

EEG Controlled VR Shooting Game with Neuro-feedback Strategy for attention training

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Why?

1. Improving children's or adult's level of attention is always a hot topic in the field of education and psychology.
2. By introducing virtual reality, we can improve the training experience and recreation level, which allows users to enjoy and focus more on the training process, utilizing the idea of gamification.

Relative Work

Positive behavioral and electrophysiological changes following neurofeedback training in children with autism, by J.A. Pineda, D. Brang, E. Hecht, L. Edwards, S. Carey, M. Bacon, C. Futagaki, D. Suk, J. Tom a, C. Birnbaum, A. Rork

Objectives

1. Build a EEG controlled VR shooting game.
2. Utilize neuro-feedback strategy to train two groups of players with increasing attention level or increasing attention time respectively.
3. Perform a test to evaluate the performance between training groups and the control group to see if the attention is improved for those who receive training.

Tools

Virtual Reality Platform: Oculus VR

VR headset: Oculus Rift

Developing tool: Unity 5.5

EEG headset: Neurosky

EEG API: Neurosky Unity 5 API

Training

We set the game to have 5 different levels. For each level, the player would have to shoot 5 random bricks by concentrating

1. For time-training group, the initial attention level is 50 and the user needs to stay above 50 for 3 seconds in order to shoot. The concentration time would increase by 1s when entering a new level
2. For level-training group, the initial attention level is 50 and the time is 3 seconds. The concentration level would increase by 10 when entering a new level
3. For control group, the attention level is always 50 and the time is 3 seconds.

Evaluation

The three groups are asked to play the game again. The evaluation test requires the players to shoot 5 random blocks with attention level 50 and concentration time 3s.

We would measure the amount of time each player need for shooting 5 bricks.



Participants

In UCSD VR lab

6 participants in total

2 for each training group

Trained to level 5 (or about 10 mins)

Test



Connect DisConnect

PoorSignal1:0

Attention1:41

Meditation1:48

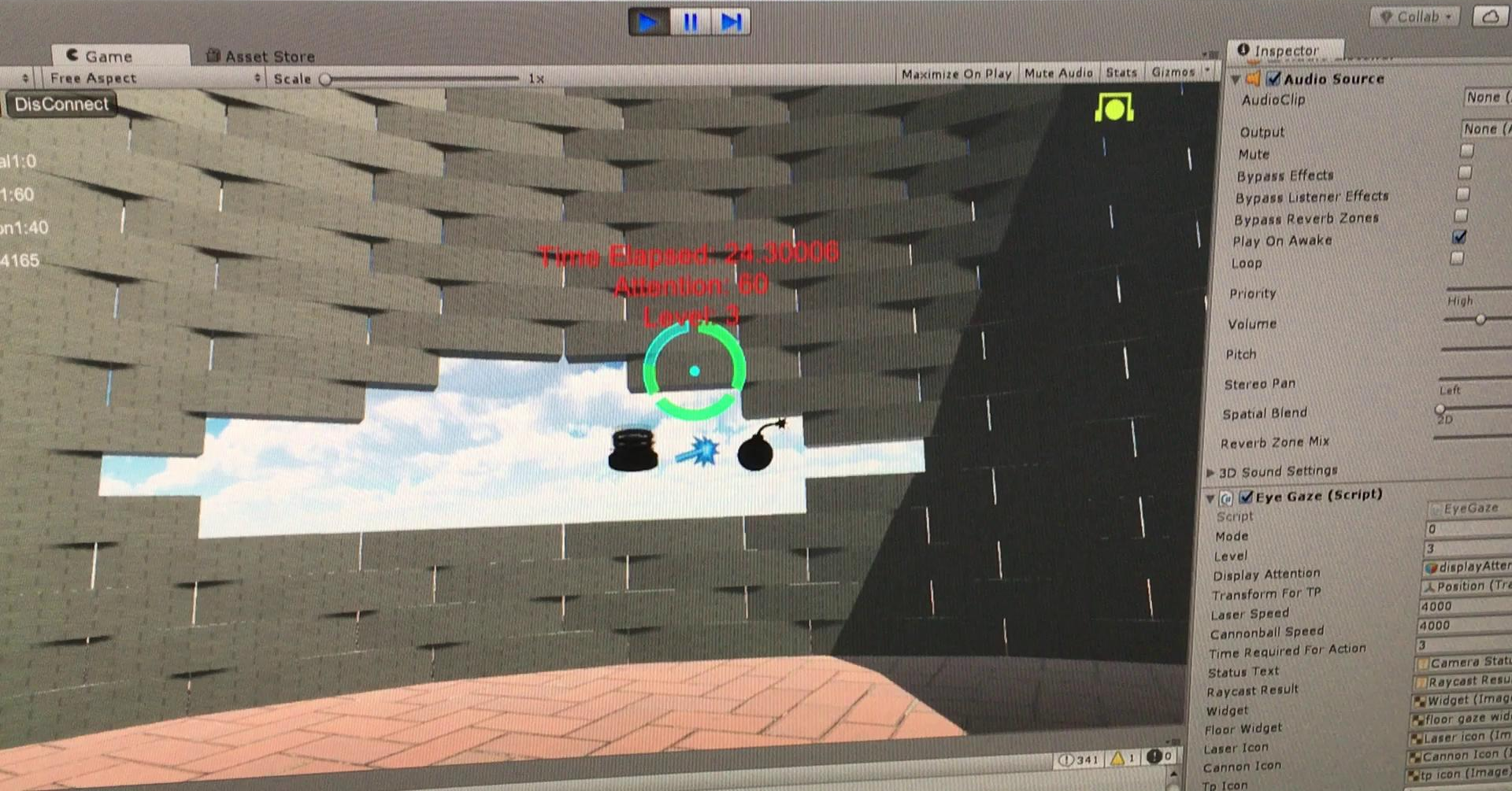
Delta:44775

Time Elapsed: 159.7005

Attention: 41

Level: 4



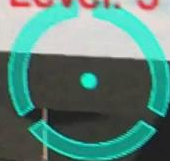




Time Elapsed: 117.9988

Attention: 54

Level: 5



Results

Participant #	Participant #1	Participant #2	Participant #3	Participant #4	Participant #5	Participant #6
Group	level	level	time	time	control	control
Highest level achieved in training	4 (threshold =70)	5 (threshold =80)	5 (cocentrate time = 6s)	5 (concentrate time = 6s)	5 sessions	5 sessions
Test time spent	32s	27s	23s	43.6s	24s	49.6s

Discussion and future work

No significant differences between groups

Train with level slightly better (?)

- Possible causes:
 - Not enough data - everyone is busy it's week 10 !
 - Tiredness - immediate test after training (may explain why time group did not perform better)
 - Not enough training
- Future work:
 - More participants and more trials
 - Appropriate time gap between training and test

Other findings:

- No one achieved above fifth level in training
 - Level #5 : threshold = 80, time = 3s / threshold = 50, time = 6s
 - Difficult to achieve the threshold/time in the last few shoots - evidence of tiredness
- Strategies to keep attentive:
 - Focus on something or some thoughts
 - Verbal thoughts worked well : e.g. sing a song in mind, speak German in mind, read words on the screen
 - Visual thoughts almost did not work: e.g. think about details of a picture/scenario, drawing something in mind

Thank you!