

Abstract

Mobile has become a delivery system for various health interventions like monitoring, journaling, symptom tracking, peer communication, practitioner consultation and self-healing. This paper explores the world of mental health based mobile applications, with emphasis on the role of HCI and gamification in development of such apps. Mobiles have become a preferred medium of delivering various wellness and mental health solutions, especially as they provide accessibility, anonymity and confidentiality in addition to novel and diverse forms of interventions. Given the gross mismatch between service providers and people who need assistance, this is a welcome solution. Most of the mobile based interventions have found to display positive effects, but the field is still nascent, and research, testing, collaboration between behavioral science and technology is continuously required to make it successful and even more effective.

Keywords: mental health apps, gamification, HCI

Gamification in Mobile based Mental Health Interventions

Mental illness is a growing problem and there is an ever-increasing gap between demand for care in this area and the supply of caregivers. Anxiety disorder, one of the more common psychiatric illnesses affects about 29% of the population and of approximately 90 million such people in the United States, 50% do not seek or receive treatment. This crisis has generated a keen interest in using technology, more specifically the mobile phone, as a medium to deliver preventive and treatment services. (Dennis, 2013).

Mental health prevention and wellness promotion has taken an entirely new direction with the advancement in technology. Devices like mobile phones, tablets, wearables, have given the public, mental health practitioners, doctors and researchers new ways to access/provide services, monitor progress, collect data and thus enhance the understanding and promotion of mental wellbeing. Smartphones have now become personal health assistants, coaches, and food assistants. Apps can be developed for almost everything. They can be used to collect information about users' typical behavior pattern and make suggestions based on these findings or in the case of a deviation, generate a signal to a designated individual, like a therapist or family member. In today's world where communication is almost completely through mobile devices, it makes sense to connect with people via this medium to get any message across. The world of mobile communication is one that cannot be ignored. It has a lot of potential for clients and clinicians alike. Some of the advantages of mobile care include convenience, anonymity, lower cost, wider reach, 24/7 services, technical support and consistency of treatment across all users. The downside of this is the flooding of mobiles with various kinds of Apps. Currently, there are no national standards for evaluating the effectiveness of the multitude of apps that are available. This new era of technological development can be both a boon as well as a curse. It offers tremendous opportunities but also raises several concerns. Mental health community and developers need to focus on making apps user friendly, safe and effective. They need to target the right population, ensure effectiveness by following recommendations of mental health experts, ensure privacy of information shared, develop and follow regulations and above all, be conscious of overselling the app/concept and building unrealistic hopes among the users. ("Technology and the Future of Mental Health Treatment" 2017). This is what biostatisticians like Ken Cheung are aiming to prevent. He is developing advanced models to determine if apps actually do improve symptoms of anxiety and depression. ("Can These Artificial Intelligence Apps Improve Mental Health?" 2017). Another set of researchers conducted a meta-analysis and systematic reviews of relevant articles published between March 1975 and March 2015 and came up with a set of guidelines and recommendations for developing effective MHapps. These recommendations are: apps need to be CBT (Cognitive Behavior Therapy) based, they should allow automated tailoring, be easy to use by non-clinical populations, make use of gamification elements to motivate and engage users, have links to support services, provide the capability to record or report mood/feelings, thoughts and behavior, recommend activities, reminders, built in triggers to engage the user, encourage non-technology based activities, have a log of past app use, conduct experimental trials to establish efficacy. Adhering to these guidelines and building an app based on HCI principles will help to optimize the effectiveness of the app. (Bakker, Kazantzis, Rickwood, & Rickard, 2016)

HCI and Mobile based Mental Health

As we have seen, mobile computing offers a seamless way of accessing health services. People need not be restricted by limited availability of health professionals, clinic hours or other health services. There is also the assurance of confidentiality and anonymity. Many health service providers are turning to cell phones as their delivery mechanism and to connect with their target audience. Cell phones are being used for various purposes - monitoring of symptoms, reminders to take medication, disseminating health related information, connecting to health professionals, etc. They may do so through a multitude of ways, the most popular one being through apps. But with numerous mobile apps out there, vying for user attention how do you stand out, draw users and keep them engaged? How can we ensure that the app is doing what it is supposed to do? How well is it meeting the needs of the target audience? This is where Human Computer Interaction (HCI) comes in, which is an interdisciplinary field and draws upon various fields including and not limited to psychology, sociology, computer science and visual design. It helps create user-centered design proving insights into usability, usefulness and relevance of technology in daily life. HCI research helps us understand how people integrate smartphone, sensorial inputs, and social networks into their behavior change efforts and accordingly design effective behavior change technologies. For example if we consider a health management app - more specifically, an app for stress management (Poole, 2013), what features will it need to have in order to motivate and engage users? Should it have sensors to pick up the physiological signatures of elevated stress and accordingly activate the features levels or should it be user driven, relying on the user to use the app as and when s/he feels the need to? Should there be triggers or interruption alarms built in so that the user will be forced to check the app? Or will s/he find it annoying? What features in the app will make one use it, engage with it? HCI helps us answer these questions. HCI principles provide guidelines for designing user centered apps. And before including gamification elements in apps, one should refer to these.

MHapp

Before we go ahead with design discussion and the application of gamification principles to an app, I would like to explain more about my idea for an app and its significance. I aim to develop an app that helps users to feel empowered and good about themselves by assisting them in a scientific way to manage their anxiety and stress effectively. It would be akin to a life coach which will guide the user to select the best course of action to deal with the given problem effectively, while building up their resilience and ability to deal with challenging life situations. Why did I choose mental health as the target area for developing an app-based intervention? The reason is that even today, mental health is a challenge in both the general and clinical populations. The World Health Organization predicts that by 2030, mental illnesses will be the leading disease globally. But at the same time, there are not sufficient resources to meet the needs of preventive care and treatment. Hence, there is emphasis on leveraging technology to help people through their difficult emotional times.

There is history of using mobiles for delivering mental health interventions and there have been plenty of reviews of several of these apps with recommendations and guideless provided for increasing their effectiveness. One of the goals is to base the app on a preventive model rather than focus on a narrow range of mental health disorder like anxiety, depression or alcoholism, so that more people could benefit from its use. One such app for stress management is 'Oiva' which was reviewed for usage, acceptance and effectiveness by researchers. Based on their findings, the

conclusion was that, an app should provide features like exercises for everyday life, focus on self - improvement over external rewards, guide the user towards making optimum choice, without restricting the availability of various choices, and provide a tool for self-reflection (Ahtinen, et.al, 2013). In line with this, the study by (Bakker, et.al, 2016) as mentioned earlier, offered similar and additional recommendations of features and functions that need to be included in a MHapp to make it effective like basing the interventions on evidence-based therapies.

What is the purpose of a MHapp in terms of the desired result? It is to empower and enable the user to deal with her/his life problems in a constructive manner. One such manner would be by overcoming the negativity and incapacitation caused by negative cogitation, anxiety, anger or negative life experience. For this to be effective, it should be based on evidence based therapeutic techniques (Bakker et al., 2016). For example, in their book ‘ International handbook of behavior Modification and Therapy’ Bellack and colleagues have distinguished between respondents and operants. In cases of respondents (which typically include emotional reactions such as anxiety, depression, anger), consequences play a minimal role as compared to operants (where consequent reinforcements play an important role, such as when rewards are used to promote a desired behavior) (Bellack, Hersen, & Kazdin, 2012). Knowing this information about our user, the kind of problem s/he is facing and the goal s/he is trying to achieve, will help the MHapp to provide the right service/functionality to her/him. This is easier said than done, but there has been much development in this area and many MHapps (e.g, Pacifica) are offering multiple functionalities like relaxation mindfulness, evidence-based therapy, etc. but studies have shown that mental health apps have still not reached the desired level of perfection in the service they provide. This may be attributed to the highly subjective and varied nature of people. People are different as they are each shaped by their genes, environment and life experiences. The human mind, thus being very versatile and differentiated, has been a challenge to understand and translated into machine learning based tools that can be used for designing CBT (Cognitive Behavior Therapy) and RET (Rational Emotive Therapy) applications.

People deal with stress in several ways; some just want to talk to a person they trust, others some play sports, or watch video games, listen to music, or do relaxation exercise, meditate, read positive quotes, and the list goes on. That is why, it is a promising idea to incorporate most, if not all these elements into the MHapp. But, in addition to all these features, in order for technology based mental health interventions to be successful, they have to be user friendly and thus be based on user centered design. In other words, we need to ‘know’ and ‘understand’ our users starting with defining our target audience and devising strategies to keep them motivated. This is where gamification comes in; as an element encouraging user engagement and motivation.

Gamification in MHapps

According to the dictionary, ‘gamification is the application of typical elements of game playing (e.g., point scoring, competition with others, rules of play) to other areas of activity, typically as an online marketing technique to encourage engagement with a product or service.’ I would say that it has now become more than a marketing technique. Yes, its primary aim is to keep users engaged and motivated to continue using the app. But over and above that, gamification helps align our (app creator’s) interests with the intrinsic motivation of our users. And for this, we need to understand their emotions and desires. (Zichermann & Cunningham, 2011). What makes

a person anxious, angry or depressed? What tools will s/he need to deal constructively with this emotion? Knowledge of human psychology and an in depth understanding of the various therapeutic techniques, both conventional (CBT, RET, etc.) and non-conventional (EMDR, NLP, etc.) is essential in order to design an app that will be successful in helping users to change their patterns of behavior, feel better, obtain more clarity and develop skills to handle their life experiences with more equanimity and confidence.

A game or play has several elements associated with it. To name a few: it's fun, offers rewards, points, badges, competitive spirit, is intellectually stimulating and above all, it is highly engaging. Games involve both physical and mental movements, and it is this integration that I believe bolsters psychological abilities. Gamification is bringing these elements into the desired activity, which in our case, is the MHapp. Gamification has been used in several MHapps. But it is still in its infancy stage. Why use game elements in apps? How does it help the cause? Games have found to be appealing, engaging and effective. In the context of MHapps, this means that applying game elements might draw more people to try the app, especially those who might not want to approach an outsider with their problems will find it more comfortable to find a solution for their problem via an app that is appealing, fun and interesting, at the same time offering support and ideas to deal with this issue. Since games, especially if offered in a rich sensorial environment (such as a colorful and interactive app) with varied options for behavior change and learning (one novel approach will be to use augmented/virtual reality to practice real life situations) will allow users to learn and try their new skills.

So, what are the key gamifying elements for mobile apps? For me, it is about adding elements of fun, encouragement and action. Hence rewards in the forms of badges, leaderboards, progress display might be option, but again, as we have seen earlier, depending on the type of user: respondent or operant rewards may not hold much meaning. Also, it depends on the situation and mental state they are in when accessing the app. If the user is in a state of anxiety (respondent) then what s/he would need is encouragement, a medium to work through the issue /incident that's bothering her, or the ability to connect and speak with someone or some form of pleasant distraction. Thus, having a goal is very important. Have a goal for the user and depending on the outcome desired, take a user through a path with reward elements like badges built along the way. We can examine this concept through a scenario. *Let's consider a user Joy who has who has just been through a difficult experience where she had been criticized/ and received negative feedback from her team members, with no acknowledgement for all the laborious work she had put in and aspects of the event that went well. She was angry, hurt, was feeling a tightness in a chest and desperately wanted to distract herself or talk to someone she trusted. She couldn't concentrate on her work, so tried watching a movie, but her thoughts always turned back to the incident and so she started looking online for a web-based app that would be more helpful. She decided to go for a web based one as she was already on her laptop watching the movie and wanted something immediate, without having to download it.* So, what would be the ideal solution for her, one that would help her feel less anxious? The immediate goal for her is to feel better so that she can concentrate on other things and not feel the palpitation or tightness in her chest that come up every time she remembers the incident. How will the app know her goal and help her achieve it? Is any gamification element required here and if yes, what will its function be? The first step would be to make her feel good about herself. So, the first page could be a colorful one, that would have a positive quote and encouraging affirmation. She would then be directed to record her mood using

a mood indicator. Once she selects that, she would be asked to pick out the emotion she is feeling (with cues to select the authentic emotion). Next, she will be asked to pick out the type of problem she is facing (interpersonal, time pressure, etc.). Once she makes her selection, she would be given a list of action items that she would like to take (which would be tailored to the type of emotion she is feeling), with a suggested one. In this case, though she is feeling angry and hurt, the primary feeling is fear, which was the one selected by her with the help of self-awareness cues given. These choices will draw from therapeutic interventions that have proven to be effective for dealing with such issues: in her case these would be any of these- to take deep breaths (or other mindfulness activities), journaling, chat options with selected buddy (known friend /stress partner' who would be sent an invite/email/text stating that Joy would like to chat with her) or online fellow user (all users will be anonymous), watch videos, play simulated game similar to her problem, CBT or RET (Rational Emotive Therapy) based Q and A session. Throughout this interaction, each time Joy makes a selection or completes a task, she will be rewarded with any or more of the following: smiley face, a thumbs up, positive affirmation, clap sounds, among others.

We want the user to engage with the app not only during stressful times, but also on a more regular basis. Thus, I will add daily activities that would help her deal with similar situations in a more efficient way in the longer run. These activities could include physical exercises, certain social or self-reflective tasks, eating right, etc. and each of these could be gamified. At regular periods, say a week or two (or a user defined timeframe) a goal check should be done in terms of how far she has come and if the goal needs to be changed in any way. Gamification elements can be added to it; like recording her progress level on each activity, and/or recording the progress on her ability to deal with such situations (which could be achieved by recording her disturbance level every time she faces such an incident). Depending on her level of disturbance, the activities can be either changed or she could move to the next level. Another added feature could be offering tips for healthy lifestyle/ interesting facts / positive affirmations that will pop up according to preset times.

Fleming and colleagues, illustrated six major categories of tested applied games as example for effectiveness of gamification. They found movement-based games to effectively reduce depression, virtual reality games that offer immersive experiences have found to yield positive results, multilevel CBT based programs utilizing a fantasy environment, designed to be completed one level a week have proven to yield reliable results. But the challenge would be to keep the users engaged with the app over longer periods of time. Another category was entertainment computer games which have shown to bring about a mood change in users by supposedly altering the mood via emotion regulation, stress release or social support pathways. In case of PTSD (Post Traumatic Stress Disorder) patients, engaging them in a visuospatial cognitive activity like Tetris (where players have to strategically move, rotate and drop "Tertiminos" to complete horizontal lines), reduced their traumatic flashbacks by interfering with their memory consolidation. Tetris has also been found effective in reducing cravings. Biofeedback based games like Wild divine and Freeze-Framer 2.0 have shown to reduce depression and anxiety, certain cognitive training games have found to have positive results on cognitive impairment. (Fleming et al., 2017) Thus, what can be inferred is that one method to offer immediate symptomatic relief is to divert the memory in performing an activity that is immersive enough to keep the user from reminiscing the negative memories.

Another app called the Challenger app used gamification elements to encourage behavior change. It emphasizes many of the behavior change technique like identifying specific goals, barrier identification, problem solving, breaking long term goals into short term challenges, accomplishing easier challenges first, celebrating success, social support and tracking personally valued information. In this app, users can select the skill they want to master, and they are given a challenge in the related area. (Miloff, Marklund, & Carlbring, 2015). For example, in the case of Joy, the skills she wants to develop might be, to handle criticism with a sense of calm and not being worried about what others might think of her. The 1st level of challenge could be - being mindful of her reactions and sensations, take deep breaths Once she achieves this, she goes on to the next level. One of the higher-level challenge could be to for her to identify her triggers and automated belief/s that makes her feel anxious. Another could be to visualize and enact the way she sees herself responding to such a situation in the future. The final challenge might be for her to actually put this into practice. Such exposure challenges are based on the behavioral theories of cognitive restructuring. ABMT (Attention Bias Modification Training) is another such therapeutic technique that is based on diverting attention from the source of the anxiety causing issue /threat. It has been found that one's exaggerated attention to threat, called as *threat bias* is the causal mechanism for anxiety and in ABMT, attention is turned away from the threat, thereby reducing symptoms of anxiety. It has also been observed to be effective in reducing stress reactivity. Compared to more conventional modes of therapy like CBT, it is briefer and less expensive. Modified versions of this technique have been delivered via mobile phones and have included gamification elements to make them more enjoyable and appealing. The aim was to also reduce stigma and increase compliance. On examining the effects of the gamified ABMT mobile application in highly trait anxious participants (N=78), it was found that a single session of the active training relative to the placebo reduced subjective anxiety and observed stress reactivity. This is in line with several other studies that have demonstrated the effectiveness of evidence-based treatment mechanisms successfully embedded into mobiles. (Dennis, et.al, 2014) Thus we need to continue exploring mobile devices as a delivery system for such interventions in the preventive, treatment and self-help contexts.

Gaming elements

Amrosimova, a senior marketing professional, blogger and entrepreneur, asserts that an app should encourage social sharing. In other words, the app must be something users will like to be associated with and excited enough to share with their social circle. Here is where gamifying it will help. As seen earlier, rewards for completing tasks (or levels) in various forms will provide an incentive for continuous engagement with the app. And if the app can be a platform for self-expression in the form of avatars or virtual gods maybe, this would make users feel encouraged and positive. Achievement recognition is yet another factor that can play a significant role in boosting the user/s morale by helping them build on their skills and help them experience an upward spiral (Fredrickson, 2001). Recognition and status are two things that people like to have and an app can make this happen through user ratings, number of followers, or status in the form of number of goals accomplished. These features will help drive user engagement (“Mobile App Engagement”, 2018). Gaponov, a web and mobile app developer, states that there are five things to consider when applying gamification elements to our app. The first is to *create a story*. In our context, this story can be simulated version based on the problem identified by the user and with the help of visuals and sound, make it a self-development journey with levels and rewards. this brings us to the next point, *building challenges*. People react/respond to situations either in a problem-solving/cognitive manner or in an emotional manner. Depending on the skill the user

needs to develop (either develop problem solving/ thinking skills or become more emotionally balanced), the challenges can be made to vary. And as we saw earlier, every challenge needs to start with a goal and it needs to be realistic, achievable and helps to solve the user's problem in some way. Positive feedback needs to be provided by the app for every task accomplished by the user and *rewards* are the obvious next inclusion. Their purpose being, to motivate users to go to the next level. It is advisable that these rewards hold value to the user in some way (an example would be where the reward depicts an object liked/loved/treasured by the user). Offering the *freedom to choose* has found to be highly motivating and is said to improve commitment (Zull, 2011). Even if these choices may be restricted, the very option to make a choice is empowering and imparts a degree of happiness, which is very important, however small and fleeting this feeling might be as the accumulation of such moments of positive feelings lead to improvement in overall functioning of the brain. (Fredrickson, 2001).

Another feature that can be included in a MHapp would be access to real time data with the help of Google places API, where the user can immediately have all the information about the facilities available to her or him in that locality (it can be a therapist, a clinic, a health food store, a health based activity or event, or even a friend). This would provide another level of support system easily accessible to the user. Thus, a properly designed MHapp will have all these features built in in a such that that it offers a seamless and delightful experience to its user, leading to enlightenment and empowerment.

Conclusion

The 'games for health' movement has explored ways in which effective interventions can be translated into game like interfaces as means to increase engagement and compliance. Though game-based approaches for mental health are just catching on, they need to be more user centered, more number of randomized control trials need to be conducted, research needs to be continuous and faster, testing needs to be rapid and there requires to be more collaborations between basic science and product development testing to respond to the increasingly diverse user needs more effectively. But the good news is that, gamifying MHapps and other health/wellness interventions has shown to have positive effects on behavior change. MHapps can base their interventions and respective gamifying elements on the psychological, neurocognitive and behavioral research findings. This will ensure a user centered approach, one that is both relevant and effective. Needless to say, this will be a continuous improvement process, but with machine intelligence, automation and augmented reality, technology can offer tremendous assistance in advancing mental health prevention and treatment.

References

- Ahtinen, A., Mattila, E., Välikkynen, P., Kaipainen, K., Vanhala, T., Ermes, M., ... Lappalainen, R. (2013). Mobile Mental Wellness Training for Stress Management: Feasibility and Design Implications Based on a One-Month Field Study. *JMIR mHealth and uHealth*, 1(2), e11. <http://doi.org/10.2196/mhealth.2596>
- Abrosimova, K. (2018). Mobile App Gamification: Integrating Game Dynamics in User Experience. Retrieved from <https://yalantis.com/blog/gamification-dynamics-mobile-app-development/>
- Bakker, D., Kazantzis, N., Rickwood, D., & Rickard, N. (2016). Mental Health Smartphone Apps: Review and Evidence-Based Recommendations for Future Developments. *JMIR Mental Health*, 3(1), e7. <https://doi.org/10.2196/mental.4984>
- Bellack, A. S., Hersen, M., & Kazdin, A. E. (2012). *International Handbook of Behavior Modification and Therapy*. Springer Science & Business Media.
- Can These Artificial Intelligence Apps Improve Mental Health? (2017, January 10). Retrieved from <https://www.mailman.columbia.edu/public-health-now/news/can-these-artificial-intelligence-apps-improve-mental-health>
- Dennis T. A., O'Toole L. J. (2014). Mental health on the go: Effects of a gamified attention bias modification mobile application in trait anxious adults. *Clinical Psychological Science*, 2(5), 576–590.
- Fleming, T. M., Bavin, L., Stasiak, K., Hermansson-Webb, E., Merry, S. N., Cheek, C., ... Hetrick, S. (2017). Serious Games and Gamification for Mental Health: Current Status

and Promising Directions. *Frontiers in Psychiatry*, 7.

<https://doi.org/10.3389/fpsyt.2016.00215>

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, 56(3), 218-226.

<http://dx.doi.org/10.1037/0003-066X.56.3.218>

Gaponov, R. (2018). Mobile App Gamification: 5 main Things to Consider – The Startup – Medium. Retrieved from <https://medium.com/swlh/mobile-app-gamification-5-mainthings-to-consider-f47cdf1e6610>

Miloff, A., Marklund, A., & Carlbring, P. (2015). The challenger app for social anxiety disorder: New advances in mobile psychological treatment. *Internet Interventions*, 2(4), 382–391.

<https://doi.org/10.1016/j.invent.2015.08.001>

NIMH . Technology and the Future of Mental Health Treatment. (2017, February). Retrieved from <https://www.nimh.nih.gov/health/topics/technology-and-the-future-of-mental-health-treatment/index.shtml>

Poole, E. S. (2013). HCI and mobile health interventions. *Translational Behavioral Medicine*, 3(4), 402–405. <https://doi.org/10.1007/s13142-013-0214-3>

Zichermann, G., & Cunningham, C. (2011). *Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps*. O'Reilly Media, Inc.

Zull, J. E. (2011). *From Brain to Mind*. Sterling, VA: Stylus Publishing, LLC