Using Robots to Study Speech

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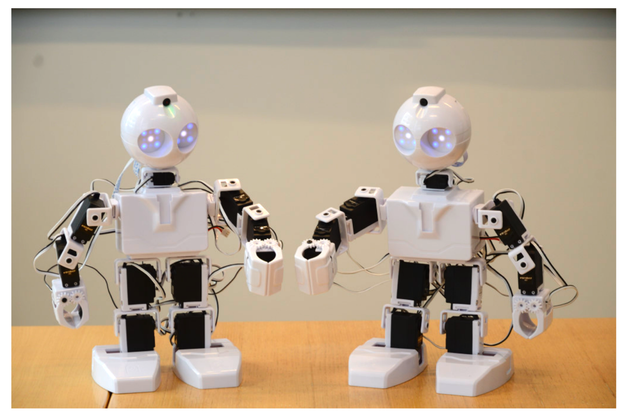


Problems Studying Speech in Interaction

- mechanisms, processes and influencing factors may not become transparent from observation of naturally occurring data only
- controlled studies in the lab may lack ecological validity
- interaction can only be studied with more than one participant
  - ➢ use of human confederates

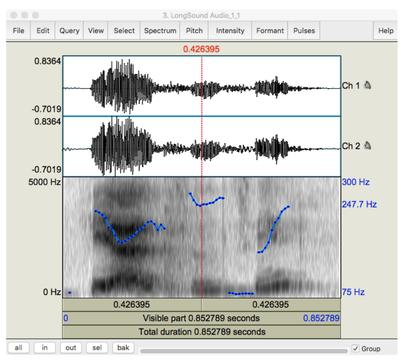
Humans as Confederates

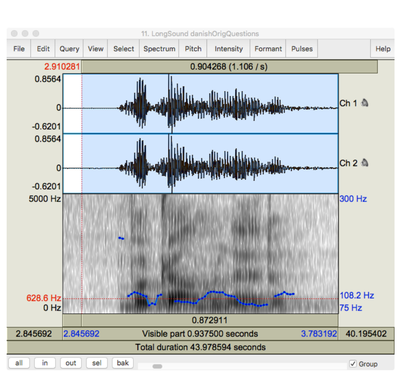
- many studies use humans as confederates
  - for instance, to analyze partner influences on storytelling (Brown & Dell 1987)
- however, studies that use naïve subjects instead of confederates often yield different results (Lockridge & Brennan 2002, Brown-Schmidt 2009)
  - ➢ Brennan et al. (2010): what confederates communicate implicitly is a *lack* of need for information
  - ➢ many aspects of communication cannot be sufficiently controlled so that they do not influence the dynamics and the outcome of the interaction

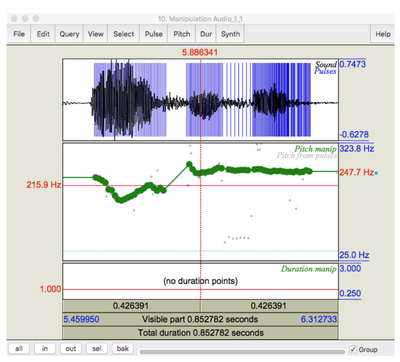
Robots as Confederates

- robots' behavior, appearance, functionality, framing etc. can be controlled in ways in which humans cannot
- robots so far inhabit only labs, so the lab is their natural habitat
- people's expectations in robots are generally
  - low
    - and thus they do not expect as complex interactions as with another person
  - open
    - and thus their expectations can be framed more easily
- robots are embodied and potentially realistic interaction partners

Example Study: The Intonation Swap Experiment

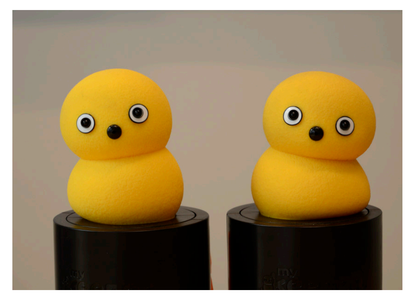






What if you transfer the intonation of your first language to your second language?

- e.g. if you are a native speaker of Danish and you are learning German?



Problem:

In questions, the intonation contour at the end of a question rises in German and stays level in Danish.

Procedure:

- We recorded questions by native speakers of German and Danish
- Using Praat, we manipulated the F0 of the original question according to the F0 of the question in the other language
- We combined the original and the manipulated sound files with a video of our Keepons
- the Keepons take turns in asking questions, where one Keepon uses the original F0, the other the manipulated F0
- participants (in an online questionnaire) are then asked to rate the two robots according to friendliness, politeness, engagement, competence etc.

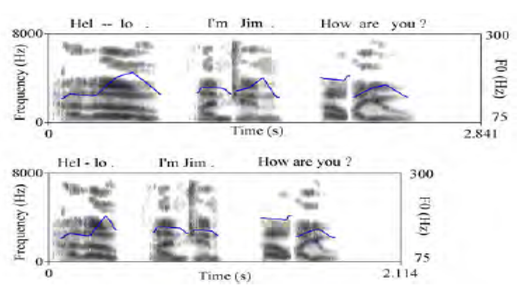
Example Study: Greetings for Friends and Strangers

Do long greetings signal friendliness and acquaintance?

- Pillet-Shore (2012) found long greetings for friends and short greetings in neutral contexts

Procedure:

- We synthesized two greetings using a free text-to-speech system
- We elongated one of the greetings using Praat
- We presented participants with two Keepon robots; either the first or the second robot greeted the participant with a long greeting



Results:

- The second Keepon with the longer greeting is rated as significantly more engaging, frienly, polite, and participants want to own it and talk to it more
- There are no results for lengthening for the first Keepon!

Where Robots Beat Human Confederates

- A robot experiment is **exactly reproduceable**, as many times as needed.
- Unlike human beings, robots **do not suffer from fatigue**. They are ready for use whenever needed.
- All linguistic features can be studied independently and **in their interactional context**, e.g. prosodic features, hesitation, lexical items or pragmatics strategies
- Robots allow the study of **behavioral variables**, e.g. to study the persuasiveness of linguistic features
- Robots of the same brand are **absolutely identical speakers**
- Studies can be carried out
  - as **online** questionnaires or as **on-site** interactional studies
  - with **human voices** or with **synthesized speech**
  - in **between-subjects** or in **within-subject** study designs

More about the lab and the amazing team can be found here:
https://www.sdu.dk/en/om_sdu/institutter_centre/idk/projekter/human-robot+interaction