Communication in humans: might familiarity affect how we attend to the environment?

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INTRODUCTION: Different mental processes are involved in communication, including **selective attention**, which allows the subject to understand the message from a speaker through information filtering, making the processing cost-effective.

At a party, there are multiple conversations simultaneously and the listener must ignore the background to attend to the target message; this is an effect widely studied in neuroscience, known as the '**cocktail party effect**'. The auditory cortex performs a neural tracking of the physical characteristics of sound, phonemes, and syllables.

Furthermore, the neural tracking of attended and unattended speakers is processed differently. Selective attention participates, leading to an increased cortical representation of attended speech (Brodbeck, et al., 2020). However, familiarity with speech, the **priming effect**, could change the neural responses (Wang et al., 2017). It remains unclear how relevant information and familiarity with the speech is neurally processed, relegating any masker, although all stimuli are similarly processed initially at the sensory level.

METHODS: We analyzed the neural activity of the attentional modulation (i.e., attentional effects) for the effect of voice and message experience on auditory attention in a multi-speaker context (N=35, electroencephalography recordings). Using a diotic listening paradigm, participants simultaneously listened to conversations between 2 speakers on different topics. The instruction was to attend to one speaker, followed by questions about message content and speaker identity (whether the speaker was young or old and female or male voice). We analyzed the neural response of speech processing for different conditions of familiarity: 'attended known' for target-priming; 'unattended known' for masker-priming and 'no prior knowledge'.
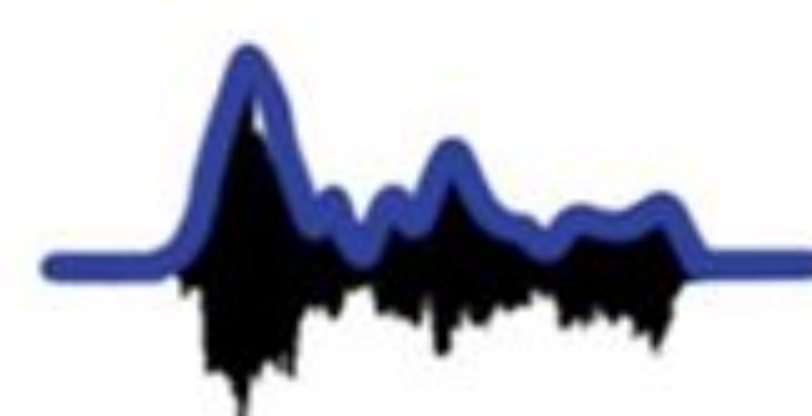
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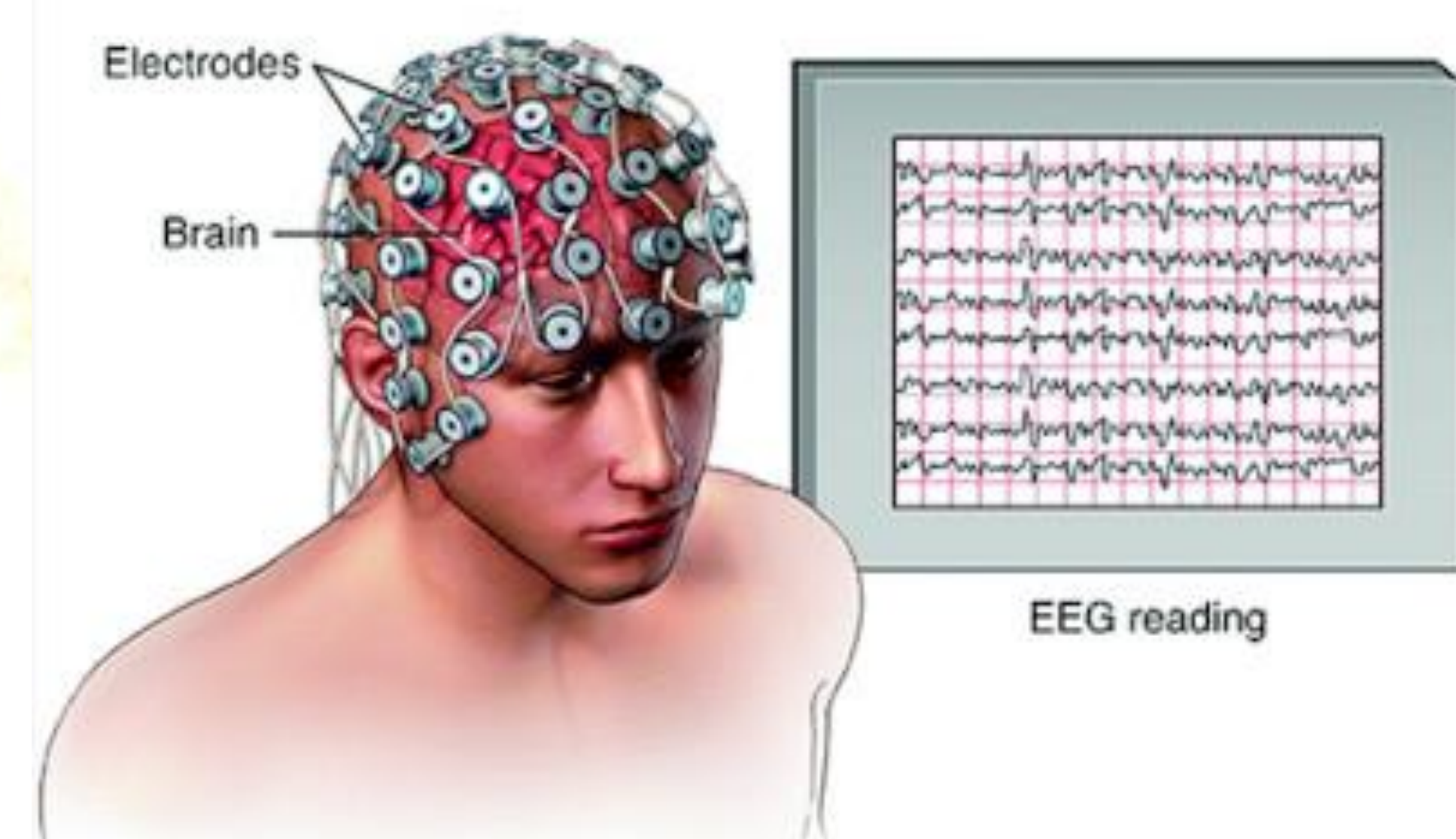
Electroencephalography (EEG) is an electrophysiological tracking technique to record the electric activity of the brain. Image from: https://sprintdiagnostics.in/electroencephalography-eeg
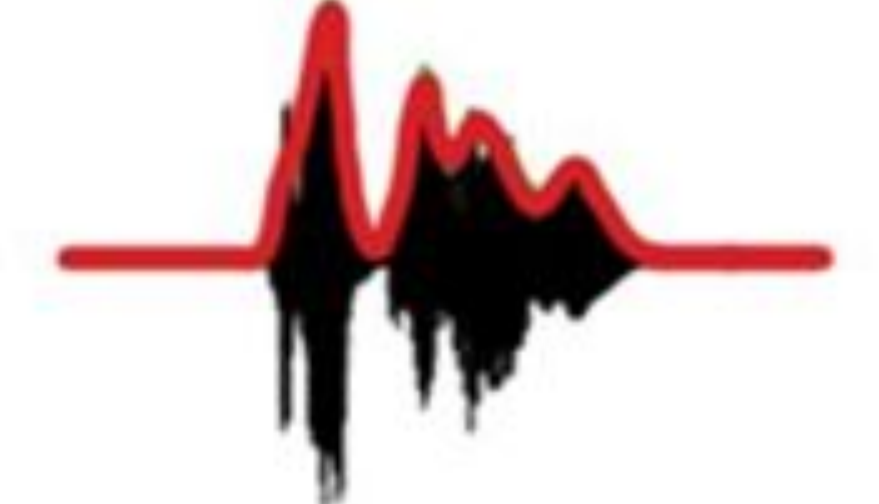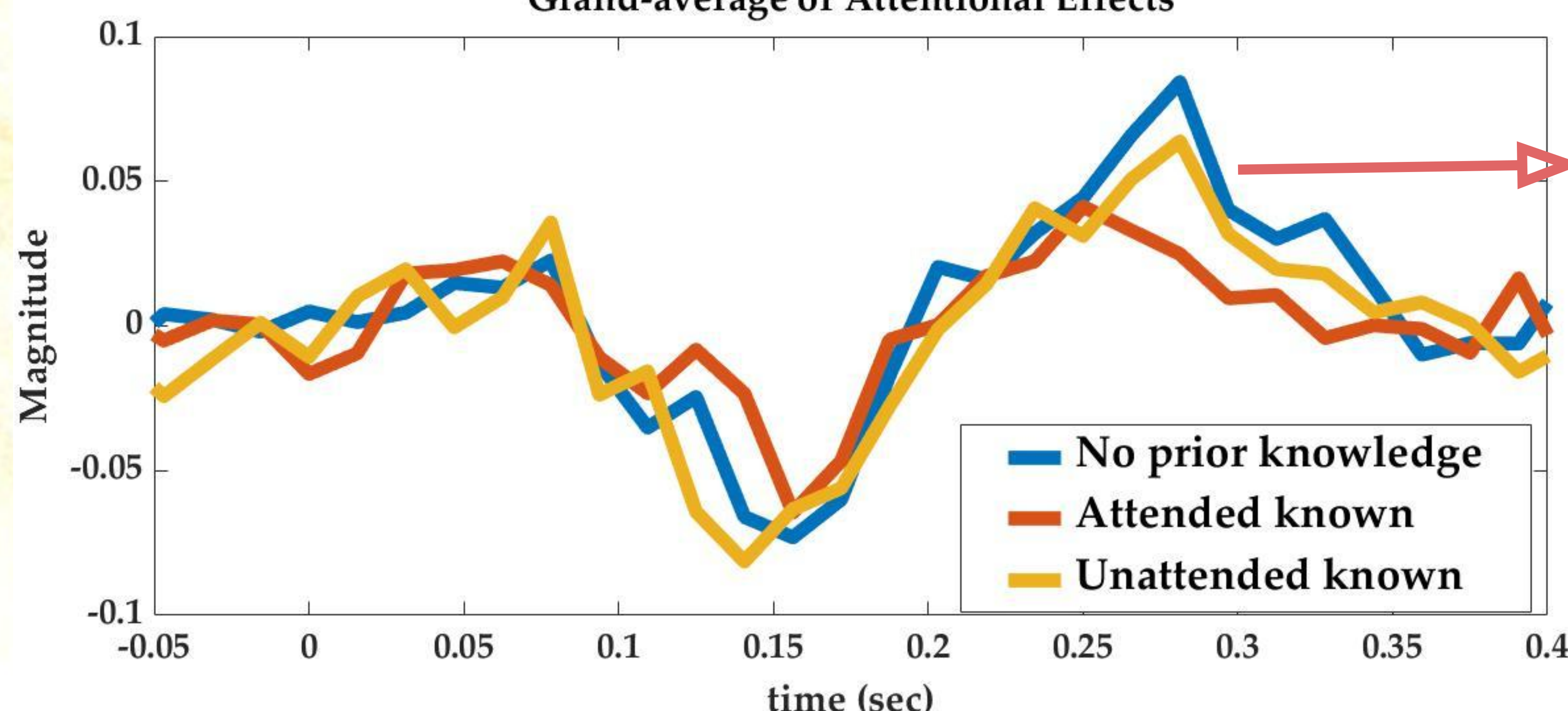
Cocktail party effect

Illustration of the cocktail party effect. Refers to the ability to focus one's attention on a particular voice while filtering out a range of other voices. Image from O'Sullivan, J. A., et al. (2015)

Magnitude of the grand-average of attentional modulations by condition. An enhancement of attentional effects for background knowledge (UK condition) was observed between 100-200ms, which does not occur with foreground knowledge (AK condition).

RESULTS: We analyzed the neural response of attentional modulation for attended and unattended speech across priming conditions. The attentional effects in the late processing stage (250 to 300 ms) only occurred in conditions unfamiliar with the target (unattended known and without prior knowledge). Nevertheless, reduced attentional effects were present in the attended known condition.
In the cocktail party effect, target-priming decreases the late-stage processing cost. In contrast, processing a new speaker involves a higher neural cost, regardless of whether the background is familiar or unknown.

DISCUSSION: In a multi-speaker environment, speech processing differs for the foreground, background, or familiarity with the speech. The brain requires more neural processing of unfamiliar attended speech in cocktail party situations. Whether the speech to be ignored is familiar or unknown, we observed attentional effects around 250 ms. Nevertheless, it did not occur equally for target priming. Together, these results might indicate that the processing cost at a stage related to semantic content depends on the knowledge of the target speaker. Therefore, familiarity with the message in a cocktail party situation requires less processing than with unfamiliar speech.

REFERENCES: Brodbeck, C., Jiao, A., Hong, L. E., & Simon, J. Z. (2020). Neural speech restoration at the cocktail party: Auditory cortex recovers masked speech of both attended and ignored speakers. PLoS biology, 18(10), e3000883.
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