BreathSenses: Classification of Digital Breathing Games

Abstract
In recent years attention has increased around digital breathing games via new technology that allows interaction between breathing and video games. While some breathing games use breath as a fun form of interaction, other games use breath to improve mental health aspects a player in order to reduce stress and anxiety. So far, little research has been devoted towards understanding the design of breathing games.

To develop an understanding towards the design of breathing games, we begin by proposing a taxonomy depending on the factors of game genre, game design analysis based on the human body senses involved, breathing technique used, aim of the breathing technique, technology used to experience the game world and technology used to measure breathing. To demonstrate the strength of our taxonomy, we analyze example games and discuss how the novel taxonomy could help game designers to create breathing games.

Author Keywords
Taxonomy; digital games; breathing; respiration.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;
**Introduction**

Breathing is something that we do all the time and yet we are mostly not aware of it. Bringing our focus intentionally onto our breath we can learn to observe it without reacting to it, simply watching each breath as it happens [1]. Further, various breathing techniques and exercises are considered fundamental for the development of both physical and mental well-being [2-4]. Inhaling makes us alert and ready for action, while exhaling calms us down, stimulates digestion and relaxes the muscles. Because breathing is the only conscious function that directly affects the heart, we can successfully treat illnesses such as hypertension and arrhythmias by controlling one's breathing [5].

Digital games offer promising opportunities for both the practice and research of breathing because the interactive nature of games allows for the development of experiential knowledge. This is important for breathing, as it will help players understand their breathing patterns and allow them to alter it if necessary [6]. Games can be engaging and that makes players forget about time and create an absorbing experience [7] unlike the traditional breathing exercises, which might lack motivation and engagement.

**Related Work**

In recent times, breathing is increasingly being used in digital games and applications. Some of the games and applications intend to use breathing as a fun form of interaction while others intend to improve physical and mental well-being of players by reducing stress and anxiety.

In a study conducted by Krestina and Andrew, "The Journey to Wild Divine" was investigated as a biofeedback management tool to teach breathing skills to children with Attention-Deficit/Hyperactivity Disorder (AD/HD). The children played the game by manipulating their heart rate using breathing techniques taught in the game [8]. Spatial poem by Choi et.al, offers a new type of visual interaction expressing the player’s own creative narrative as a real-time visual by playing a musical instrument, which is an emotional human behavior. When a player blows the instrument, to make sounds, the blow changes into energy that makes the player walk continuously in a virtual space [9]. Marshall et.al, explored the potential of breathing as an effective and engaging way to enable the control of individual seats on physical amusement rides. Tactics for designing rides in the future that could possibly incorporate breath control were proposed in their research [10]. Moraveji says that influence over behavior can happen with the most basic physiological change that we have conscious control over i.e., breathing. He further states that feedback would help change the simplest behavior that matters and in our context, it is breathing [6]. He has not pursued breathing from a playful perspective, but his words about feedback point towards gaming as a potential way to change behavior [11]. This work inspired us to build the taxonomy towards understanding the design of breathing games. We call this the breathsenses taxonomy.
<table>
<thead>
<tr>
<th>Game Genre</th>
<th>Example Game</th>
<th>Breathing Technique Used</th>
<th>Aim of the Breathing Technique</th>
<th>Game Design Analysis using MDA Framework Based on Human Body Senses Involved During the Gameplay</th>
<th>Technology Used To Experience the Game World</th>
<th>Measure Breathing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open World</td>
<td>Deep</td>
<td>Diaphragmatic Breathing</td>
<td>Reduced Stress, Calm &amp; Playful</td>
<td>Movement of the body detects the breathing, A circle on the screen indicates the player's breathing, The ambient sound of an underwater world keeps the player immersed</td>
<td>Use a device that is placed around the player to measure breathing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diaphragmatic Breathing</td>
<td></td>
<td>Breath rate is fed back into the game, The circle expands and contracts while the player breathes, The movement in the water is supported by the sound</td>
<td>A custom-made mask is used to plunge the player into a world of darkness</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>None</td>
<td>Playful Experience</td>
<td>The sense of sight is obscured by the mask worn by players, The players hold their breath to hear alien sounds,</td>
<td>Custom-made mask is used to plunge the player into a world of darkness</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>This makes players focus on different sounds in the game, Amends shock into darkness, hoping to hear the sound of the alien race</td>
<td>A microphone inside the mask is worn by the player to measure breathing</td>
<td></td>
</tr>
<tr>
<td>Casual</td>
<td>Risky</td>
<td>Breath Retaining</td>
<td>Reduced anxiety while being playful</td>
<td>Players move and collect coins while breathing, Players replicate the breathing by looking at the screen, The sound of the character breathing creates an illusion of</td>
<td>Use a smart phone to immerse the player</td>
<td>Playful does not measure breathing of the player</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Player replicate the character's breathing movement, Ambient sound of the character breathing creates an illusion of</td>
<td>Use a smart phone to immerse the player</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Players' breathing is sensed by the device and taken as input</td>
<td>Used a smart phone to immerse the players</td>
<td></td>
</tr>
</tbody>
</table>

**Table 1: The BreathSenses Taxonomy: Towards Understanding Breathing Games**

**Taxonomy**
Breathsenses is the taxonomy we propose shown in Table 1.0. The taxonomy consists of the following factors:

- Game genre
- Game design analysis based on the human body senses involved
- Breathing technique used
- Aim of the breathing technique
- Technology used to experience the game world
Technology used to measure breathing

Future Opportunity
While the breathsenses taxonomy informs game designers about how breathing games have been designed, it also helps them by showing the gaps that have been highlighted in orange color, indicating unexplored territory. Game designers who intend to design breathing games, can use the unexplored territory and design games by involving more combinations of human body senses during gameplay. Game designers also have the opportunity to explore combinations of breathing techniques and technologies as shown in the breathsenses taxonomy. Further, game technology enthusiasts might benefit from the breathsenses taxonomy and design new and exciting gaming interfaces. This might be possible by considering different combinations of human body senses that they want to involve while playing games.

Conclusion
Although this might not be the only way, but the breathsenses taxonomy is one of the ways towards understanding the design of breathing games. We believe that it can act as a stepping-stone for game designers who intend to design breathing games. Our next step, post this work is to design and develop our own breathing games and receive feedback from relevant audiences. With our work, we hope that people will learn to breathe better and game designers will start designing more breathing games.
References