# DYNAMIC VR-BASED MOTION BIO-FEEDBACK ALGORITHM FOR ACTIVE CLP EXPOSURE

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# Overview

Current exposure-based therapies for PTSD, phobias, and ADHD lack personalization, real-time safety monitoring, and patient agency. This technology introduces a dynamic virtual reality (VR) algorithm that creates a closed-loop perceptual (CLP) exposure system by integrating real-time ocular kinematics and physiological signals. The system continuously adapts visual stimuli based on the userâ&#128;&#153;s gaze stability and emotional state, enabling individualized control over the pace and content of exposure. This active engagement facilitates neural plasticity and behavioral change, under therapist supervision, in a safe and immersive environment.

# Applications

- Treating ADHD with biofeedback during gamified training sessions
- Treating PTSD with AI-assisted triggering environments that recreate the specific traumatic episode while monitoring patient distress for safety
- Treating phobias using simulated exposure therapy
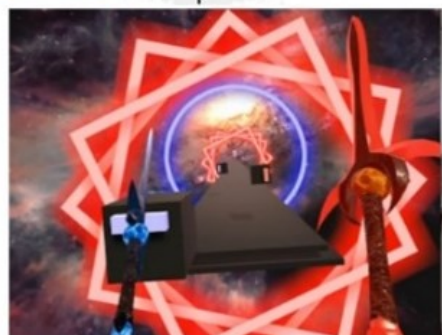
# Differentiation

- Medication-free treatment, preventing common side effects such as insomnia, weight loss, and increased heart rate
- Highly personalized 3D VR experience that is immersive and enjoyable for a range of age groups
- Real-time engagement of eyes, legs, and hands with direct feedback
- Enhanced signal reliability & low variability

# Development Stage

The system has been validated for ADHD using an eye-tracking-enabled VR headset that modulates visual clarity based on gaze stability. Development of a gradual, safe exposure protocol is underway for PTSD and phobia applications.
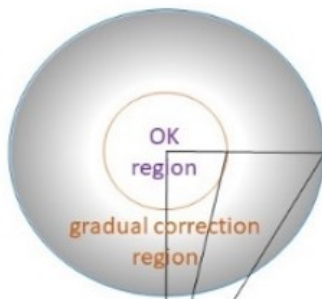
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# Biofeedback protocol



$$MF(r) = \begin{cases} 1 & |r < r_{thresh} \\ \dfrac{1 - \dfrac{r}{r_{max}}}{2} & |r_{thresh} < r < r_{max} \\ 0 & |r > r_{max} \end{cases}$$

centered gaze:
sharp video, loud sound

not centered gaze:
blurred video, low sound

OK region

gradual correction region

Use of an integrated eye tracker in a VR headset to monitor gaze stability and dynamically adjust image clarity based on gaze dynamics.
This closed-loop feedback method has been validated in individuals with ADHD.