Colman, Pulford, and Lawrence, in the current issue of this journal, present theory and data to advance a psychologically informed approach to game theory. While supporting their project, I respond to their critique of projection theory, question their overly flexible way of evaluating alternative proposals, and note that two of these alternatives, team reasoning and Stackelberg reasoning, cannot get off the ground without assuming social projection. Lastly, I note that the empirical data Colman et al. present provide stronger support for so-called Level-I reasoning than the authors acknowledge.

Keywords: game theory, social dilemmas, decision heuristics

Classic Game Theory (CGT) is a great intellectual achievement, which has stimulated theory and research in many disciplines (von Neumann & Morgenstern, 1944). Yet, many social scientists are troubled by the theory’s failure to explain collective action. The assumptions of common knowledge and instrumental rationality cast a long shadow. In many collective games, where cooperation matters, CGT predicts tragedy worthy of Aischylos (Hardin, 1968).

Noting widespread cooperation (Kropotkin, 1902) and variation over individuals and contexts, behavioral scientists have struggled to articulate theories that fit these data. Andrew Colman and his collaborators are among those who have searched for a psychologically plausible game theory (Colman, 2003; see also Van Lange, Joireman, Parks, & Van Dijk, 2013). A single, dominant theory has not emerged. Perhaps people approach different strategic games with a toolbox of heuristics, each of which shortcuts the strict assumptions of CGT while yielding more socially (and personally) desirable results. This possibility suggests itself in the common-interest games, which Colman, Pulford, and Lawrence (this issue) address in their article.

In the High-Low (i.e., Hi-Lo) game, two players win a high payoff if they both choose strategy H, and both receive a low payoff if they both choose L. If they choose different strategies, neither gets anything. Colman et al. show that classic theory fails to predict behavior because it boasts three Nash equilibria (two pure and one mixed), but no way to choose among them.

How do ordinary people solve such a coordination problem? Colman et al. reject the principle of indifference because it leads to question begging. For player 1 to assume that player 2 throws darts without realizing that player 1 knows this would be to violate the common knowledge assumption. Yet, Colman et al. use assumptions of CGT to refute an alternative theory, a point worth remembering.

The next alternative is social projection theory, which predicts that a player in the Hi-Lo game will choose H, assuming that the other player will probably come to the same decision (Krueger, DiDonato, & Freestone, 2012). No inferences about other players’ thought processes are necessary. Colman et al. raise two objections. First, they note that projection works only inasmuch as players are ignorant of each other’s motives, intention, or preferences. Usually people do have some knowledge about others, which dilutes any contribution their own
choice might make when predicting the choice of another. The same argument was brought against Dawes’s (1989) reformulation of the “false consensus effect” in rational Bayesian terms. Empirical work has since shown that self-related information dominates (in part because there is more of it; Krueger & Clement, 1994), but also that projection decreases when more other-related information becomes available (Robbins & Krueger, 2005). In experimental games, the players’ mutual anonymity is often stressed, which creates the condition under which projection works best.

Second, Colman et al. question whether projection theory can be applied to contemplated choice. The theory assumes that before making a decision, players consider the inferential implications of each strategy. If they play H, they will have to rationally assume that most others also choose H; if they play L, they must infer that most others also choose L. In the absence of any countervailing reason, why would they then not choose H? Colman et al. argue (without proof) that contemplated choice has less inductive power than actual choice. However, the Bayesian calculus knows no difference between contemplation and action. The resistance to the statistical equivalence of contemplated and actual choice probably stems from a metaphysical commitment to free will (Krueger et al., 2012). Players are supposed to make their choices freely and independently. That is true enough, but because they are cut from the same biological and cultural cloth and because they are facing the same task, two randomly picked players will more likely agree than disagree. Social projection theory exploits this brute fact.

Colman et al. then discuss three other approaches. The first is cognitive hierarchy theory. Here, “Level-1” players are of particular interest: they assume that other players choose randomly (throw darts), which allows them, the Level-1 players, to choose a payoff-maximizing strategy. This works in the Hi-Lo game but fails to predict the high levels of cooperation seen in assurance games and prisoner’s dilemmas. Colman et al. are also concerned about the asymmetries that arise when most players believe they are deeper thinkers than others. A final problem is that player 1’s assumption that player 2 chooses randomly is the same that Colman et al. already rejected when discussing the principle of indifference. If the common-knowledge axiom is used to exclude one alternative to game theory, why not use it to exclude another? If one agrees, however, that players choose strategies heuristically, the assumption of common knowledge need not trouble any explanatory effort.

The second contender is the theory of team reasoning. Its key idea is that individuals reason on behalf of the group, asking what they can do to maximize the collective payoff. In the Hi-Lo game, a team reasoner finds that choosing strategy H is necessary, though not sufficient, to realize the Hi-Hi payoff. There are three problems. One is that the assumption that a player’s own contribution is necessary for collective success breaks down in large-N public-goods games or problems of collective action, such as voting. In large-N games, one would have to add an assumption of positive social identity or the idea that people feel good about being part of a successful collective even if their own contribution is negligible (Tajfel & Turner, 1979). Social projection theory does not require this additional assumption (Acevedo & Krueger, 2004).

Another problem is that the theory of team reasoning itself concedes that it will work only if there is “a belief that the other player(s) will do likewise” (p. 42). Although Colman et al. note that “this should be distinguished from social projection theory” (p. 42), they do not say how. They offer that team reasoning assumes a parameter omega to represent “the probability that a player will adopt the team-reasoning mode” (p. 42). Social projection theory uses such a parameter as well, provides a theoretical rationale for it, and guides its empirical measurement. The final problem is that in some games, self-interest and collective interest are identical. In the Hi-Lo game, a methodological individualist simply asks, “What do I want, and what is necessary for me to do to achieve it?”

Finally, Colman et al. introduce strong Stackelberg reasoning. Stackelberg retains the game theoretic axioms of common knowledge and individual rationality, but adds that players act as if their choices were obvious to others. To say that player 1’s intentions are transparent to player 2 implies the inverse. One might say that player 1 knows what player 2 will do and chooses the best reply. This raises the question of how any player knows what another player will do. Colman et al. assert that players are not
omniscient but that they “choose strategies as if they believed that their coplayers could anticipate their choices” (p. 43). In the Hi-Lo game, player 1 chooses H, as if believing that player 2 knows that he would choose H, and that player 2 therefore chooses H. Each player’s choice is the best reply to the other’s best reply to one’s own. . .—it does look circular. Stackelberg reasoning has players expect each other to choose as they themselves do. Social projection theory arrives at the same conclusion but describes how players arrive at probabilistic predictions. Yet, in games that are not payoff-dominant, theoretical predictions diverge. Like CGT, Stackelberg reasoning predicts mutual defection in the prisoner’s dilemma, whereas projection correctly predicts widespread cooperation.

If cognitive hierarchy theory, team reasoning, and Stackelberg reasoning are potential solutions to game-theoretic challenges, one needs to know which type of reasoning captures the intuitions and ruminations of ordinary people. In two experiments, Colman et al. turn to asymmetric games, carefully designed to pit the three theories against one another. Social projection, having been critically reviewed in the introduction, is no longer in the mix. It has nothing to offer in asymmetric games. The data suggest that Level-1 reasoning is the clear winner. Table 1 (p. 48) shows that Level-1 reasoning predicts the results in 9 of 12 cases. The binomial probability of this result, or a more extreme outcome, is .004 (with \( p = 1/3 \) to score a hit in given game). Team reasoning and Stackelberg each make only 3 correct predictions (binomial \( p = .82 \) for this result or a better one). Although it appears that only Level-1 reasoning beat chance, verbal protocols suggested that some players reasoned for the team or like Stackelberg.

To conclude, current work to find new ways to study social dilemmas and experimental games may benefit from the view that people make judgments and decisions by using heuristics (Hertwig, Hoffrage, & the ABC Research Group, 2013). Full rationality may neither be necessary nor desirable. Social projection and Level-1 reasoning hold promise for further development, whereas team and Stackelberg reasoning may also play a role once their boundary conditions are properly understood.

References


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