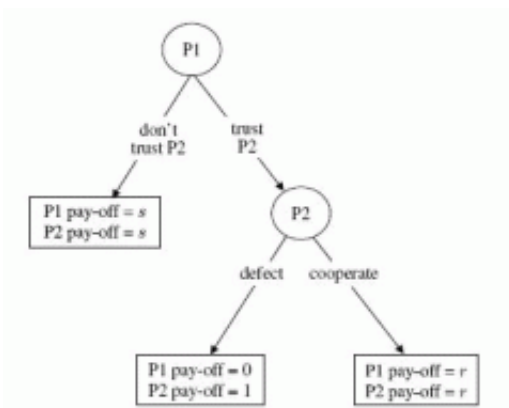


Study Shows How We Evolved Different Personalities

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The researchers performed simulations of the above game to understand how behavior variation evolves in a population. Player 1 (P1) chooses to trust or not trust Player 2 (P2). If trusted, P2 chooses to take advantage of P1 to gain a higher pay-off, or be trustworthy. The pay-off relation is 0

(PhysOrg.com) -- Although members of the same species share more than 99 percent of their genetic makeup, individuals often have small differences, such as in their appearance, susceptibility to disease, and life expectancy. Another difference, one that has gone overlooked from the evolutionary perspective, is personality variation. Even identical twins can have personality types at opposite ends of the spectrum.

This observation has led researchers to ask how evolution may have selected for personality variation within a species. A team from the UK has recently suggested a novel yet simple answer: that variation begets variation. They explain how there is no single ideal personality (as there is an ideal hand or eye, which we all share), but nature instead promotes different personalities.

In their recent study, John McNamara, Philip Stephens, and Alasdair Houston from the University of Bristol, and Sasha Dall of the University of Exeter, Cornwall Campus, explain how natural selection can prevent individuals in a species from evolving toward a single optimum personality, using a game theory scenario.

In their study, the researchers focus on the evolution of trust and trustworthiness. The game scenario they use is a variant of the Prisoner's Dilemma. First, Player 1 chooses to trust or not trust Player 2. Not trusting gives Player 1 a small payoff, and Player 2 gets nothing. If Player 1 trusts Player 2, and Player 2 is trustworthy, then both players receive the same medium-size payoff. But if Player 1 trusts Player 2, and Player 2 isn't trustworthy, Player 1 receives nothing, and Player 2 receives the maximum pay-off. In other words, Player 1 takes a risk if choosing to trust Player 2.

At this point, it seems that Player 2 should always choose to be untrustworthy, so that he always receives the maximum payoff. However, as in real life, the game is iterative. And – this is the important factor – Player 1 can do some background research on Player 2, and find out how often Player 2 has been trustworthy in the past. If Player 2 has a record of being untrustworthy, then Player 1 probably won't trust him.

This “social awareness” comes at a cost for Player 1, so Player 1 must decide if the cost is worth the information. If a population of Player 2's has variation in its records of trustworthiness, then Player 1 could learn useful information by learning a Player 2's history. (Realistic methods of acquiring information include, for example, talking to third parties or observing facial expression.) But if a Player 2 population generally has the same records, then the cost of social awareness wouldn't be worthwhile for Player 1.

In simulations with multiple players, individual patterns of trust and trustworthiness were allowed to evolve freely. By watching simulations of the game, the researchers found that the Player 2 population evolved variability in trustworthiness in response to sampling by the Player 1 population. For the Player 2 population, variation was the best strategy for gaining the trust of Player 1, and then exploiting that trust to maximize their pay-off on occasion. This variation, in turn, meant that Player 1 could gain helpful information by paying

the cost of being socially aware – which, once again, provoked more variation in the Player 2 population.

The researchers noted several interesting results of the game. If the Player 1 population was too trusting, the Player 2 population exploited that, and became less trustworthy. Dall said the team was pleasantly surprised by two results: that the model predicted behavioral variation in both player types, and also predicted two distinct variation patterns for Player 2's behavior.

“Not only were we able to explain why variation should be maintained as social interactions become more extensive, we were able to explain how discrete behavioral types might evolve in otherwise continuous behavioral traits,” Dall said to *PhysOrg.com*.

As he elaborated, the presence of a few socially aware Player 1's will not only keep the Player 2's in check, but also allow for more variation among Player 1's.

“You only need a certain number of samplers to enforce trustworthy Player 2 behavior, and so there will be a limit to the numbers of samplers that will be maintained by selection. Once samplers are common enough, everyone else should adopt unconditional, cost-free Player 1 behavior.” In other words, some Player 1's will always trust, while other Player 1's will never trust one another.

As the researchers concluded, even though this study focuses on a specific model, the general finding that variation begets variation in social contexts has broad implications for understanding evolution and game theory. Past results in game theory have discovered individual differences in trust and trustworthiness, and now studies like this one help to explain this variation. This study and others also show that evolutionary game theorists cannot ignore the importance of individual variation in their models. Meanwhile, the researchers will continue to investigate exactly why we have different personalities.

“More generally, the question of ‘why personality variation evolves’ requires a more complex answer, which we're only just starting to unravel as evolutionary biologists,” Dall said. “The chances are that there isn't just one reason, and which particular reason is relevant depends on the context. So far, our social awareness reason is one of the few that has been proposed to explain variation in a

cooperative context. Social awareness also appears to work in an aggressive context: individuals adopt consistent levels of aggression to avoid getting in real fights, since if someone can predict you're going to be aggressive, they will avoid provoking you; individual differences arise via frequency dependence again, as the more aggression there is around you, the less you should bother fighting – this is the famous Hawk-Dove game outcome.”

More information: McNamara, John M.; Stephens, Philip A.; Dall, Sasha R. X.; Houston, Alasdair I. “Evolution of trust and trustworthiness: social awareness favours personality differences.” *Proceedings of the Royal Society*, doi:10.1098/rspb.2008.1182.

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