

Size does matter: Group size and mating preferences drive deeper male voices

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Deeper male voices in primates, including humans, offer more than sex

appeal—they may have evolved as another way for males to drive off competitors in large groups that favored polygyny, or mating systems where a male has multiple mates, according to researchers. The research is the most comprehensive investigation of differences in vocal pitch between sexes to date and has the potential to help to shed light on social behavior in humans and their closest living relatives.

The average speaking pitch of an adult male [human](#) is about half the average pitch, an octave lower, than that of an adult female human, said David Puts, professor of anthropology at Penn State and study co-author.

"It's a sex difference that emerges at [sexual maturity](#) across species and it probably influences [mating](#) success through attracting mates or by intimidating competitors," he said. "I thought it has to be a trait that's been subjected to [sexual selection](#), in which mating opportunities influence which traits are passed down to offspring. Humans and many other primates are highly communicative, especially through vocal communication. So it seems like a really relevant trait for thinking about [social behavior](#) in humans and primates in general."

The researchers used specialized computer software to visualize vocalizations and measure voice pitch in recordings from 37 anthropoid primate species, or those most closely related to humans, including gorillas, chimpanzees and recordings of 60 humans evenly divided by sex. Samples for each species included at least two male and two female vocal recordings, for a total of 1,914 vocalizations. The team then calculated average male and female vocal fundamental frequency for each species to see how pronounced the difference was between sexes.

The scientists collected additional information for each species to help identify correlations between male versus female voice pitch and factors that could have contributed to the trait's evolution. Additional variables included [body size](#) and body mass differences between males and

females, habitat type, adult sex ratios, mating competition intensity and testes size. They also categorized each species by mating system—monogamous, in which males and females have one mate at a time; polygynandrous, in which males and females have multiple mating partners; and polygynous, in which some males have several mates.

The researchers used these data to test five hypotheses simultaneously to identify which factors may have played the strongest roles in driving sex differences in vocal pitch. The hypotheses were: intensity of mating competition, large group size, multilevel social organization, trade-off against the intensity of sperm competition, and poor acoustic habitats. Previous research has looked at one or two of these hypotheses at a time. The current study is the first to test multiple hypotheses simultaneously for vocal pitch differences using a robust dataset, ensuring data consistency and garnering convincing results, according to Puts.

The team found that fundamental frequency differences by sex increased in larger groups and those with polygynous mating systems, especially in groups with a higher female-to-male ratio. They reported their findings today in *Nature Communications*.

"Our findings highlight the important role of sexual selection and offer possible evolutionary explanations for why males and females differ in voice pitch across primates," said Toe Aung, first author and assistant professor of psychology and counseling at Immaculata University, who worked on the study as part of his doctoral dissertation at Penn State.

"This research also provides insight into sex differences in voice pitch in our common ancestors who lived millions of years ago."

Deeper male voices may act as an additional way to fend off mating competitors without having to engage in costly fighting by making males sound bigger, in addition to other physical traits like height and muscle size, according to the researchers. In adult humans, for instance, males

vocalize at an average of 120 hertz whereas females vocalize at an average of about 220 hertz, putting humans right in the middle of polygynous societies, the researchers reported.

"Although social monogamy is really common in humans, mating and reproduction in our ancestors was substantially polygynous," Puts said. "Our findings help us to understand why male and female voices of our species differ so drastically. It may be a product of our evolutionary history, particularly our history of living in large groups in which some males reproduced with multiple females."

Additional contributors to the study included Alexander Hill, University of Washington; Dana Pfefferle, University of Goettingen, Germany; Edward McLester, Max Planck Institute of Animal Behavior, Konstanz, Germany; James Fuller and Jenna Lawrence, Columbia University; Ivan Garcia-Nisa, Rachel Kendal and Megan Petersdorf, Durham University, U.K.; James Higham, New York University; Gerard Galat, French National Research Institute for Sustainable Development; Adriano Lameira, University of Warwick, U.K.; Coren Apicella, University of Pennsylvania; Claudia Barelli, University of Florence; Mary Glenn, Humboldt State University; and Gabriel Ramos-Fernandez, National Autonomous University of Mexico

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