Housemate game

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Abstract

In this paper we examine the different possible strategies when playing a type of extended chicken game, which involves both sides choosing when they are going to yield. I predict that it will be difficult to find a strategy which will consistently be more effective than backing down at the first chance possible. This assumption relays on similar papers on the difficulty of finding a “best strategy” for iterated PD and SD games. (Reference here). Experimental results show that under some conditions such a strategy is found, but its effectiveness isn’t much greater than that of the naïve strategy.

Introduction

The housemate game is a two player simultaneous game based on similar games such as the game of chicken or the snowdrift game. In the traditional version of the game, both players decide simultaneously between being a cooperating and defecting (see payoff table in figure X). The principle of the game is that while it is to both players’ benefit if one player yields, the other player's optimal choice depends on what his opponent is doing: if his opponent yields, the player should not, but if the opponent fails to yield, the player should. There are a lot of papers on possible strategies for iterated versions of these kind of games (see references) but in this paper we try to take a look at one version in which players don’t choose if to defect, but when.

In our version of the game, instead of choosing between two options, each player chooses an integer which represents how long he\she is willing to wait before completing a given communal task – when to yield. The payoff for the completion of this task decays as time passes. The amount by which the value decreases is given as a decay constant and is calculated as such:

Where the “Time” variable is the smaller of the two integers chosen by the players. Choosing the smaller integers means yielding first, and therefor having to pay a “Tax”, a deduction of a fixed amount of points. This deduction represents the effort involved in completing the task (see payoff figure XX).

The main purpose of this paper is to explore how the introduction of time into the game influenced it, find how human players approach it, and find a viable strategy which is consistently better than the naïve one.

In order to preform experiments, I built a web application that allows players to play the iterated version of the new format. The application allowed me to find the general patterns of play found among most human players, gather data on their effectiveness and test AI agents that implemented different strategies. Results showed that most human players’ strategies could be generalized into a few broad categories –

* Conservative players who prefer to stay on the safe side and pick very small integers, even when the decay factor is small in comparison with the tax.
* Greedy players who preferred to choose integers very close to the highest possible one (without risking negative payoff), even when the decay factor is large in comparison with the tax.
* Players who attempted the “tit-for-tat” strategy.
* Players who attempted to “one-up” their competitor in each following round.

Application & game rules.

To explore this version of the game I built a web application using oTree, a software platform for economics experiments (see link). That allowed players to play the game with the new rules and allows automated agents to compete against one another. Players would receive a link which would match them with an opponent and shown a screen with instructions and a blank box to enter an integer. Players would play each opponent for 5 rounds, with the current round number and total round numbers appearing promptly on the top of the page (see figure A). After entering their choice they would go into a waiting screen until their opponent made his choice and then returned to the previous screen with an updated round number and a table indicating what were both players’ choices and their payoff for the round (figure B). After all five rounds were concluded each player got a new link assigning him to a new opponent.

Experimental design and procedures

The experiment was conducted at the computer lab of BGU. The study group consisted of six men and two women, all around the ages of 25-35. All participants were given a computer and assigned an unknown opponent. During the experiment participants were asked to refrain from talking to each other, as to avoid comparing strategies. After the first five minutes of starting the game new links were sent to all participants so they could be matched to a new opponent. This procedure was repeated after an additional five minutes. After all the results were analyzed and a basic understanding of player types was formed, these types were implemented as basic AI agents. In addition to those based on observed strategies two additional agents were created

* A semi random agent who each round ran a loop which started chose an integer at random, with a higher chance of choosing integers within a certain range.
* An agent who was an improvement of the “one-upper”. It would decide between on upping the opponents last picked integer or choosing 0, whichever would produce the higher payoff assuming the opponent would pick the same integer this round.