

Monkeys 'understand' rules underlying language musicality

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This is a Squirrel monkey/*Saimiri sciureus*. Credit: Photo: M. Böckle

Many of us have mixed feelings when remembering painful lessons in German or Latin grammar in school. Languages feature a large number of complex rules and patterns: using them correctly makes the difference between something which "sounds good", and something which does not. However, cognitive biologists at the University of Vienna have shown that sensitivity to very simple structural and melodic patterns does not

require much learning, or even being human: South American squirrel monkeys can do it, too.

Language and music are structured systems, featuring particular relationships between syllables, words and musical notes. For instance, implicit knowledge of the musical and grammatical [patterns](#) of our language makes us notice right away whether a speaker is native or not. Similarly, the perceived musicality of some languages results from dependency relations between vowels within a word. In Turkish, for example, the last syllable in words like "kaplanlar" or "güller" must "harmonize" with the previous vowels. (Try it yourself: "güller" requires more movement and does not sound as good as "güller".)

Similar "dependencies" between words, syllables or musical notes can be found in languages and musical cultures around the world. The biological question is whether the ability to process dependencies evolved in human cognition along with human language, or is rather a more general skill, also present in other animal species who lack language.

Andrea Ravignani, a PhD candidate at the Department of Cognitive Biology at the University of Vienna, and his colleagues looked for this "dependency detection" ability in squirrel monkeys, small arboreal primates living in Central and South America. Inspired by the monkeys' natural calls and hearing predispositions, the researchers designed a sort of "musical system" for monkeys. These "musical patterns" had overall acoustic features similar to monkeys' calls, while their structural features mimicked syntactic or phonological patterns like those found in Turkish and many human languages.

Monkeys were first presented with "phrases" containing structural dependencies, and later tested using stimuli either with or without dependencies. Their reactions were measured using the "violation of expectations" paradigm. "Show up at work in your pyjamas, people will

turn around and stare at you, while at a slumber party nobody will notice", explains Ravignani: In other words, one looks longer at something that breaks the "standard" pattern. "This is not about absolute perception, rather how something is categorized and contrasted within a broader system." Using this paradigm, the scientists found that monkeys reacted more to the "ungrammatical" patterns, demonstrating perception of dependencies. "This kind of experiment is usually done by presenting monkeys with human speech: Designing species-specific, music-like stimuli may have helped the squirrel monkeys' perception", argues primatologist and co-author Ruth Sonnweber.

"Our ancestors may have already acquired this simple dependency-detection ability some 30 million years ago, and modern humans would thus share it with many other living primates. Mastering basic phonological patterns and syntactic rules is not an issue for squirrel monkeys: the bar for human uniqueness has to be raised", says Ravignani: "This is only a tiny step: we will keep working hard to unveil the evolutionary origins and potential connections between language and music".

More information: Ravignani A, Sonnweber R-S, Stobbe N, Fitch WT. 2013 Action at a distance: dependency sensitivity in a New World primate. *Biol Lett* 20130852. [dx.doi.org/10.1098/rsbl.2013.0852](https://doi.org/10.1098/rsbl.2013.0852)

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