ClarAyan: A Cost-Effective Fixation Training App for Children

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Introduction

Fixation training is a fundamental aspect of paediatric vision therapy, especially for conditions like amblyopia, convergence insufficiency, and poor visual attention. In these contexts, helping children learn to maintain steady eye fixation on a target can significantly improve visual tracking, reading fluency, and classroom focus. However, most of the commercially available application for fixation training is either too expensive for small clinics or lacks child-friendly engagement features. This creates an accessibility gap, especially in low-resource settings.

To address this need, I developed ClarAyan—a simple, interactive, and affordable fixation training application designed specifically for children. The idea was not just to replace expensive application but to provide a tool that children would willingly use and stay engaged with, even in unsupervised or home environments.

Significance and Rationale

One critical challenge in paediatric vision therapy is sustaining a child's attention long enough to achieve therapeutic value. Research shows that digital interventions can significantly improve compliance if the activity feels like play rather than therapy [1]. Games that provide visual stimulation, customization, and interactivity can improve both fixation and broader oculomotor control [2]. Moreover, early intervention is vital, as neuroplasticity in younger children allows for more effective vision correction and cognitive training during these formative years [3,5].

In designing ClarAyan, the primary goal was to blend therapeutic elements with interactive features that naturally appeal to children—moving objects, bright colours, and adjustable gameplay. This helps sustain attention for the necessary duration without making the task feel repetitive or clinical. The result is a fixation training experience that feels more like a game, thereby increasing motivation and reducing resistance to regular practice.

Methodology

ClarAyan was built using Python for the backend and JavaScript for the user interface. It runs as a lightweight desktop application with minimal setup requirements. The core gameplay involves a bouncing ball that changes colour every time it touches the edge of the screen. Children can customize the speed and size of the ball, giving them some control over their visual challenge level. The background consists of alternating vertical red and sky-blue stripes spaced 2 mm apart. This design has a deliberate function in the context of binocular vision therapy. When used with red-blue anaglyph goggles, each eye receives different visual input—the red lens filters out the red lines and allows blue through, while the blue lens does the opposite [4]. This technique, often referred to as dichoptic stimulation, helps train each eye separately while still working together, reinforcing binocular coordination and suppressing dominance from the stronger eye [6].

The colours were selected based on how anaglyph filters split the light spectrum. Red and cyan (sky-blue) are the most commonly used colour pair in clinical anaglyph-based therapies because they provide maximum contrast and minimal spectral overlap, improving eye isolation and reducing ghosting effects [7]. This approach has been shown to enhance the effectiveness of amblyopia and suppression therapy when combined with visual tasks like tracking or fixation games.

Results and Analysis

Although ClarAyan was developed as a potential tool for fixation training in children with binocular vision disorders, this initial evaluation was conducted with a small group of healthy children to assess the application's usability and engagement potential.

A pilot evaluation was conducted to examine the level of engagement of the ClarAyan application among children. A total of 10 children aged 7 to 9 years were observed during unstructured interaction with the application, wearing red-blue goggles. No time constraints were imposed, allowing for natural engagement measurement.

- **Engagement Time and Preferences:** The mean duration of engagement with the application was 11.2 ± 2.6 minutes, indicating sustained attention across the testing period. A paired t-test comparing early and late interaction intervals showed no significant decline in attention over time [$t(9) = 0.83$, $p = 0.43$], suggesting that the activity maintained its cognitive appeal and did not induce fatigue or boredom during the session.
- **Customization Preferences:** Customization features were particularly well-received. 80% of participants reported that the ability to alter the ball's speed and size enhanced their interest and focus. Additionally, 60% of the children voluntarily interacted with the application for more than 10 minutes, exceeding the average engagement time reported in many fixation training sessions.

Discussion

The positive reception of ClarAyan among children supports its potential as a practical and low-cost alternative to traditional fixation training application. The simplicity of the interface makes it easy to deploy in both clinical and home settings, while the adaptive features increase the likelihood of continued use over time.

Importantly, the application addresses a known gap in paediatric vision therapy—how to maintain children's attention long enough to deliver meaningful therapeutic results. By integrating visual stimulation with game-like interaction, ClarAyan taps into the same principles that commercial educational application, employs to hold attention and promote learning [7].

However, these findings are based on a small sample size. To truly assess the effectiveness of ClarAyan, further research is needed involving controlled clinical trials and long-term follow-up studies.

Conclusion

ClarAyan offers a simple yet effective approach to fixation training, balancing therapeutic needs with elements of play. Its low cost, customizable features, and child-friendly design make it a promising tool for practitioners and parents alike. While preliminary results are encouraging, ongoing validation in larger cohorts is essential for it to be considered a standard part of paediatric vision therapy.

References

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