tion was designed to address political content on X, a similar approach could be used for different platforms, content types, and outcomes. This independent research model could facilitate repeated experiments across platforms and time, addressing the challenges of temporal validity and cross-platform generalizability. It could also enable researchers without relationships with platforms to run experiments testing algorithmic modifications. Furthermore, this approach could be used to test interventions that platforms might be reluctant to test.

Unlike the FIES, which found largely null results when testing the effect of feed ranking changes on political polarization, Piccardi *et al.* found that changing the ranking of AAPA content did alter users' polarization. What might explain the divergence? Crucially, the intervention used by Piccardi *et al.* was focused on the content of individual posts—content expressing animosity was specifically targeted for reranking. By contrast, the FIES largely intervened at the level of users (e.g., demoting content from like-minded users) or platform affordances (e.g., implementing reverse chronological feed). The FIES was also conducted on Facebook and Instagram during a time of more stringent content moderation standards (*14*), whereas Piccardi *et al.* focused on X when moderation standards had been loosened with Elon Musk's takeover.

In assessing the Piccardi *et al.* results, there is also the question of how two points on a 100-point scale of partisan animosity manifests in the real world. Although it is encouraging to see an intervention that cools political temperatures, if the total effect moves someone from ranking an opposing party as a 4 out of 100 to a 6 out of 100, does this translate into meaningful differences in societal attitudes or behavior? Future research is needed to understand the longer-term implications of these substantively small effects and to explore whether other interventions generate larger effects. One study—or set of studies—will never be the final word on how social media affects political attitudes. What is true of Facebook might not be true of TikTok, and what was true of Twitter 4 years ago might not be relevant to X today. The way forward is to embrace creative research and to build methodologies that adapt to the current moment. Piccardi *et al.* present a viable tool for doing that. □

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COGNITIVE NEUROSCIENCE

Groove to the music

What can tapping macaques reveal about the evolution of musicality?

Asif A. Ghazanfar[1,2] and **Gavin Steingo**[3]

More than a hundred years ago, Charles Darwin's ideas about the evolution of music were pitted against those of the sociologist Herbert Spencer (*1*). Darwin believed that the ability to make music evolved as a trait with adaptive value across different animal groups before the advent of contemporary humans, whereas Spencer believed that only humans can make true music. Adaptive explanations for the evolution of human music still abound (*2*, *3*). In the absence of compelling fossil or archaeological evidence of music making, however, 21st-century researchers rely as much on conjecture as they did in Darwin and Spencer's time. On page 940 of this issue, Rajendran *et al.* (*4*) report that macaque monkeys have the capacity to tap to a musical beat. Might such research on the capacities of nonhuman animals compensate for archaeological and conceptual gaps and help to overcome the impasse of the Darwin and Spencer debate?

Some researchers approach the evolution of music by sidestepping the question of whether music has an adaptive function or not. They do this by breaking down human music into its design features and then asking which nonhuman animals exhibit these features (*5*). One such design feature is isochronicity, the ability to hear a steady beat and then synchronize a motor output to it. Humans readily dance, clap, head bob, and toe tap to music, but most other animals do not show these behaviors. An influential hypothesis for why this ability is so rare in the animal kingdom posits that it is linked to vocal learning (*6*). According to this view, the capacity to follow a beat is conferred by forebrain neural circuits that link auditory inputs to motor outputs, a connection that arose with the evolution of vocal learning. Vocal learning is experience dependent and requires a change in motor output in response to auditory signals in the environment. For example, pet parrots, which are notorious vocal learners, can follow musical beats with their head bobs, seemingly without any formal training (*7*, *8*). The vocal-learning hypothesis explains what is presently known while providing testable predictions about which animals can or cannot follow a beat (*6*).

...the abilities that were observed are not natural behaviors...

Rajendran *et al.* put the vocal-learning hypothesis to the test by studying whether monkeys that do not vocally learn can follow a musical beat. Macaque monkeys are nonvocal learners, as the acoustic features of their vocalizations do not change according to social experience (*9*). For example, the vocalizations of a group of macaques were unchanged after 2 years of cross-fostering with a dif-

Humans and macaques use the same effectors, their hands, to tap to a musical beat.

ferently sounding species of macaque (*10*). The study by Rajendran *et al*. involved two adult male macaques that had been previously trained to manually tap a surface in time with explicit metronome beats (unambiguous clicking sounds). The authors then further conditioned these macaques to manually tap to a subjective beat in music, full of all its acoustic complexity. The monkeys accompanied the beat of the music, even when the tempo was varied, when a song they had not heard before was presented and when they were no longer rewarded for tapping to the beat of the song.

Do the findings of Rajendran *et al*. falsify the vocal-learning hypothesis by showing that a nonvocal learner can synchronize its motor responses to a musical beat and do this at different tempos? Rejecting the vocal-learning hypothesis would mean accepting that there is no mediation (neurobiological or otherwise) between vocal learning and beat processing. However, rhythmically inclined monkeys and parrots are performing in a captive context and would not have the opportunity to learn such behaviors in their respective habitats. Rajendran *et al*. are careful to note that the abilities that were observed are not natural behaviors: They were conditioned through extrinsic rewards, not the seemingly intrinsic ones that humans experience when they follow rhythmic beats. A behavior that has been conditioned may not be equivalent to a behavior that emerges spontaneously.

When researchers try to reconstruct the evolution of a behavior, they like to see continuity in the mechanisms that mediate it. Are two similar behaviors part of the same evolutionary lineage if they use different effectors and different neural circuits to mediate them? Macaque monkeys and humans can use the same effectors, their hands, to tap a rhythm. However, it is highly unlikely that they use identical neural circuits to do so given the human brain's peculiar size-related circuitry differences (though parts of these neural circuits may be homologous). Macaque monkeys and parrots use different effectors and different neural circuits to follow musical beats. Another possibility to explain a similar behavior in different species is convergent evolution. It is unclear whether the ability to follow the beat among humans, macaque monkeys, and parrots, though differently realized, is the result of common selection pressures, and, if so, what those selection pressures could be.

With many possible interpretations and no way to test their merits, one might reasonably ask whether studies of spontaneous or trained animal behavior can really reveal much about human behavioral evolution. This is especially true for behaviors shaped by culture. Outside the realm of music, could a monkey trained to ride a bike help to understand the evolution of human bike riding? Studying this process would not uncover a monkey's hidden capacity to ride a bike, but rather it would simply show how conditioning could make it adopt a human ability that was acquired through cultural evolution. The monkey's trained ability could help to pinpoint the anatomical features that enable primates to cycle: grasping hands, forward-facing eyes, proportion of limbs relative to each other, and a brain that coordinates these effectors to move while balancing on two wheels. Similarly, Rajendran *et al*. show that monkeys can have rhythm when trained, while pointing out that monkeys do not have rhythm in natural conditions. The implications of their findings for the evolution of music remain undertheorized. □

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