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P36

FAST PUPILLARY AND AUDITORY RESPONSES TO HIGH TEMPORAL MODULATED SOUNDS SUGGEST A HUMAN MAGNOCELLULAR AUDITORY PATHWAY FOR THREAT DETECTION

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BACKGROUND

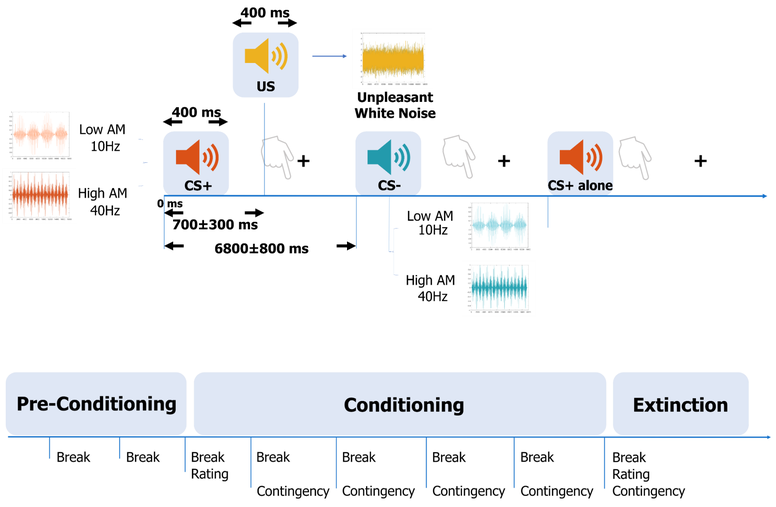
- Neural models for emotional processing in vision suggest the existence of a fast route to the amygdala that allows for fast detection of threat and subsequent adaptive behavior in humans [1,2].
- This route involves magnocellular neurons that mediate coarse visual processing and elicits responses to threat in amygdala and visual cortices at earlier latencies than other more fine-grained pathways that involve parvocellular neurons [3].
- In auditory domain, animal evidence suggests the existence of a similar fast route for threat processing, but it still remains unknown in humans [4,5].

AIMS

To sought whether a similar fast, magnocellular route to the amygdala might mediate fast responses to threat for audition, noticeable in behavioral and auditory cortical responses, as well as pupil size, based on evidence that magnocellular auditory neurons are particularly sensitive to high temporally modulated (High AM) sounds [5].

METHODS

FEAR CONDITIONING TASK



STIMULI

- Conditioned (CS+) and non-conditioned (CS-) stimuli (female and male /a/ vowel stimuli), which could be either High (40 Hz) or Low (10 Hz) amplitude modulated (AM)
- A very loud (not painful) unpleasant White Noise (~100 dB) (US)

PARTICIPANTS

- 28 healthy volunteers (16 males), 18 to 31 years

MEASURES

- Behavioural measures (only hits)
- Pupillometry: Pupil dilation
- Electroencephalography (EEG): Auditory Response: middle latency event-related potentials (ERPs)

PUPILLOMETRY

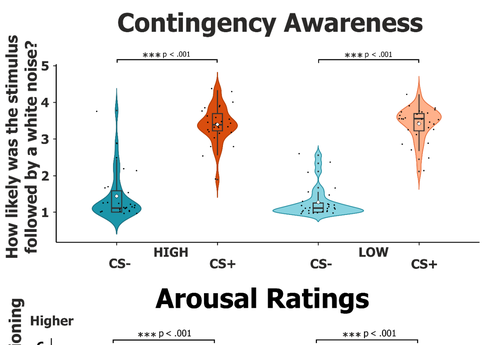
- Estimation of blinks and saccades effect through deconvolution
- Missing data & blinks padded by 100 ms and linearly interpolated
- Additional blinks estimated by peak detection on pupil signal velocity
- Blinks separated by less than 250 ms were merged into a single blink
- Z-scored

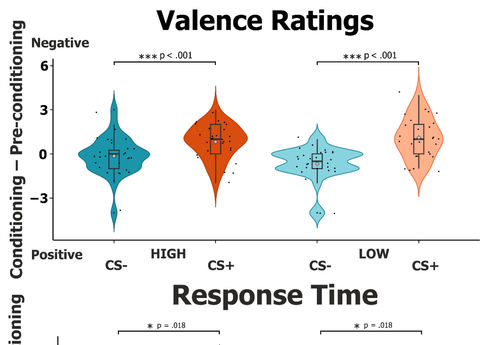
	Bandpass filter	Epoch window	Down-sampling	Baseline correction
Pupil dilation analysis	0.05 - 4 Hz (third-order Butterworth filter)	-500 to 1500 ms	100 Hz	-500 - 0 ms

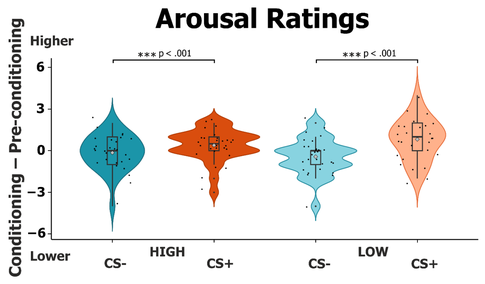
	High-pass filter	Low-pass filter	Notch filter	Baseline correction	Epoch window	Rejection delta threshold
ERP analysis	10 Hz	200 Hz	49 – 51 Hz	-200 - 0 ms	-200 to 1000 ms	75 µv

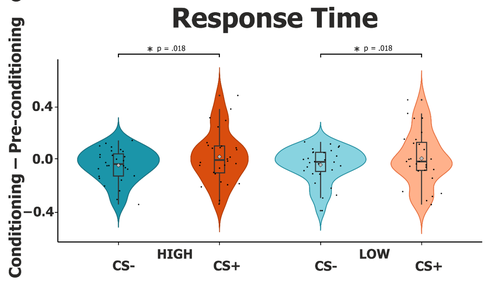
RESULTS

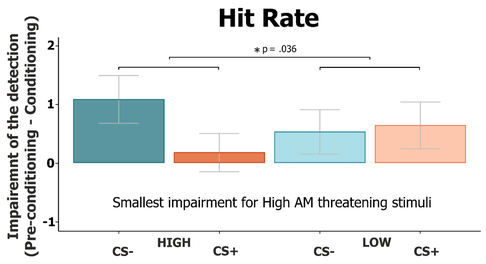
BEHAVIORAL RESPONSE



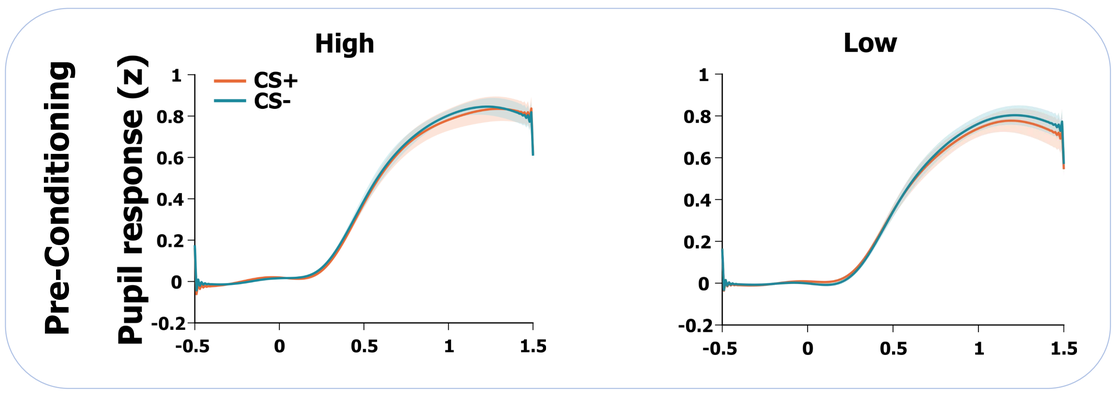


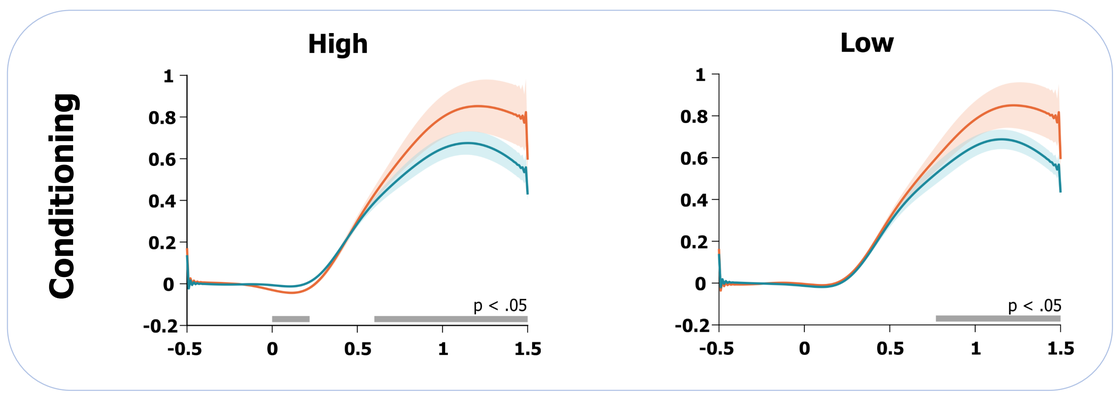




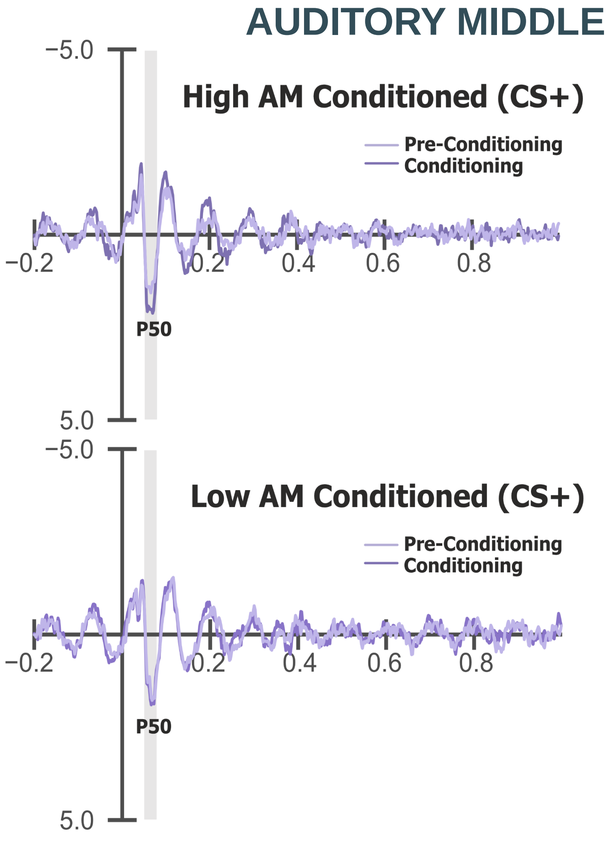


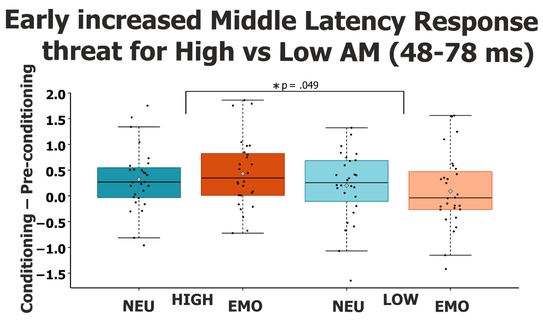
PUPILLARY RESPONSE



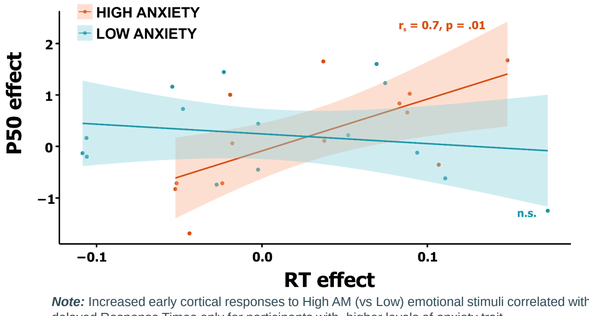


AUDITORY MIDDLE LATENCY RESPONSE (Cz)

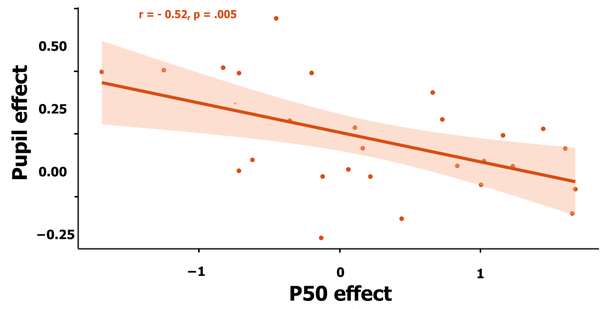




CORRELATIONS



Note: Increased early cortical responses to High AM (vs Low) emotional stimuli correlated with delayed Response Times only for participants with higher levels of anxiety trait



Note: Increased early cortical responses to High AM (vs Low) emotional stimuli correlated with decreased pupil dilation

CONCLUSION

- Behavioural and pupillary responses show that the fear conditioning task was effective across High and Low AM voices. Thus, CS+ stimuli acquired threat value, a mechanism that is directly associated with amygdala response.
- ERP and pupillometry results, as well as their correlations with behavioral and electrophysiological responses, suggest an early emotion response to High AM threat stimuli that may be compatible with an ultrafast amygdala response, that is not present in Low AM.
- Thus, high amplitude modulation in sounds may be an optimal tool to selectively activate and investigate a putative fast auditory route to the amygdala, similar to that in the visual system.

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