# Music and language

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1.The relationship between music and language has attracted scholarly debate over a long period of time in history, from various perspectives.

2.Recent years have witnessed a growing interest in the scientific study of language and music by cognitive and neural scientists, linguists, among others.

3. The goal of such endeavors usually involves a central question that yet to be resolved, which is, "what perceptual and cognitive operations are specific to language, and which are also involved when processing other types of well-constructed and organized signals, such as music?" However, recent research from interdisciplinary perspectives showed that both music and language are complicated cognitive processes that require bi-hemispheric processing from multiple parts of the brain; therefore it is often favorable to limit the research scope to specific areas and levels instead of talking about music and language as single entities. Thus a more general shift in the research scope emerges: (Patel 2008:417): "[No matter similar or different,] Comparing music and language provides a powerful way to study the mechanisms that the mind uses to make sense out of sound."

4. This is especially true when we consider that music and language both involve multiple levels of representation. In this presentation I am going to address the research literature in the specific four areas: pitch/melody, rhythm, syntax, and evolution.

5. Recent literature on pitch processing points to the hypothesis that there exists a covert association in mental representations between musical and linguistic pitch perception,

formed possibly during the critical period. Deutsch et colleagues showed that the high percentage of musicians with absolute pitch in East Asia can be explained as a feature first acquired in language acquisition among native speakers of tone languages. In a 2010 paper, Patel et al found that intonation-processing deficit in amusia was largely associated with a psychophysical pitch direction discrimination deficit, suggesting that amusia impacts upon one's language abilities in subtle ways, and support previous evidence that pitch processing in language and music involves shared mechanisms. In an earlier study, Stegemoller and colleagues (2008) found evidence that higher levels of musical experience were associated with decreased energy at frequency ratios not corresponding to the 12-tone scale in both speech and song. Finally, Patel reports a newly invented technological tool, namely, the prosogram, in the comparative studies of musical and linguistic melodies. Based on the discrepancies between the actual speech signal and human perception of speech sounds, this prosogram allows multiple steps of transformation of the raw F0 contour in speech, rendering a level tone to most of the speech segments, thus facilitating its comparison with musical melodies.

6. the idea of nPVI stems from the empirically failed notion of isochrony in language rhythmic typology (e.g. stress-timed, syllable-timed, and mora-timed languages). This index points to the degree of vowel reduction, complexity of syllable structures, and variability of vowel and consonant internals, thus on some level quantifying the rhythmic differences among different languages. Subsequent studies applied this method to instrumental music (e.g.,French vs. English music, Japanese vs. American), which showed musical nPVI values from different cultures that were consistent with the nPVI values of their native language, thus providing first empirical evidences that the rhythmic

characters of the instrumental music are influenced to a certain degree by the rhythm of the composers' native language.

7.Another line of research related the notion of perceptual grouping biases in music to the rhythmic patterns of one's native language. One interpretation of these findings is that non-linguistic duration-based grouping is not governed by universal, inborn principles, but emerges entirely from bottom-up statistical learning of duration patterns at phrase boundaries in the auditory environment (dominated by speech for humans).

8. The research on melodic interval patterns and rhythm using CV and nPVI makes possible the calculation of the linguistic and musical prosody of a given culture and a quantitative mapping of their distance. (the Rhythm-Melody space or RM space by Patel and colleagues). although the current corpus in such studies needs to be broadened.

9. Early research on musical syntax in relation to linguistic syntax stems from the idea of generative grammar (Lerdahl&Jackendoff 1983;), although the forms of the two theories appeared to be not at all alike. In a recent paper Pesetsky and Katz(2009) reorganized the format of GTTM using linguistic formal analysis, and proposed the "Identity Theses for Language and Music". The thesis contends that "All formal difference between language and music are a consequence of differences in their fundamental building blocks (arbitrary pairings of sound and meaning in the case of language; pitch-classes and pitch-class combinations in the case of music). In all other respects, language and music are identical (Pesetsky and Katz, 2009: 3)."

On the other hand, recent debate in neuroscience has focused on the question of whether there is shared or domain- specific processing of music and linguistic syntax. Contradictory evidences of the debate include on the one hand, the well-documented

disassociations between the two (such as individuals with normal hearing showing impairment of syntactic processing in one domain while remaining intact in the other, e.g., aphasia without amusia, or vice versa), and on the other, neural-imaging data pointing to the overlap in the processing of linguistic and musical syntax. Patel (2003) proposed to resolve this paradox by a conceptual distinction between syntactic representation and syntactic processing in brain structure, or the Shared Syntactic Integration Resource Hypothesis (SSIRH). This hypothesis contends that linguistic and musical syntactic processing engage different cognitive operations, but rely on a common set of neural resources for processes of structural integration in working memory.

10.Subsequent experiments provided evidence showing an interference effect when processing musical and linguistic syntax simultaneously.

11.while scholars have proposed hypothesis such as an early 'musi-language' stage when pitch contrast was used as the means of communication prior to the emergence of speech articulation, views on the role of music in human evolution range from "adaptionist" view (natural selection) to "biologically useless" (the evolutionary role of language seem to be subject to less dispute). Recent evidences from evolutionary biology support neither of these views. On the one hand, contrary to language, there is no absolute evidence pointing to the evolutionary advantage of music in natural selection; on the other hand, the human musical activities bear significance in shifting and shaping the brain structure, as well as other psychological and physiological characters. In other words, our brain is constantly modified by the very thing that it created, and music is something that once created, human could not live without it (kind of like the ability of making fire). Patel proposed that music is a "***biologically powerful human invention***", or "transformative

technology of the mind." (Patel 2007)