

A 3D Serious Game for Improving Social Skills of Children with ADHD via Multimodal Rhythm-centric Exercises

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Children diagnosed with ADHD are often at a disadvantage regarding their social interactions at school and at play due to their symptomatic inattention, impulsivity and hyperactivity. That may lead to isolation, low self-esteem and even depression. Music is shown to significantly help children maintain focused attention as well as offer a timed structure around their actions, involving melody and tempo. Music can also aid the development of cognitive ability, self-confidence and promote limits and rules. Through music, children can learn how to control but not limit their impulsivity, learn to pause and wait for their turn and apply such social skills to their every-day life. We aim to produce a multimodal 3D serious game, which unlike currently available visual games, will exploit the benefits of music and rhythm helping children diagnosed with ADHD to overcome their psychosocial challenges. Past research has put forward 3D serious games providing task-based practice in order to enhance and maintain attention, increase children's ability to focus, remember specific visual prompts, enhance gross and fine motor skills as well as the ability to hold still on one pose for a specific period of time (Hashemian&Gotsis, 2013). Although, such games often require full body engagement of the player, there is doubt whether such games have a long-term positive effect as well as whether what the children achieve during playtime, can be generalized as an accomplished skill in their every-day life and interactions. In an effort to introduce rhythm, therefore, engage the body's own physiology, relevant research has put forward a respiration game named ChillFish for children with ADHD, including breathing exercises as a way to control stress level (Sonne& Jensen, 2016). The player is breathing into a sensor-mounted LEGO fish which controls ChillFish and children are engaged with the hardware involved and the experience. As ChillFish was single-user and children with ADHD live in a social environment at school and at play, we put forward an innovative 3D serious game which employs sophisticated rhythm protocols played with drums in a group setting, offering a richer multimodal experience and aiming to engage and motivate children to complete gamified tasks in the classroom or at playtime.

ADDventurousRhythmicalPlanet

The game presented in this paper named *ADDventurous Rhythmical Planetis* designed for children diagnosed with ADHD, 8-12 years old and it is currently at an advanced stage of development.

It uses rhythm exercises as a main expression tool with the guidance of a music instructor. Each player holds a drum connected through Wifi with the game, using a piezoelectric transducer with an ESP8266. Data are collected in relation to when each drum is struck and which child it belongs to. Drum actions drive the gameplay which only progresses when the player reproduces the beat requested relatively accurately as guided by the instructor. At the beginning, children are guided through the process of learning basic rhythm concepts. Later, they are introduced to cooperative and interactive playful actions together with other non-ADHD players, in a multi-player stage. It is hypothesized that this process will motivate them to socialize among peers and, therefore, improve their overall mental health and self-confidence. We gather quantitative data in terms of action logs as well as qualitative data of children actions together with specialized practitioners, evaluating the usability as well as the overall improvement of social skills and attention deployment as observed during the game as well as in or outside the classroom. The story of the game unfolds as following. An alien crashed with her spaceship in an unknown planet. During the crash, pieces of the spaceship are scattered in the planet's craters. The player needs to go around the planet and retrieve the pieces in order to repair the spaceship and continue her journey. The craters are now angry because they had spaceship debris pieces thrown at them. The players have to collectively reproduce the rhythm that each crater asks for, in exchange for each piece.



Figure 1: Level 1 of the game / Main character of the game

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