The Use of Robotic Players in Online Games

Jon Guest, Matthew Olczak and Robert Riegler
Aston Business School

DEE September 2021

In-class games

- Evidence short in-class games/experiments can have a positive impact on student learning
- Carter and Emerson (2012) no significant difference paper v online
- Guest (2015) highlights social interaction.

Online asynchronous delivery

-> students can’t play interactive games against one another.

- An alternative is to run games in which students play against robotic players that make decisions according some pre-programmed rules.
  - E.g. Prisoners’ dilemma game in

MobLab

AIM: Investigate how student perceptions and behaviour change when robotic players are used in games.

Related literature

- Prisoners' dilemma games:
  - **Framing** e.g. Ross & Ward (1996) – community game -> more cooperation than Wall Street game
  - **Characteristics –** do gender, risk preference, patience, a strategic mindset & other personality traits affect behaviour? (e.g. Davis et al. 2016).
- Ultimatum/dictator and public good games:
  - Anonymity/social distance -> more selfish behaviour (e.g. Hoffman et al. 1994 and Berrens et al. 2004)
  - Fairness – accept smaller offers if come from a robot (Blout, 1995).
- Economics students may be/become more **self-interested/greedy** (Frank et al. 1993, Wang et al. 2011 and Lanteri, 2012).
- Also some interesting papers from an AI perspective using investment games (Wu et al., 2016 and Zanatto et al., 2019)
  - These focus on human-robot interactions rather than comparisons with human-human interactions.

Design

- 4 online webinars – circa 45-70 students in each
  - ran standard prisoners' dilemma game against same opponent for 8 rounds

- 4 treatments:
  i) KNOW HUMAN
  ii) KNOW ROBOT
  iii) BELIEVE ROBOT, ACTUALLY HUMAN
  iv) BELIEVE HUMAN, ACTUALLY ROBOT

- Used ClassEx to programme the robot to cooperate with prob 0.51

Pre game questionnaire

- Gender
- Age
- Home or overseas student
- Studied econ before
- Course

- On a scale of 1-7 where 1=Strongly disagree …… and 7=Strongly agree:

Do you agree that greed is bad/immoral/incorrect?

Post game questionnaire

- Asked the greed question AGAIN

- Plus:
  - Do you agree that the game was fun to play?
  - Do you agree that the game will help you to understand economic theories?
  - Do you agree that the game represents real-world situations?

Post game reactions

Variable	N	Mean
Fun	205	4.95
Theory	203	4.92
Real	203	4.91

+ no significant differences across treatments

Greed

Variable	Treatment	N	Mean
Pre greed	All	204	4.84
Post greed	All	204	4.76

After the game -> mildly more favorable to greed
BUT not significantly so

Greed – by treatment

Variable	Treatment	N	Mean
Pre greed	Human	46	4.65
Post greed	Human	46	4.80
Pre greed	**Robot**	**42**	**5.07 ****
Post greed	**Robot**	**42**	**4.69 ****
Pre greed	Think robot	49	4.78
Post greed	Think robot	49	4.65
Pre greed	Think human	67	4.88
Post greed	Think human	67	4.87

After the game -> more favorable to greed when knowingly playing against a robot

Joint cooperation

	Prop of rounds in which both players cooperated
All	18%
Human	35%
Robot	12%
Think robot	10%
Think human	19%

-> joint cooperation is most likely when know your opponent is another student

AND perception of your opponent seems to contribute to a fall in cooperation.

Probability both choose cooperate

Variable	Coefficient
Constant	-0.0713
Male	-0.229**
Home	-0.438
Econ	0.461***
Econ before	-0.241***
Round	-0.0731***
Robot	**0.0458**
Log likelihood	-542.549
Pseudo R^2	0.0337
N	1202

Probability both choose cooperate

Variable	Coefficient
Constant	0.0349
Male	-0.265***
Home	-0.553**
Econ	0.461***
Econ before	-0.206**
Round	-0.0736***
Robot	0.163
Robot AND know this	**-0.308*** **
Log likelihood	-538.801
Pseudo R^2	0.0404
N	1202

-> evidence perception about your opponent affects strategic decision making

Probability play cooperate in *t* having established joint cooperation in *t-1*

Variable	Coefficient
Constant	0.508
Male	-0.0634
Home	-0.131
Econ	0.534***
Econ before	-0.131
Round	0.00347
Robot	0.209
Robot AND know this	**-1.194*** **
Log likelihood	-144.234
Pseudo R^2	0.1037
N	257

-> more likely to deviate from cooperation when know opponent is a robot

Conclusions

- Evidence that knowingly playing against a robot can affect:

    1. strategic decision making
    2. learning outcomes.

- This suggests care in relying on asynchronous games with robot players.

- Potential for future work on more complex robot strategies
    - can these be used to shape the learning outcomes?