When power is toxic: Dominance reduces influence in groups

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Dominant and subordinat male A. burtoni Credit: The Jordan Lab

Being the strongest, biggest and most aggressive individual in a group might make you dominant, but it doesn't mean you make all the decisions.

A new study of fish behavior published in the *Proceedings of the National Academy of Sciences* shows that dominant individuals can influence a group through force, but passive individuals are far better at bringing a group to consensus. The study, published by an international team from the Max Planck Institute of Animal Behavior, the University of Konstanz and the University of Texas at Austin, overturns assumptions that dominant individuals also have the greatest influence on their groups, and sheds light on the potential of domineering individuals to obstruct effective communication in organizations.

"The same traits that make you powerful in one context can actively reduce your influence in others, especially contexts in which individuals are free to choose who to follow," says senior author Alex Jordan, a group leader at the Max Planck Institute of Animal Behavior and at the University of Konstanz's Cluster of Excellence Center for the Advanced Study of Collective Behavior.

"Dominant individuals can force their will on the group by being pushy, but that also makes them socially aversive. When it comes to bringing peers to consensus during more sophisticated tasks, it is the least aggressive individuals that exert the greatest influence. Our results illustrate that although domineering individuals most often ascend to positions of power, they can in fact create the least effective influence

structures at the same time."

Separating dominance and influence

To disentangle the effects of dominance and influence, the researchers studied groups of a social cichlid fish, Astatotilpia burtoni. "This species form groups with strict social hierarchies, in which dominant males control resources, territory and space," says Mariana Rodriguez-Santiago, co-first author on the study and a doctoral student in the lab of co-corresponding author Hans Hofmann at UT Austin.

"We ask if the colorful dominant males, which are aggressive, central in their social networks, and control resources, are most influential. Or if drab subordinate males wield the greatest influence, despite being passive, non-territorial, and having little or no control over resources."

The researchers separated the effects of social dominance from social influence by examining how information flows between either dominant or subordinate males and their groups in two different contexts: routine social behavior, or a more complex social learning task. In the more complex social learning task, dominant or subordinate male fish were trained that a certain colored light on one side of the tank meant food would soon arrive at that location. These "informed" individuals were then placed into new groups of uninformed individuals and researchers asked which group—those with informed dominant or subordinate males—more quickly learned to associate a colored light with food.

Dominant and subordinate male A. burtoni Credit: The Jordan Lab

The cost of being domineering

The researchers observed the movement of the fish and found that in routine social interactions the dominant males exerted the greatest

influential by chasing and pushing the group around. But in the more complex task in which influence was not forced on the group, and individuals had a choice about who to follow, it was subordinate males who wielded the greatest influence in their social groups. In groups with a subordinate male as demonstrator, fish quickly came to a consensus about which light to follow, moving together as a coherent unit to succeed in the task. With a dominant male as the informant, groups were far slower to reach consensus if they did at all.

Breaking down behavior with machine learning

By using additional machine-learning-based animal tracking, employing cutting-edge techniques developed in the computer sciences, researchers were able to break down the behavioral differences between dominant and subordinate males: Dominant males were central in behavioral social networks (they frequently interacted with others) but they occupied peripheral locations in spatial networks (they were avoided by others). The technology provided insights never before available, revealing the mechanisms of influence as well as the outcome.

"By capturing behavioral data that are impossible to be measured with the naked eye, our automated tracking methods revealed that it was not the difference in social position between dominant and subordinate per se, but rather, in the way they moved and interacted with others," says co-first author Paul Nührenberg, a doctoral student at the Cluster of Excellence, Center for the Advanced Study of Collective Behavior at the University of Konstanz. "These behavioral differences lead directly to differences in social influence."

Rethinking leadership

This result touches on the evolution of animal societies as well as

leadership structures in organizations. "In many societies, whether animal or human, individuals in positions of power all possess a similar suite of traits, which are aggression, intimidation and coercion," says Jordan. "But effective communication requires the presence of a diversity of voices, not just the loudest. Our results from a natural system show that allowing alternative pathways to positions of power may be useful in creating stronger advisory, governmental, and educational structures."

More information: Mariana Rodriguez-Santiago et al, Behavioral traits that define social dominance are the same that reduce social influence in a consensus task, *Proceedings of the National Academy of Sciences* (2020). DOI: 10.1073/pnas.2000158117

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