

# Modularity or non-modularity of pitch deficits in Congenital Amusics? A developmental perspective is the key

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Keywords: Congenital amusia; Cognitive modularity; Pitch; Development

## Abstract

Cognitive modularity is important for understanding the mechanisms of learning and brain development. In the music domain, congenital amusia is a neurodevelopmental disorder which specifically impairs pitch processing. As pitch is a common element in both music and speech, increasing interests has been focused on the integrity of pitch processing in the speech domain. The current consensus (e.g., Vuvan et al., 2015) is that amusics' pitch deficits in music domain also compromise linguistic pitch processing. However, this is mainly based on adults' data. For Congenital amusia which is known as developmental disorder, a developmental perspective is lacking. In the current study, we aimed at examine cross-domain pitch processing of amusic adults in light of the cross-domain pitch development in 9-year-old normally developing children. We tried to reexamine the issue of pitch modularity by comparing the end results of the developmental pitch disorders in amusic adults with the on-going dynamic cross-domain pitch development in normally developing children.

Using lexical tone pairs and musical pitch pairs with matched intervals (approximately 5 semitones), we collected electrophysiological data with a passive oddball paradigm and behavioral performance with an active discrimination task.

For musical pitch processing, as expected, amusics performed similar to the children group as reflected by the mismatch responses and behavioral performance, both groups lagged significantly behind the control adults. Time frequency analysis also demonstrated the same group differences, amusics showed inter trial coherence (ITC) similar to the children group, whereas both of these two groups had significantly weaker ITC than the control adults. For lexical tone processing, however, although both amusics and the children group lagged behind the control adults as indexed by the mismatch responses and behavioral performance, amusics outperformed children group in these two measures. More importantly, amusics and the control adults both had stronger ITC than the children group, whereas the former two groups were not statistically distinguishable.

Taken together, our results highlighted the importance of a developmental perspective for the issue of pitch modularity among amusics. Although part of our results regarding the direct comparison between amusics and the control adults seemed supportive of earlier non-modularity notion, the additional contrasts gained from the normally developing children group speaks against it. Our results showed that pitch processing in amusics is modularized. Pitch modularity is a result of development rather than innate.

## References

Vuvan, D. T., Nunes-Silva, M., & Peretz, I. (2015). Meta-analytic evidence for the non-modularity of pitch processing in congenital amusia. *Cortex*, 69, 186-200.