Investigating the Specificity of Pre-Speech Auditory Modulation
From Global Gating to Selective Silence?

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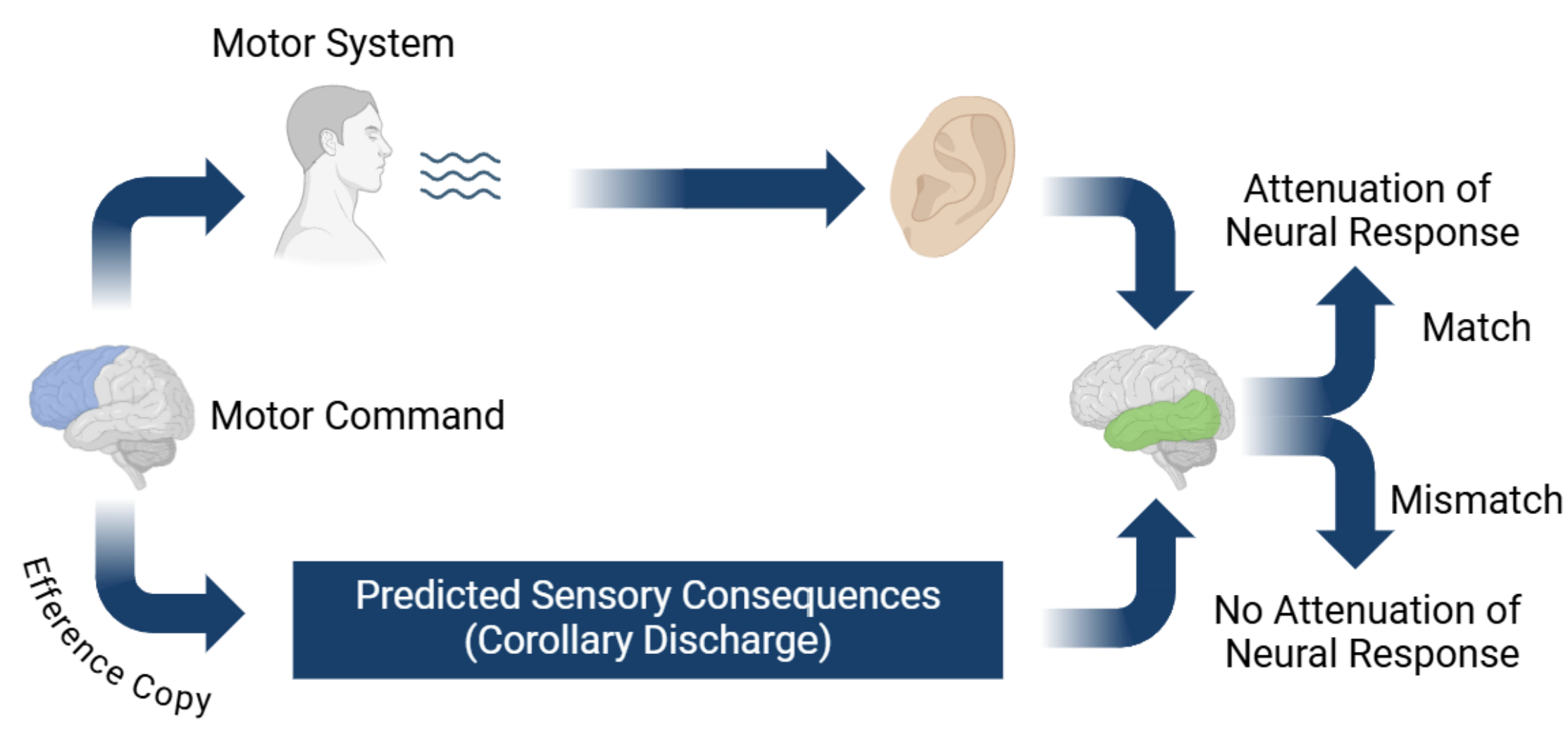Universität
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Introduction

Fig 1. Internal Forward Model based on [1]. Figure created with biorender.com.

- Auditory N1 amplitudes are suppressed for self-generated sounds [2].
- The amount of suppression is reduced when the feedback is altered [2].
- Auditory N1 amplitudes are also suppressed when stimuli are presented during speech preparation (pre-speech auditory modulation, PSAM) [3].

Objective:
Replicate the PSAM effect and investigate whether it resembles a general gating mechanism or a precise prediction-based suppression.

Hypothesis

Suppressed N1 amplitudes are expected during **speech preparation** compared to passive listening, with **stronger suppression** (indicated by a more positive PSAM effect) for **later probes** and those **matching** the **expected vocalization**.

Methods

Sample, Materials & Task
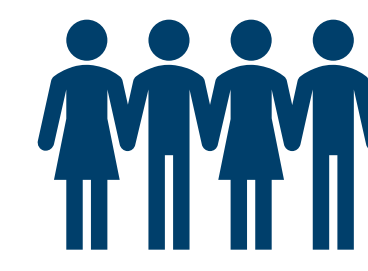
After excluding 7 participants due to technical issue (1) and too many excluded trials (6), **n = 28** (20 female, 8 male) participants were included in the final analyses. The mean age was 24.68 years (SD = 3.26).

Before the main task, each participant recorded a set of **21 repetitions** of the syllable /ga/. The recording with the **median F0** was **chosen** as the probe.
Next to the **unaltered probe**, an **altered probe** was created by applying a **-4ST pitch-shift**.
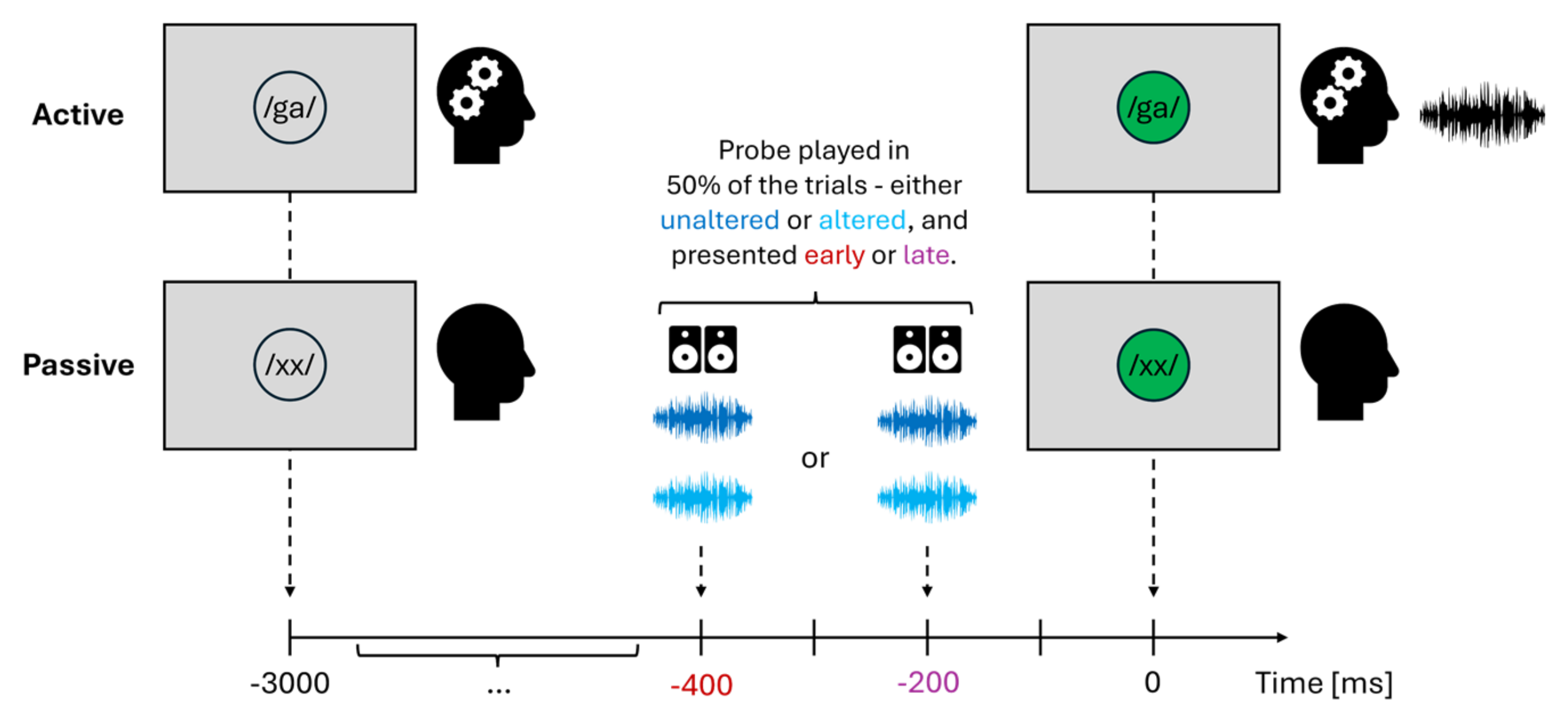

Fig 2. Experimental Procedures.

Results

Analysis

N1 amplitude = Most negative peak between 90ms to 140ms

PSAM effect = N1 amplitude (active) – N1 amplitude (passive)

Contrary to the hypothesis, N1 responses were enhanced during speech preparation. The PSAM effect was not affected by probe onset and probe type.

Main Effect Task Condition: β = 1.21, SE = 0.53, $t(189)$ = 2.28, p = .024
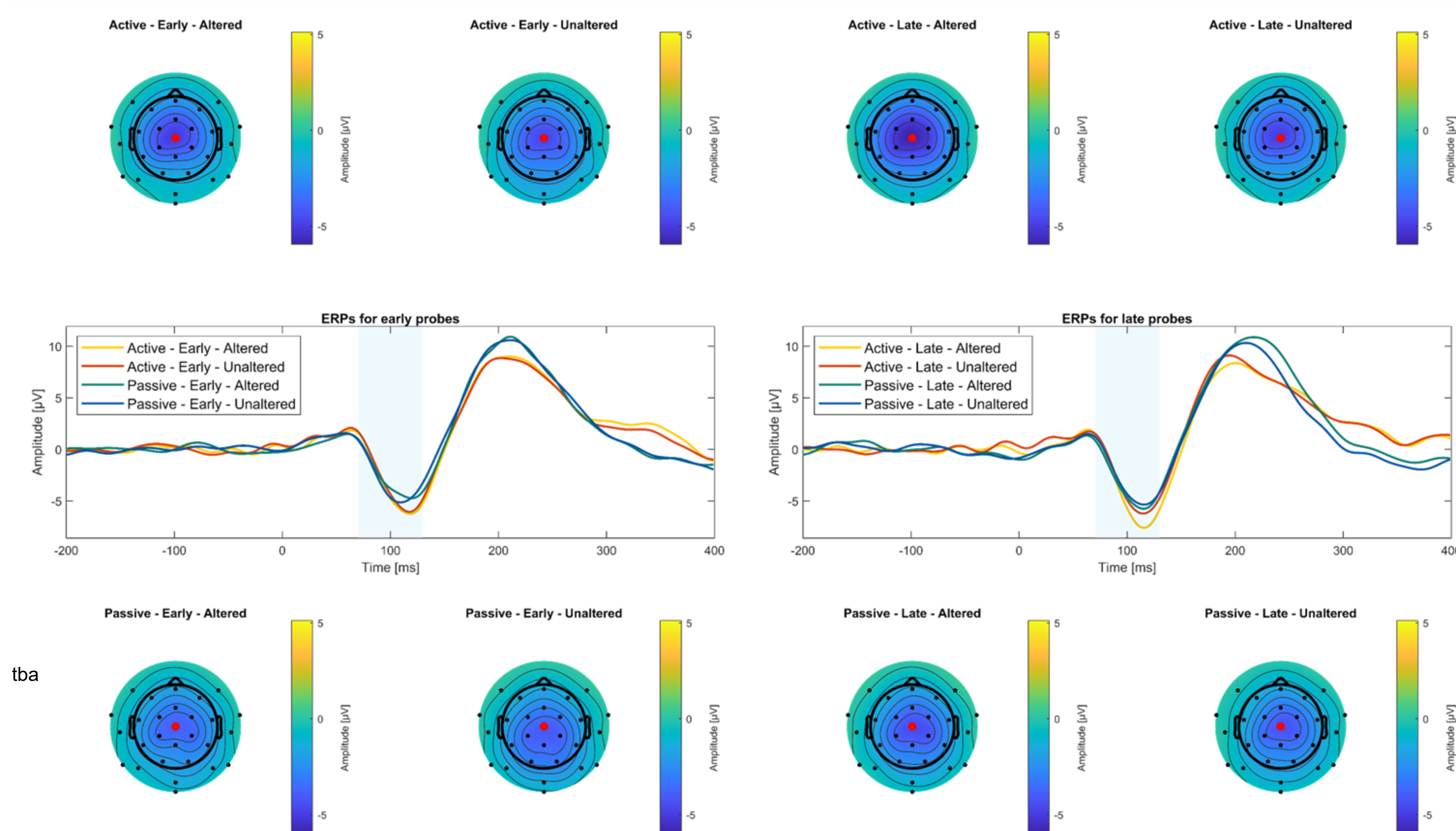
All p > .05

Fig. 3. Grand average baseline-corrected ERPs for electrode E01 and topographies for all conditions. Topographies averaged over 90ms to 140ms.
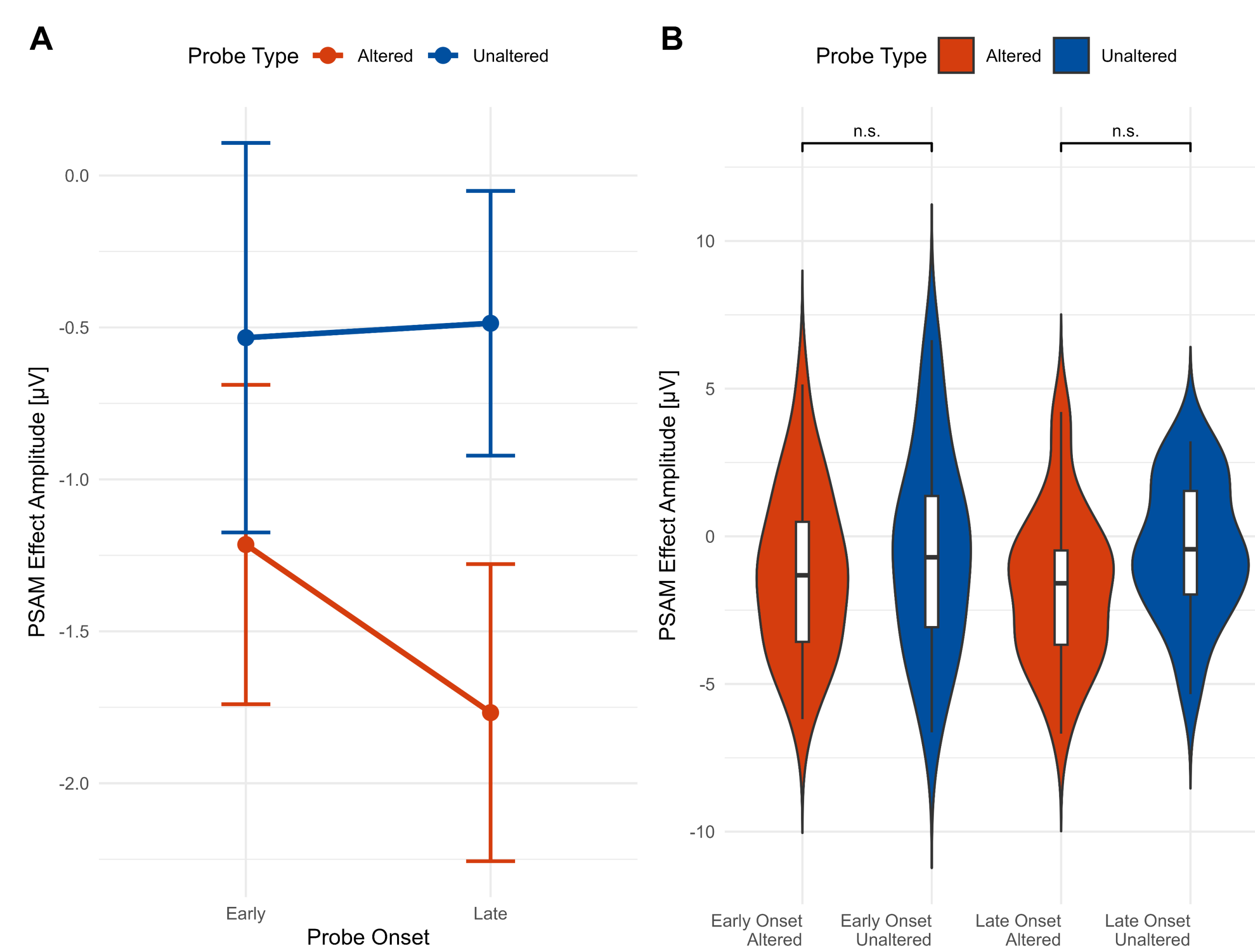

Fig. 4. PSAM Effect by Probe Type and Probe Onset. Error bars in (A) represent within-subject standard errors.

Discussion

Enhanced instead of suppresed N1 amplitudes during speech preparation

The absence of N1 suppression during speech preparation, unlike prior findings [3], may result from methodological differences - such as pseudo-randomized trials instead of blocks, a longer preparation phase, and the use of a syllable instead of words. However, the unexpected results may also be explained by alternative theoretical accounts suggesting that motor-induced enhancement, rather than suppression, can occur depending on the stage of action (e.g., general preparation vs. specific preparation vs. execution) [4].

Non-specific modulation of auditory responses during early and late speech preparation

Contrary to our hypothesis and prior vocalization studies [2], N1 modulation during speech preparation was not specific to expected feedback. Similar responses to altered and unaltered probes suggest that the observed auditory modulation at this stage is relatively unspecific - at least for basic features like pitch.

Limitations

The large number of trials (960) may have affected participant compliance. Furthermore, as we did not assess participants' preparation strategies, our understanding of the underlying mechanisms remains limited.

[1] Blakemore et al. (2000). NeuroReport, 11(11). https://doi.org/10.1097/00001756-200008030-00002
[2] Heinks-Maldonado et al. (2005). Psychophysiology, 42(2), 180–190. https://doi.org/10.1111/j.1469-8986.2005.00272.x
[3] Daliri & Max (2016). Frontiers in Human Neuroscience, 10. https://doi.org/10.3389/fnhum.2016.00234
[4] Li et al. (2020). Cerebral Cortex, 30(11), 5806–5820. https://doi.org/10.1093/cercor/bhaa154

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