

# More connectivity does not always lead to more complex technology

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Many technologies used in human societies are beyond the inventive capacities of individuals. Instead, technologies result from a cumulative process where innovations are gradually added across many generations—think from the wheel to modern cars or from early planes to space shuttles.

Previous work in the field of cultural evolution suggested that larger and more connected groups should exhibit higher levels of cultural complexity. Larger groups are more likely to include highly skilled individuals and thus, should exhibit higher innovation rates. In addition, more connected groups allow individuals to tap into a larger pool of cultural models, which helps useful information to spread and prevents cultural loss.

New findings by Arizona State University researchers Maxime Derex and Robert Boyd published in the *Proceedings of the National Academy of Sciences (PNAS)* show that more connectivity does not always lead to more complex technology.

In this experiment, participants were asked to discover successive innovations to produce a virtual remedy and stop the spread of a virus. During the game, innovations could occur by either incremental improvement or recombination of different cultural traits. Two experimental treatments were compared. In the first set, participants were part of a fully connected group of six individuals and were constantly allowed to observe solutions produced by their group

members. In the second set, participants were members of a partially connected network of three subgroups of two players. In that case, participants could only observe the solutions of the other player within their subgroup, and different subgroups were occasionally connected by the movement of individuals between subgroups.

The results show that fully connected groups performed well in the short-run but rapidly converged toward the same solutions. As a consequence, fully connected groups did not exhibit cultural diversity, preventing innovation in combining different cultural traits. In comparison, innovation appears slower in partially connected groups but solutions are more diverse.

"In fully connected groups, the individuals' propensity to learn from successful cultural models—a common strategy that allows us to copy efficient solutions from others—quickly reduced the diversity of solutions. Partially connected groups are more likely to produce diverse solutions, allowing them to innovate further by combining different solutions," said Maxime Derex, postdoctoral researcher with the Institute of Human Origins.

At the end of the experiment, none of the fully connected groups were able to discover the most complex innovations, while 58 percent of the partially connected groups were successful innovators. These results show that partial isolation is a strong driver of cultural diversity and that larger and more connected populations do not necessarily exhibit higher cultural complexity. However, Derex and Boyd warn that small and isolated groups might be exposed to higher rates of cultural loss, suggesting that an optimal level of connectedness probably balances cultural loss and [cultural diversity](#).

This experiment also suggests that changes in patterns of interaction between groups of people may have been critical in our evolutionary

past.

"Our results suggest that increased contact as human populations spread across the world could have been important in the explosion of new technologies that appears at the same time," said Rob Boyd, research affiliate with the Institute of Human Origins and Origins Professor in the ASU School of Human Evolution and Social Change.

About 60,000 years ago, humans emerged from Africa and rapidly spread across the globe. Technology played a critical role in that process, because it allowed humans to thrive in habitats for which they are poorly suited biologically. These results suggest that contacts between previously isolated groups could have brought different skills and cultural traits together and may have led to periods of sudden leaps in cultural accumulation. The resulting technologies may have helped early humans to quickly adapt to new environments.

Provided by Arizona State University

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