

A virtual reality game designed to address auditory hypersensitivity for autistic young people.



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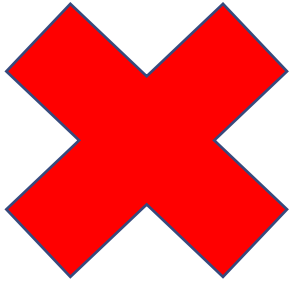
  
animmersion

50 to 70%

of the autistic population experience  
hyperresponsiveness to sound in their lifetime.



- **Hyperacuity**  
Sounds feel louder
- **Misophonia**  
Anger or disgust at specific sounds
- **Phonophobia**  
Fear of specific sounds
- **Recruitment**  
Higher growth in perceived loudness at higher intensity (frequency)



Physical features  
of ear anatomy



Sensory processing  
pathway



Current treatment recommendations are based on cognitive behavioural therapy techniques such

as:

Systematic  
desensitisation



The present study is based on the earlier work by Johnston and colleagues (2020).

Article

## SoundFields: A Virtual Reality Game Designed to Address Auditory Hypersensitivity in Individuals with Autism Spectrum Disorder

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**Abstract:** Individuals with autism spectrum disorder (ASD) are characterised as having impairments in social-emotional interaction and communication, alongside displaying repetitive behaviours and interests. Additionally, they can frequently experience difficulties in processing sensory information with particular prevalence in the auditory domain. Often triggered by everyday environmental sounds, auditory hypersensitivity can provoke self-regulatory fear responses such as crying and isolation from sounds. This paper presents SoundFields, an interactive virtual reality game designed to address this area by integrating exposure based therapy techniques into game mechanics and delivering target auditory stimuli to the player rendered via binaural based spatial audio. A pilot study was conducted with six participants diagnosed with ASD who displayed hypersensitivity to specific sounds to evaluate the use of SoundFields as a tool to reduce levels of anxiety associated with identified problematic sounds. During the course of the investigation participants played the game weekly over four weeks and all participants actively engaged with the virtual reality (VR) environment and enjoyed playing the game. Following this period, a comparison of pre- and post-study measurements showed a significant decrease in anxiety linked to target auditory stimuli. The study results therefore suggest that SoundFields could be an effective tool for helping individuals with autism manage auditory hypersensitivity.





## **Aim:**

- The main aim of this project is to further develop and evaluate a low-cost implementation of the 'SoundFields' VR framework for treatment of auditory hypersensitivity in autistic children and young people.

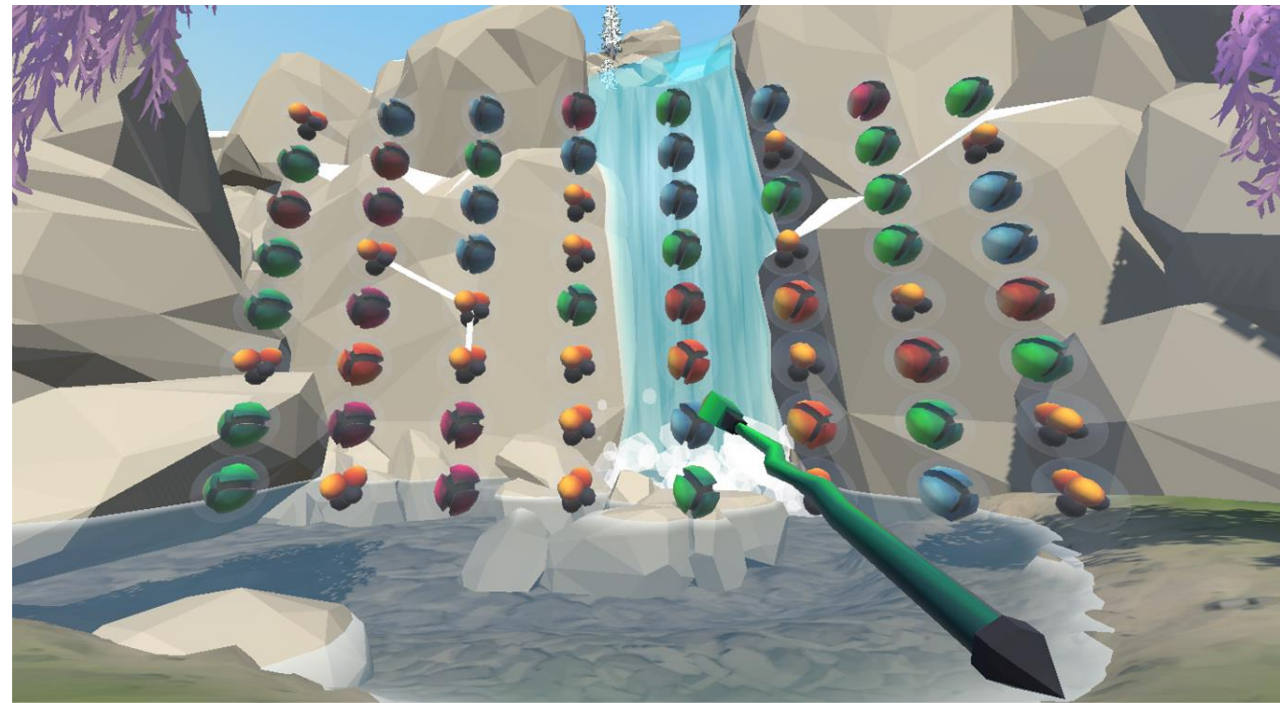
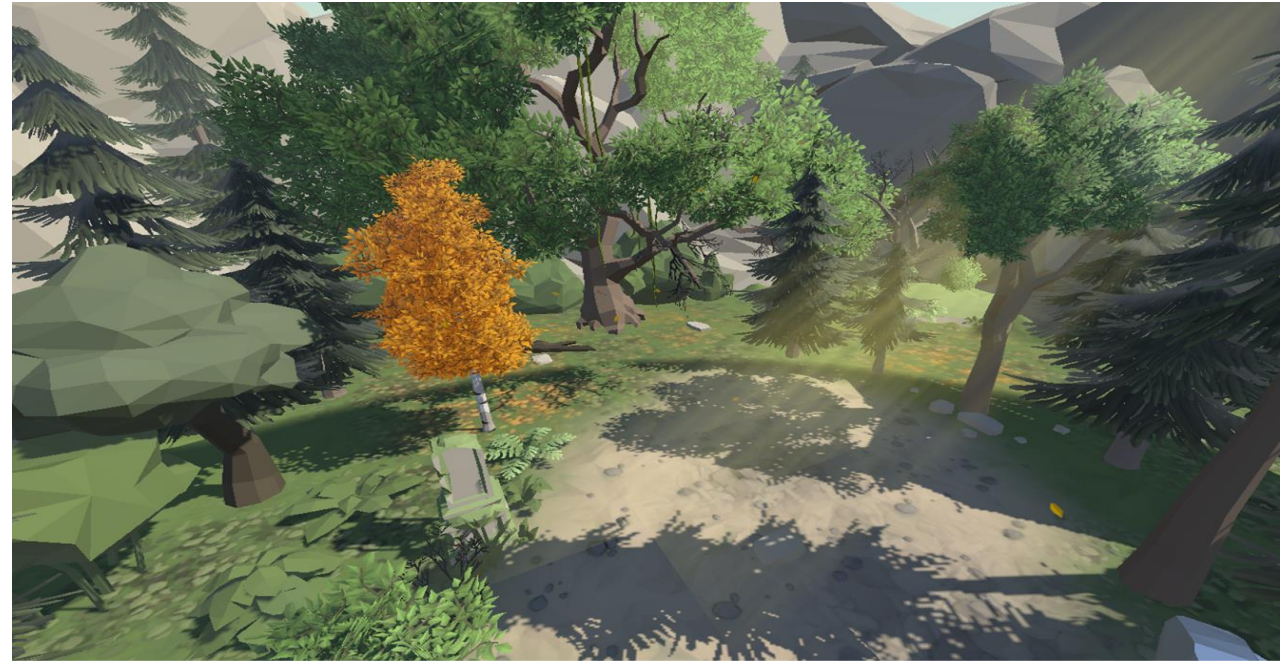
## **Objectives:**

1. To develop the application to run on low-cost VR headsets
2. To recruit a co-design panel of clinicians, teachers and young people and their families to assist in the application development and refinement
3. To evaluate the effectiveness of the application in a longitudinal study.



# Co-design

- 5 Young people
- 6 Parents
- 3 Professionals





# Recruitment

## Inclusion criteria:

Aged 8 – 18 years

Diagnosis of Autism

Experience sound hyperresponsiveness (sound sensitivity)

## Exclusion criteria:

Photosensitive epilepsy

## Participant characteristics

Total recruited: 9

Sex: 3 girls and 6 boys

Age range: 8-13 years

Ethnicity: All white British



**Girls**

**Boys**





How do you feel?

Very Happy	A little Happy	OK	A little Unhappy	Unhappy	Very Unhappy



# At home study

- Complete the longitudinal (10-week) study
- Children required to play 30 mins a week
- Self guided intervention
- Pre-Post self reported emotional responses
- Tracked voluntary interactions with stimuli



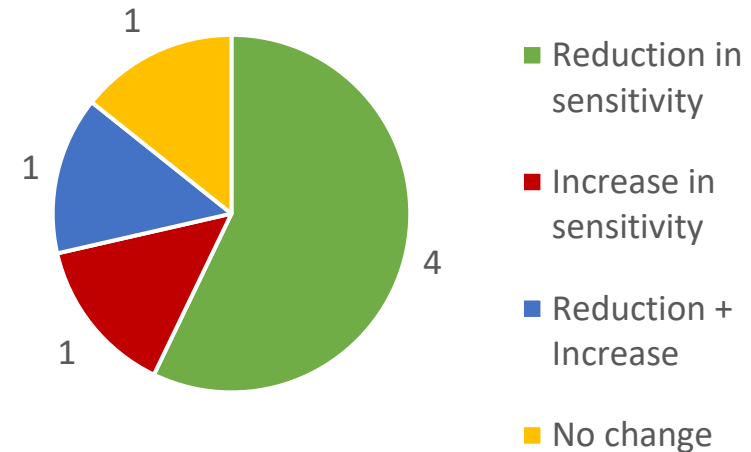
# Results

## Self-Reported Emotional Response (SRER)



- 5 participants reported a decrease in sensitivity for at least one target stimulus
- 2 participants reported an increase in sensitivity to at least one target stimulus
- 1 participant reported a decrease in one sounds increase in another
- 1 participant reported no change

Baseline - 10 wk change [number of children]

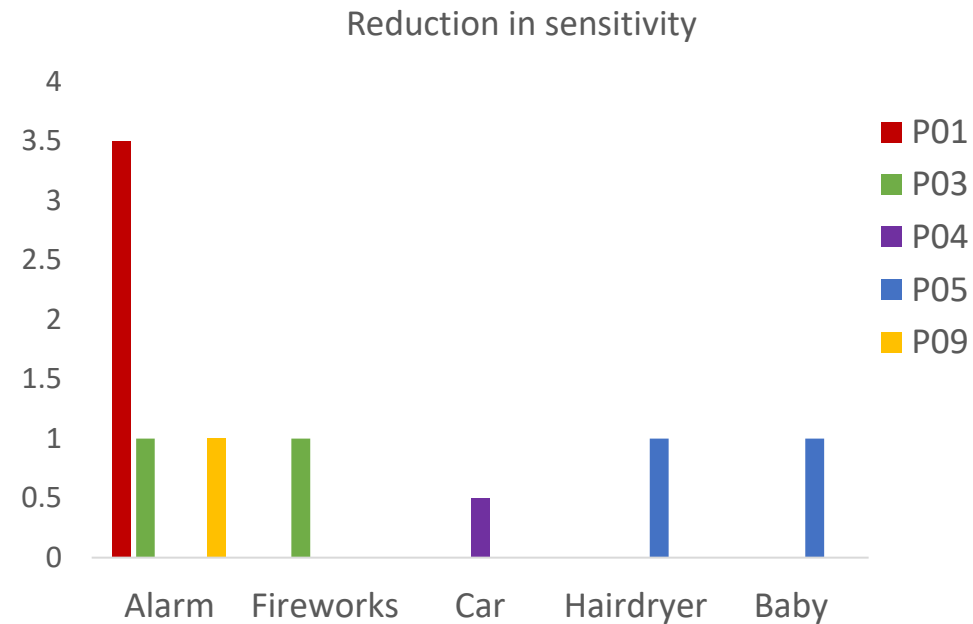
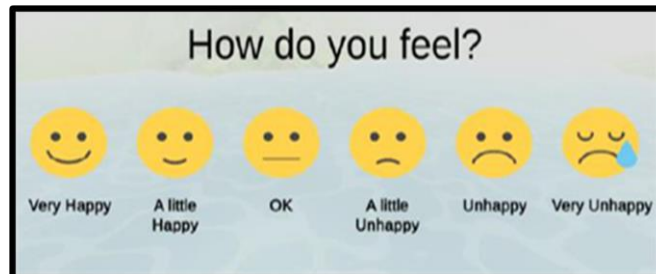


# Results

## Self-Reported Emotional Response (SRER)

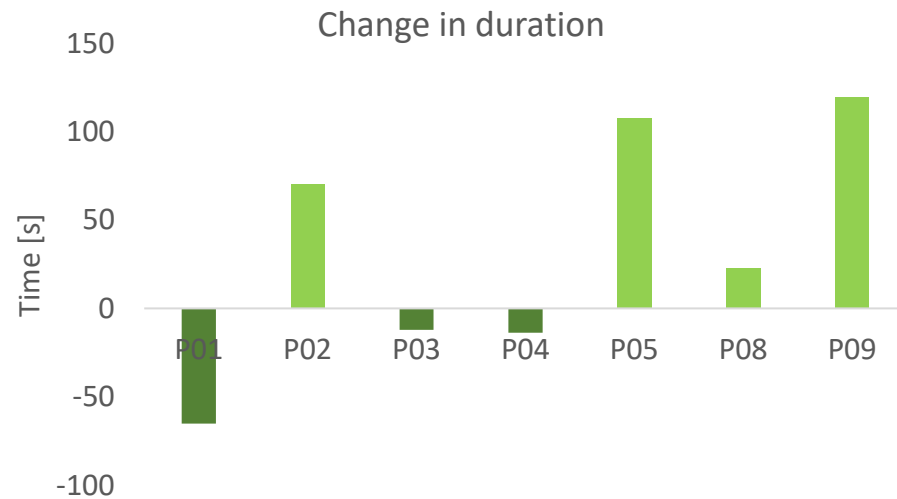
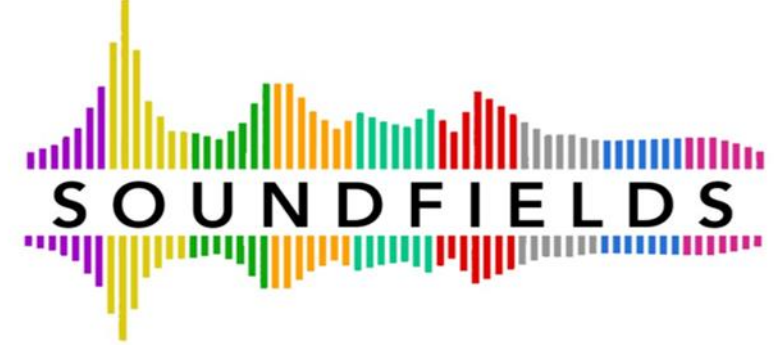


- SRER scale ranges 1-6
- Mean decrease in SRER for all participants was 1.29



# Results

## Changes in interaction behaviour



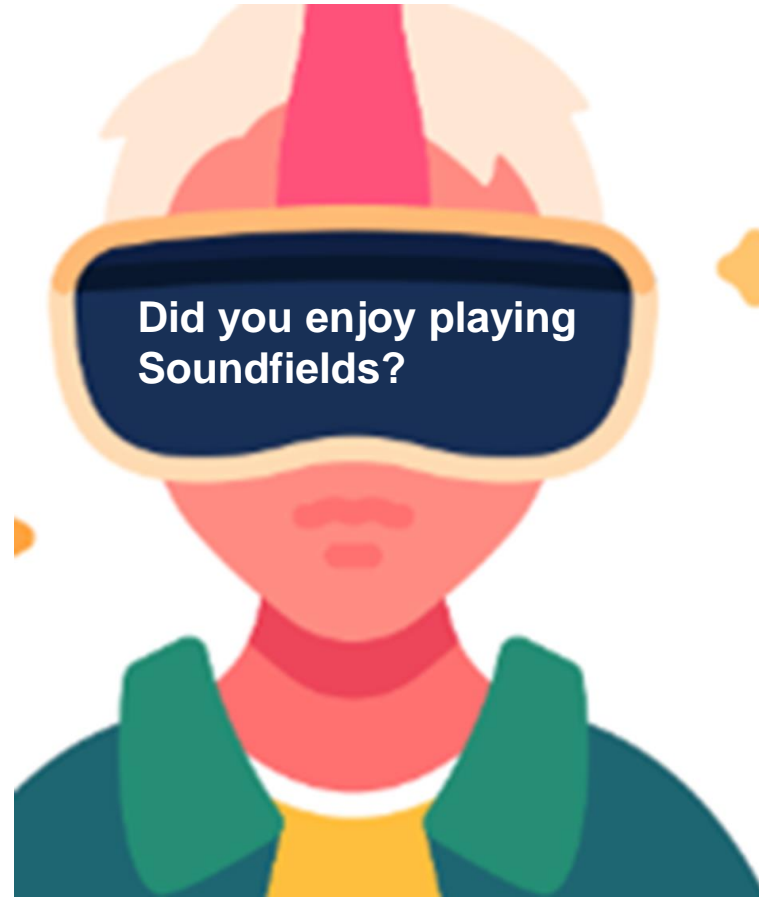
- 4 participants showed an increase in interaction time over the course of the study
- On average, a total increase of 33 seconds (28% of average initial interaction length)
- 4 participants chose to lower intensity level and only 1 participant increased. 2 remained constant throughout the study
- On average, intensity was lowered from 2.9 to 2.3

# Results

What did they say?

Err it wasn't very entertaining. It was a little babyish

Yeah, once it had updates, few things were annoying. One game started crashing



Yeah it was a lot of fun!

Yeah it was fun I liked the game



# Results

What did they say?

I feel a bit better  
but I don't usually  
hear those things

Kinda the same  
as before

How do you feel about  
the sounds you don't  
like now?

I think it has helped  
a tiny bit. I can  
ignore them more

I think it's pretty  
much the same





# Results

## What can we improve

Build on the rewards and achievement system to foster more engagement

Add companion mobile app that allows parents to choose stimuli and exposure levels

How can Soundfields improve?

Address bugs that appeared during user testing

Include more games to engage wider population



# What happens next?

- Sound fields found to be an acceptable and feasible intervention however not enough participants to measure effectiveness
- Disseminate findings in open access journal
- Address improvements to software
- Prepare for a larger scale trial to test the efficacy of the application as a treatment





Thank you!

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