

The Research Group  
Artificial Intelligence Lab

has the honor to invite you to the public defence of the PhD thesis of

## Eladio Montero-Porras

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:

**Analysing Strategies and Decision-Making Processes in  
Social Dilemmas: Insights from Social Preferences**

Promotors:

Prof. dr. Tom Lenaerts (VUB)  
Dr. Jelena Grujic (DataMinded)

The defence will take place on

**Monday, September 16, 2024 at  
4:30 pm in auditorium I.0.01**

The defence can also be followed  
through a live stream: [click here to join](#).

**Members of the jury**

Prof. dr. Ann Nowé (VUB, chair)  
Prof. dr. Beat Signer (VUB, secretary)  
Prof. dr. Pieter Libin (VUB)  
Prof. dr. Annelien Smets (VUB)  
Prof. dr. The Anh Han (Teesside University,  
UK)  
Prof. dr. Andreia Sofia Teixeira  
(Northeastern University London, UK)

**Curriculum vitae**

I was born in San Ramón, Alajuela, Costa Rica. I am currently a Researcher at the Vrije Universiteit Brussel's Artificial Intelligence Laboratory, where I have been working under the direction of Professor Tom Lenaerts and Dr. Jelena Grujić. I have been studying the processes of human decision-making using experimental game theory and machine learning methods. Specifically, my work focuses on studying the heterogeneity of behaviour in social problems, and how humans share resources with each other and intelligent systems to optimize the outcome of decision-making in complex situations. I also like to try new food, music shows and coffee.

**Abstract of the PhD research**

Researchers across various fields study human cooperation in social dilemmas, where acting selfishly is enticing, but harms collective outcomes. Understanding how cooperation arises becomes crucial in managing natural resources, fighting pandemics or avoiding other catastrophes that require collective coordination.

This thesis explores cooperation, emphasising that the variability in individuals' preferences, and expectations shape the outcomes of social dilemmas. Previous work has provided theoretical answers to these questions through modelling and behavioural experiments; but the relationship between individuals' expectations, their context and their decision-making processes is far from fully explored, in this thesis we join theoretical and experimental approaches to improve the understanding of the strategies used and consequently the emergence of cooperation.

The first part shows that context and social preferences significantly influence strategies, reflecting the complexity of aligning individual profit with collective benefits. In this part, we propose a methodology to infer strategies in the Iterated Prisoner's Dilemma, a widely used game to understand how cooperation arises where it is best to act selfishly. Our work reveals how participants adapt and stabilise their strategies in this game over time. The methodology categorises participants by the context they experience in the game, revealing that strategy adaptation is influenced by the type of partner interactions. Moreover, we investigate reaction times and visualise participants' deliberation and intuitive processes in three settings of the Iterated Prisoner's Dilemma. We found that individuals who reciprocate their opponents' actions collect evidence slower than those making categorical decisions.

The second part builds on these insights from the Common Pool Resource dilemma experiment which simulates the extraction of a common resource, where participants must coordinate to consume the resource sustainably. We designed an experiment where participants were confronted with different default values, a socially optimal, a strongly selfish, or no default extraction value. Defaults are known to be effective at influencing behaviour in and out of the laboratory, as they often can serve as shortcuts for cognitive decision-making. The default value presented significantly impacted participants' extraction behaviours, especially when aligning against their inherent inclinations. This reveals the potential of defaults as nudges for sustainable resource management.

Overall, the thesis provides a comprehensive analysis of decision-making processes in strategic settings, offering new insights into the mechanisms of cooperation and the factors influencing individual and collective choices.