Impact of auditory intervention on neural synchronization in pre-readers at cognitive risk for dyslexia

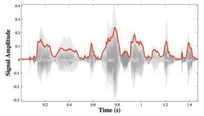
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Background

Developmental Dyslexia
• core deficit: auditory temporal processing

Speech Envelope



4 Hz: syllable information

20 Hz: phoneme information

Impaired neural synchronization to important frequencies in the speech envelope
➡ Interferes with speech perception and ultimately reading and writing

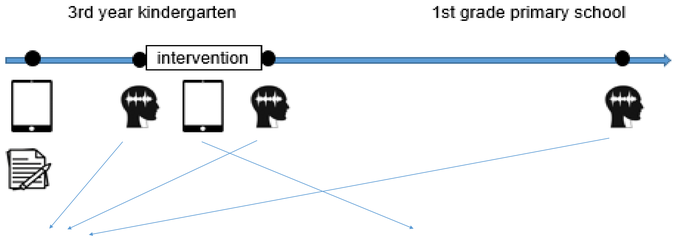
Dyslexia Paradox
• dyslexia is only diagnosed after most effective intervention period (Ozernov-Palchik, & Gaab, 2006)
➡ Need for preventive intervention

Objectives

Preventive intervention for pre-readers at cognitive risk for dyslexia

➡ Do auditory deficits benefit from a preventive intervention?

Design



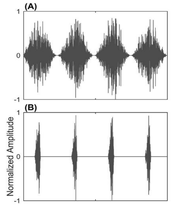
Auditory Steady-State Responses (ASSR)

Intervention

4 & 20 Hz

AM

PULS

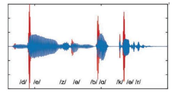


(Van Hirtum, Ghesquière, et al., 2019)

1. GraphoGame (GG) (Richardson, & Lyytinen, 2014)



2. Onset Enhanced Speech Envelope (EE) training (Geurts, & Wouters, 1999; Koning, & Wouters, 2012; Van Hirtum, Moncada-Torres et al.,2019)



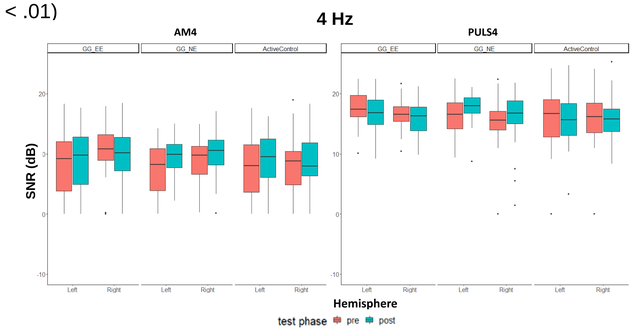
Intervention study design

GG + EE	GG + non EE (NE)	Active control
GG 15 min	GG 15 min	Control game 15 min
Active EE listening 10 min	Active NE listening 10 min	Active NE listening 10 min
Pre 31 / Post 29 / Cons 26	Pre 31 / Post 29 / Cons 29	Pre 29 / Post 26 / Cons 24

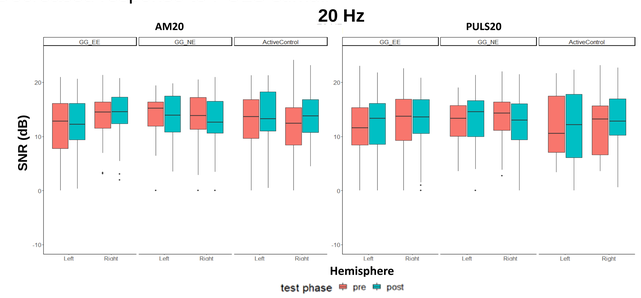
Results

Participants show a higher SNR to PULS stimuli at 4 Hz ($p < .001$)

At 4 Hz, while for the AM stimuli, there is a right hemispheric processing preference, for the PULS stimuli there is a left hemispheric processing preference ($p < .01$)



Participants show a higher SNR to the AM stimuli at 20 Hz ($p < .01$)
➡ Decreased response to PULS stimuli



Take home

No intervention effects on neural synchronization (no group effects)

Relative decrease in response to PULS stimulus compared to AM stimulus at 20 Hz
➡ indication for future reading problems?

Follow-up after onset reading instruction necessary

Hemisphere findings at 4 Hz in contrast to previous studies

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