Study proposes new theory for evolution of infant-directed song

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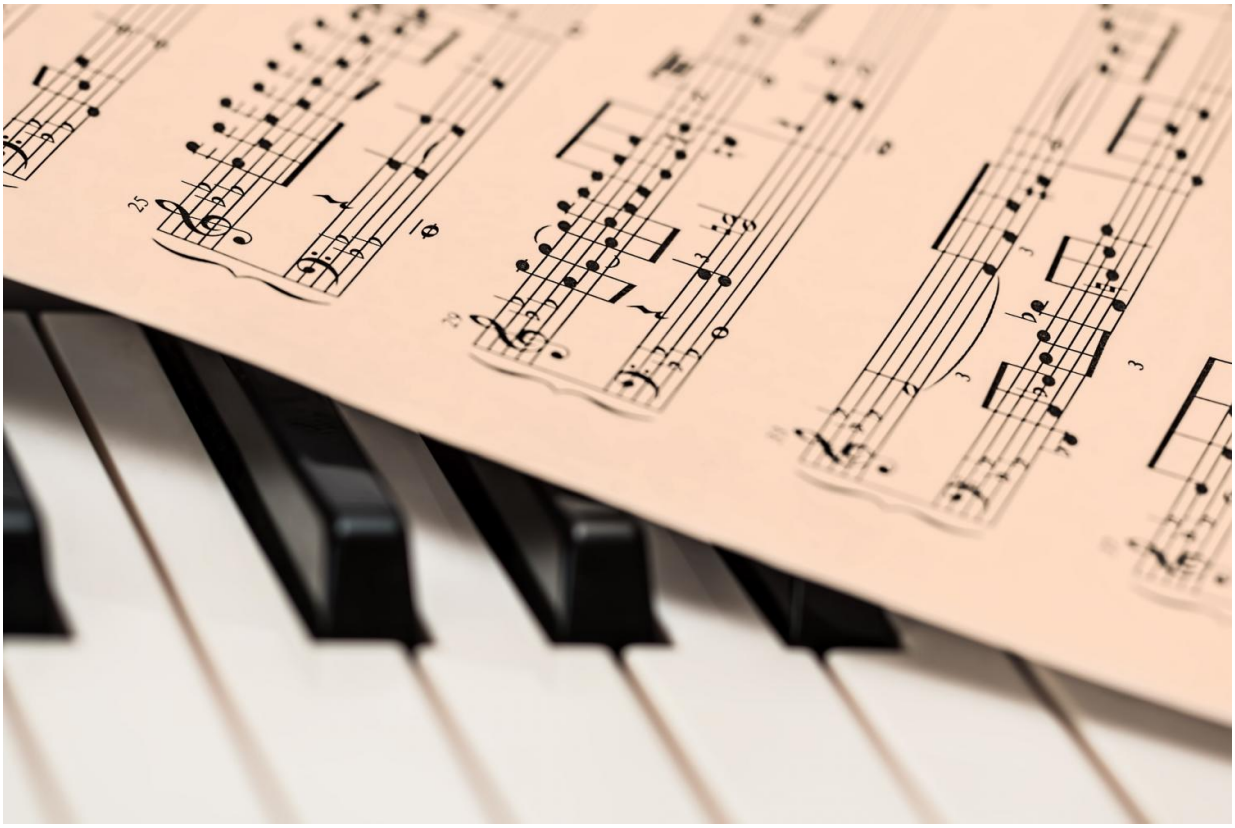

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These days, it's a territory mostly dominated by the likes of Raffi and the Wiggles, but there's new evidence that lullabies, play songs, and other music for babies and toddlers may have some deep evolutionary roots.

A new theory paper, co-authored by Graduate School of Education doctoral student Samuel Mehr and Assistant Professor of Psychology Max Krasnow, proposes that infant-directed song evolved as a way for parents to signal to children that their needs are being met, while still freeing up parents to perform other tasks, like foraging for food, or caring for other offspring. Infant-directed song might later have evolved into the more complex forms of music we hear in our modern world. The theory is described in an open-access paper in the journal *Evolution and Human Behavior*.

Music is a tricky topic for evolutionary science: it turns up in many cultures around the world in many different contexts, but no one knows why humans are the only musical species. Noting that it has no known connection to reproductive success, Professor of Psychology Steven Pinker, described it as "auditory cheesecake" in his book How the Mind Works.

"There has been a lot of attention paid to the question of where music came from, but none of the theories have been very successful in predicting the features of music or musical behavior," Krasnow said. "What we are trying to do with this paper is develop a theory of music that is grounded in evolutionary biology, human life history and the basic features of mammalian ecology."

At the core of their theory, Krasnow said, is the notion that parents and infants are engaged in an "arms race" over an invaluable resource—attention.

"Particularly in an ancestral world, where there are predators and other people that pose a risk, and infants don't know which foods are poisonous and what activities are hazardous, an infant can be kept safe by an attentive parent," he said. "But attention is a limited resource."

While there is some cooperation in the battle for that resource—parents want to satisfy infants appetite for attention because their cries might attract predators, while children need to ensure parents have time for other activities like foraging for food—that mutual interest only goes so far.

Attention, however, isn't the only resource to cause such disagreements.

The theory of parent-offspring conflict was first put forth over forty years ago by the evolutionary biologist Robert Trivers, then an Assistant Professor at Harvard. Trivers predicted that infants and parents aren't on the same page when it comes to the distribution of resources.

"His theory covers everything that can be classified as parental investment," Krasnow said. "It's anything that a parent could give to an offspring to help them, or that they may want to hold back for themselves and other offspring."

Sexual reproduction means that every person gets half of their genes from each parent, but which genes in particular can differ even across full siblings.

Krasnow explains, "A gene in baby has only a fifty percent chance of being found in siblings by virtue of sharing two parents. That means that from the baby's genetic perspective, she'll want a more self-favoring division of resources, for example, than her mom or her sister wants, from their genetic perspectives."

Mehr and Krasnow took the idea of parent-offspring conflict and applied it attention. They predict that children should 'want' a greater share of their parents' attention than their parents 'want' to give them. But how does the child know it is has her parent's attention? The solution, Krasnow said, is that parents were forced to develop some

method of signaling to their offspring that their desire for attention was being met.

"I could simply look at my children, and they might have some assurance that I'm attending to them," Krasnow said. "But I could be looking at them and thinking of something else, or looking at them and focusing on my cell phone, and not really attending to them at all. They should want a better signal than that."

Why should that signal take the form of a song?

What makes such signals more honest, Mehr and Krasnow think, is the cost associated with them - meaning that by sending a signal to an infant, a parent cannot be sending it to someone else, sending it but lying about it, etc. "Infant directed song has a lot of these costs built in. I can't be singing to you and be talking to someone else," Krasnow said. "It's unlikely I'm running away, because I need to control my voice to sing. You can tell the orientation of my head, even without looking at me, you can tell how far away I am, even without looking."

Mehr notes that infant-directed song provides lots of opportunities for parents to signal their attention to infants: "Parents adjust their singing in real time, by altering the melody, rhythm, tempo, timbre, of their singing, adding hand motions, bouncing, touching, and facial expressions, and so on. All of these features can be finely tuned to the baby's affective state—or not. The match or mismatch between baby behavior and parent singing could be informative for whether or not the parent is paying attention to the infant."

Indeed, it would be pretty odd to sing a happy, bubbly song to a wailing, sleep-deprived infant.

Krasnow agrees. "All these things make something like an infant

directed vocalization a good cue of attention," he continued. "And when you put that into this co-evolutionary arms race, you might end up getting something like infant-directed song. It could begin with something like primitive vocalizations, which gradually become more infant directed, and are elaborated into melodies."

"If a mutation develops in parents that allows them to do that quicker and better, then they have more residual budget to spend on something else, and that would spread," he said. "Infants would then be able to get even choosier, forcing parents to get better, and so on. This is the same kind of process that starts with drab birds and results in extravagant peacocks and choosy peahens." And as signals go, Krasnow said, those melodies can prove to be enormously powerful.

"The idea we lay out with this paper is that infant-directed song and things that share its characteristics should be very good at calming a fussy infant—and there is some evidence of that," he said. "We're not talking about going from this type of selection to Rock-a-Bye Baby; this theory says nothing about the words to songs or the specific melodies, it's saying that the acoustic properties of infant directed song should make it better at calming an infant than other music."

But, could music really be in our genes?

"A good comparison to make is to language," Krasnow said. "We would say there's a strong genetic component to language—we have a capability for language built into our genes—and we think the same thing is going to be true for music."

What about other kinds of music? Mehr is optimistic that this work could be informative for this question down the road.

"Let's assume for a moment that the theory is right. How, then, did we

get from lullabies to Duke Ellington?" he asked. "The evolution of music must be a complex, multi-step process, with different features developing for different reasons. Our theory raises the possibility that infant-directed song is the starting point for all that, with other musical behaviors either developing directly via natural selection, as byproducts of infant-directed song, or as byproducts of other adaptations."

For Pinker, the paper differs in one important way from other theories of how music evolves in that it makes evolutionary sense.

"In the past, people have been so eager to come up with an adaptive explanation for music that they have advanced glib and circular theories, such as that music evolved to bond the group," he said. "This is the first explanation that at least makes evolutionary sense - it shows how the features of music could cause an advantage in fitness. That by itself doesn't prove that it's true, but at least it makes sense!"

Provided by Harvard University

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