frontiers in Human Neuroscience

ORIGINAL RESEARCH
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Neurofeedback Training of Auditory Selective Attention Enhances Speech-In-Noise Perception

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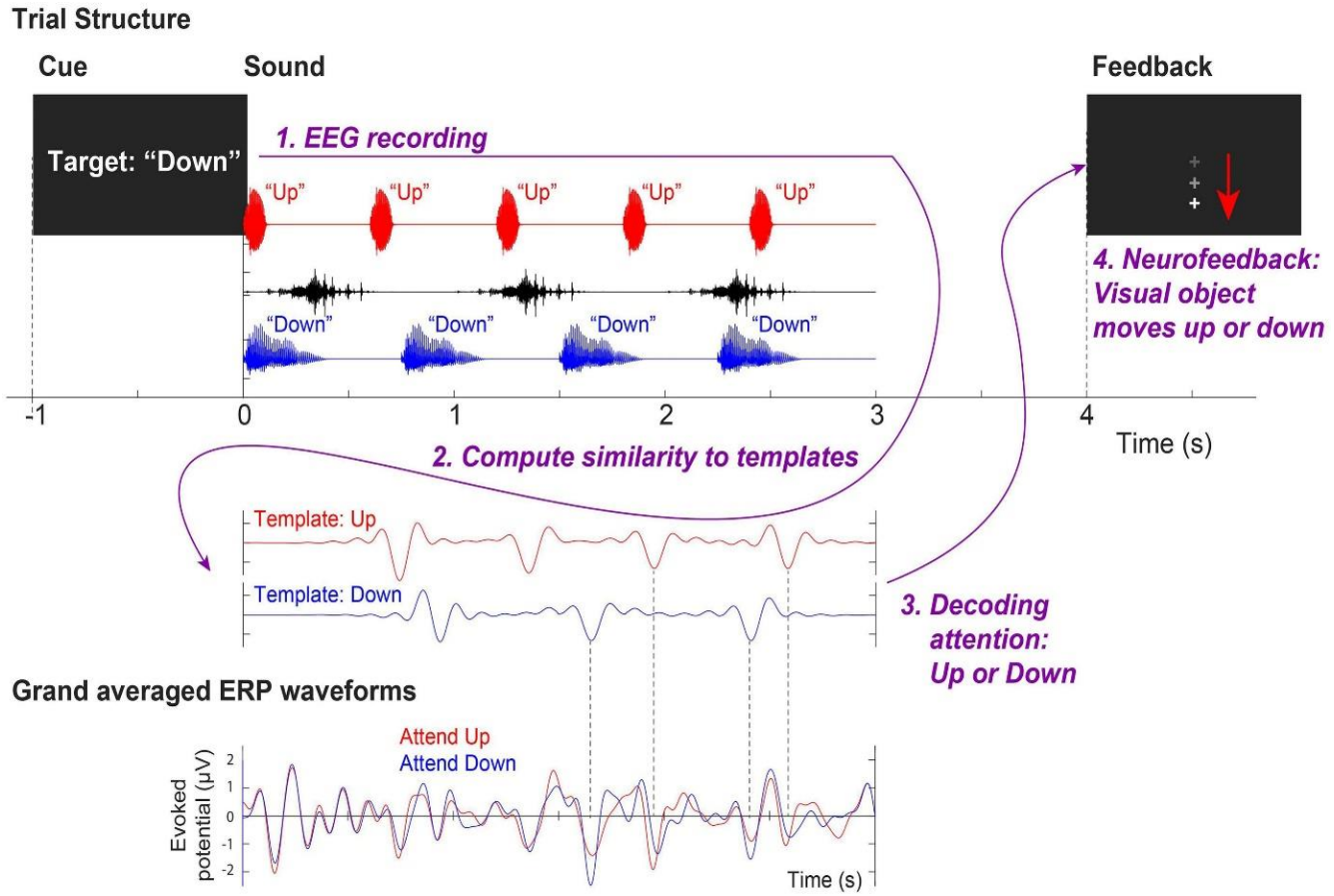
Training Paradigm



- 64 Channel EEG
- 2048 Hz
- Single-trial Feedback

- **Down** (+30 azimuth; male speaker)
- **Up** (-30 azimuth; female speaker)
- **Noise** (0 azimuth; water splash)

- 4 sessions
- 120 trials per session

Group Differences

Experimental Group

- No change in stimuli
- Single-trial decoding for up/down target via template-matching
- Visual feedback (object moving up or down)

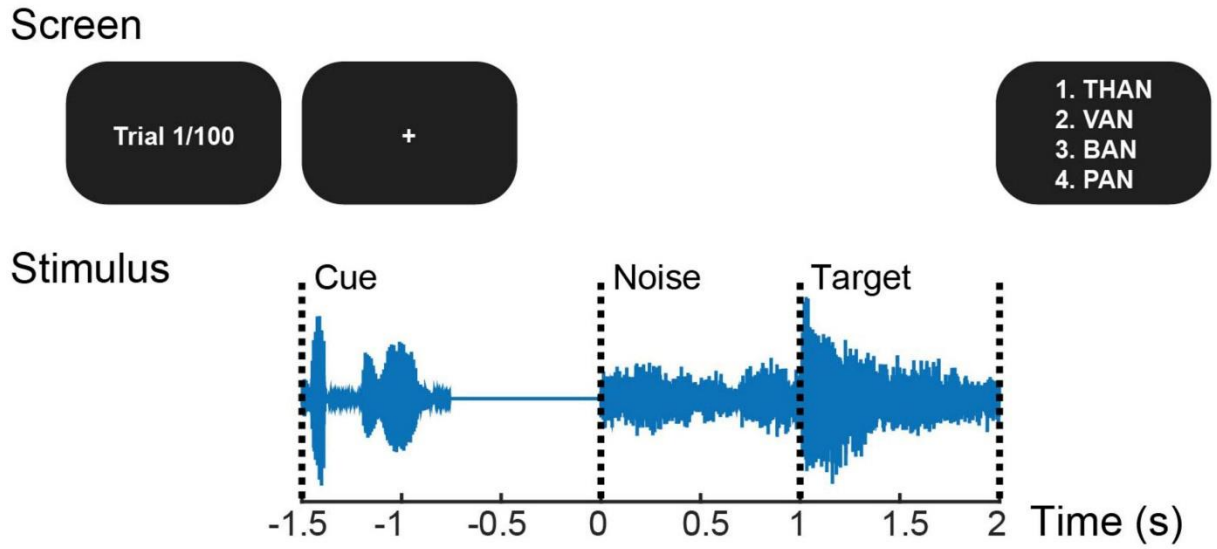
Placebo Group

- One of the last 3 UP or 2 DOWN had a deviant/higher pitch (oddball)
- Subjects press number
- Behavioral feedback (Correct/Incorrect) is shown

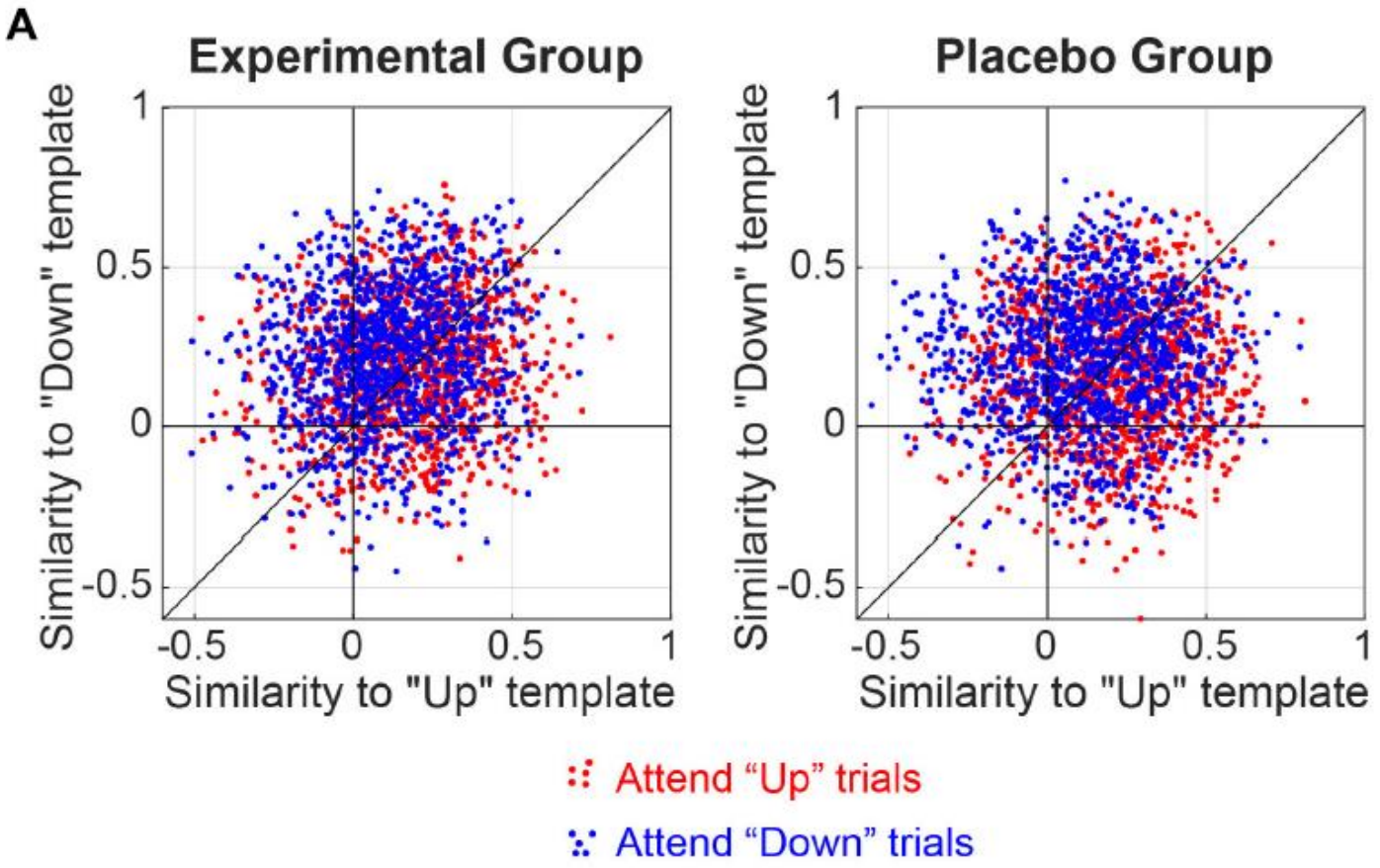
Experimental Design – SiN Test

- California Consonant Test
- 100 monosyllabic consonant-vowel-consonant English words
- 8-talker babble noise

- Target = 65 dB SPL
- Noise either + 3 dB or -3 dB (randomly chosen 50 words).



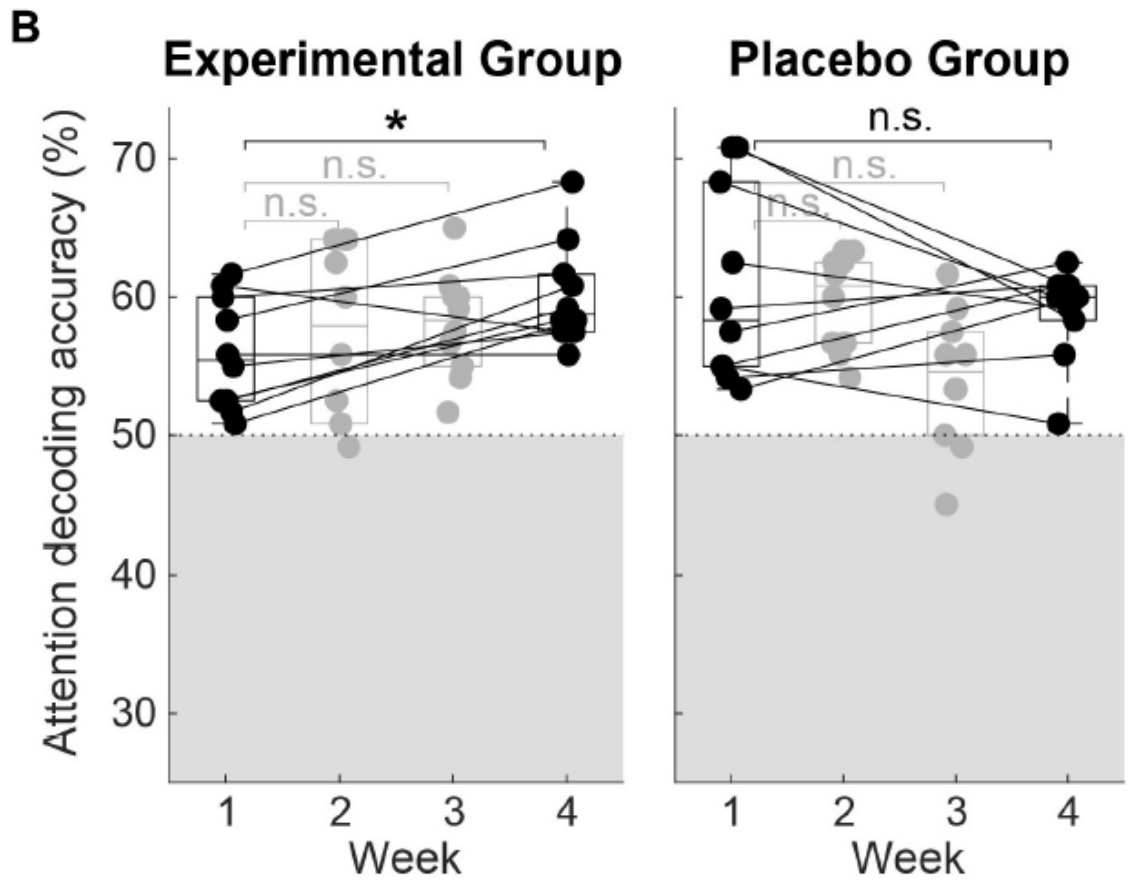
Results – 1a



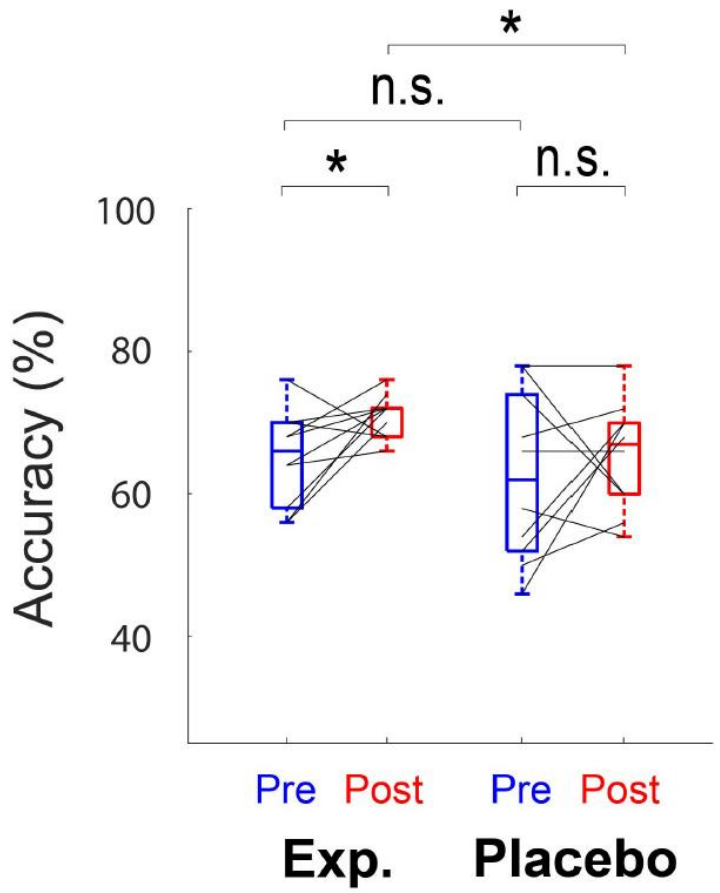
$$\text{Accuracy}_i = \frac{B_i}{R_i}$$

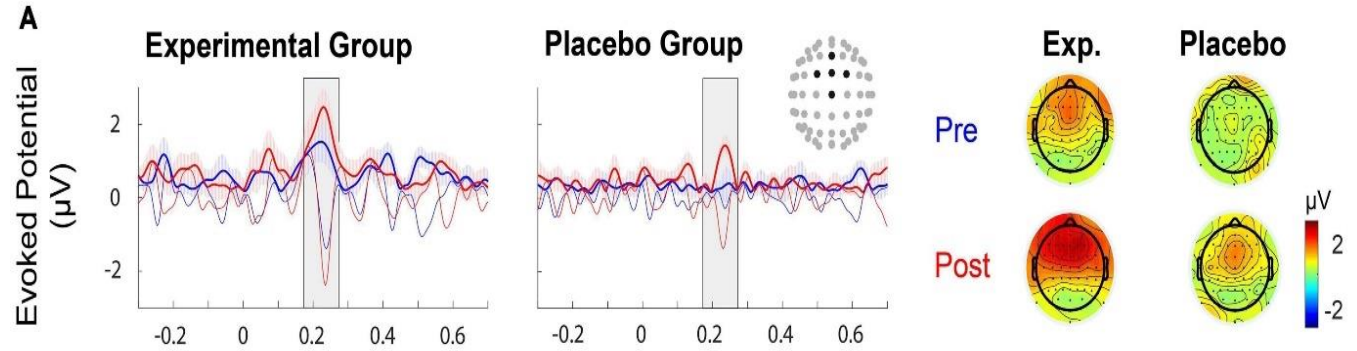
$$\text{Average Accuracy} = \frac{1}{n}\sum_{i=1}^{n} \text{Accuracy}_i$$

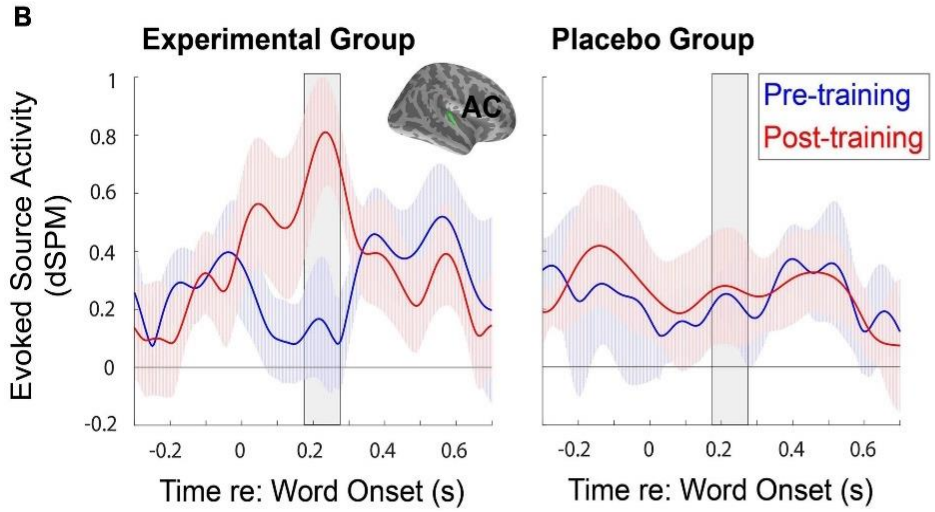
Results – 1b

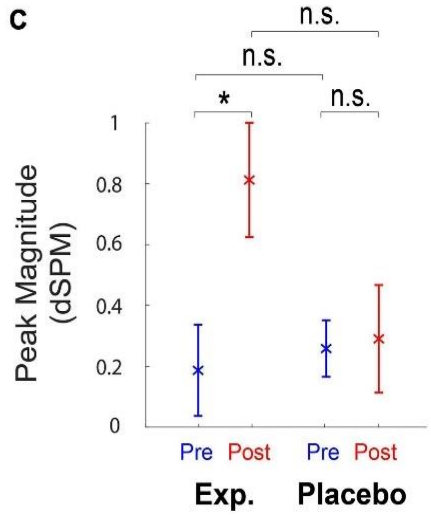

B
Experimental Group
Placebo Group
Attention decoding accuracy (%)
70
60
50
40
30
*
n.s.
n.s.
n.s.
n.s.
n.s.
1
2
3
4
Week
1
2
3
4
Week

Results – 2


*
n.s.
*
n.s.
100
80
60
40
Accuracy (%)
Pre Post Pre Post
Exp. Placebo


A
Experimental Group
Placebo Group
Evoked Potential (μV)
2
0
-2
-0.2 0 0.2 0.4 0.6
Exp.
Placebo
Pre
Post
μV
2
-2


B
Experimental Group
Placebo Group
AC
Pre-training
Post-training
Evoked Source Activity (dSPM)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.2 0 0.2 0.4 0.6
Time re: Word Onset (s)
Time re: Word Onset (s)


C
n.s.
n.s.
*
n.s.
Peak Magnitude (dSPM)
1
0.8
0.6
0.4
0.2
0
Pre Post Pre Post
Exp. Placebo

Discussion Pointers

- Experimental Design
- Results
- Statistical Analysis
- Other comments