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Blind stealing: Experience and expertise in a mixed-strategy poker experiment ☆

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ABSTRACT

We explore the role of experience in mixed-strategy games by comparing, for a stylized version of Texas Hold-em, the behavior of experts, who have extensive experience playing poker online, to the behavior of novices. We find significant differences. The initial frequencies with which players bet and call are closer to equilibrium for experts than novices. And, while the betting and calling frequencies of both types of subjects exhibit too much heterogeneity to be consistent with equilibrium play, the frequencies of experts exhibit less heterogeneity. We find evidence that the style of online play transfers from the field to the lab.

1. Introduction

Game theory has revolutionized the field of economics over the last 60 years and has had a significant impact in biology, computer science, and political science as well. Yet there is conflicting evidence on whether the theory successfully predicts human behavior. For mixed-strategy games, i.e., games requiring that a decision maker be unpredictable, these doubts have emerged as a result of laboratory experiments using student subjects. In these experiments, the behavior of student subjects is largely *inconsistent* with von Neumann's minimax hypothesis and its generalization to mixed-strategy Nash equilibrium: students do not choose actions according to the equilibrium proportions and they exhibit serial correlation in their actions, rather than the serial independence predicted by theory.[2] On the other hand, evidence from professional sports contests suggests that the on-the-field behavior of professionals in situations requiring unpredictability does conform to the theory, e.g., see Walker and Wooders (2001) who study first serves in tennis and see Chiappori et al. (2002) and Palacios-Huerta (2003) who study penalty kicks in soccer.

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[2] See Fig. 1 of Erev and Roth (1998) for a discussion of 12 such experiments, and see Camerer (2003) for a survey of mixed-strategy experiments. See Brown and Rosenthal (1990) and Shachat (2002) for more on O'Neill (1987)'s classic experiment. See Wooders and Shachat (2001) for the theoretical analysis of repeated win-loss games.

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This evidence suggests that behavior is consistent with game theory in settings where the financial stakes are large and, perhaps more important, where the players have devoted their lives to becoming experts, while behavior is less likely to be consistent with theory when the subjects are novices in the strategic situation at hand. The present paper explores the role of experience in mixed-strategy games by comparing the behavior of novice poker players to the behavior of expert players who have extensive experience playing online poker, a setting where randomization is essential to good play.[3] We find that the behavior of experts is closer to equilibrium than the behavior of novices. Nevertheless, even our expert players exhibit significant departures from equilibrium.

Our experimental game is a stylized representation of "blind stealing," a strategic interaction that commonly arises in popular versions of poker such as Texas Hold'em. In order to maximize the saliency of the experience of the expert players, the game is endowed with a structure and context similar to an actual game of "heads up" (two player) Texas Hold'em. In the experimental game, just as in heads up Hold'em, the players alternate between one of two positions which differ in the size of the ante (known as the "blind") and who moves first. Employing the same language used in actual play, we labeled these positions as the "small blind" and the "big blind." The action labels also correspond to their real-world counterparts: The small blind position moves first, choosing whether to "bet" or "fold." Following a bet by the small blind, the big blind chooses whether to "call" or "fold."[4]

While the experimental game is a highly stylized version of Texas Hold'em, the game is sufficiently rich that the small blind has an incentive to bluff and thereby attempt to "steal" the blinds. In equilibrium, when holding a weak hand, the small blind mixes between betting or folding. He is said to have "stolen" the blinds when he bets with a weak hand and the big blind folds. Likewise, the big blind mixes between calling or folding when holding a weak hand and facing a bet.

We find that, in aggregate, both students and expert poker players bet too frequently relative to equilibrium, although poker players bet at a frequency closer to the equilibrium. Students also call too frequently, while the poker players call at the equilibrium rate. At the individual-player level, Nash (and minimax) play is rejected far too frequently to be consistent with equilibrium. However, Nash play is rejected less frequently for poker players than students, for both positions. Thus the behavior of experts is closer to equilibrium than the behavior of novices. The differences in play are statistically significant.

Novices and experts also differ in how their behavior changes over time. From the first half to the second half of the experiment, the equilibrium mixtures of novices move (in aggregate) closer to equilibrium for both the small and the big blind positions. By contrast, although the mixtures of the experts are slightly closer to the equilibrium mixtures in the second half, the change between halves is not statistically significant. Thus the closer conformity of the experts to equilibrium is a consequence of a difference in initial play. Indeed, considering only the second half of the experiment, one cannot reject that novices and experts mix at the same rate, although students do exhibit more heterogeneity in their choice frequencies. This suggests that the behavior of novices, who have limited or no experience in the field, approaches the behavior of experts, once novices obtain sufficient experience with the (simple) experimental game.

A unique feature of our study is that we obtain the "hand histories" of the online play (e.g., at Poker Stars, Full Tilt Poker, etc.) for some of our expert players. Hand histories are text files that show a complete record of the cards a player receives, the actions he takes, and the actions he observes of his opponents, once he joins a game. A player may choose to have this data automatically downloaded onto his computer as he plays. Using the hand history data, we compare the subjects' behavior in our game to their online behavior. We find that the playing style of experts is correlated between the field and the lab: players who are aggressive online (i.e., they bet with a high frequency) are also aggressive in our experimental game. Hence, when the context is similar, the style of play transfers from one setting to another.

Related literature

Recent experimental work has highlighted the importance of field experience on behavior in markets and games.[5] For mixed-strategy games, Palacios-Huerta and Volij (2008) argue that Spanish professional soccer players exactly follow minimax in O'Neill's (1987) classic mixed-strategy game when in the laboratory, and very nearly follow minimax in a 2×2 "penalty kick" game they develop. This is evidence, so they argue, that experience with mixed-strategy equilibrium play on the field (e.g., Palacios-Huerta, 2003) transfers to the play of abstract normal form mixed-strategy games in the laboratory. In other words, subjects who play mixed-strategy equilibrium in one setting will play it in another.

This finding has been challenged from two directions. Levitt et al. (2010) are unable to replicate it, using either professional American soccer players or professional poker players, two groups of subjects that are experts in settings requiring randomization. They report that "…professional poker players play no closer to minimax than students …and far from minimax predictions." The aggregate choice frequencies of soccer players deviate *more* from minimax in the O'Neill game

[3] According to David Sklansky, a winner of three World Series of Poker bracelets, "…a person who bluffs with approximately the right frequency – and also, of course, in a random way – is a much better poker player and will win much more money in the long run than a person who virtually never bluffs or a person who bluffs too much." See Sklansky (2007).

[4] Rapoport et al. (1997) employ students, who were not selected for experience playing poker, to test the minimax hypothesis in a simplified poker game in which only the first player to move has private information. Unlike in the present paper, their experiment is largely framed in an abstract context.

[5] See, for example, Alevy et al. (2007), List (2003), Levitt et al. (2011), and Garratt et al. (2012). Fréchette (forthcoming) provides a nice survey of experiments that compare the behavior of students and professionals. Camerer (2011) argues that the evidence supports the conclusion that behavioral regularities found in the lab generalize to the field.