

fMRI Neurofeedback for Stress Regulation in Police Officers Using AI-Generated Stimuli

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Introduction

Work-related stress is a major contributor to health concerns among emergency workers, particularly police officers. Neurofeedback (NF), a real-time self-regulation training of brain activity, provides a promising approach for improving emotion regulation and stress resilience. Building on the fMRI NF protocols for special forces (Bressler et al., 2023), this ongoing study investigates the feasibility of applying individualized NF to stress- and fear-related brain activity in police officers.

Methods

A key innovation is the use of AI-generated images tailored to occupation-specific stress stimuli, which were identified through focus groups and translated into visual stimuli through image generation. Fifteen participants from the Dutch Police will complete a rating task assessing image valence, arousal, threat level, and personal relevance before the scan. Next, during a single fMRI session, participants will perform (1) a mapping task involving passive viewing of neutral and negative images, after which the individual target region for NF will be identified; and (2) two NF runs in which image size reflects activity within the selected stress-responsive brain regions. Participants will be instructed to downregulate the induced activity. Physiological measures (heart- and breathing rate) will be collected throughout the scan (Figure 1).

Subjective ratings will be analyzed using paired samples tests. fMRI data will be analyzed using general linear models, with online analyses informing NF target selection (Turbo-BrainVoyager). NF performance and changes in regional brain activation across runs will be assessed using repeated-measures analyses.

Results

Preliminary results from 9 participants show lower valence ($t = -9.80$, $p < .001$), and higher arousal ($t = 12.66$, $p < .001$) and threat ($t = 14.22$, $p < .001$) ratings for the negative images compared to the neutral images. Furthermore, we anticipate that AI-generated negative images will elicit stronger activation in stress-related neural networks, than neutral images, and that participants will be able to downregulate activity within these regions with NF.

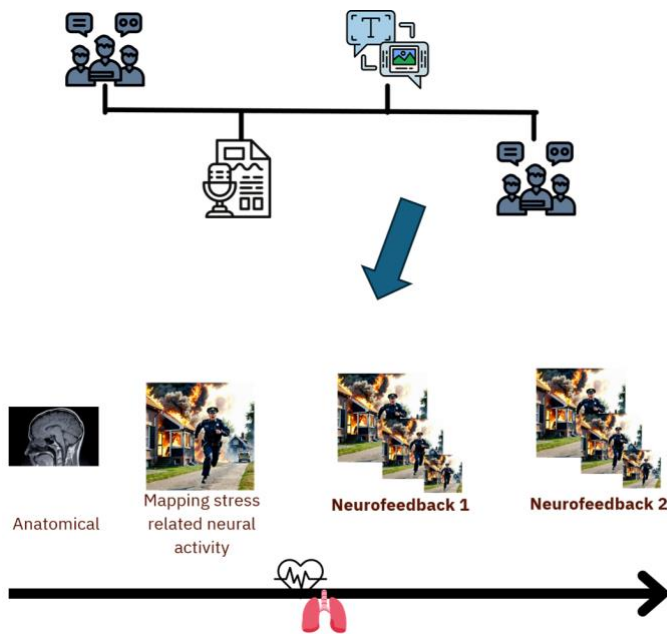
Conclusions

Preliminary results confirm the feasibility of using AI generated images for subjective stress induction. The findings will provide a foundation for future interventions aimed at improving stress regulation in emergency workers.

Data analysis is expected to be completed by the time of the conference.

Figure 1

Study Procedures



References

Bressler, R. A., Raible, S., Lührs, M., Tier, R., Goebel, R., & Linden, D. E. (2023). No threat: Emotion regulation neurofeedback for police special forces recruits. *Neuropsychologia*, 190, 108699. <https://doi.org/10.1016/j.neuropsychologia.2023.108699>