ACTISS
ACTION FOR COMPUTATIONAL THINKING
IN SOCIAL SCIENCES

ACTISS PROGRAMME CURRICULUM

ACTISS PROGRAMME

Action for Computational Thinking in Social Sciences
COURSE PROGRAMME

CURRICULUM

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ACTION FOR COMPUTATIONAL THINKING
IN SOCIAL SCIENCES
Project number: 2018-1-PL01-KA203-050951
Warsaw/Groningen/Berlin 2021

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Preface

This document provides an overview of a MOOC programme on social computation at an introductory level, created by an international team of ACTISS project. The programme is addressed especially to learners of social sciences (mostly bachelor level) who often experience high levels of anxiety when it comes to mathematics, computers and formal modeling and have no working knowledge of advanced algebra, mathematical analysis, programming etc, but it is open for a larger audience.

The programme consists of a series of short introductory courses that will give them an opportunity to *peek over this fence* built of fears, stereotypes and lack of practice. These courses help the learners experience that computational approach to social sciences is, first, worthwhile, as it provides a new angle to look at societal phenomena and second, accessible, if only approached from the story side rather than from the mathematical formulas side.

We hope this will encourage the learners to engage in more demanding courses or, at minimum, approach the computational social sciences with a better general understanding.

Agata Komendant-Brodowska, *project leader*
&
the educational team: Anna Baczko-Dombi, Katarzyna Abramczuk and Wander Jager

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Below you can find some **practical information on where to find and how to use course materials - both for learners and teachers**.

In the second part of the document we present an **overview of five ACTISS courses**:
-->People, Networks and Neighbours: understanding social dynamics (main introductory course)
-->Social Network Analysis: The networks connecting people
-->Understanding Human Behaviour: Introduction to Game Theory and Shared Resources
-->Why do ghettos form in a tolerant society? Schelling's model and the introduction of cellular automata
-->Decision Making in a Complex World: Using Computer Simulations to Understand Human Behaviour

For each course (module) we present main information about the course (course at a glance), learning objectives, general description of the course and the course structure. For all Futurelearn courses we also attach a link to the course trailer that is available on the ACTISS YouTube channel.

At the end of the document we include **a recommended reading list and some additional resources**, especially for those interested in going further after completing the ACTISS programme. The list consists of two parts:

- Key literature and resources - existing papers, guidebooks, web resources etc. that a student at an introductory level will be able to understand without the knowledge of formal modeling techniques. The accessibility is crucial for these materials.
- Suggested further reading and resources - more advanced materials for the learners interested in exploring given topic (they can also include existing courses for more formally oriented audiences)

HOW TO USE COURSE MATERIALS?

If you want to learn:

- Check out more detailed information on courses, links and materials at actiss-edu.eu
- Look up the links to Futurelearn courses available at actiss-edu.eu and pick the one you're most interested in. Courses on Futurelearn will provide you with a more user-friendly learning experience than learning by yourself with the help of our materials (progress tracking, automatic feedback to the quizzes, email reminders about the start of subsequent weeks, ability to discuss exercises with other learners etc.).
- If you prefer to learn by yourself or the courses that are most interesting to you are not available at the moment, please download the course materials (a set of materials sorted by weeks) and go through the subsequent steps: articles, videos (links to all YouTube videos are provided in the text), exercises. All the links to videos and models to be experimented with are provided within the text. Correct answers to quizzes are provided at the end of each week's materials.

If you're a teacher:

- Check out more detailed information on ACTISS courses, links and materials, including NetLogo models at actiss-edu.eu
- Check out broader instructions for teachers that are provided in the Teacher's Guide, available for each course, at actiss-edu.eu
- We encourage you to use the materials to enrich your courses: you can download all the materials for the course and use them as a whole segment or pick the ones that best suit your needs. Educational materials are divided in weeks (units) and each week consists of a series of appr. 20 small steps:
    - short articles - max.1000 words, usually followed by a discussion prompt,
    - short videos - max. 6 minutes (links are included in the text),
    - discussion questions,
    - exercises (if they relate to models, links are included in the text),
    - quizzes (2-6 questions to check student understanding)
- Some steps may be used as a homework assignment (articles, videos, exercises), some can be used within a classroom setting (discussion questions, exercises, quizzes)

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- Educational materials are downloadable as a set of pdf files, each containing one week's materials and additional exercises and educational scenarios are provided in the Teacher's Guide for a certain course

DESCRIPTION OF ACTISS COURSES

Module 1 People, Networks and Neighbours: Understanding Social Dynamics

Click on the icon to join the course on:

Future Learn

COURSE AT A GLANCE

Course title	People, networks and neighbours: understanding social dynamics: Quick and easy introduction to computational social science
Number of weeks/units	3
Number of hours per week/unit	4
Total study time	12
Summary	**Learn why social processes seem so unpredictable and understand better the basics of social dynamics.** This course will help you understand why social processes seem so unpredictable and understand the basics of social dynamics better. It's designed to show you a new interesting way of approaching questions about social behaviour. Throughout, you'll focus on social mechanisms and will explore how models and simulations can help to understand those mechanisms.
Target learners	This course is designed for anyone who is interested in understanding human behaviour, especially in how different social processes work. It will be particularly useful for professionals dealing with situations where social change takes place (or is desirable) and where social influences play a role, such as in the context of public policy, business, marketing, and healthcare. If you are studying social sciences and are curious how a computational approach works, this course will be particularly helpful.

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	If you are an academic teacher (also when you've had no prior experience with this approach yet) and you're considering enriching your own courses, we encourage you both to take the course on Futurelearn, and to use the materials for your students.
Requirements / prerequisites for learners	None
Educator(s)	Agata Komendant-Brodowska, University of Warsaw Anna Baczko-Dombi, University of Warsaw with instructional design support from Tom Spits, University of Groningen and with the support of Educational team of ACTISS Project: Wander Jager, University of Groningen Katarzyna Abramczuk, University of Warsaw

COURSE TRAILER

Click on video to view the trailer

LEARNING OBJECTIVES

At the end of the course learners should be able to:

- explain how behaviour of individuals can lead to unexpected results on a group or societal level
- describe a new way of looking at social phenomena, focussing on underlying mechanisms
- discuss how models can help decipher social processes
- argue how similar social processes are present across different contexts
- describe how modelling works, both with a simple pen-and-paper model and computer simulation of a social mechanism
- identify the opportunities that computational models offer for understanding social processes

COURSE DESCRIPTION

In all courses within the ACTISS programme we want to provide people who identify as having 'no brain for science' (a fear for computation and formulas) with a very gentle introduction to Computational Social Science, to pen-and-paper formal models and to Agent-Based Models. We want to build up interest in this domain and their confidence in this area. By the end of the course we want the learners to be able to experience how modelling and simulations can help understand social phenomena and to experience how investigating a social phenomenon with the use of an Agent-Based Model works. We also want them to be aware of the potential benefits of using a computational approach to practical situations and be willing to try them out.

In this course we want the learners to discover a new way of looking at social phenomena. We will explore how micro behaviours lead to macro outcomes and how unexpected things can happen on the way. So, we will be paying special attention to social dynamics. We will investigate some simple social processes (starting with a question of how people organise a small protest) with the help of simple models that illustrate how humans behave, how they influence each other and what unexpected outcomes may result from those behaviours. For that we will use examples, animations and simple tools - no mathematical and programming skills are required!

Throughout the course the learners will have an opportunity to:

- investigate pen and paper and computer models that illustrate social processes
- experiment with a simple simulation of a social mechanism
- explore unintended consequences of individual behaviour
- discover a new way of looking at social phenomena by focusing on social mechanisms that connect individual perspectives and the group/societal outcome
- experience how social simulations can help analyse problems
- identify common patterns of a social process within different domains
- recognise how computational models can help decipher a variety of social mechanisms
- summarise different possible uses of computational models for studying social phenomena

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A JOURNEY THROUGH THE COURSE

First, we will explore how micro behaviours lead to macro outcomes and how unexpected things can happen on the way and it will gives us an opportunity to explore:

- the complex nature of micro-to-macro link
- what is a formal model of social phenomenon
- how similar social mechanisms can be present across different contexts
- the butterfly effect (how small changes in initial conditions lead to big changes in final result)

Then we will move on to exploring how modelling works a bit further with an addition of introducing networks of social relations. The learners will:

- explore a simple pen-and-paper model of a process of social influence
- experience the importance of structural constraints of individual behaviour
- experience how small change can lead to a huge change or no change at all!
- observe dynamic processes and how growth is not always linear which will help us build up an intuition of non-linear dynamics

Finally, we move on from pen-and-paper to computational models. The learners will:

- play with an agent-based model (and learn what it is!)
- play with parameters (what is a parameter and what is its role in simulations)
- observe some real life applications of agent-based models and discuss how this approach can be useful, e.g. for designing public policies

COURSE STRUCTURE

Week 1: Recipe for revolution

This week introduces basic concepts of social dynamics, modelling and simulations. It introduces the concepts of: model, modelling and simulations. We start with asking the question about difficulties with predicting social behaviour and then we build a simple model of organising a protest (based on a simple threshold model).

Keywords: social dynamics, micro-macro problem, butterfly effect, model, modelling, simulation, computational social science, computational models

Week 2: Conformity, friends and networks

This week is about exploring how relations and networks impact social processes and it provides a quick glance at Social Network Analysis.

Keywords: social influence, social networks, social network analysis, computational social science, computational models

Week 3: Neighbours, flags and a bird's eye view

This week introduces spatial dimension to the models, we introduce the term Agent-Based Models and play with a simple simulation in NetLogo. We investigate how a protest may spread spatially with simple cellular automata (we don't use this term but it should be searchable by that term), show real-life examples of models and then wrap up all the course's activities.

Keywords: social dynamics, spatial models, neighbours, cellular automata, Agent-Based Models, ABM, NetLogo, social simulation, emergence, computational social science, computational models.

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Module 2 Understanding Human Behaviour: Introduction to Game Theory and Shared Resources

Click on the icon to join the course on:

Future Learn

COURSE AT A GLANCE

Course title	Understanding Human Behaviour: Introduction to Game Theory and Shared Resources
Number of weeks/units	4
Number of hours per week/unit	3
Total study time	12
Summary	Explore the issues humans face when sharing and cooperating, and use game theory, models, and simulations to identify solutions. This four-week course will help you explore why sharing goods or tasks is difficult. You'll enrich your understanding of the problems people have when they share and cooperate, and examine essential models that can support you in your future career in social sciences and beyond.
Target learners	This course is designed for anyone interested in understanding human behaviour, especially when sharing and cooperation are involved. It will be particularly useful for professionals dealing with challenges related to public goods, common resources, and cooperation. If you are studying social sciences and are curious how a computational approach works, this course will be particularly helpful.

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	If you are an academic teacher with no prior experience with this approach yet and you're considering enriching your own courses, we encourage you to take the course on Futurelearn, and use the materials for your students.
Requirements / prerequisites for learners	None
Educator(s)	Agata Komendant-Brodowska, University of Warsaw Wander Jager, University of Groningen Katarzyna Abramczuk, University of Warsaw Anna Baczko-Dombi, University of Warsaw with instructional design support from Tom Spits, University of Groningen and with the support of the Educational team of ACTISS Project.

COURSE TRAILER

Click on video to view the trailer

LEARNING OBJECTIVES

At the end of the course learners should be able to:

- Discuss the problem of conflict between individual and collective rationality using examples.
- Apply the basic concepts from game theory to explain some of the mechanisms leading to the ecological crisis and its potential solutions.
- Solve simple games using basic game theoretical tools.
- Experiment with a simple agent-based model by changing the properties of the existing components.
- Identify the opportunities computational models and simulations offer to help study complicated social processes.

- Evaluate possible solutions to problems related to public goods with the help of computational modelling.

COURSE DESCRIPTION

In all courses within the ACTISS programme we want to provide people who identify as having 'no brain for science' (a fear for computation and formulas) with a very gentle introduction to Computational Social Science, to pen-and-paper formal models and to Agent-Based Models. We want to build up interest in this domain and their confidence in this area. By the end of the course we want the learners to be able to experience how modelling and simulations can help understand social phenomena and to experience how investigating a social phenomenon with the use of an Agent-Based Model works. We also want them to be aware of the potential benefits of using a computational approach to practical situations and be willing to try them out.

In this course you will:

-> Expand your understanding of social sciences

This course will help you explore why sharing goods or tasks is difficult. You'll enrich your understanding of the problems people have when they share and cooperate, and examine essential models that can support you in your future career in social sciences and beyond.

-> Discover social solutions to help tackle different problems

You'll have a close-up look at situations when actions (that are rational from an individual point of view) lead to non-optimal social outcomes. Investigating the mechanisms that underlie the common action and public goods problems, you'll gain an insight into the behavioural dynamics affecting the ecological crisis we currently face. You'll also explore some social solutions to tackle such problems and reflect on the importance of strengthening social ties, norms, social control, sanctions, and institutions.

-> Understand how to use computational modelling to face challenges

You'll explore social computation and computational modelling as a useful methodology. With this knowledge, you'll systematically study the interactions between individual behaviour, group behaviour, and public goods.

-> Apply game theory and agent-based modelling (ABM) - without prior mathematical or programming skills

You'll apply the basic concepts from game theory to explain some of the mechanisms behind the overuse of natural resources. This will then help you explore some potential solutions going forward. Throughout the course, you will use examples, animations, and game-like tools, designed by the experts from University of Warsaw and University of Groningen – no mathematical and programming skills are required

COURSE STRUCTURE

Week 1: The challenges of cooperation

This week we will investigate why sharing goods and tasks might lead to problems and explore the conflict between individual and social rationality. This will also be an opportunity to introduce the basics of game theory

Keywords: common goods, public goods, game theory, game matrix, equilibrium, strategy, Prisoner's Dilemma, Pareto optimality

Week 2: Free riders and the Tragedy of the Commons

This week we will be investigating what happens when more people share goods and will discuss the problem of free riding. We will also try out a simple tool that helps analyse multi-person situations and get to know a famous story about farmers who share a grazing land, the Tragedy of the Commons.

Keywords: common goods, common-pool resources, public goods, multi-person games, free rider problem, Tragedy of the Commons

Week 3: Problems with renewable goods

This week introduces the problem of resource dynamics. We'll be investigating what happens when a community uses a renewable good (e.g. fish stock) and paying a closer attention to what happens in time. We'll be using a simple simulation to study what happens and what factors influence the process.

Keywords: common goods, common-pool resources, renewable resources, resource dynamics, social simulation, agent-based models.

Week 4: How to succeed in managing ecological resources

This week is more about solutions. We will investigate how people usually deal with problems related to sharing and cooperating. We will be discussing how social control mechanisms help us, humans, enforce and sustain cooperation, learn about Elinor Ostrom's research about

managing the commons and experiment with some solutions that fishermen might use to prevent damaging the fish stock.

Keywords: common goods, common-pool resources, renewable resources, social simulations, agent-based models, Elinor Ostrom, social control

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Module 3 Why do ghettos form in a tolerant society? Schelling's model and the introduction of cellular automata

COURSE AT A GLANCE

Course title	Why do ghettos form in a tolerant society? Schelling's model and the introduction of cellular automata
Number of weeks/units	2
Number of hours per week/unit	3-4
Total study time	7 hours; 12 hours with additional materials
Summary	In this course we would like to concentrate on spatial segregation and a question about an inevitability of ghettoisation. It will be a pretext for introducing spatial models, with special emphasis on cellular automata. We will start from Schelling's segregation model as a very intuitive example of spatial multiagent model. It will help learners get some intuitive grasp of such models and basic understanding of modelling spatial processes. It will also show what are the basic characteristics of such models. We will start by introducing some social phenomenons in which space is important. It' s happening with residential - or wider - spatial segregation. Then we will talk about one of the best known models - Thomas Schelling's model of spatial segregation and you will have a possibility to experiment a bit with it. In the second part of the materials we will look at the models in this group in more detail from the "technical and structural" point of view, you will learn what Cellular Automata is and what it has in common with forest fire and simulation of life. Then - at the end we will keep coming back to spatial segregation and we will see what the model approach can contribute to its understanding.
Target learners	This course is designed for anyone who is interested in understanding human behaviour, especially in how different social processes work. It will be particularly useful for professionals dealing with challenges related to urban studies, migration policy, local administration.

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	If you are studying social sciences and are curious how a computational approach works, this course will be particularly helpful. If you are an academic teacher (also when you've had no prior experience with this approach yet) and you're considering enriching your own courses, we encourage you to use the materials for your students.
Requirements / prerequisites for learners	None
Educator(s)	Anna Baczko-Dombi, University of Warsaw Educational expert: Esther Arrindell, University of Groningen In cooperation with: Agata Komendant-Brodowska (project leader), University of Warsaw, Nataliia Sokolovska, The Alexander von Humboldt Institute of Internet and Society Gabriela Grzelak, University of Warsaw
Additional information	This course is avaliable in website wersion only

LEARNING OBJECTIVES

At the end of the course learners should be able to:

- Understand a basic concept of spatial segregation
- Discuss the problem of inevitability of ghettoisation on the base of Thomas Schelling model
- Experiment with a simple spatial agent-based models by changing the properties of the existing components and propose possible expansion of the model
- Recall and understand the main terms associated Cellular Automata models and their benefits and limitations

COURSE DESCRIPTION

In all courses within the ACTISS programme we want to provide people who identify as having 'no brain for science' (a fear for computation and formulas) with a very gentle introduction to Computational Social Science, to pen-and-paper formal models and to Agent-Based Models. We want to build up interest in this domain and their confidence in this area. By the end of the course we want the learners to be able to experience how modelling and simulations can help understand social phenomena and to experience how investigating a social phenomenon with the use of an Agent-Based Model works. We also want them to be aware of the potential benefits of using a computational approach to practical situations and be willing to try them out.

In this course we start from the problem of spatial segregation with its specific mechanisms is a fascinating example of a macroscale social phenomena which is not only a simple sum of individual actions - if we compare it with answers for survey questions about level of tolerance (which base on individual declarations), they cannot be translated in an easy way into results on maps. It shows that there is a need for a tool which could help us understand the underlying mechanisms of spatial segregation. Then agent based models that focus on dynamics of agents in a certain physical space - called spatial models, namely cellular automata - are introduced. We are starting from Thomas Schelling's segregation model, then - in week two - more examples of cellular automata - game of life, forest fire. Learners are also trying to translate one model into another and bring models closer to reality. At the end we came back to Schelling's model, and advantages associated with dynamic approach to spatial segregation topic. For all of that we will use examples, animations and simple tools - no mathematical and programming skills are required!

A JOURNEY THROUGH THE COURSE

- In this module we would like to concentrate on a question about an inevitability of ghettoisation. It will be a pretext for introducing spatial models, with special emphasis on cellular automata. We will start from Schelling's segregation model as a very intuitive example of spatial multiagent model. It will help learners get some intuitive grasp of such models and basic understanding of modelling spatial processes. It will also show what are the basic characteristics of such models. It is also a case of a model that is worth studying even in its simplest version (the only characteristics of the agents are their "colour" and the

level of tolerance and we have a simple definition of neighbourhood) as it makes the learners see the unobvious consequences of individual choices at the level of the population. That could also be easily translated into language of real life consequences ("Imagine, that you live in this segregated neighbourhood, does your child have a chance to play with children from another group of agents?") which could involve learners emotionally.

- This introduction will serve as a starting ground for more systematic introduction to spatial models (cellular automata). It will be presented and trained on popular and uncomplicated models (eg. LIFE - populations and resources; forest fire, evacuation models) with well documented potential of adding new elements. On the basis of these models we will show that the same conceptual apparatus allows modeling of seemingly different phenomena.
- Then learners could come back to the topic of spatial segregation and learn about more applications of cellular automata based models used for analysing different issues (forest fire, gossip)

COURSE STRUCTURE

Week 1: Spatial segregation and Schelling's model

We will start by introducing some social phenomenons in which space is important. It' s happening with residential - or wider - spatial segregation. Then we will talk about one of the best known models - Thomas Schelling's model of spatial segregation and you will have a possibility to experiment a bit with it.

Keywords: Schelling's segregation model, neighbourhood, rules of change the state, dynamics, iteration, census data, segregations maps

Week 2: Cellular automata

In the second part of the materials we will look at the models in this group in more detail from the "technical and structural" point of view, you will learn what Cellular Automata is and what it has in common with forest fire and simulation of life. Then - at the end we will keep coming back to spatial segregation and we will see what the model approach can contribute to its understanding.

Keywords: Cellular Automata, cells, iteration, grid, borders of grid, attributes of an agent, Game of life, forest fire, neighbourhood

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Module 4 Social Network Analysis: The Networks Connecting People

Click on the icon to join the course on:

Future Learn

COURSE AT A GLANCE

Course title	Understanding Human Behaviour: Introduction to Game Theory and Shared Resources
Number of weeks/units	4
Number of hours per week/unit	3
Total study time	12
Summary	Explore the issues humans face when sharing and cooperating, and use game theory, models, and simulations to identify solutions. This four-week course will help you explore why sharing goods or tasks is difficult. You'll enrich your understanding of the problems people have when they share and cooperate, and examine essential models that can support you in your future career in social sciences and beyond.
Target learners	This course is designed for anyone interested in understanding human behaviour, especially when sharing and cooperation are involved. It will be particularly useful for professionals dealing with challenges related to public goods, common resources, and cooperation. If you are studying social sciences and are curious how a computational approach works, this course will be particularly helpful. If you are an academic teacher with no prior experience with this approach yet and you're considering enriching your own courses, we encourage you to take the course on Futurelearn, and use the materials for your students.
Requirements /	None

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prerequisites for learners	
Educator(s)	Agata Komendant-Brodowska, University of Warsaw Wander Jager, University of Groningen Katarzyna Abramczuk, University of Warsaw Anna Baczko-Dombi, University of Warsaw with instructional design support from Tom Spits, University of Groningen and with the support of the Educational team of ACTISS Project.

COURSE TRAILER

Click on video to view the trailer

LEARNING OBJECTIVES

At the end of the course learners should be able to:

- Discuss the problem of conflict between individual and collective rationality using examples.
- Apply the basic concepts from game theory to explain some of the mechanisms leading to the ecological crisis and its potential solutions.
- Solve simple games using basic game theoretical tools.
- Experiment with a simple agent-based model by changing the properties of the existing components.
- Identify the opportunities computational models and simulations offer to help study complicated social processes.
- Evaluate possible solutions to problems related to public goods with the help of computational modelling.

COURSE DESCRIPTION

In all courses within the ACTISS programme we want to provide people who identify as having 'no brain for science' (a fear for computation and formulas) with a very gentle introduction to Computational Social Science, to pen-and-paper formal models and to Agent-Based Models. We want to build up interest in this domain and their confidence in this area. By the end of the course we want the learners to be able to experience how modelling and simulations can help understand social phenomena and to experience how investigating a social phenomenon with the use of an Agent-Based Model works. We also want them to be aware of the potential benefits of using a computational approach to practical situations and be willing to try them out.

In this course you will:

-> Expand your understanding of social sciences

This course will help you explore why sharing goods or tasks is difficult. You'll enrich your understanding of the problems people have when they share and cooperate, and examine essential models that can support you in your future career in social sciences and beyond.

-> Discover social solutions to help tackle different problems

You'll have a close-up look at situations when actions (that are rational from an individual point of view) lead to non-optimal social outcomes. Investigating the mechanisms that underlie the common action and public goods problems, you'll gain an insight into the behavioural dynamics affecting the ecological crisis we currently face. You'll also explore some social solutions to tackle such problems and reflect on the importance of strengthening social ties, norms, social control, sanctions, and institutions.

-> Understand how to use computational modelling to face challenges

You'll explore social computation and computational modelling as a useful methodology. With this knowledge, you'll systematically study the interactions between individual behaviour, group behaviour, and public goods.

-> Apply game theory and agent-based modelling (ABM) - without prior mathematical or programming skills

You'll apply the basic concepts from game theory to explain some of the mechanisms behind the overuse of natural resources. This will then help you explore some potential solutions going forward. Throughout the course, you will use examples, animations, and game-like tools,

designed by the experts from University of Warsaw and University of Groningen – no mathematical and programming skills are required

COURSE STRUCTURE

Week 1: The challenges of cooperation

This week we will investigate why sharing goods and tasks might lead to problems and explore the conflict between individual and social rationality. This will also be an opportunity to introduce the basics of game theory

Keywords: common goods, public goods, game theory, game matrix, equilibrium, strategy, Prisoner's Dilemma, Pareto optimality

Week 2: Free riders and the Tragedy of the Commons

This week we will be investigating what happens when more people share goods and will discuss the problem of free riding. We will also try out a simple tool that helps analyse multi-person situations and get to know a famous story about farmers who share a grazing land, the Tragedy of the Commons.

Keywords: common goods, common-pool resources, public goods, multi-person games, free rider problem, Tragedy of the Commons

Week 3: Problems with renewable goods

This week introduces the problem of resource dynamics. We'll be investigating what happens when a community uses a renewable good (e.g. fish stock) and paying a closer attention to what happens in time. We'll be using a simple simulation to study what happens and what factors influence the process.

Keywords: common goods, common-pool resources, renewable resources, resource dynamics, social simulation, agent-based models.

Week 4: How to succeed in managing ecological resources

This week is more about solutions. We will investigate how people usually deal with problems related to sharing and cooperating. We will be discussing how social control mechanisms help us, humans, enforce and sustain cooperation, learn about Elinor Ostrom's research about managing the commons and experiment with some solutions that fishermen might use to prevent damaging the fish stock.

Keywords: common goods, common-pool resources, renewable resources, social simulations, agent-based models, Elinor Ostrom, social control

Module 5 Decision Making in a Complex World: Using Computer Simulations to Understand Human Behaviour

Click on the icon to join the course on:

Future Learn

COURSE AT A GLANCE

Course title	Decision Making in a Complex World: Using Computer Simulations to Understand Human Behaviour
Number of weeks/units	2
Number of hours per week/unit	3
Total study time	6 hours
Summary	The learners of this course will study how humans make decisions by exploring illustrative videos, short articles, and simulations on your own computer.
Target learners	Students (Bachelor and Masters) in social sciences who are curious about CSS (studying at bachelor level). Teaching staff of social scientific programmes, curious about CSS. Students (Bachelor and Masters) in computational sciences that have an interest in targeting human behaviour.

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IN SOCIAL SCIENCES
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Warsaw/Groningen/Berlin 2021

Co-funded by the
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	General audience: everyone curious to learn more about how people make judgments and decisions in a complex world
Requirements / prerequisites for learners	None, but having done the first CSS course (Introductory Module) will help.
Educator(s)	Wander Jager; Katarzyna Abramczuk

COURSE TRAILER

Click on video to view the trailer

LEARNING OBJECTIVES

By the end of the course, you'll be able to...

- Explain how humans make decisions, according to classic and more contemporary theories on human decision making from different disciplines: economics, psychology and sociology.
- Explain how the environment and societal clues can shape choices and the other way around.
- Apply a simple algorithm / model describing a decision process in a chosen situation.
- Experiment with different individual decision processes and their impact on the social level.
- Debate the need for accurate representation of individual choice and decision behaviour when analysing social phenomena.
- Identify which human behaviour has been included in a (computational) model.

COURSE DESCRIPTION

Gain insights into the social phenomena around making choices

People use social cues to help them make decisions in diverse situations. This information is often scarce and uncertain but is also sometimes overwhelmingly abundant. With so many variables, how does the human decision-making process actually work?

On this three-week course, the University of Groningen will explain decision making in the complex world that we live in. Their unique approach encompasses not only conventional theories about social norms but also cutting-edge computer simulation frameworks that help make sense of human behaviour.

Review historical and current theories on the decision-making process

On this course, you'll draw on classic theories of human behaviour, social learning, and social norms as well as the latest thinking in economics, psychology, and sociology.

This background will help you understand the concept of rationality in decision making, as well as how environmental and social cues shape and are shaped by the choices we make.

Apply a computational approach to human decision making

After looking at the theory behind social phenomena and social reality, you'll get to apply a simple algorithm and see how it describes the decision process in a specific situation.

You'll also get to experiment with variations in decision processes that occur naturally among people by running them through the computer simulation.

See how individual behaviour and social reality shape each other

The University of Groningen is known for delivering both engaging material and strong academic support, and this course is no exception.

Blending classic and modern ideas about social learning, and showing how modern technology can be used to understand social norms, the University gives great insights into how and why individuals and groups make the choices that they do.

ACTION FOR COMPUTATIONAL THINKING
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COURSE STRUCTURE

Week 1: Modelling individual choices

This week we will reflect on how people make decisions and judgments. We will think about what a rational decision is and how it can be modeled. We will see how choice behavior may change depending on the circumstances. Finally we will discuss the theory of bounded rationality developed by psychologists and economists and see how it can help us understand choices when information available is scarce and cannot be relied upon.

Week 2: The social dimension

This week we will reflect on the social dimension of how people make decisions. When we make decisions as humans, we take advantage of the information that is around us, to help us inform what the best decision is. New elements will be added to models of decision-making and we will use simulations to explore how these elements change the process and results.

Week 3: Integrating decision making into models

In the previous week, we started slowly to include new elements into the simulations. We added exploration, information exchange, normative influence and network density as factors. This week we will explore a bit deeper what different aspects of human decision making and behaviour can be integrated in computational models.

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Suggested literature and resources - examples

Module 1

Suggested literature and resources - examples

Boccara, N. (2003). Modeling complex systems

De Marchi, S., & Page, S. E. (2014). Agent-based models. *Annual Review of political science*, *17*, 1-20.

Epstein, J. M. (1999). Agent‐based computational models and generative social science. *Complexity*, *4*(5), 41-60.

Epstein, J. M. (2006). *Generative social science: Studies in agent-based computational modeling*. Princeton University Press.

Epstein, J. M. (2008). Why model?. *Journal of Artificial Societies and Social Simulation*, *11*(4), 12.

Giles, J. (2012). Making the links. *Nature*, *488*(7412), 448-450.

Lazer, D., Pentland, A. S., Adamic, L., Aral, S., Barabasi, A. L., Brewer, D., ... & Jebara, T. (2009). Life in the network: the coming age of computational social science. *Science*, *323*(5915), 721-723.

Young, P. H. (1998) Individual Strategy and Social Structure: An Evolutionary Theory of Institutions, Princeton: Princeton University Press.

Vallacher, R. R., Read, S. J., & Nowak, A. (Eds.). (2017). Computational social psychology. Routledge

Suggested further reading and resources

Gilbert, N. & Troitzsch, K. (2005). Simulation for the Social Scientist. Open University Press, 2nd ed.

Axelrod, R. (2003) Advancing the Art of Simulation in the Social Sciences, Japanese Journal for Management Information System, Special Issue on Agent-Based Modeling, 12(3).

Coleman,J, Foundations of Social Theory

The journal JASSS - Journal of Artificial Societies and Social Simulation. On-line & open-access: http://jasss.soc.surrey.ac.uk/JASSS.html

NETLOGO - the popular open-access modelling platform with library:
https://ccl.northwestern.edu/netlogo/

The CECAN on-line course on agent based modelling for the social scientist:
https://www.cecan.ac.uk/events/agent-based-modelling-social-scientist-4-6-february-2019?fbclid=IwAR1PnbOPUEo3bVjFqHNTf7pJMqfN_0Tn1uftwaXszbQKUGZh2nimDj_7oPQ

Module 2

Suggested literature and resources - examples

Dixit A., Skeath S. (2004). *Games of Strategy, 2nd edition*. New York/London: W.W. Norton & Company
Straffin, P. D. (1993). Game theory and strategy (Vol. 36). MAA.
Watson, J. (2002). Strategy: an introduction to game theory (Vol. 139). New York: WW Norton.

Suggested further reading and resources

Hardin, G. (1968) The Tragedy of the Commons. Science 162 (3859) 1243-1248.
Nagendra, H., Ostrom, E. (Lead Authors) and Saundry, P. (Topic Editor) (2008): Governing the commons in the new millennium: A diversity of institutions for natural resource management. In: Encyclopedia of Earth. Eds. Cutler J. Cleveland [First published in the Encyclopedia of Earth November 16, 2007; Last revised August 12, 2008; Retrieved November 11, 2012].
Governing the commons in the new millennium: A diversity of institutions for natural resource management Deadman, P. J. (1999). Modelling individual behaviour and group performance in an intelligent agent-based simulation of the tragedy of the commons. *Journal of Environmental Management*, *56*(3), 159-172.

Module 3

Suggested literature and resources - examples

Schelling - segregation model, available in Netlogo
Schelling, T. C. (1971). Dynamic models of segregation. *Journal of Mathematical Sociology*, *1*(2), 143-186.
European Values Survey, World Values Survey - selected data about neighbourhood composition preferences
Hegselmann, R., & Flache, A. (1998). Understanding complex social dynamics: A plea for cellular automata based modelling. *Journal of Artificial Societies and Social Simulation*, *1*(3), 1.
Schelling, T. (1978) *Micromotives and Macrobehavior*, New York: Norton.Nowak, A., Szamrej, J., Latane', B. (1990) From private attitude to public opinion: A dynamic theory of social impact. *Psychological Review*, 97, s. 362-376.
Boccara, N. (2003). Modeling complex systems
Vallacher, R. R., Read, S. J., & Nowak, A. (Eds.). (2017). *Computational social psychology*. Routledge.
https://www.youtube.com/watch?v=SpGHKkp8uxM&t=0s&list=PL3YjZETJFvLumP_A_5wuAAM1dihPOEJEF&index=14

https://www.lincolninst.edu/publications/articles/urban-spatial-segregation
https://www.nytimes.com/interactive/2015/07/08/us/census-race-map.html

Suggested further reading and resources

Helbing, D., Farkas, I. J., Molnar, P., & Vicsek, T. (2002). Simulation of pedestrian crowds in normal and evacuation situations. *Pedestrian and evacuation dynamics*, *21*(2), 21-58.
Fossett M., Waren W. 2005. Overlooked implications of ethnic preferences for residential segregation in agent-based models. „Urban Studies" 42 (11): 1893-1917.
Laurie, A.J., Jaggi, N.K. 2003. Role of 'vision' in neighbourhood racial segregation: a variant of the
Schelling segregation model. „Urban Studies" 40 (14): 2687-2704.
Wasserman, H., Yohe, G. 2001. Segregation and the provision of spatially defined local public goods. „The American Economist" 45: 13-24.
Nowak, A., Szamrej, J., Latane', B. (1990) From private attitude to public opinion: A dynamic theory of social impact. *Psychological Review*, 97, s. 362-376.
Paolillo, R., & Jager, W. (2019). Simulating acculturation dynamics between migrants and locals in relation to network formation. *Social Science Computer Review*, 0894439318821678.
Cattacin, S. (2006). Why not "ghettos"? The governance of migration in the splintering city. *Willy Brandt Series of Working Papers in International Migration, Migration and Ethnic Relations*, *6*(2).

Module 4

Suggested literature and resources - examples

Jackson, M. O. (2008). *Social and Economic Networks.* Princeton: Princeton University Press.
Watts, D. J., & Strogatz, S. H. (1998). Collective dynamics of 'small-world' networks. *Nature*, *393*(6684), 440-442.
Rainer Hegselmann, Frederic Amblard, and many successors work on opinion dynamics- selected papers

Suggested further reading and resources

Flache, A., & Macy, M. W. (2011). Small worlds and cultural polarization. *The Journal of Mathematical Sociology*, *35*(1-3), 146-176.
Rainer Hegselmann, Frederic Amblard, and many successors work on opinion dynamics - selected papers

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Module 5

Suggested literature and resources - examples

Goldstein, D. G., & Gigerenzer, G. (2002). Models of ecological rationality: the recognition heuristic. Psychological review, 109(1), 75.
Henrich, J., & McElreath, R. (2003). The evolution of cultural evolution. Evolutionary Anthropology: Issues, News, and Reviews: Issues, News, and Reviews, 12(3), 123-135.
Jager, W. (2017). Enhancing the Realism of Simulation (EROS): On Implementing and Developing Psychological Theory in Social Simulation. Journal of Artificial Societies and Social Simulation 20 (3) 14 <http://jasss.soc.surrey.ac.uk/20/3/14.html>. doi: 10.18564/jasss.3522
Simon, H. A. (1955). A behavioral model of rational choice. The quarterly journal of economics, 69(1), 99-118.
Scott, J. (2000). Rational choice theory. Understanding contemporary society: Theories of the present, 129, 671-85.
Yamagishi, T., Kikuchi, M., & Kosugi, M. (1999). Trust, gullibility, and social intelligence. Asian Journal of Social Psychology, 2(1), 145-161.
CONSUMAT and/or HUMAT

Suggested further reading and resources

Bikhchandani, S., Hirshleifer, D., & Welch, I. (1998). Learning from the behavior of others: Conformity, fads, and informational cascades. Journal of economic perspectives, 12(3), 151-170.
Bosch-Domenech, A., Montalvo, J. G., Nagel, R., & Satorra, A. (2002). One, two,(three), infinity,...: Newspaper and lab beauty-contest experiments. American Economic Review, 92(5), 1687-1701.
Gigerenzer, G., & Goldstein, D. G. (1996). Reasoning the fast and frugal way: models of bounded rationality. Psychological review, 103(4), 650.
Heinrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., Gintis, H., ... & Hill, K. (2005). Economic man in cross-cultural perspective: Behavioral experiments in 15 small-scale societies. Behavioral and Brain Sciences, 28(6), 795-855.
Hoffrage, U., Hertwig, R., & Gigerenzer, G. (2000). Hindsight bias: A by-product of knowledge updating?. Journal of Experimental Psychology: Learning, Memory, and Cognition, 26(3), 566.
Hung, A. A., & Plott, C. R. (2001). Information cascades: Replication and an extension to majority rule and conformity-rewarding institutions. American Economic Review, 91(5), 1508-1520.
Kahneman, D. (2003). Maps of bounded rationality: Psychology for behavioral economics. American economic review, 93(5), 1449-1475.

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McElreath, R. (2016). The coevolution of social learning and sensitivity to changing environments. BioRxiv, 080507.
Schurz, G., & Hertwig, R. (2019). Cognitive Success: A Consequentialist Account of Rationality in Cognition. Topics in cognitive science.
Intertemporal choice perspective: Videos with “Marshmallow test”; Loewenstein, G. i Prelec, D. (1992). Anomalies in intertemporal choice − evidence and an interpretation. Quarterly Journal of Economics, 107(2), 573−597.

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