Designing a Smartphone Exergame for Children with Cerebral Palsy in the Home Environment

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Introduction

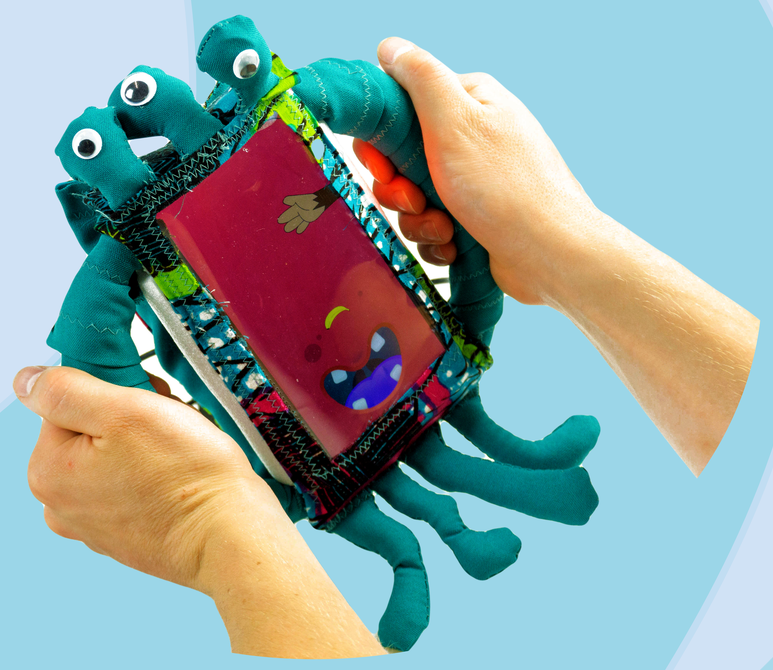
Children with Cerebral Palsy (CP) are often faced with chronic motoric impairments, with **spasticity** being the most common. In order to increase functionality, repetitive therapeutic exercises are regularly prescribed, often resulting in poor adherence. **Exergames** can be used to make these exercises more engaging. But maintaining intrinsic motivation over an extended period of time poses a challenge for therapists.

In this research, we introduce a **smartphone-based** exergame called the Squid Monster which can be played in the **home environment**. After finalizing our research through design process (RtD) with a user study, we evaluate how a machine learning **movement classifier and a dynamic difficulty adjustment** system could support the game's efficacy.

Method

Results

The final design consists of a steering-wheel-shaped phone casing and a smartphone application The game stimulates the user to perform a supination movement by steering the Squid Monster to eat the bananas. The second interaction is a controlled squeeze interaction used to operate the blender. Both interactions are based on therapeutic exercises.



- The user study showed signs of the desired interaction, yet compensation strategies were also observed.
- The gathered data showed substantial interpersonal differences.

Conclusions

- The interaction with the Squid Monster prototype showed **therapeutic potential**, according to the interviews with the medical experts and the observations made during the user study.
- Measured **interpersonal differences** during the user study emphasise the need for difficulty personalisation, whilst observed compensation strategies highlight the potential of a machine learning movement classifier in terms of enhancing medical efficacy.
- **Future iteration**: Designing clear In-game metaphors remained challenging yet is crucial when trying to stimulate flow. We propose a specific focus on **feedforward** mechanisms, aiming to provide information in the run-up to an event rather than after the event. These mechanisms should be in **unison** with the aspired AI architecture, using the user's movement patterns as game input and changing the difficulty based on the individual's competence.

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