

# Computational Pragmatics

Autumn 2015

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# Practical Matters

- **Lecturer:** Raquel Fernández ([raquel.fernandez@uva.nl](mailto:raquel.fernandez@uva.nl))  
Science Park 107, room F1.07
- **TA:** Julian Schlöder ([julian.shloeder@gmail.com](mailto:julian.shloeder@gmail.com))
- **Website:** Slides, references, and other important information will be posted on the course's website:  
<http://www.illc.uva.nl/~raquel/teaching/cosp/>
- **Timetable:**
  - ▶ Tuesdays & Fridays 13-15h, room SP G3.05.
- **Relevant seminars at the ILLC:**
  - ▶ Computational Linguistics Seminar (CLS)
  - ▶ DIP (discourse processing) ColloquiumCheck the ILLC Events webpage for details.

# What is this course about?

Models of language use in interaction.

This year the course is dedicated to **dialogue modelling**: the study of how communication takes place through language in conversation.

This involves, among other things, investigating:

- how dialogue participants coordinate to take turns in speaking and to achieve mutual understanding;
- what makes a dialogue coherent; and
- how knowledge about how dialogue works can be used to design artificial agents that are able to converse with humans.

## A transcript fragment from the Switchboard corpus:

B.52 utt1: Yeah, /  
B.52 utt2: [it's,+ it's] fun getting together with immediate family. /  
B.52 utt3: A lot of my cousins are real close /  
B.52 utt4: {C and} we always get together during holidays and  
weddings and stuff like that, /  
A.53 utt1: {F Uh, } those are the ones that are in Texas? /  
B.54 utt1: # {F Uh, } no, # /  
A.55 utt1: # {C Or } you # go to Indiana on that? /  
B.56 utt1: the ones in Indiana, /  
B.56 utt2: uh-huh. /  
A.57 utt1: Uh-huh, /  
A.57 utt2: where in Indiana? /  
B.58 utt1: Lafayette. /  
A.59 utt1: Lafayette, I don't know where, /  
A.59 utt2: I used to live in Indianapolis. /  
B.60 utt1: Yeah, /  
B.60 utt2: it's a little north of Indianapolis, about an hour. /

## Some key units of analysis

- **Turns:** stretches of speech by one speaker bounded by that speaker's silence – that is, bounded either by a pause in the dialogue or by speech by someone else.
- **Utterances:** units of speech delimited by prosodic boundaries (such as boundary tones or pauses) that form *intentional units* – that is, that can be analysed as an action performed with the intention of achieving something.
- **Dialogue acts:** intuitively, conversations are made up of sequences of actions such as *questioning, acknowledging*, . . . a notion rooted in *speech act theory*.

# Main topics we will cover

- Turn taking
- Dialogue acts
- Grounding
- Dynamic semantics for dialogue
- Dialogue systems
- Convergence and alignment

Some references where you can find overviews of the field:

R. Fernández (2014) Dialogue. In *Oxford Handbook of Computational Linguistics*, 2nd edition.

Schlangen (2005) Modelling dialogue: Challenges and approaches. *Künstliche Intelligenz*, 3:23-28.

D. Jurafsky & J. Martin (2009) *Speech & Language Processing*, chapter 24 "Dialogue and Conversational Agents".

M. McTear (2002) Spoken Dialogue Technology: Enabling the Conversational User Interface, *ACM Computing Surveys*, 34(1).

K. Jokinen & M. McTear (2010) *Spoken Dialogue Systems*, Synthesis Lectures on Human Language Technology.

# Prerequisites

No formal prerequisites are required to follow the course. However, some basic things are expected from you:

- I'll assume some basic knowledge of **semantics** / **pragmatics**
- an **empirical orientation**: an interest in the empirical evidence behind theoretical claims; and in working with existing data, or in collecting data via experiments.
- a **computational inclination**: an interest in computational methods of enquiry and evaluation
  - ▶ if you don't know any programming, you are still welcome
  - ▶ you are encouraged to learn some basic programming skills

# Course evaluation

- **Coursework: 30%**
  - ▶ some graded exercises
  - ▶ possibly some non-graded exercises  
(failing to submit means losing 0.5 on total coursework grade)
  - ▶ reading and discussion of relevant research papers  
( $\approx 10\%$  at my discretion)
- **Final project (paper + presentation): 70%**
  - ▶ done in groups (ideally two people, three may also be possible)
  - ▶ on-topic philosophical/theoretical essays could be an option, but
  - ▶ ideally, your project should include an empirical/computational component, e.g. analysis of real data or some sort of implementation



# Final projects

Any topic related to the themes covered in the course. A few ideas on possible types of projects (abstracting over particular topics):

- a quantitative corpus study of some interesting phenomenon
- a machine learning experiment using an existing corpus
- an analysis of data collected by yourself in an experiment
- an implementation of an interesting problem
- an analysis and small extension of a paper from the literature
- an analysis of interesting connections between different approaches
- ...

Some options in this list may seem unfeasible to you, but they may be perfectly possible – don't abandon an interesting idea before discussing it with me!

# Learning outcomes

To succeed in the course, you should demonstrate an understanding of the topics covered by being able to:

- **Analyse** and critique the research questions and the methodology used to address them in existing relevant literature.
- **Formulate** your own research questions within the scope of the course.
- **Apply** appropriate (empirical/computational) techniques to address your research questions.
- **Write** about the work of others and your own work in proper scientific style.
- **Present** the work of others and your own work to an audience in a clear and engaging way.

This is a research-oriented course (slightly more appropriate for 2nd-year master's students, but 1st-year's are welcome too if committed!).

# Timeline

- Find a **project partner** and think about a **topic** by end of Sept.
- **Project proposal** approved by me no later than 2 Oct.
- The last two weeks of the course will be dedicated to working on your project, with class **brainstorming sessions** and team **supervision meetings** with me and Julian.
- Project **presentations** during the exam week (dates TBD).
- Deadline for **final paper**: Monday 26 Oct (no extensions).

You will find these and more details on the course website.

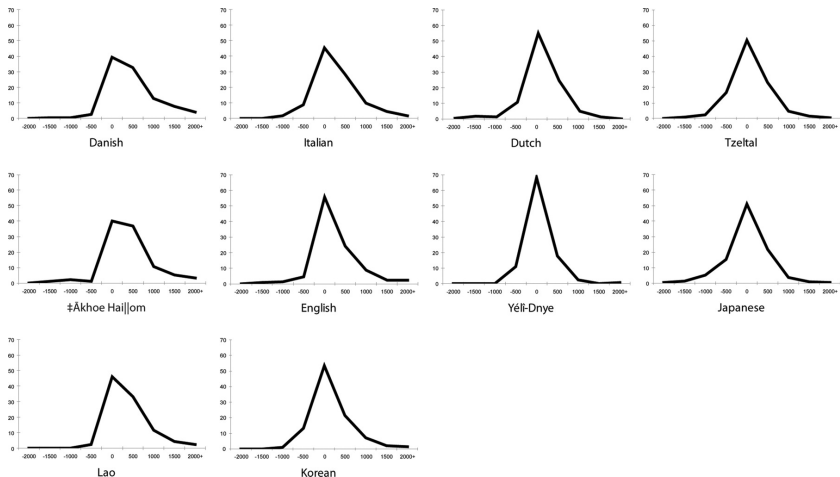
**End of Introduction**

# Turn Taking

Dialogue participants do not only need to make decisions about what to say, but also about *when to say it*  $\rightsquigarrow$  **timing**

- Turn-taking is one of the fundamental organisational principles of conversation.
- Learned early: within the first 2 years of life
- There are some individual and cultural differences
- But also strong universal patterns: tendency to minimize both *overlap* and *gaps* between turns

# Distribution of turn transition length in milliseconds in 10 languages:



Stivers et al. (2009) Universals and cultural variation in turn-taking in conversation, *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*.

# Empirical facts: what we know about how it works

Turn-taking happens very smoothly:

- **Overlaps are rare**: on average, less than 5% of speech.
- **Inter-turn pauses are very short**:  $\sim 200\text{ms}$  (less than 500ms.)
  - ▶ even shorter than some intra-turn pauses
  - ▶ shorter than the motor-planning needed to produce the next utterance

*How do we do it?*

Turn-taking can't be *reactive* (we do not react to silence as most artificial conversational agents do) — turn taking is **predictive**: we *project* turn endings and turn transitions.

Humans are able to rather accurately predict whether an utterance will continue and for how many words.

# Turn Taking Models

The seminal model of turn taking was put forward by sociologists within the framework of Conversation Analysis (Sacks et al. 1974)

Sacks, Schegloff, & Jefferson (1974) A simplest systematics for the organization of turn-taking in conversation.

- Turns consist of **turn constructional units** (TCUs) with **projectable** points that can be predicted beforehand.
- Such projectable points act as **transition relevance places** (TRPs) where turn transitions are relevant.



# Conversation Analysis Model

Three rules govern the expected behaviour at TRPs:

- 1 if devices to select a next speaker (e.g. questions, gaze, naming) are used, the current speaker stops and the selected speaker takes the turn;
- 2 else, any other speaker may take the turn (may *self-select*),
- 3 if no other party takes the turn, then the current speaker may continue.

Predictions:

- **Minimal overlap**
  - ▶ only one speaker may generally be speaking at any time (speakers wait to TRPs)
  - ▶ overlap may occur at wrongly projected TRPs
  - ▶ overlap may occur when there are competing next speakers
- **No silence gaps as the norm**
  - ▶ to the extent that TRPs are projectable.
  - ▶ if silence occurs, it is typically for a reason  $\rightsquigarrow$  silence is informative.

# Turn-Taking Models

Duncan and colleagues proposed a system of **turn-yielding clues**: the likelihood of a speaker change increases linearly with the number of indicators jointly displayed.

Duncan (1972). Some signals and rules for taking speaking turns in conversations. *Journal of Personality and Social Psychology*, 23(2):283–292.

- **turn yielding**: syntactic closure / pragmatic completion plus acoustic information (rising/falling intonation; faster speaking rate); . . .
- **turn-holding**: certain prosodic patterns signal that the speaker plans to hold the turn beyond syntactic completion; word fragments and filled pauses
- **turn requesting**
- **backchannelling**

Recent research has aimed at making all these notions more precise: large scale studies and implementation in dialogue systems.

Gravano and Hirshberg (2011) Turn-taking cues in task-oriented dialogue, *Computer Speech & Processing*, 5(3).

# To do

## For this Friday 4 Sept:

- read one research paper on turn taking (see website for references); we'll discuss this in class.

## Homework #1: due Tuesday 8 Sept

- Transcribe a fragment of a conversation between two human interlocutors
- pay attention to: turn segmentation, overlap, pauses, turn holding, turn yielding, and turn taking signals

You will find more details on the course website later today.