

HST.725 Spring 2009

Some fundamental problems in the psychology of music

Here are some suggested topics, but you are not limited to these. Please choose from the list or suggest your own problem. Write up an account of the nature of the problem (1-2 paragraphs), its theoretical significance (1 paragraph), current theories (if any, 1-3 paragraphs), two plausible hypothetical explanations (2-4 paragraphs), ideas concerning how the question might be solved or hypotheses tested (1 paragraph), and some assessment of how soon the problem will likely be solved (1 paragraph). Each student will present a problem and outline their thinking about it, which will form the basis for a class discussion.

- 1. How is fine timing information that is available in early stages of auditory processing utilized by the central neuronal processors?**
- 2. How do we account for the perceptual invariance of pitch and timbre over large dynamic ranges? What are the central representations/mechanisms?**
- 3. What is the nature of the cortical representation of auditory objects such that two instruments with different pitches can be heard simultaneously?**
- 4. Transposition: What is the neuronal basis for the ability to recognize transposed melodies?**
- 5. Time-stretching: What is the neuronal basis for the ability to recognize rhythmic patterns with different tempos?**
- 6. What are the roles of descending pathways and recurrent connections in the auditory pathway, cerebral cortex, and limbic system vis-à-vis music?**
- 7. Is there a coherent mapping between timbral space as studied by music perception researchers and phonetic space as studied by speech psychoacousticians?**
- 8. Are there basic operations and neuronal mechanisms that can realize analysis of both musical and linguistic structure (syntactics)? Are there music-specific faculties?**
- 9. Long term memory and music: how are melodies retained over long periods of time (years, decades). What is the nature of the engram for music?**
- 10. What would it take to design cochlear implants that permit their users to get melody, harmony, and timbre?**
- 11. What is the present state of automatic music recognition? What are the current barriers? How does this compare with automatic speech recognition?**
- 12. Is music perception/cognition well described in terms of Bayesian inference?**

13. What is the role of the cerebellum in music perception?
14. Where in the brain are tonal and rhythmic expectancies generated? What is the nature of the representation of pitch and rhythm in these areas?
15. What does auditory-visual synesthesia have to say about neural coding? Are the associations arbitrary or do similar ones recur?
16. What are the parallels and differences between auditory and visual perception and cognition (e.g. transpositional invariance and magnification and/or translation invariance)? Are auditory and visual grouping mechanisms subserved by similar (or analogous) operations/neurocomputations?
17. What would a full-blown neurocomputational and neurological theory of musical preference and personality look like?
18. What music therapies are possible?
19. Why does music (and/or rhythmic induction) help (some) patients with movement initiation disorders? What does this say about the relation between music and motor control?
20. What is the nature of auditory-motor linkages for finger tapping, musical performance, and dance? Does rhythm perception activate motor centers, and does rhythmic activity facilitate rhythm perception?
21. Comparative psychology of music: To what extent do animals generate rhythmic expectancies? tonal expectancies? musical preferences?
22. What is the nature of neuronal processes responsible for music that one cannot get out of one's head (auditory imagery)? Is there a tie-in with some types of central tinnitus?
23. What are the similarities and differences between musical and spoken humor?
24. Are there critical periods and/or stages of development of music cognition?
25. Add your own fundamental questions.

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