

Kids vs. Adults: Minimax Play in the Lab and Field

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Extended Abstract

Acting in an unpredictable manner on the one hand and trying to guess out another person's behavior on the other hand can be a quite valuable ability already in early childhood. Take the children's game of rock-paper-scissors. Paper covers rock, rock destroys scissors and scissors cut paper. Children have been using this game for ages as a tool for decision-making (Fisher 2008). If this game is translated in a game-theoretic setting rational players would start mixing in a Nash equilibrium, playing each strategy with equal probability. Or take another game popular among children: hide & seek. Let there be two locations where the hider can hide and hence two places where the seeker can seek. If the seeker looks in the wrong place the hider wins. If the seeker looks in the right place the seeker wins. Again, if one wants to translate this in a game-theoretic setting, assuming the same as above, one calls the game a 'constant-sum game' and in Nash equilibrium in mixed strategies each player plays each strategy with equal probability (there is no equilibrium in pure strategies). Translating this back, however, to the children setting is not as straightforward as one might have wished. In a one-shot game it is not clear what a mixed strategy really is. When playing this game repeatedly it might still be controversial how a mixed strategy in game theory translates to behavior of players in a real game with material payoffs. This has been a hotly debated issue in the literature and some major comments on that are reviewed later on. One way out of this trap is to look at games of this sort from an evolutionary game theory perspective. Since rock-paper-scissors and hide & seek typically have a repeated character it will be fascinating to see whether evolutionary dynamics are present when young children repeatedly play such games.

Some researchers have tested for mixed strategies in the lab and in the field with the common result that human adults are incapable of playing these (for an overview see the chapter on mixed strategy equilibrium in Camerer (2003)). One prominent exception (also exhibiting the hide a seek character) has been the study of Walker and Wooders (2001) about minimax-play among professional tennis players at Wimbledon. Walker and Wooders were

able to show that these highly trained professionals are indeed able to pretend a randomized behavior. But, as mentioned before, this is one among a few rare exceptions where mixed strategy play has been found in the lab or the field (see also Chiappori et al. 2002, Palacios-Huerta 2003).

For children evidence on mixed strategy play has been rare if not inexistent. But according to Camerer (2003, p.66) “the youngest children (...) are *closer* to the self-interest prediction of game theory than virtually any adult population! This is a huge hint that experience does *not* teach people to behave like payoff-maximizing game-theorists, as is often presumed. If anything, the opposite seems to be true.” And later on he argues based on a finding by Ross and Levy (1958) that children do not tend to alternate outcomes as often as adults when asked to generate a random series that hence “(...) [the] evidence from children is important because it implies that misrandomization is *not* a mistake that is easily erased by learning. Quite the opposite: It is a mistake that is *caused* as developing minds acquire the erroneous intuition that small samples should all have the properties of large ones” (Camerer 2003 p. 134-135). We test whether this observation is also true for the behavior of children in a game with only one equilibrium in mixed strategies.

In some recent experiments, children under the age of 7 have been shown to lack the strategic skills to perform successfully in strategic settings but it has also been found that there is some development as children grow older (e. g. Brosig-Koch et al. 2012, Sher et al. 2014, Czermak et al. 2010). None of these studies, however, had a focus on dynamics when children played in such strategic settings. For adults, there have been numerous studies investigating repeated play and the associated dynamics (e.g. O’Neill 1987, Brown and Rosenthal 1990, Rapoport and Boebel 1992, Mookherjee and Sopher 1997, Ochs 1995, Binmore et al. 2001) but it remains an open question whether these findings also apply for children.

We therefore conducted an experiment with 288 children aged 3 to 6 years in five kindergartens in Tyrol and 90 students in Innsbruck (Austria). If children would show a similar performance as adults in the dynamics of such a constant-sum game this would change our view on children’s ability to play strategic games. We find that children’s behavior shows more serial correlation than adults and they more often switch their strategies independent of the success rate. Our results rather suggest that even though humans usually never get very good at behaving in an unpredictable way they certainly get better in that from childhood to adulthood.