Classification of Stress Management mHealth Apps Based on Octalysis Framework

Full paper

Shaimaa Ewais
Claremont Graduate University
Shaimaa.Ewais@cgu.edu

Ala Alluhaidan
Claremont Graduate University
ala.alluhaidan@cgu.edu

Abstract

Many mHealth apps have been developed to assist people in self-care management. Most of them aim to engage users and provide motivation to increase adherence. Gamification has been introduced to identify the left and right brain drives in order to engage users and motivate them. We are using Octalysis framework to map how top rated stress management apps address the right brain drives. 12 stress management mHealth apps are classified based on this framework. In this paper, we explore how Gamification has been used in mHealth apps, the intrinsic motivation using self-determination theory, methodology, and findings. In the discussion, we identify design principles that will better suited to enhance intrinsic motivation for people who seek self-stress management.

Keywords
mHealth, stress management, gamification, octalysis.

Introduction

Over the past few years, mobile users have witnessed a proliferation in mobile applications’ production. The open source platforms’ concept has captured developers’ attentions and interests in developing and promoting their apps’ ideas. Accordingly, mobile users have access to numerous applications which vary in their objectives, focus, accessibility, and design.

Several mHealth apps are designed to change or reinforce health behaviors and well-being. Some of those mHealth apps have utilized the concept of “gamification” to make their applications more engaging and to increase users’ motivations. Gamification has been defined as “the use of game design elements in non-game context” (Deterding et al, 2011, p.9). The gamification term is backed to 2008 when it was originally used in digital media industry. Yet, it wasn’t embraced till the second half of 2010 (Deterding et al. 2011).

Despite the fact that there is a growing trend in using the power of gamification in mHealth apps, it is still blurred how mHealth applications’ developers have utilized gamification design elements in their apps. Additionally, there is a gap in literature on how apps’ developers derive gamification design decision for specific health behaviors or context.

Our interest in this paper is to classify the stress management mHealth apps design in view of Octalysis framework. The main objective is to investigate how mHealth apps’ developers have furnished their apps with games elements and strategies they sought to implement to help users to control their stress.
Literature Review
In the past few years, there has been an interest in utilizing the gamification concept in mHealth apps. Several gamification mechanisms such as Badges, leaderboards, points and levels, challenges and quests, social engagement loops, and onboarding have been evaluated against their effectiveness for chronic disease management; bant, mySugr, RunKeeper, Fitocracy, and Mango Health in specific are being described in how they integrate the gamification component. Furthermore, specific design considerations are defined for better addressing the implementation of gamification in mHealth apps. These guidelines are: 1) The context of gamification component should suit the app purpose 2) The importance of the consistency on what the app does and not removing a feature without informing the user (confirming feature existence), 3) Avoidance of over usage of a certain mechanism, and 4) taken user demographic into consideration (Miller et al. 2014). Yet, these guidelines were concerned about high level design and did not refer to the Octalysis framework.

Another study made in 2014 explores the relation between health behavior constructs, gamification, and game elements. 132 apps with 13 health behavior constructs, 6 core components of health gamification, and 10 effective game elements were analyzed. This study proves that behavioral theory is associated with gamification while gamification does not provide capacity or opportunity/trigger. In fact, gamification is only associated with composite motivational behavior scores (Lister et al. 2014). This study was limited to Apple store apps that concerns with health and fitness in the domain of physical activity and diet.

A qualitative study conducted to evaluate the most popular themes in Mobile apps that attract children. The popular themes found are: 1) Virtual avatar. 2) Gaming and 3) Social Media. The study used this analysis to design a new app “Avafeed” and incorporated those popular characteristics to help children choose healthier food. The app was targeted for children and released on Apple store September 2012 (Yulin,n.d).

To improve the transition from dependent care in children when they become adult, gamification has been proved to be an effective way. Birmingham Children’s Hospital Adolescent Rheumatology Team (UK) was exploring a list of skills that may help in engaging the user and enhance their perception of self-care. A framework is proposed to guide health care providers in how to use gamification to improve engagement in self-care domain (Wilson & McDonagh, 2014).

Theoretical Background
Self Determination Theory
Self-determination theory (SDT) is a motivational theory in social psychology. This theory has been derived from experiments that were testing the impacts of extrinsic rewards on intrinsic motivations. Moreover, this theory focuses on the impacts of social environments on individuals’ attitudes, behaviors, values and motivation. The main assumptions of SDT are: (1) human beings are active in their development, (2) they are intrinsically motivated towards their development and (3) they have a set of universal basic psychological needs (Deci & Ryan. 2000)

Stress is associated with many mental and physical problems. Stress-related phenomena can be however explained using SDT. Better stress management is associated with higher intrinsic goals. Thus, mHealth apps, which designed to better stress management, should augment the internal events and encourage higher mindfulness. The impact on liveliness and perceived positive energy associated with stress management refers to autonomy motivation, mindful awareness and intrinsic aspirations (Weinstein && Ryan, 2011).

Locus of causality and autonomy are necessary to improve and maintain intrinsic motivation. Competence and self-direction also should be available for intrinsic motivation to happen. Rewards and social pressure can undermine the intrinsic motivation (Ryan, 2000).

Methodology
This study is based on qualitative research methodology. Our sample consisted of top rated 12 stress management mHealth apps in google and apple stores for 2014 (Holland, 2014). Our aim is to see how
well those apps’ developers have adopted the gamification concept. Initially, we evaluated each application’s description individually in both apple and google store to examine what features are included in each app. Moreover, we have downloaded each app to detect other embedded design elements were not explained in developers’ description. Afterwards, we have reevaluated all the applications collaboratively to detect whether we had any disagreement in our classification for their gaming design elements. Based on the collaborative evaluation, we had associated each gaming design elements in those apps to the main 8 core drives in Octalysis. Finally, we have plotted each application on octagon shape that represents the Octalysis framework. Our classification is based on 1) left brain versus right brain and 2) white hat versus black hat gamifications.

**Octalysis Framework**

Octalysis framework was introduced by Chou in 2013 (www.yukaichou.com). The Octalysis framework takes octagon shape in which each side represents a core drive. There are 8 core drives in Octalysis framework. These core drivers are: 1) Epic Meaning & Calling, 2) Development & Accomplishment, 3) Empowerment of Creativity & Feedback, 4) Ownership & Possession, 5) Social Influence & Relatedness, 6) Scarcity & Impatience, 7) Unpredictability & Curiosity and 8) Loss & Avoidance. Within each core, there are a number of games strategies or elements that corresponds to each drive. For instance, points, badges, leaderboard, rewards and progress bar are highly related to accomplishment core drive. Implementing those features is assumed to increase extrinsic motivations. This is only one approach to engage users in using the apps based on the perception of; the more they use the app, the greater the rewards and points they will get. Figure (1) is a full representation for Octalaysis framework with its gaming strategies based on each core drive.

![Figure (1): Complete Octalysis Framework](image)

According to Chou (2103), octalysis’s core drives can be separated into different categories based on how they are linked to the origin and the type of motivations. As for the origin of motivations, people can be motivated either extrinsically or intrinsically. For instance, incentives and rewards are external factors in our social environment that were verified to motivate people to perform a certain behavior or an action. Corresponding to the distinction between extrinsic and intrinsic motivators, Chou has classified the core drives in his framework into “right brain” and “left brain” categories. He has claimed that the core motivators located on the right brain category are related to intrinsic motivations, while drives located on the left brain are more based on extrinsic motivations. Even though Chou has labeled these categories as right and left brain, he has stated that these labels are not related to brain studies Figure (2-a) represents the left and right brain Octalysis’s classification.

Additionally, Chou has claimed that octalysis’s 8 core drives can be further classified into two categories based on the type of motivator. According to Chou, the top core drives in his framework are considered as positive motivators and he called them “white hat”, while the button core drives are negative motivators and he labeled them as “black hat”. For instance, in the avoidance core drive, users are mainly motivated to use an app or a system to avoid losing. On the other hand, empowerment drive engages users as it gives them more positive feeling of having control over themselves. This classification doesn’t indicate that white hat is more preferable than black hat, but it indicates there should be a balance between the positive and negative motivators. Figure (2-b) represents the core drives classifications based on negative and positive motivations.
Stress Management mHealth App Evaluation

Our focus in this paper is on stress management mHealth apps. Our sample included top twelve rated stress management applications for 2014. Table (1) Shows the list of the applications considered in this study.

<table>
<thead>
<tr>
<th>Icon</th>
<th>App Name</th>
<th>Icon</th>
<th>App Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Breath2Relax" /></td>
<td>Breath2Relax</td>
<td><img src="image" alt="Equanimity" /></td>
<td>Equanimity - Meditation Timer &amp; Tracker</td>
</tr>
<tr>
<td><img src="image" alt="Relax &amp; Rest Guided Meditations" /></td>
<td>Relax &amp; Rest Guided Meditations</td>
<td><img src="image" alt="Self-Help for Anxiety Management (SAM)" /></td>
<td>Self-Help for Anxiety Management (SAM)</td>
</tr>
<tr>
<td><img src="image" alt="Calming Music to Simplicity" /></td>
<td>Calming Music to Simplicity</td>
<td><img src="image" alt="I Can Be Fearless by Human Progress" /></td>
<td>I Can Be Fearless by Human Progress</td>
</tr>
<tr>
<td><img src="image" alt="Worry Box---Anxiety Self-Help" /></td>
<td>Worry Box---Anxiety Self-Help</td>
<td><img src="image" alt="Stop Panic &amp; Anxiety Help" /></td>
<td>Stop Panic &amp; Anxiety Help</td>
</tr>
<tr>
<td><img src="image" alt="Qi Gong Meditation Relaxation" /></td>
<td>Qi Gong Meditation Relaxation</td>
<td><img src="image" alt="Universal Breathing - Pranayama Free" /></td>
<td>Universal Breathing - Pranayama Free</td>
</tr>
<tr>
<td><img src="image" alt="Acupressure- Heal Yourself" /></td>
<td>Acupressure- Heal Yourself</td>
<td><img src="image" alt="Sleep Time – Alarm Clock" /></td>
<td>Sleep Time – Alarm Clock</td>
</tr>
</tbody>
</table>

Table(1): Stress Management mHealth Applications
Our evaluation is based on Octalysis framework. The main target is to investigate the games’ strategies implemented in those apps and identify their main design’s focus. In specific, we were aiming to classify the implemented games strategies based on motivation origin and type. Appendix (A) gives a lay out for our full evaluation and a brief description for the identified games features within each core drive for each app. After evaluating those apps, we derived two octagon shapes that has apps logos plotted on each core drive to detect commonality across apps’ design.

Figure (3) shows our classification for each of the detected game elements based on what core drive each element belongs to, how each element relates to extrinsic or intrinsic motivations (Left versus right brain) and finally whether each design element is positive or negative motivator.

**Figure (3) Evaluation for stress management mHealth apps based on Octalysis framework**

**Discussion and findings**

There are multiple stress management apps available for Android and IOS, however, we narrowed our research to the top apps which utilize one or more gamification component. The apps that only focus on scenery or music were excluded. Based on our evaluation (in Appendix A), we have concluded that most of the studied applications are located in the left brain area where the emphasis is mainly on extrinsic motivations. Only few applications have games strategies implemented in their design based on intrinsic motivations. Accomplishment and ownership from right brain drives are more dominant features which may reasoned to the easiness and straight forward implementation. Intrinsic motivation is more thoughtful process and more difficult in implementation since it gives the user more control such as real-time control and choice perception. Additionally, social sharing for user data may be blocked for health confidentiality protocol such as HIPAA.

Nonetheless, most of the applications are located at the top of Octalysis framework. As already mentioned above, the core drive located at the top part of Octalysis framework are considered as positive motivators. It is obvious that most of those applications have a common agreement that positive motivators are more suitable for stress reduction. We also notice that the density tends to center on Meaning component 75%. The meaning component was found as lessons, tutorials, and informative/virtual instructions in the apps. Though, we have found that there is one app (I can be fearless by human progress) that did a good job in balancing extrinsic with intrinsic motivation, and positive and negative motivations. The developers in this app have utilized different games elements from octalysis framework such as, points, log and statistics, lock a secret, narrative, share with friends, and sudden rewards.

Table (2) shows the percentages of the investigated applications across the 8 main Octalysis core drives. As can be indicated, 50% of stress management control mHealth apps have accomplishments and ownership games dynamics as extrinsic motivators implemented in their design. Also, 33% of the apps
have social influence game strategy represented as sharing data with friends, or sharing data with providers, or inviting friends to use the apps embedded in the apps. Additionally, 33% of the apps have empowerment feature. Majority of the apps have successfully address the meaning component. This table provides an evident that the main focus in those apps is on extrinsic motivation compared to intrinsic and on positive motivation compared to negative one.

<table>
<thead>
<tr>
<th># of Apps</th>
<th>Left Brain (Extrinsic Motivations)</th>
<th>Right Brain (Intrinsic Motivations)</th>
<th>Left &amp; Right Brain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Accomplishment</td>
<td>Ownership</td>
<td>Scarcity</td>
</tr>
<tr>
<td>12</td>
<td>50%</td>
<td>50%</td>
<td>8%</td>
</tr>
</tbody>
</table>

Table (2): Apps density (By Percentage) on Left and Right Brain gamification

**Conclusion and Recommendation**

The gamification concept has been presented in the stress management mHealth apps studied in this paper. Many of the applications have already developed some of the gaming features in their design. However; our evaluation has revealed that the main focus in those apps’ design is on core drives that correspond to extrinsic motivations. Even though extrinsic motivators such as rewards, points and badges can engage users, but it is not necessarily means that users will be using those apps for long term. The focus on extrinsic motivations only might be attributed to the lack of understanding of gamification concept and how successfully we can implement it in mHealth apps' design. Alternatively, extending extrinsic motivations could be due to possible misperception of gamification as magnifying extrinsic motivations only. Extending extrinsic motivations only won’t lead to the optimal outcomes for self-stress management context.

Currently most of stress management apps focus on accomplishment and ownership. These extrinsic drives may negatively affect the stress control process by undermining intrinsic motivation. In addition, this doesn’t adhere to the self-determination theory for intrinsic motivation in order to enhance stress control. The app design should incorporate elements from empowerment such as choice perception and voluntary autonomy. This gamification component is very essential to allow users to develop sense of autonomy and satisfaction.

**References**


<table>
<thead>
<tr>
<th>#</th>
<th>App</th>
<th>Android</th>
<th>Apple</th>
<th>Accomplishment</th>
<th>Ownership</th>
<th>Scarcity</th>
<th>Empowerment</th>
<th>Social influence</th>
<th>Unpredictability</th>
<th>Avoidance</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Breath2Relax</td>
<td>Y</td>
<td>Y</td>
<td>Progress bar, step by step tutorial</td>
<td>Learning curve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Equanimity - Meditation Timer &amp; Tracker</td>
<td>Y</td>
<td></td>
<td>Progress bar</td>
<td>Monitoring, write notes, adjust interval</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Social prod</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Acupressure: Heal Yourself</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Voluntary Autonomy</td>
<td></td>
<td>Narrative</td>
</tr>
<tr>
<td>4</td>
<td>Qi Gong Meditation Relaxation</td>
<td>Y</td>
<td></td>
<td>Step by step exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Narrative</td>
</tr>
<tr>
<td>5</td>
<td>Calming Music to Simplicity</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Narrative</td>
</tr>
<tr>
<td>6</td>
<td>Worry Box Anxiety Self-Help</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Narrative</td>
</tr>
<tr>
<td>7</td>
<td>Stop Panic &amp; Anxiety Help</td>
<td>Y</td>
<td></td>
<td>Points</td>
<td>Learning curve and monitoring</td>
<td></td>
<td></td>
<td>Keeping history of previous panic attacks</td>
<td>Narrative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Sleep Time – Alarm Clock</td>
<td>Y</td>
<td>Y</td>
<td>Progress bar</td>
<td></td>
<td>Instant Feedback &amp; Tech Support</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Relax &amp; Rest Guided Meditations</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td>Real-time Control &amp; Choice Perception</td>
<td>Narrative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>I Can Be Fearless by Human Progress</td>
<td>Y</td>
<td></td>
<td>Points</td>
<td>Log &amp; statistics</td>
<td></td>
<td>Unlock a secret</td>
<td>Sharing with Facebook</td>
<td>Sudden rewards</td>
<td>Narrative</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Universal Breathing - Pranayama Free</td>
<td></td>
<td></td>
<td>Log</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Narrative</td>
</tr>
<tr>
<td>12</td>
<td>Self-Help for Anxiety Management (SAM)</td>
<td>Y</td>
<td>Y</td>
<td>Tracker</td>
<td></td>
<td>Social clouds</td>
<td></td>
<td>Avoidance by keeping a history of anxiety in the past</td>
<td>Narrative</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Appendix A:** Gamification evaluation for top 12 rated Stress mHealth Apps