The biological foundations of the language and music capacity: quest for uniqueness?

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In his influential book *Biological Foundations of Language* (1967), Lenneberg suggested the existence of "a biological matrix with specifiable characteristics" (394) for each cognitive capacity. Although Berwick and Chomsky (2016) claim—referring to Lenneberg's work under pointing out how it has been extended (Curtiss, 2012)—that biological specificity of the language capacity is now well established, we think that current research on the music capacity indicates that the relationship between language and music capacities needs to be clarified at the cognitive as well the neural level. In our talk, we discuss the relationship between those two capacities on the basis of current theoretical as well as empirical findings. The results suggest that intriguing similarities and important differences exist at the same time on several representational levels: temporal integration, i.e. projecting domain-specific hierarchical structures onto temporal linearly ordered structures, is similar, but syntactic categories and propositional meaning in language as well as tonal hierarchy and isochronous beat in music are unique to each domain (Asano & Boeckx, 2015). To resolve that shared/distinct conundrum one possible approach is indicated by Lenneberg's suggestion to regard language processing theoretically as "a special form of pattern recognition" (393) as described by generative grammar. In accordance with this idea, music has been investigated as formal grammar (e.g., Sundberg & Lindblom, 1991; Steedman 1984; Rohrmeier, 2011). Moreover, modern comparative research from theoretical (e.g., Hauser & Watumull, 2016), neuroscientific (e.g., Fitch et al., 2012), and evolutionary perspective (e.g., Fitch & Hauser, 2004; Rohrmeier et al. 2015) implies such a "pattern processing" point of view. However, thinking of formal systems as descriptions of internal representations or of cognitive capacities means thinking of abstract theoretical models, which means that a comparative biological framework requires linking these formalisms to mental and neural processes. Thus, we discuss the application of formal grammar theory in current empirical comparative research on the language and music capacity. In addition, to deal with the shared/distinct conundrum and bridge this gap for a comparative biological research program, we point out that a data-base system integrating empirical findings from biological research and computational cognitive models of language and music processing is needed. In particular a cognitive ontology for studying the computational properties of the language and music capacity needs to be developed (Price & Friston, 2005; Poldrack, 2006).