Functionally defining the neural correlates of music processing.

AUTHOR BLOCK: *A. S. GREENBERG*¹,², R. RANDALL²;
¹Psychology, Univ. of Wisconsin-Milwaukee, Milwaukee, WI; ²Ctr. for the Neural Basis of Cognition, Carnegie Mellon Univ., Pittsburgh, PA

Abstract:
Standard practice in functional MRI (fMRI) study design and analysis has increasingly relied upon process-specific localizer stimuli, due in large part to improved awareness of the non-independence problem (Kriegeskorte et al., 2010). As a result, fMRI researchers now routinely independently define cortical networks that correlate with a given psychological process in separate imaging runs from those of the main task(s). This has necessitated the development of agreed-upon stimuli that consistently evoke the core regions associated with a given process. These “localizer runs” also must be short in length so as not to take imaging time away from the primary task. Recent localizer development has focused on body image representation (Weiner & Grill-Spector, 2011), biological motion processing (Pyles et al., 2007), and sentence processing (Rogalsky & Hickok, 2008), to name a few. Here we show a simple, robust, and quick localizer for defining the neural correlates of music cognition. Subjects perform a 1-back memory task while presented (in a block design) several short samples of recorded music alternating with epochs of frequency-band and time-domain scrambled versions of each sample. Music samples comprised commercially recorded classical solo-piano music. Most excerpts were complete musical phrases ending with a half or authentic cadence. A small number were within-phrase examples that did not end with a cadence. All excerpts were normalized with respect to peak amplitude and time (by stretching or compressing) to 5500ms long. The relative simplicity of the stimuli allowed for a short imaging time while maintaining consistent activation of the network. The previous literature has been primarily concerned with dissociation of music processing from language and from primary auditory cortex (Fedorenko, 2012). In the current study, we found reliable activation outside the known regions in temporal and inferior frontal cortex, suggesting that our stimulus/task engages a more complete network involved in music processing. We discuss these results in relation to the existent, small literature on music cognition. Finally, we apply these independently defined nodes of the music-processing network to the analysis of a musicality judgment study in which we begin to uncover the underlying computations in each of these regions. Further neuroimaging investigations of music cognition will enhance our understanding of the brain regions involved in representing and processing organized pitch sequences.

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