

Human AI: Modeling, Simulation and Analysis of Adaptive Human Mental, Social and Health-Related Processes

SYLLABUS

VU Amsterdam Summer School

20-31 July, 2026

Any general questions for the Summer
School support team? Contact
amsterdamsummerschool@vu.nl.



Course Details

Title	Human AI: Modeling, Simulation and Analysis of Adaptive Human Mental, Social and Health-Related Processes
Coordinator(s)	Prof.dr. Jan Treur
Other lecturers	
Form(s) of tuition	On campus
Approximate contact hours	60
Approximate self-study hours	25

Teaching staff (in order of appearance)

Prof.dr. Jan Treur

Course description

Human processes of all kinds are complex and adaptive. Mental, social, and health-related processes can all change and adapt over time with human behaviour. Mental processes can change as a result of learning, social interactions can evolve over time, and health-related processes are susceptible to change too. This course will present theories and findings from a wide range of disciplines, including various branches of cognitive, social, health and neuroscience, to gain insight into underlying mechanisms of human processes that can be exploited in human causal AI modeling and simulation. The various scientific theories form a factual basis for modelling the processes. We can understand these often adaptive mechanisms through causal relations and causal pathways, which form adaptive dynamical systems that we can model as networks. Using this theoretical framework and the software provided, students can easily simulate a variety of scenarios. During the second week, students will carry out activities that could lay the foundations for a publication that can be finished later on. This course introduces a network-oriented causal AI modelling approach based on adaptive causal networks. This approach is useful for modelling dynamical systems for social interactions and mental and health-related processes. These network models cover the dynamics of causal effects, changing causal connections and excitability or sensitivity thresholds. Higher-order adaptiveness is another topic covered in the course, which includes the role of metaplasticity and the extent to which plasticity occurs in mental or neural processes.

Learning objectives

By the end of the course, students will be able to:

- Identify different types of mental, social and health-related processes
- Understand how individual and social behaviour emerges from mechanisms known from Cognitive, Affective and Social Neuroscience, and from Cognitive and Social Sciences, and Health Sciences
- Design network models for adaptive mental, social and health-related processes
- Perform simulations based on these models using the provided Network-Oriented Modeling software environment

Assignments and Assessment

The course includes 4 Group Assignments in the first week and a Final Group Assignment in the second week which includes a report and presentation. Assessment will be based on these assignments on a 50/50 basis for the first week and second week. Attendance is strongly recommended as without that passing the course will be extremely hard or impossible.

Provisional reading list

Chapters from the following two 2016 and 2020 books on the topic (from the 2016 book, chapters 2, 3, 7, 11; from the 2020 book chapters 1, 2, 3, 4, 6, 7, 9); in addition, some chapters from the two 2026 books:

- Treur, J. (2016). Network-Oriented Modeling: Addressing Complexity of Cognitive, Affective and Social Interactions. Springer Publishers. Within the university VU freely downloadable at <http://link.springer.com/book/10.1007/978-3-319-45213-5>. Table of Contents with links to abstracts and slides per chapter: <https://www.researchgate.net/publication/305930006>.
- Treur, J. (2020). Network-Oriented Modeling for Adaptive Networks: Designing Higher-Order Adaptive Biological, Mental, and Social Network Models. Springer Nature. Within VU freely downloadable at: <https://link.springer.com/book/10.1007/978-3-030-31445-3>. Table of Contents with links to abstracts and slides per chapter: <https://www.researchgate.net/publication/334576216>
- Treur, J. (ed.) (2026). How Environment and Epigenetics Lead to Reduced Self-Regulation and the Development of Related Mental Disorders: A Computational Multi-Level Adaptive Dynamical System Analysis. Springer Nature. Within VU freely downloadable at: <https://link.springer.com/book/9783032170286>
- Ullah, N., Treur, J. (ed.) (2026). The Interplay of Emotion Regulation and Mental Health: An Adaptive Dynamical Systems Analysis Approach. Springer Nature. Within VU freely downloadable at <https://link.springer.com/book/9783032165435>

Course Schedule

See below.

		Books				Lecturer															
		Book 1: Network-Oriented Modeling Book 2: Network-Oriented Modeling for Adaptive Networks Open the ToC of these books to get clickable links to the chapters				Jan Treur Lectures playlist		Note that most areas contain hyperlinks to books, slides, additional material (A),and movies (M). If clicking does not work, open Edit hyperlink and copy the link to your browser.													
Week		20-jul		20-jul		21-jul		21-jul		22-jul		22-jul		23-jul		23-jul		24-jul		24-jul	
Room week		Monday Morning		Monday Afternoon		Tuesday Morning		Tuesday Afternoon		Wednesday Morning		Wednesday Afternoon		Thursday Morning		Thursday Afternoon		Friday Morning		Friday Afternoon	
	lecture times	10:00 - 10:30 lecture		12:30 - 13:00 lecture		8:30 - 9:00 lecture		12:30 - 13:00 lecture		8:30 - 9:00 lecture		8:30 - 9:00 lecture		12:30 - 13:00 lecture		8:30 - 10:00 lecture		12:30 - 13:00 lecture			
	subject and slides	Lecture 1: Introduction: Causal AI and Causal Networks		Lecture 2: Designing Mental and Social Causal Network Models		Lecture 3: The Role of Emotions in Mental Processes		Lecture 4: From Mental Processes to Social Processes		Lecture 5: Adaptive Causal Network Models by Self-Models		Excursion		Lecture 6: Higher-Order Adaptive Causal Network Models		Lecture 7: Higher-Order Adaptive Social Network Models		Lecture 8: Modeling the Role of Epigenetics in Mental Disorders		Lecture 9: What remains and choice of topic for Final Project	
	texts	Book 2 Ch 2. Ins and Outs of Network-Oriented Modeling Book 2 Ch 9. A Modeling Environment for Network Models		Book 1 Ch 2. A Temporal-Causal Network Modeling Approach M1. Cyclic network of sheep		Book 1 Ch 3. How Emotions Come in Between Everything M2. A world of individuals		Book 1 Ch 7. Emergence of Shared Understanding and Collective Power M3. From attraction between individuals to collective power		Book 2 Ch 1. On Adaptive Networks and Self-models Book 2 Ch 3. Modeling Network Adaptation using Self-models		Book 2 Ch 9. A Modeling Environment for Adaptive Network Models		Book 2 Ch 4. Modeling Higher-Order Network Adaptation Book 2 Ch 7. Modeling Higher-Order Adaptive Processes in Evolution		Book 2 Ch 7. Modeling Higher-Order Adaptive Processes in Evolution Book 2 Ch 6 Social Network Models for Bonding by Homophily		On Dynamics, Adaptation and Control of Internal Mental Models		Examples of publications based on Final Project Assignments	
	exercising times	10:30 - 12:00 practical session		13:00 - 14:45 practical session		9:00 - 12:00 practical session		13:00 - 15:30 practical session		9:00 - 12:00 practical session				9:00 - 12:00 practical session		13:00 - 15:30 practical session		10:00 - 12:00 practical session		13:00 - 15:30 practical session	
	subject	Assignment 1a: Minitutorial for the Nonadaptive Matlab Template		Assignment 1b: Mental Network simulation for a soap scenario		Assignment 2a: A Mental Network for emotion regulation		Assignment 2b: A Social Network model: simulation of contagion		Assignment 3: Designing an Adaptive Causal Network Model		Excursion		Assignment 4: Designing a Multilevel Adaptive Causal Network Model		Assignment 4: Designing a Multilevel Adaptive Causal Network Model		Final Project Assignment: choice of a topic		Final Project Assignment: choice of a topic	
Computer room:																					
Room		27-jul		27-jul		28-jul		28-jul		29-jul		29-jul		30-jul		30-jul		31-jul		31-jul	
Room week		Monday Morning		Monday Afternoon		Tuesday Morning		Tuesday Afternoon		Wednesday Morning		Wednesday Afternoon		Thursday Morning		Thursday Afternoon		Friday Morning/Afternoon		Friday Afternoon	
	exercising times	8:30 -15:30 Supervised group work		8:30 -15:30 Supervised group work		8:30 -15:30 Supervised group work		8:30 -15:30 Supervised group work		8:30 -12:30 Supervised group work		Excursion		8:30 -15:30 Supervised group work		8:30 -15:30 Supervised group work		8:30-15:30 10 minute presentations p 15:30-... - Goodby drink			
	subject	Final Project Assignment		Final Project Assignment		Final Project Assignment		Final Project Assignment		Final Project Assignment		Excursion		Final Project Assignment		Final Project Assignment		Final Project Presentation			

