## Research Question

1. Reputation on fostering collaboration amongst decision makers: recreating the results and programs developed by Santos, Santos, Pacheco in their paper *Social Norms of Cooperation in Small-Scale Societies*.
2. Effect of constrained communication in collaboration of decision makers utilising reputation.

Should be a 2-3 page project description to your supervisor. This should provide a brief description of the research project including motivation, aims, intended outcomes, proposed research methodology and an indicative timeline

## Motivation

In order to understand our behaviour and our willingness and ability to cooperate with those around us in both small and large populations, it is vital that we can create detailed and accurate simulations based on proven mathematical models which explain and model how random populations reach states with a high rate of cooperation. The area of indirect reciprocity using reputation in prisoner’s dilemma games played between individuals in a larger population has been the focus of recent research in game theory. A number of papers have been published exploring the effect of strategies based on reputation in the prisoner’s dilemma game and a detailed look at those which foster cooperation in small populations. The main research paper on which this project will be based is “Social Norms of Cooperation in Small-Scale Societies” by Santos, Santos, and Pacheco.

Despite the detailed look into fostering cooperation in small populations, there has been little research done looking into the effect of constrained communication between agents in a population playing the prisoner’s dilemma game. Research has been done in introducing a propagation delay for information regarding reputation among a population playing the ‘trust game’ involving an investor and a trustee which maintains some resemblance to the prisoner’s dilemma game (Manapat, M. L., 2012). However one aspect of the information propagation delay not explored was the possibility of information mutation, or the interpretation error associated with information exchange. In the model produced by Santos et al. the assumption is made that information is known instantly and globally after any single interaction and the conclusions made in the paper should align well with a small population in which information propagation delay and information propagation error is implemented. It is as the population size increases that information propagation delay and error should show a larger difference in findings.

In the example of online auction marketplaces such as *eBay* where the reputation of each individual user is shown to all globally and instantly, a model without information propagation delay and error should provide an accurate method of understanding the behaviour in such a society. However in the case of person-to-person interactions in a population subject to information error and propagation delays as the population size increases, the accuracy of a model omitting these characteristics may come in to question.

## Aims

The primary aim of this project is to recreate the findings of Santos, Santos, and Pacheco which will allow further exploration into more detailed models of the prisoner’s dilemma game within populations. The paper outlines simulation parameters based on equations to model the process in which the prisoner’s dilemma game is played over time in a population. The simulation itself however is a simple probability based computer program operating on the defined population and each agent’s characteristics.

## Intended Outcomes

The goal of this project is to write a program utilising a number of equations detailed in Santos et al. to model a prisoner’s dilemma game in a population.

## Proposed Research Methodology

The application to be developed in this project will be created in the Python programming language to allow for ease of prototype development. The majority of the work however lies in translating the equations used to model individual process dynamics into feasible iterative processes that can be executed in the program.

## Timeline

The expected progression of the project should be as follows:

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Week:  Phase: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Initial Meeting | - | - |  |  |  |  |  |  |  |  |  |  |  |
| Review of Literature | - | - |  |  |  |  |  |  |  |  |  |  |  |
| Writing Proposal | - | - |  |  |  |  |  |  |  |  |  |  |  |
| \*\*\* Development of models and resources for outcome | - | - |  |  |  |  |  |  |  |  |  |  |  |
|  | - | - |  |  |  |  |  |  |  |  |  |  |  |
| Project Presentation | - | - |  |  |  |  |  |  |  |  |  |  |  |
| Final Report | - | - |  |  |  |  |  |  |  |  |  |  |  |

## Bibliography

Manapat, M. L. (2012) *Delayed and Inconsistent Information and the Evolution of Trust*. (Accessed 12/08/2016), <http://link.springer.com/article/10.1007/s13235-012-0055-6>

Santos, Santos, Pacheco (2016) *Social Norms of Cooperation in Small-Scale Societies*,