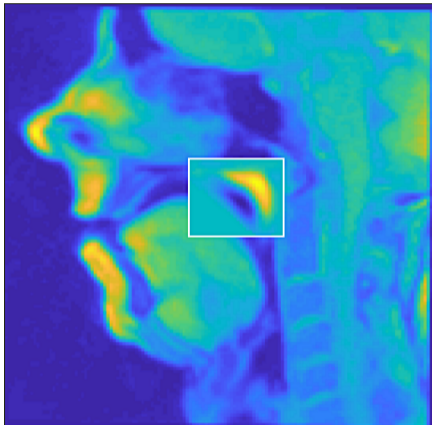




# Principal Components Analysis (PCA) to capture velum movement

PCA model

PC1 velum  
signal



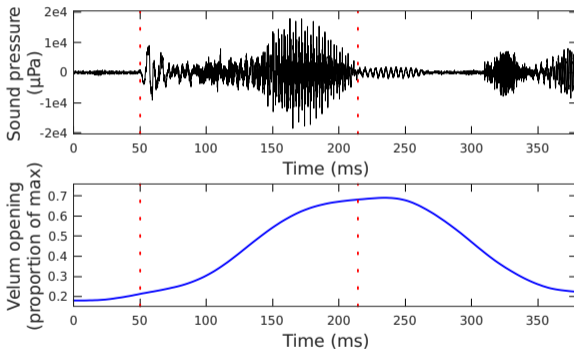
*PC1 coefficients/loadings (positive: bright/yellow, negative: dark/blue)*

- Region of interest (RoI) around the bounds of velum movement for each speaker
- Voxels in the RoI were extracted for all words containing VN sequences
- Principal components analysis (PCA) models built with voxels as dimensions
- The primary degree of freedom (DoF) in the RoI is velum opening/closing; the first component (PC1) thus captures this DoF
- PC1 loadings/coefficients were verified manually; sign of PC1 scores was flipped as necessary so that increase = velum opening, decrease = velum closing



PC1 = velum opening/closing signal

PCA model  
PC1 velum  
signal



*PC1 score velum opening signal for Panther*

- PC1 scores scaled by speaker (0-1) and logged for each rt-MRI frame
- The result is a time-varying signal of velum opening/closing at 50 fps
- For all speakers, smaller values represent a more closed velum, larger values represent a more open velum