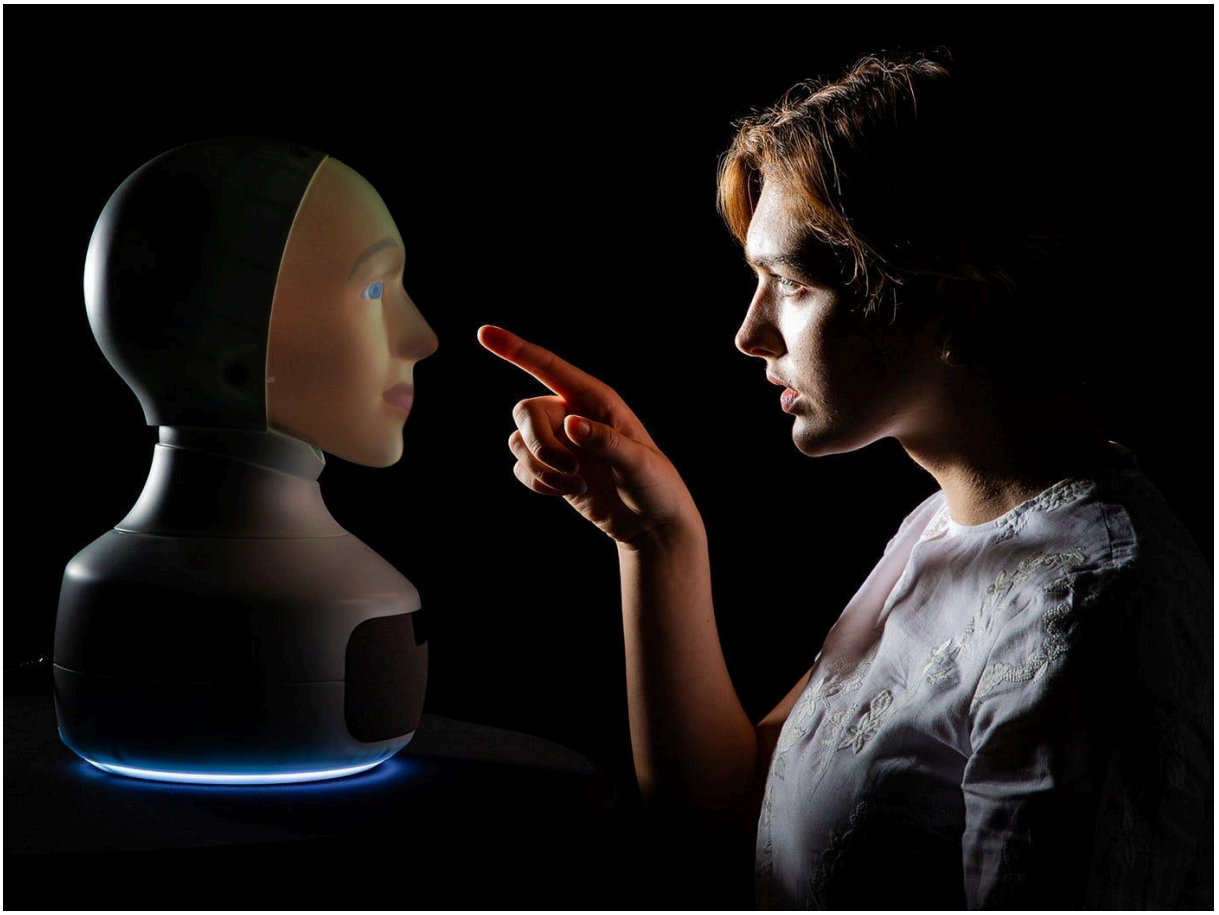
Course Syllabus

Conversational AI

Version 2: Sept 2024



Entry requirements

Open for master students in Linguistics and Communication, Data Science, Artificial Intelligence, Computer Science, Cognitive Neuroscience.

Aims

This course introduces students to the field of interactive language technology, provides hands-on experience working with speech technologies, and equips students to build and assess interactive interfaces. Looking under the bonnet of current 'social' technologies, the course aims to foster a deeper understanding of how these interfaces work and what their limits are, and to enable students to participate in ongoing discourse about risks and uses in academic research and society at large. Upon completion of the course, students are familiar with the main ingredients that make or break conversational interfaces.

Content

This course introduces current language and communication technologies, covering a wide range of "AI"-powered technologies including text generators (e.g. ChatGPT), dialogue systems, and social robotics, broadly covered under the nomer "Conversational AI". Starting from human interaction as the primary ecology of language, we look at how interactive interfaces exploit linguistic structures,

interactional infrastructure and ways of sense-making that people bring to interactive language use. Students will learn the basics of interactive language modelling and explore the scientific and theoretical foundations of understanding structure and variation in conversational speech. Aspects of conversational infrastructure covered include turn-taking, interactive repair, and action ascription. The course also touches upon societal and ethical issues that emerge alongside the rise of conversational interfaces. A unique aspect of this course is the hands-on group work on cutting-edge social robots and large language models. This provides students with relevant expertise in the engineering, design and evaluation of conversational AI. This course might appeal to anyone interested in recent approaches to conversational AI and understanding why talking machines still struggle to hold up their end of a conversation.

Learning objectives

At the end of this course, the student will be:

- Proficient users of different types of spoken language technologies while being aware of their limitations
- Have some knowledge about key algorithms and techniques that make these technologies work
- Proficient in engineering, design, and research workflows that employ AI-powered language technologies
- Informed participants of current discussion on the risks and opportunities of the use of AI technologies in academic research and society at large

Mode of instruction

Seminars

Contact hours

1 1/2 hours per week (One seminar).

Type of assessment

- Midterm exam, 20% of the final grade, minimum of 5.5. (open book)
- Final project , 80%, minimum of 5.5.
- In order to pass the course, both the exam and final project need to be passed.
- If students do not pass the course after the resit, they will have to do the entire course again.

Contact information

Course coordinator & Lecturer: Dr. Andreas Liesenfeld (andreas.liesenfeld@ru.nl)

Lecturer: Dr. Mark Dingemanse (mark.dingemanse@ru.nl)

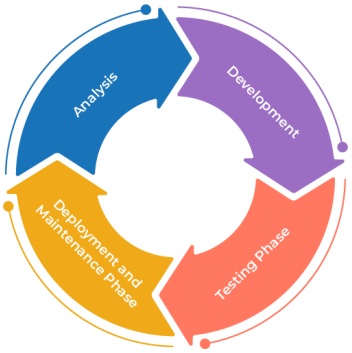
Workload

Activity	Workload (estimate)
Seminars	20 hours
Reading	30 hours
Seminar preparation	30 hours
Final project	88 hours
Total	**168 hours (6 ECTS)**

Midterm exam (20% of final grade)

The open book midterm exam consists of open-ended (essay-style) questions regarding the course content of week 1-7.

Final project (80% of final grade)



The final project will be completed in groups, with a clear division of labor between individual group members. The project focuses on the development and evaluation of a skill/product using various conversational AI/social robot platforms. Using a classic 4-step research and development (R&D) life cycle framework, the team step-by-step (1) develops, (2) tests, (3) deploys, and (4) analyses(evaluates) their spoken language technology.

Students can pick between “engineer” and “designer” roles. Engineering roles focus on the development of technical skills and involve scripting in Python. Designer roles focus on conversation design and evaluation techniques, and involve user testing and industrial design expertise.

As a team, students decide together which type of technology they want to develop, implement, and evaluate. As a first step, the team presents a Research and Development (R&D) plan that outlines how the skill will be developed and tested, drawing on the frameworks discussed in the assigned readings of week 7-14. Working towards several progression milestones, the team then independently designs, develops, tests, and evaluates the robots skill over the course of week 7-14 of the course.

Assessment

The final project is graded in equal parts based on a submitted individual project report and the final project presentation of the team.

Project report (individual submission)

In around 1000 words, each team member reports and reflects on their role in the research and development process. Drawing on the required readings of their role as either engineer or conversation designer, the report details approaches to development or evaluation of social robots following the “IMRaD” format.[1] The report needs to contain empirical data in form of either a

[1] https://en.wikipedia.org/wiki/IMRAD

(Python) script for engineer roles or a transcription of a conversation between a human user and the robot in conversation analytic ("Jeffersonian") format for conversation designer roles.[2]

Project presentation (group presentation with individual Q&A)

To conclude the project, the team presents the results of their Research and Development (R&D) cycle in a conference setting. The presentation includes a demo of the developed product/skill as well as a presentation of the R&D process that details the team's approach to development, testing, deployment, and analysis/evaluation. Taking turns, each team member should present a maximum of 3 slides during this presentation. The presentation will conclude with an individual Q&A during which each team member reports the work they have done in the team and reflects on their role as engineer/designer drawing on the required readings.

Assessment rubrics

The final project (report and presentation) will be graded for:

Display knowledge of content of required readings [primary]: Does the report/presentation display knowledge of the concepts covered in the required readings of the course? Related to both engineer/designer roles, does the report/presentation cover relevant approaches to research and development of social robots?

Depth of description [secondary]: Are all concepts and approaches explained clearly, thoroughly and concisely? Are steps of a typical R&D life cycle described in sufficient detail? Are relevant theoretical and technical limitations, problems, and solutions discussed?

Presentation quality [tertiary]: Is the report/presentation well organized, formatted, and professionally presented? It should not only entirely be written in full sentences, but quality of writing/presentation matters: write/present in a clear, academic, and succinct style. In the report, include references to the course readings where relevant and include a bibliography.

[2] https://www.universitytranscriptions.co.uk/jefferson-transcription-system-a-guide-to-the-symbols/

Schedule

Date	Seminar	Preparation & Readings	Lecturer
3 Sept	**Introduction**: Orientation & Course overview Setting up devices and colab		Liesenfeld & Dingemanse
10 Sept	**Seminar 1:** Conversational structures: turn-taking and repair	Dingemanse, M., & Enfield, N. J. (2024). Interactive repair and the foundations of language. Trends in Cognitive Sciences, 28(1), 30–42. doi: 10.1016/j.tics.2023.09.003	Dingemanse
17 Sept	**Seminar 2:** Conversational Artificial "Intelligence"	Turing, A. M. (1950). Chapter "The Imitation Game" in Computing machinery and intelligence. Mind, 59(236), 433-460.	Dingemanse
24 Sept	**Seminar 3:** Representing conversation	Chapter "Introduction" in Weizenbaum, J. (1976). Computer power and human reason: from judgment to calculation. W. H. Freeman.	Liesenfeld & Dingemanse
1 Oct	**Seminar 4:** The action problem	Levinson, S. C. (2013). Action formation and ascription. In J. Sidnell & T. Stivers (Eds.), Handbook of Conversation Analysis (pp. 103–130). Blackwell Publishers.	Liesenfeld & Dingemanse
8 Oct	**Seminar 5:** Progressivity and grounding	Fischer, Joel E., Stuart Reeves, Martin Porcheron, and Rein Ove Sikveland. 2019. 'Progressivity for Voice Interface Design'. In Proceedings of the 1st International Conference on Conversational User Interfaces - CUI '19, 1–8. Dublin, Ireland: ACM Press. doi:10.1145/3342775.3342788.	Dingemanse
15 Oct	**Seminar 6:** Language technologies for all?	Voinea, Cristina. 2018. 'Designing for Conviviality'. *Technology in Society*, 52 (February): 70–78. doi:10.1016/j.techsoc.2017.07.002.	Liesenfeld & Dingemanse
22 Oct	Exam period, no seminar	**Mid-term exam**	
29 Oct	Exam period, no seminar		
5 Nov	**Conversational AI group project:** Planning the group projects		Liesenfeld & Dingemanse
12 Nov	**Conversational AI group project:** Setting up Raspberry PI / Furhat SDK	Skantze, G. (2021). Turn-taking in conversational systems and Human-Robot Interaction: A Review. Computer Speech & Language. Computer Speech & Language, 67, 101178. Liesenfeld, A., Lopez, A. and Dingemanse, M. (2023). The timing bottleneck: Why timing and overlap are mission-critical for conversational user interfaces, speech recognition and dialogue systems. In the 24rd Annual Meeting of the Special Interest Group on Discourse and Dialogue (SIGDial 2023).	Liesenfeld & Dingemanse

19 Nov	**Conversational AI group project:** Conversation design and engineering	**For engineers:** Chapter 1 “What Is a Virtual Assistant?” in Pieraccini, R. (2021). AI assistants. MIT Press. Chicago Chapter 1 “Introduction to spoken dialogue systems” in Jokinen, K., & McTear, M. (2010). Spoken Dialogue Systems. Morgan & Claypool Publishers. **For designers:** Chapter 1 “Introduction” in Pearl, C. (2017). Designing Voice User Interfaces: Principles of Conversational Experiences. O’Reilly. Chapter 1 “Conversation and Conversation Analysis” in Liddicoat, A. J. (2021). An introduction to conversation analysis. Bloomsbury Publishing.	Liesenfeld & Dingemanse
26 Nov	**Conversational AI group project:** Research and development (R&D) cycles	**For engineers:** Chapter 2 “AI and Machine Learning?” in Pieraccini, R. (2021). AI assistants. MIT Press. Chicago **For designers:** Bolden, Galina B. 2015. ‘Transcribing as Research: “Manual” Transcription and Conversation Analysis’. Research on Language and Social Interaction 48 (3). Routledge: 276–80. doi:10.1080/08351813.2015.1058603. Chapter 7 “Interacting with an Assistant” in Pieraccini, R. (2021). AI assistants. MIT Press. Chicago	Liesenfeld & Dingemanse
3 Dec	**Conversational AI group project:** Engineering and design workflow reporting	**For engineers:** Chapter 15 “Chatbots & Dialogue Systems” in Jurafsky, D. and Martin, J.H., (2024). Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition. https://web.stanford.edu/~jurafsky/slp3/15.pdf **For designers:** Liesenfeld A. & Dingemanse, M. (2024) Interactive probes: action-level evaluation for dialogue systems. forthcoming.	Liesenfeld & Dingemanse
10 Dec	**Conversational AI group project:** Implementation and evaluation workflow reporting	Marge M, Espy-Wilson C, Ward NG, Alwan A, Artzi Y, Bansal M, Blankenship G, Chai J, Daumé III H, Dey D, Harper M. Spoken language interaction with robots: Recommendations for future research. Computer Speech & Language. 2022 Jan 1;71:101255.	Liesenfeld & Dingemanse
17 Dec	**Conversational AI group project:** Project report submission**,** presentation and assessment		Liesenfeld & Dingemanse