

## HOMEWORK QUESTIONS DUE THURS OCT 11<sup>th</sup> BY 6P

1. READING ASSIGNMENT: In preparation for our first seminar on Oct 18<sup>th</sup>, please read "Neurophysiology and Neuroanatomy of Pitch Perception: Auditory Cortex" (posted under Week 2 in CCLE).

2. Please visit the Auditory Neuroscience link at BrainMusic.org and review the Figures.

3. In class, we discussed several concepts that form the foundation of modern scientific inquiry and guide experimental approaches to research on mind-brain correlates. Type the letter of the concept on the line preceding the corresponding paragraph. Use each letter once. (8 points)

- A. Verificationism
- B. Falsificationism
- C. Existence Proof
- D. Neuroanatomically-Dissociable Psychological Functions

\_\_\_\_\_ In class we listened to a show on Public Radio International about Case SC, a Tony Award-winning musical director who suffered damage the Orbitofrontal Gyri in the Left and Right Frontal Lobes due to a Stroke. Subsequently, he couldn't control his emotional and visceral responses to music, especially his lifelong favorites, like Puccini's *Madame Butterfly*. Case SC demonstrates that emotional and visceral responses to music can be heightened following lesions of the Left and Right Orbitofrontal Gyri. However, we don't know if that's true for most people, especially since Case SC had extraordinary talent in music. (2 points)

\_\_\_\_\_ Carl Wernicke was a 19th century German neurologist who published the first cases of what he termed "Cortical Deafness" and "Sensory Aphasia." The latter term is now often referred to as "Wernicke's Aphasia." In right-handed patient populations with acute Left Hemisphere strokes involving posterior Auditory Association Cortex, speech comprehension is severely impaired (Sensory Aphasia) but speech production is normal or mildly impaired. This observation suggests that speech comprehension and speech production are governed by different mental operations housed in different brain regions. (2 points)

\_\_\_\_\_ Introspection is not an acceptable scientific method for answering questions about how the brain perceives, performs, remembers, feels, and creates music. Nor are anecdotes an acceptable means of understanding the potential health benefits of "music therapy". One must formulate testable hypotheses whose truth value can be tested via well-controlled experiments. The Vienna Circle of Logical Empiricism (Moritz Schlick, Otto Neurath, Rudolph Carnap, and others), sometimes referred to as the "logical positivists," considered a proposition to be outside the realm of science if the truth value of the proposition could not be established by empirical observation. (2 points)

\_\_\_\_\_ We can't really prove any hypothesis is true beyond doubt using scientific methods. Karl Popper argued that science advances not by verifying whether hypotheses

are true but by generating conjectures that withstand empirical refutation. In other words, what scientists can do empirically is exclude what is *not* true. By ruling out hypotheses using rigorous empirical methods, scientists can refute or refine a theory, even if they can't prove beyond a doubt the theory is true. Scientific theories advance and evolve over time by this process. (2 points)

4. Experimental methods scientists use to study music cognition differ with respect to their spatial resolution (range = micrometers to centimeters) and temporal resolution (range = microseconds to two hours). (8 points)

a. Rank the following methods from 1 through 4 with respect to their temporal resolution, where "1" corresponds to the method with the highest temporal resolution and "4" the lowest.

\_\_\_\_\_ functional magnetic resonance imaging (1 point)

\_\_\_\_\_ extracellular microelectrode recordings (1 point)

\_\_\_\_\_ electroencephalography (1 point)

\_\_\_\_\_ positron emission tomography (1 point)

b. Rank the following methods from 1 through 4 with respect to their spatial resolution, where "1" corresponds to the method with the highest spatial resolution and "4" the lowest.

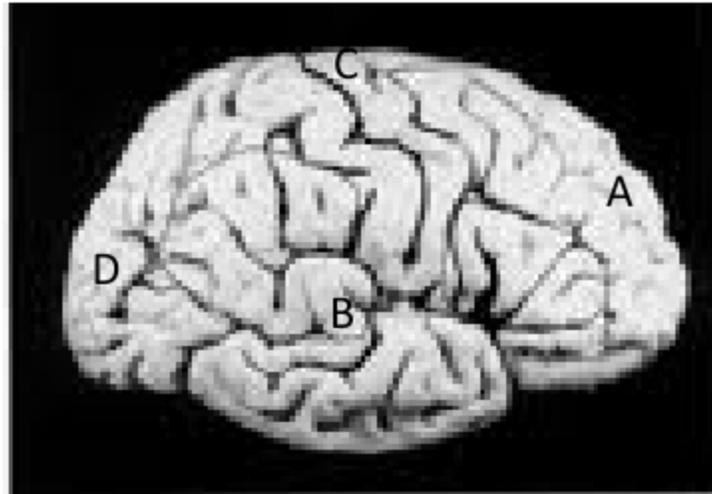
\_\_\_\_\_ functional magnetic resonance imaging (1 point)

\_\_\_\_\_ T1-weighted magnetic resonance imaging (1 point)

\_\_\_\_\_ electroencephalography (1 point)

\_\_\_\_\_ positron emission tomography (1 point)

5. Match the Music-Related Function to its *Anatomical Location* (see the *letter* on the Lateral View of the Right Hemisphere below) and its corresponding *Functional Subsystem of the Cerebral Cortex* (see the corresponding *Roman numeral* in the list below the brain). Write the letter/numeral on the line following the description. Use each letter and numeral once. (16 points)



- I. Modality-Specific System (Auditory)
- II. Modality-Specific System (Motor/Somatosensory)
- III. Modality-Specific System (Visual)
- IV. Supra-Modal System (Future-Supramodal Subsystem)

Auditory Analysis & Representation (e.g., perception of melody, harmony, rhythm, timbre, voice):

Corresponding Anatomical Structure: Letter = \_\_\_\_\_. (2 pts)

Corresponding Functional Cortical Subsystem: Roman Numeral = \_\_\_\_\_. (2 pts)

Expectancy Generation, Violation, & Satisfaction (e.g., repetition, return, appoggiatura):

Corresponding Anatomical Structure: Letter = \_\_\_\_\_. (2 pts)

Corresponding Functional Cortical Subsystem: Roman Numeral = \_\_\_\_\_. (2 pts)

Visual Perception (e.g., stage lighting, scene design, facial expression, language):

Corresponding Anatomical Structure: Letter = \_\_\_\_\_. (2 pts)

Corresponding Functional Cortical Subsystem: Roman Numeral = \_\_\_\_\_. (2 pts)

Kinetics & Kinesthetics (e.g., dancing, singing, foot-tapping):

Corresponding Anatomical Structure: Letter = \_\_\_\_\_. (2 pts)

Corresponding Functional Cortical Subsystem: Roman Numeral = \_\_\_\_\_. (2 pts)

END