed research protocol, and preliminary results were presented.

Branckaert et al. (2018) examined assistive technology for people with dementia through the lens of playful interaction design. The authors argued that adapting playful interaction principles to the needs of people with dementia will improve the interactions of caregivers and family members by stimulating emotions. The authors identified and discussed challenges for design and HCI research and exemplified the approach using a music-playing pillow as a design case.

CHALLENGES FOR CLINICAL USE

While games have shown clinical potential, integrating game-based mental health interventions into the clinical context will be challenging. Health apps for smartphones have similar issues regarding clinical uptake [5]. Investigating acceptance of new technologies, advantages for patient engagement, and the use of games within established therapy contexts opens up promising avenues for future research.

Tom Van Dale and Nele De Witte (2017) explored why the uptake of e-mental health interventions has been slow, despite promising results in controlled trials. Adapting widely used acceptance models, they devised a questionnaire to provide insight into end-user acceptance (i.e., professionals and patients) of, and attitudes toward, technology-based e-mental health interventions.

Newell et al. (2018) focused on mindfulness and the potential for games to maximize patient engagement in therapy. They designed a game to help people learn mindfulness, and in a trial compared the game to traditional teaching techniques. They discussed how gaming can either be mindful or not. Their work raises interesting questions about the ability of different types of activities to promote mindfulness, in particular intrinsically enjoyable activities such as gaming.

EVALUATING GAME-BASED INTERVENTIONS

Besides considerations around how new technologies fit into clinical praxis and how patients can be engaged, it is vital to rigorously evaluate the efficacy of novel approaches. Considering that games have several properties that are atypical for clinical interventions, authors asked how researchers and designers should evaluate games for mental health.

Newell et al. (2017) presented a systematic review of research investigating the effects of video games on depression and anxiety in regard to participant characteristics, features characteristics of video games and video game play, study-design characteristics, change in depression and anxiety outcomes, and theoretical orientations and mechanistic agents of change. Their work emphasized that the mechanisms of video games positively affecting depression and anxiety are not yet well understood.

Danilina et al. (2017) conducted a systematic review of evaluations of the effectiveness of game interventions in supporting mental health. Despite significant work to design such games and evaluate acceptance and feasibility, only a relatively small number of evaluations of effects upon mental health were found in the literature. And only a subset of these published evaluations were randomized control trials (RCT), which is considered by many health researchers to offer the best standard for collecting evidence on effectiveness.

However, Anouk Tuijnman and Joanneke Weerdmeester (2017) argued that for those attempting to design therapeutic games, an RCT provides limited useful information about design issues. Their argument echoes other criticisms from within HCI, pointing out that RCTs are time consuming, do not enable formative testing during development, and typically examine the impact of an overall system without testing individual features (e.g., [6]). These authors argued for the use of alternative research paradigms in evaluating games for e-mental health.

MENTAL-HEALTH ASSESSMENT

Several authors were also interested in using games to assess mental health or to measure cognitive abilities over time. The general idea behind these approaches is that games feature cognitive challenges that are similar to those commonly used in clinical assessment. The promise is that in-game performance data, expressed for example as a response time or short-term memory recall, can be used for modeling and assessing cognitive deviations and predicting mental health.

Lomas et al. (2017) presented their exploration of the power of mobile games to measure a player’s cognitive function—frequently, longitudinally and in the wild, and just as important, at scale and at low cost. Here, the promise of games (relative to other mobile tools) is in effectively measuring cognitive function while also motivating the user to engage with the tool in an ongoing manner. Their approach could support patients and clinicians engaged in therapy, as well as enable new forms of data-driven psychological research into the nature and prevalence of psychiatric conditions and the efficacy of treatments.
Gielis et al. (2017) explored the potential of the digital card game Klondike Solitaire as a screening instrument for cognitive impairment among older adults. Building a screening tool based on already measured cognitive performance data (i.e., card play) promises to have increased assessment adherence leading to more accurate data over time. Results from an initial study exploring the clinical potential and the cognitive functions that could be assessed with Solitaire were presented. Karsten Gielis and Vero Vanden Abeele (2018) also presented an image-processing toolkit to gather game metrics from Klondike Solitaire for cognitive assessment. The paper included technical details of the toolkit and results from a preliminary study.

Max Birk and Regan Mandryk (2018) argued that behavioral traces from commercial off-the-shelf games can be used as digital biomarkers to model and assess mental health. They presented an overview of potential data sources (e.g., APIs, controller input) and their relevance for modeling mental health. Their framework focused on metrics to characterize players’ observable traits and discussed the importance of each metric for mental health modeling, showing existing statistical associations between metrics and specific diagnoses.

CHALLENGES
While the presented research is positive about the potential of video games for mental health, there are also several obstacles that need to be addressed moving forward.

Implementing new technologies and translating knowledge into the clinical context is challenging [7]. As addressed by Tuijnman and Weerdmeester (2017), it is undetermined if current standards in clinical evaluation are doing interactive interventions justice. A wise direction might be the perspective that Coyle et al. (2017) and Newell et al. (2018) take: Instead of aiming to replace therapeutic interventions, focusing on supporting or augmenting existing interventional approaches.

Gielis et al. (2017), Lomas et al. (2017), and Birk and Mandryk (2018) explore the potential of off-the-shelf games for assessment, raising questions about the use of video games as a leisure activity. Games might be played while the user is distracted, affecting the quality of collected data. Sometimes people might just play to pass time, while in other moments they play mindfully and use games to have meaningful experiences. These intra- and inter-individual differences in how games are used need to be understood and accounted for.

Using digital traces, including data gathered from video games, raises ethical questions. Because such data use might be incongruent with a user’s intentions, people need to be unambiguously aware of how their data is used. Using game data to flag mental health issues or track cognitive abilities raises ethical questions; for instance, how inferences about health derived from game-based data are handled and how they may be shared. Ethical standards need to be discussed and defined to create responsible solutions for interpreting and using play data as well as ensuring that informed consent is obtained.

Research around video games for mental health must also consider diversity (e.g., sex, race, and age)— marginalized groups potentially benefit most from low-access barrier interventions when considered during the design (see Iocovides et al. (2017)). Researchers and healthcare practitioners must be aware of biases in game design and research to develop standards that include the most vulnerable populations.

While these highlighted challenges require attention, the presented research directions highlight that video games for mental health are a promising source of innovative ideas with the potential to narrow the access gap and decrease the burden of mental health care for many.

ENDNOTES
1. Friedrich, M.J. Depression is the leading cause of disability around the world. 7AMA 317, 15 (2017), 1517–1517.

Max Birk is an assistant professor in the Systemic Change group at Eindhoven University of Technology. His work draws from psychology, interaction design, and data science, and leverages video games to contribute to a healthy society, improve entertainment experiences, and develop tools and methods for researching interactive experiences.

Greg Wadley is a senior lecturer in the School of Computing and Information Systems at the University of Melbourne, Australia. His research evolves around the design and evaluation of technologies for health and well-being, including collaborative projects in the areas of mental health, social connectedness, smoking cessation, and chronic pain.

Vero Vanden Abeele is a professor at the Faculty of Engineering Technology, KU Leuven. Her research relates to game-based assessment and the gamification of self-assessments, with a specific focus on understanding attentional and motivational processes to increase adherence and reliability of measurement.

Regan Mandryk co-directs the Interaction Lab at the University of Saskatchewan. With over 150 papers that have been cited over 7,500 times, she creates novel ways of understanding player experience in partnership with multiple industrial and international collaborators. She also develops and evaluates games for health and games that foster interpersonal relationships.

John Torous is a faculty member and director of the Division of Digital Psychiatry in the Department of Psychiatry at Beth Israel Deaconess Medical Center. His research explores smartphone/sensor data for relapse prediction in serious mental illnesses. He is editor in chief for JMIR Mental Health and leads the American Psychiatric Association’s efforts on the evaluation of apps.