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The Benefits of Digital Games for the Assessment and Treatment of Mental Health

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INTRODUCTION

Mental health issues affect a significant proportion of people – from stress-related disorders (e.g., anxiety, depression), to personality disorders, to addiction disorders [1], the range of and degree of severity of mental health issues has invited researchers and practitioners to consider alternate forms of assessment and treatment. In particular, the use of digital technology in intervention design for mental health holds promise [23].

There are a number of factors that can support the successful assessment and treatment of mental health issues using digital interventions [2, 41]. For example, for efficacious treatment, patients need to adhere to the intervention repeatedly over the long term. For effective assessment, tests need to be standardized in their administration and results compared to a large reference group. For both assessment and treatment, interventions should be accessible to people from different geographic locations and demographic populations, and professionals should be able to customize interventions for individual patients and assess measurable changes in the participants over time.

These factors that describe good intervention design – i.e., accessible, motivating, broadly appealing, and tailored toward individuals with different preferences – also characterize the space of digital games. Recent estimates suggest that more money is spent purchasing games (\$92b) than music (\$18b) and movies (\$62b) combined [16]. Four out of five American households own a device that is used to play video games and 115 million Americans play games [18]. Internationally, the global game market is expected to exceed \$102 billion by 2017 [29]. Although people sometimes assume that it is highly immersive console and computer games that drive the game industry, 35% of those same revenues are expected to be generated through smart phones and tablets, on which people tend to play games that are more casual in nature. With so much time and money being spent (by choice) on digital games, researchers have questioned what it is about games that make them so motivating to play [38] and how we can translate these motivating features into non-game environments – a process known as gamification [17]. Serious games – games that leverage this ability to motivate behaviour and retain attention in serious contexts – have been effective at, for example, encouraging behaviour change [27] and fostering activities that lead to learning [36].

Recent interest in the application of game elements specifically for the assessment and treatment of mental health issues has grown. Interest ranges from work that shows the prevalence and utility of games for relieving stress and dissipating noxious moods (leading to improved well-being) and research on how games aid the recovery from stressful or boring work [34] through to research on therapeutic applications that incorporate game-based elements [14]. However, the bulk of work in the space of games for mental health has tended to focus on creating therapeutic games. For example, researchers have introduced game-based elements into standard therapies used to treat stress-related disorders (e.g., attention bias modification training (ABMT), cognitive behavioural therapy) with the idea of increasing their engagement and appeal [14].

However, the potential of digital games in the domain of mental health goes beyond increasing the engagement of mental health interventions. For example, assessment may require long-term and repeated access to behavioural responses to standard stimuli. Many mobile games are now being designed specifically to encourage short-term daily use, rather than deep immersive play for hours on end [15]. They achieve this by using cooldown timers to prevent people from playing too much in a single sitting and by giving rewards for people to come back daily with the goal of attracting players for minutes a day over the span of months. Embedding daily assessment in this style of game may have the potential to increase adherence. Or consider the large commercial games with millions of daily players – for example, League of Legends alone has over 67 million players with 25 million people playing daily [39]. Mining the data produced by popular commercial games has ethical implications, yet this type of analytics research could inform trends in mental health, provide normative values from large populations, and reveal deviations in behaviour that are indicative in the context of mental health.

In this paper, we describe four main benefits (i.e., motivational pull, broad appeal, accessibility, and quantifying behaviour) that games offer in the domain of mental health, describe our research that informs our position, and present possibilities for future directions. Although not comprehensive of the advantages of games in the domain of mental health, these four benefits provide a starting point to discuss use of digital games for the effective assessment and treatment of mental health in a modern society.

BENEFITS OF GAMES

In this paper, we address four aspects of games that provide value for the assessment and treatment of mental health.

Motivational Pull

For efficacious treatment, patients need to adhere to the intervention repeatedly over the long term. To increase adherence, participants should be intrinsically motivated to engage in a task – i.e., should do so volitionally and not because they are receiving external prompting or reward [44]. Previous work has shown that participants who engage in training under their own volition exhibit better adherence, which may result in greater efficacy [37].

Digital games tend to naturally foster task engagement and intrinsic motivation [38]. People are choosing to play games in their leisure time, and spend a significant amount of time engaging in gameplay. As noted before, the latest report from the Entertainment Software Association (ESA) shows that more than 115 million players in the US alone play games on a daily basis, resulting in an average of 6.5 hours of weekly gameplay [18]. Because of the motivational pull of games, game-elements have been applied in non-game contexts to increase adherence to activities that result in, for example, behaviour change or learning. Also known as gamification, the use of gameful elements has been broadly explored for health related applications. For example, the game re:mision [24], has shown that contextualizing cancer in a game can foster a model of disease, increase patient compliance with rehabilitation plans, and increase the efficacy of rehabilitation.

In our own work, we have sought out ways to use interaction design to increase intrinsic motivation with digital applications. We initially showed that how we see our own personality in the game (game-self) affects the motivation to play [5]. We then leveraged this finding to show that identification with an in-game avatar in a simple game leads to increased engagement with and invested effort in a boring task, also translating into measureable differences in behaviour [6]. In dozens of studies on digital games (e.g., [4-10], we assess motivation using scales from self-determination theory, showing how satisfaction of needs (i.e., competence, autonomy, relatedness) in games affects resulting motivation (i.e., enjoyment, effort, and pressure) and well-being (i.e., positive and negative affect) [38]. Our results show how we can use games to foster intrinsic motivation with applications and foreshadow how game-design could be used in the future to facilitate long-term engagement in the assessment and treatment of mental health.

Broad Appeal

Although people from different demographics may be more susceptible to mental health issues (e.g., adolescents [13]), the prevalence of depression, anxiety, or personality are not solely restricted to a certain segment of the population [28]; people of various ages, genders, socioeconomic statuses, levels of education, and cultures are affected.

Although games have a reputation of appealing to a stereotypical young male gamer, the appeal of digital game play is actually much broader. The previously mentioned ESA report [18] shows that 26% of game players are younger than 18, but that 27% are over 50 (30% are 18-35, whereas 17% are 36-49). In addition, 44% of game players are female and women over 18 represent a significantly larger part of the game-playing population (33%) than boys age 18 or younger (15%). Not only are games appealing to a diversity of people, they are appealing to large numbers of people; the same report suggests that the average U.S. household owns at least one dedicated game console, PC or smartphone [ibid].

Our work on computer games spans different ages of players, ranging a focus specifically on children [27] to the elderly who live in institutionalized care [21, 22]. Although we also focus our research on committed players who self-identify as gamers [26], and work with the typical university student study volunteer [5], we have recently moved more of our research to crowdsourcing platforms, such as Amazon's Mechanical Turk [6, 9, 10]. Crowdsourcing data collection allows us to conduct experiments with a broader range of demographics that better represent the population [3]. For example, AMT provides access to more than 500,000 workers in more than 190 countries and our experience from dozens of crowdsourced game studies with over 4000 participants suggests that people of all ages from various walks of life are interested in computer games.

In creating motivating game-based applications for the assessment and treatment of mental health issues, researchers do not need to be concerned that their solutions will only appeal to a narrow group of people. The motivational pull of games described in the previous section applies broadly across the demographic groups [7,9] who can benefit from targeted applications for improved mental health.

Accessibility

Because mental health issues are broadly prevalent across demographic groups, it is important to ensure that people across all demographics have access to assessment and treatment, independent of their work schedule, geographic location, or the capacity of the healthcare system.

When home-based video entertainment began, an argued advantage was that video games provide a partner to play with who is always available [20]. A game system is always accessible, independent of time of the day or even location (thanks to the increased prevalence of gaming on mobile devices). Because digital content can be delivered to any place that has Internet access, games are accessible in most geographical locations, which gives them advantages over psychotherapy for countries with distributed and remote populations (e.g., Canada). The efficacy of eHealth applications has already been explored for therapeutic approaches, based on traditional interventions (e.g., CBT [2]) and the gamification of these types of eTherapies holds significant promise for engaging people in assessment and treatment, regardless of their geographical location.

Although games are accessible in remote locations, they also hold advantages for addressing mental health in populated regions. The capacity for treatments in modern cities is often exhausted; this shortage of available treatment resources results in increased waiting time for patients [12] and undiagnosed mental issues in early stages [25], which may translate into tangible (e.g., loss of work hours) and intangible (e.g., loss of life quality) outcomes. The convenience of in-home therapy offered by game-based approaches (as opposed to visiting a clinic) may also expand the reach of mental health treatments [27].

Quantifying Behaviour for Personalization

In addition to the accessibility that games provide for in-home therapy, there are also benefits in terms of the data volume produced by players within the context of the game. Gameplay datasets from tens of thousands of players enable individualized treatments and accurate assessment. Instead of estimating a population (as in experiment samples), assessing behaviour on a large scale allows researchers to reliably identify and investigate subgroups of interest whose data can be dwarfed by more dominant patterns of behaviour, or treated as noise. Consider, for example, a single study with 200 people diagnosed with Anxiety Disorder (DSM V, 300.23); all patients have been treated following a standard approach [11], which showed an hypothetical effective treatment for 80% of patients – a successful intervention. However, 20% did not respond to the treatment. Exploring why the treatment was unsuccessful for these 40 people becomes difficult to investigate, because of the dominance of individual differences in small samples. Starting with a larger population of 100,000 participants would allow researchers to examine specific subgroups who would benefit from individualized treatment.

Previous work has shown that individual differences matter for therapeutic and medical treatment [19, 45]. President Obama announced the Precision Medicine Initiative (PMI) [40] in January 2015, which aims to connect researchers, health care providers, and patients to develop individualized care. Personalization and customization has long been a goal of designers for digital games, and we and other researchers have explored how individual differences affect game experience (i.e., needs satisfaction, motivation, and affect) and behaviour (e.g., [8, 31]). For example, we modeled how different types of players respond to different persuasive strategies [33] and different aspects of the health belief model [31] in the context of a healthy-eating application. In another example, we show that the relationship between self-esteem and well-being is mediated by the players' needs satisfaction and motivation, suggesting that individualized approaches are needed to increase the efficacy of serious games for players low in self-esteem [9].

Creating individualized interventions requires the kinds of models that we have been developing, and will also benefit from leveraging gameplay data. For example, we modeled the motivation of more than 2000 players of a social network

game and demonstrated how personality moderates game experience [8]. Furthermore, we showed how these results translate into game behaviour derived through analytics mining. We additionally show behavioural differences by mining game log data in the context of looking at how feeling socially excluded in a game context affects hostile cognitions [7] and how fostering autonomy in a game increases the time spent in a subsequent boring task [36]. Our results illustrate how player experience manifests itself in player behaviour and also demonstrate the value of large datasets to understand subtle differences in behaviour.

The extension of personalized interventions guided by large gameplay datasets into mental health is promising. Consider, for example, the aforementioned ABMT therapy [14] – a task that trains participants to shift their attention away from negative stimuli and reduce anxiety. A game environment based on the ABMT with a large user base would allow researchers to assess larger sample sizes, administer treatments on a large scale, and to observe changes in behavioural patterns as an outcome of such treatments. The features commonly logged in digital games, e.g., key pressed, reaction time, or time played, may be indicative of therapeutic efficacy or uptake and can be leveraged to inform healthcare providers, epidemiologists, and researchers.

DISCUSSION AND CONCLUSION

In this paper, we argue that games have benefits for the assessment and treatment of mental health. Although we have identified and presented four main benefits of games that we have experience with, there are of course many other advantages that could be discussed. For example, specifically for assessment, it is important that data is comparable across populations and that assessments are standardized, regardless of how, when, and by whom they are administered. Digital games are a good option for ensuring standardized delivery of assessments because games follow rules and procedures in the context of a rigid computer-controlled task. Games also chain together tasks that require different skills, e.g., quick reaction times, or the ability to solve a puzzle [30], allowing researchers and practitioners to assess varying abilities in a stable environment. Related work in game-based psychoacoustic assessment in children has shown that game-based assessment increases adherence by children, is more enjoyable, may reduce the age of children who can be assessed, and may even improve upon traditional assessment in terms of accuracy [42].

Although games offer incredible potential, there are also considerations that future research will have to address. For example, the ethical considerations of embedding assessments and therapies must be addressed. Mental health issues range in severity from mild problems to clinical issues that should be handled by a mental health professional. Ensuring that people are being treated according to the severity of their situation is paramount. Along these lines, game-based solutions can bridge assessment and therapy, perhaps by encouraging people to undertake traditional therapy or by bridging

the time while people wait for access to therapy. Finally, there are differences between custom games that target specific serious purposes (e.g., [14]) and commercial games that can be leveraged for serious purposes (e.g., Portal 2 (Valve, 2011) to teach physics [43]). Differentiating between these two approaches will be important as game-based solutions are developed.

We argue that in the future, games could significantly contribute to the assessment and treatment of mental health issues by providing a motivational and accessible environment that appeals to a broad audience, supports personalization, and allows for the quantification of behaviour.

AUTHOR BIOS

Max Birk is a PhD Student at the University of Saskatchewan. His research evolves around the psychological concept of the self, focusing on implications for player experience research and game design, e.g., modeling motivation and engagement. Max studied at the University of Trier, Germany, where he researched the physiological and endocrinological effects of videogames. His thesis was supervised by Dr. Dirk Hellhammer. Working in psychophysiology, experimental psychology, games user research, and HCI, Max has a variety of experience, all connected by his interest in games. He has consulted for several indie game companies and served on the CHI PLAY 2015 and CHI 2014 and CHI 2016 WIP PCs. With 20 published or accepted papers related to games, and several best paper awards, Max was also selected for the prestigious IDGA Scholar at GDC program in 2016.

Regan Mandryk pioneered the area of physiological evaluation for computer games in her award-winning Ph.D. research on affective computing at Simon Fraser University with support from Electronic Arts. With over 150 publications that have been cited over 4200 times, she continues to investigate novel ways of understanding player experience in partnership with multiple industrial and international collaborators, but also develops and evaluates persuasive games, exergames, games for special populations including children with neurodevelopmental disorders, games that foster interpersonal relationships, and ubiquitous games that merge the real world with the game world. Regan has been the invited keynote speaker at international game conferences, led Games research in the GRAND NCE, was the papers chair for CHI PLAY 2015 and 2016, and is leading the new games subcommittee for SIGCHI.

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