

String quartets become guinea pigs for a social interaction study

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(Medical Xpress)—The capacity for group behavior affects the success of innumerable species, and it's a notable feature of human behavior. All major human achievements, from lunar exploration to moving a couch

up a flight of stairs, depend on complex social interactions, many of which consist of nonverbal information flow.

All human cultures develop music and perform in groups. A collaborative of Canadian researchers recently designed a unique experiment to test the propagation of information between groups of musicians engaged in a joint [performance](#), and they have published their results in the *Proceedings of the National Academy of Sciences*.

The researchers recruited two internationally famous professional music ensembles—the Cecilia Quartet and the Afiara Quartet. The Cecilia Quartet performed 12 different chorales from the Baroque period; the Afiara Quartet performed 12 pieces from the Classical period. The musicians did not rehearse, and had not previously performed the selected pieces together. Using the two distinct styles of classical music enabled the researchers to study how the features of the music itself influenced coordinated movement and information flow among the musicians.

Using [motion capture technology](#), the researchers recorded the swaying motions of the musicians as they performed. Prior to performance, the researchers gave the musicians confidential sheets informing them whether they were a leader or a follower. They were further informed that each trial had one leader and three followers.

The results of the experiment demonstrate that anterior-posterior body sway couplings served as a form of nonverbal interpersonal coordination and as indicators of [leadership roles](#), and strongly affected the musicians' self-evaluations of the quality of the performance. Assigned leaders were more influential to followers than followers were to leaders; leaders also influenced followers more strongly than one follower influenced another follower.

The study further revealed that physical coordination and the understanding of leader/follower roles was strongly correlated with visual stimuli; during trials in which the musicians were hidden from one another, coordinated movements were not as strongly established.

By applying an analytical method called Granger causality, the researchers were able to determine "who leads whom" in each trial. The assignment of a leader for each performance allowed the researchers to observe that [information flow](#) changes with leadership assignment, and that body sway was not simply a motor byproduct of musical performance, instead serving as nonverbal communication with the rest of the group.

The researchers wrote, "In conclusion, the present study showed that manipulation of leadership roles and visual information interactively modulated interpersonal coordination in string quartets across styles of music played, as reflected by interpersonally coupled body sways indexed by Granger causality." They note that further study is required to determine how interpersonally conveyed [information](#) guides motor coordination in each performer.

More information: Body sway reflects leadership in joint music performance. *PNAS* 2017 ; published ahead of print May 8, 2017, [DOI: 10.1073/pnas.1617657114](https://doi.org/10.1073/pnas.1617657114)

Abstract

The cultural and technological achievements of the human species depend on complex social interactions. Nonverbal interpersonal coordination, or joint action, is a crucial element of social interaction, but the dynamics of nonverbal information flow among people are not well understood. We used joint music making in string quartets, a complex, naturalistic nonverbal behavior, as a model system. Using motion capture, we recorded body sway simultaneously in four

musicians, which reflected real-time interpersonal information sharing. We used Granger causality to analyze predictive relationships among the motion time series of the players to determine the magnitude and direction of information flow among the players. We experimentally manipulated which musician was the leader (followers were not informed who was leading) and whether they could see each other, to investigate how these variables affect information flow. We found that assigned leaders exerted significantly greater influence on others and were less influenced by others compared with followers. This effect was present, whether or not they could see each other, but was enhanced with visual information, indicating that visual as well as auditory information is used in musical coordination. Importantly, performers' ratings of the "goodness" of their performances were positively correlated with the overall degree of body sway coupling, indicating that communication through body sway reflects perceived performance success. These results confirm that information sharing in a nonverbal joint action task occurs through both auditory and visual cues and that the dynamics of information flow are affected by changing group relationships.

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