[DEMO] Adventurous Dreaming Highflying Dragon: A Full Body Game for Children with Attention Deficit Hyperactivity Disorder (ADHD)

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ABSTRACT

Adventurous Dreaming Highflying Dragon is a full body-driven, game prototype for children ages 6-8 with a diagnosis of Attention Deficit Hyperactivity Disorder (ADHD). The current prototype incorporates research evidence showing that physical activity can help improve ADHD-related symptoms. Physical activity is integrated with cognitively challenging tasks that may improve brain activity by encouraging goal planning and dedication. The current prototype is includes three mini-games, each of which teaches skills with real-life use potential. Players role-play as a young dragon in the story and virtual world as they repeat virtual tasks several times to gain mastery over real-life skills. Each activity is focused on a specific strength/weakness reported in children with ADHD, with game mechanics targeting ADHD diagnosis categories: specific hyperactivity, impulsivity and inattention.

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Keywords

Games, ADHD/ADD, Kinect, Attention, Executive Function, Motor skills, Prototyping

1. INTRODUCTION

The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) reports that 3-7% of school-aged children have ADHD[1]. Although symptom-based diagnosis and prevalence estimate remain controversial, the presence of ADHD symptoms in young children can be impair quality of life[8] and affect executive function outcomes[7]. This project seeks to provide an opportunity for structured, interactive training and evaluation to assist children with combating symptoms of ADHD without the need and expense of constant supervision by a child psychiatrist, which is often not covered by health insurance plans. Our current model of describing executive function, includes working memory, cognitive flexibility and inhibitory control recognized as "crucial building blocks for early development of both cognitive and social capabilities"[3]. Regardless of whether one describes ADHD through a clinical diagnosis model, or a neurodevelopmental model[5], it is generally accepted that problems with directing and managing attention can impair brain development, task performance in daily living, affect regulation and social functioning. Some therapies have been shown effective in children with a medical diagnosis of ADHD, with increasing evidence that exercise and play-oriented interventions could improve functioning and decrease symptoms[2, 4, 6, 10, 11]. The aim of the project is to introduce a fun and playful experience that can teach players how to pay attention for longer periods of time. The design objective for all game-related tasks in this project is to maintain attention while players use different body gestures to control the main character in the game. Improving attention takes practice so players can continue to practice for as long as they can until they master a certain task.

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2. ORIGINS OF GAME CONCEPT

This project was developed as a student thesis project from within a prominent US game design program, hoping that it can influence and inspire a new generation of game-makers to tackle the aforementioned challenges. The first author, student and lead designer for this project established the following design ideals: full-body engagement, child-appropriate theme, repeatable levels and empowerment-based feedback. In addition, she sought to develop a world and concept that would be "beautiful, interesting and imaginative" so it can immerse children without them feeling they are using an overtly "educational" game. The game concept was developed through discussions with faculty researchers and clinicians who specialize in adult and pediatric ADHD.

Figure 1. Game environment concept art (Left Image)
Figure 2. Main character concept art (Right Image)

Cognitive style of children with ADHD is described as qualitatively different from most of their peers, and what may be needed for training is patience, reinforcement and encouragement [9]. Video games can assist with all of these needs. The narrative of the game involves the story of a young dragon's life, aiming to engage children to play and repeat it until the end. This provides a *modular play structure*, breaking tasks down into smaller tasks and making multiple mini-games from them. The game allows children to keep playing to repeat tasks and achieve mastery, with hope that some of these skills can generalize into real life so children can begin to do things they were not able to do before. The game tries to incorporate the social integration issue as a theme, and reframes it in a positive way through its story, which may help these children feel good about themselves. The game

takes place in a charming, happy, playful and a bit mysterious little floating dragon island (see Figure1). Players play as the main character in the game, a very young dragon (see Figure2), who is not a hero from the beginning, but who can eventually gain experiences and skills, and become a hero. Each mini-game has its own scenario and takes place at different locations in the island for variety and mitigation of boredom. All mini-games are tied into the main narrative of the game, which comprises the entire story of the *adventurous dreaming highflying Dragon* (adhD). The audio feedback is one of the most important elements in the reward system of this project. Children with ADHD often get bored or discouraged to finish a task. Encouragement from other people or from their peers may be a very effective way to keep them engaged. The game provides audio feedback to cheer players based on their performance.

3. DESCRIPTION OF PROTOTYPES

Each prototype design focuses on a main ADHD feature, (hyperactivity, impulsivity, inattention) with overlap in required skills. *Forrest* (see Figure3) provides a practice space for attention and aims to increase the ability to focus and remember specific visual prompts. Our clinical advisors suggested that mastery of this mini-game might increase potential for learning through focused attention. The game asks players to memorize a certain sequence of desired objects so they can retrieve them during play. A visual indicator of what is being asked for is presented onscreen. The player has to match and catch the required object with their body while different objects appear within different color trees. Difficulty is escalated by introducing more colors and different shapes. The color of trees and objects begins simpler and increases in complexity over time. Mastering complexity is rewarded with increase in challenge, whereas matching mistakes restarts the level.

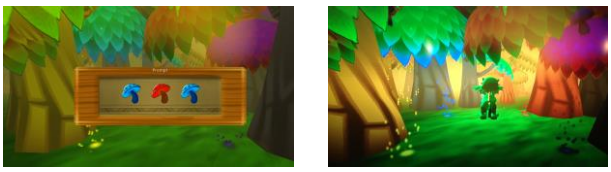

Figure 3. *Forrest* mini-game prototype

Cave (see Figure4), provides practice to enhance gross and fine motor skills, which may improve hand-eye coordination reported by our clinical advisors to be poorer in children with ADHD because of hyperactivity and fidgeting. In *Cave*, players are informed about the existence of a fragile and valuable object in the middle of the rock, which needs to be uncovered unharmed. The player as a little dragon has to be careful with their big claws while breaking pieces of rock to get to the precious core whose location is not predictable. This requires escalating of precision and accuracy. The game also asks the player to tap the floor to rotate the rock on two axes, which will make each segment of it accessible. Generalization benefits for *Cave* may benefit many gross motor and fine motor skills (sports, typing, music playing).

Figure 4. *Cave* mini-game prototype

Water Tower (see Figure5) trains the ability to hold still on one pose. The goal is to move gradually to poses that are more complex and to maintain them for a longer period of time. In the beginning, the game starts with couple of cracks on a wall, and asks the players to put any part of their body on the cracks to avoid any expansion of cracks, and to hold the pose for few seconds to heal the water tower. Eventually, the game generates more cracks on the water tower and that asks for more body parts of players to cover them. The patience required here might be helpful for children with impulsivity, and the game itself can be very fun, as players have to improvise many poses to heal the cracks. Mastering complexity is rewarded with more opportunity to be creative with body postures, while "failure" is not immediately penalized.

Figure 5. *Water Tower* mini-game prototype

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