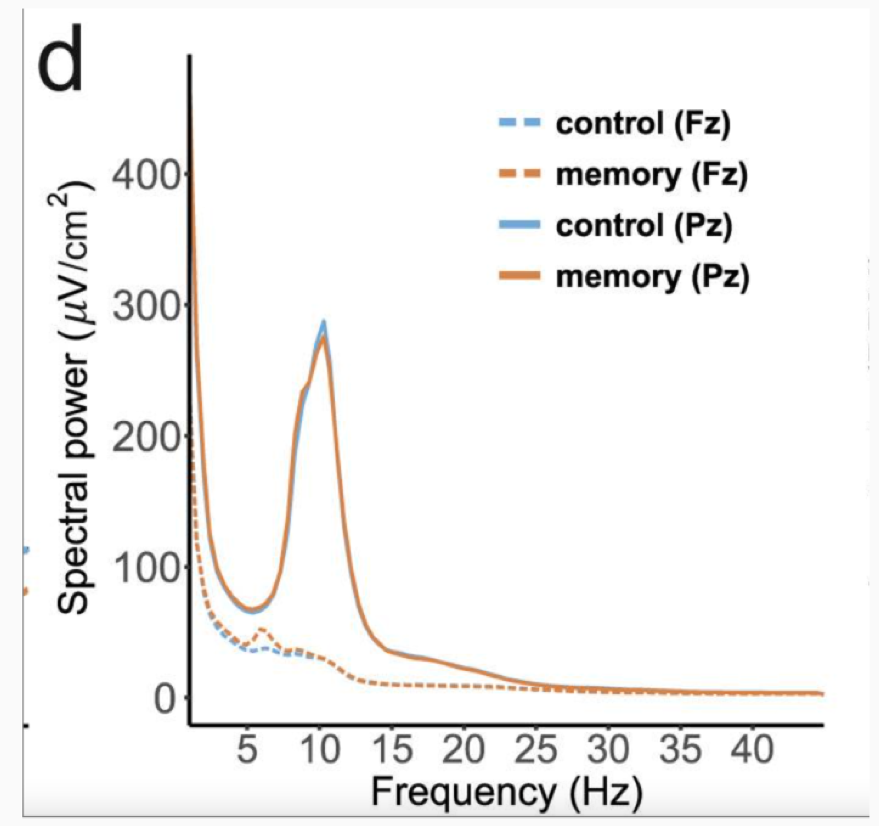
(**d**) Absolute spectral power after current source density (CSD) transformation at Fz and Pz channels averaged over 2 second epochs corresponding to encoding and maintenance of single digits in all conditions. For ERP and spectral power analyses, the artifacts were first suppressed by means of independent component analysis (ICA) and then visually identified epochs still containing artifacts were rejected.



From https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9206021/
Furthermore, confirming expectations from verbal WM EEG literature17,18, we observed an increase in frontal midline theta activity at around 6 Hz in the memory condition compared to the control condition (see Fig. 3d).

128 Hz, emotive headband
1.0 second epochs
Remove artifacts (blinks, brow raises)

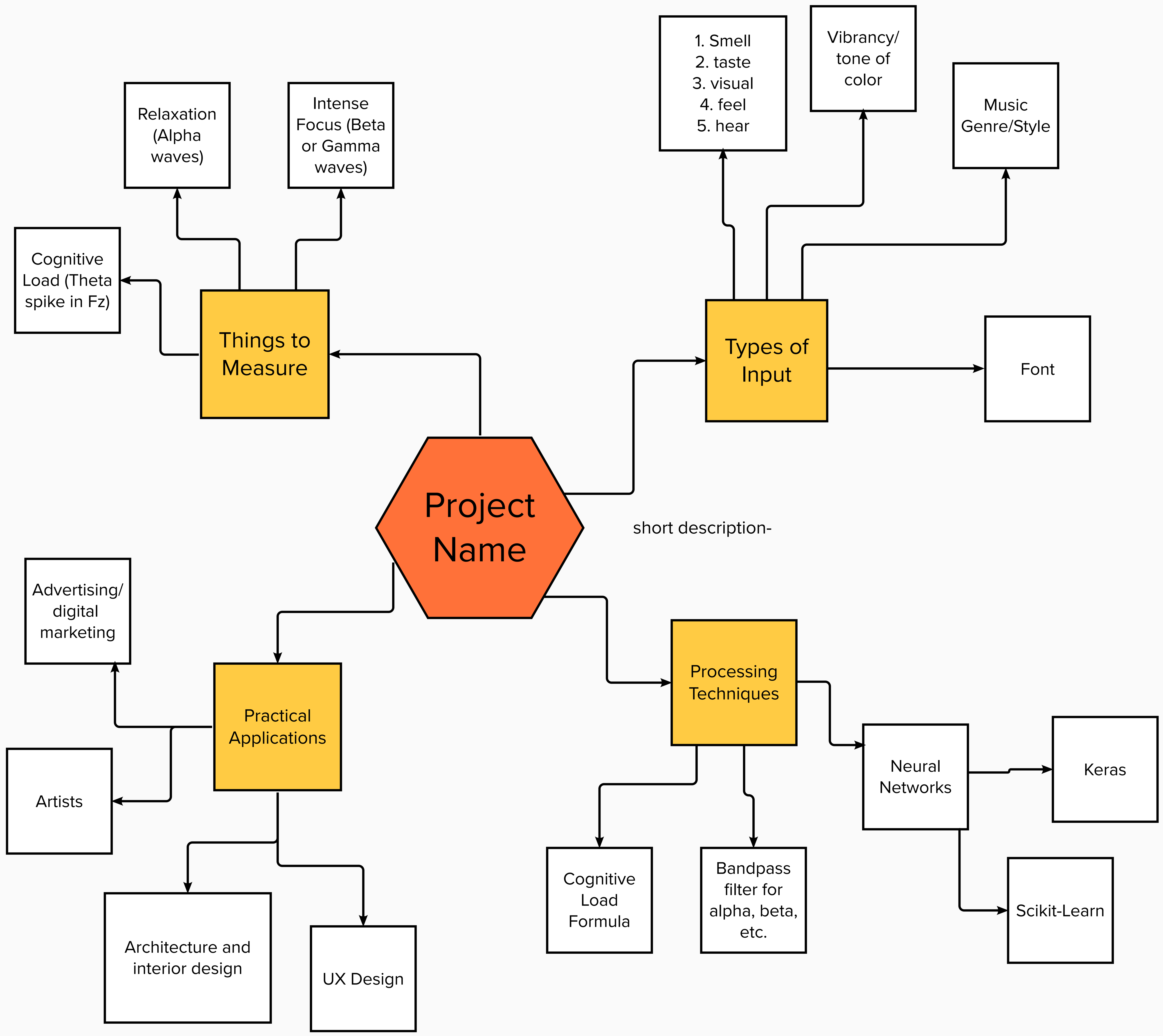
Focus on alpha (7.5-12.5 Hz) and theta (4-7.5 Hz) waves
S-transform

Our computation of cognitive load derived from EEG uses the individual mean frequencies in both the alpha and theta frequency bands. The mean frequency is computed as:

$$f(\omega) = \frac{\sum_{i=0}^{n-1} I_{\omega(i)} f_{\omega(i)}}{\sum_{i=0}^{n-1} I_{\omega(i)}} \quad (1)$$

where ω is the frequency band in question, n is the number of frequency bins in ω, f_i is the frequency at bin i and I_i is the energy density of ω at frequency bin i. This formulation

of mean frequency is used to compute the frequency shifts in both the alpha and theta wavebands. The frequency shift of a waveband is given by $f_t(\omega) - f_b(\omega)$ where f_t is the frequency content determined from EEG collection during each trial and f_b is the frequency content collected during inter-trial rest periods. Additionally, the change in energy density in a waveband, $\Delta|f(\omega)|$, is the difference of energy densities at the mean frequencies: $\Delta|f(\omega)| = |f_t(\omega)| - |f_b(\omega)|$.



Klimesch identified working memory performance decreases during task-related stimulation expressed as theta power decreases with simultaneous alpha power increases with respect to baseline measurements [Kli99]. We form our model of cognitive load per trial, $L(t)$, as the combination of frequency and power changes in both the alpha and theta bands.

$$L(t) = \Delta|f_t(\alpha)|f_t(\alpha) - \Delta|f_t(\theta)|f_t(\theta) \quad (2)$$