Lost in Translation

Tamara Lorenz
Mechanical Engineering, Electrical Engineering & Psychology
University of Cincinnati
Translation?

- **Linguist: between which languages**
  - Translating a word from one language to another

- **Psychologist: from research to application**
  - Translating a fundamental finding into practice

- **Engineer: between two locations**
  - Translating an object form A to B
Translation from HHI to HRI

• Both psychological and engineering concepts
  – Translate fundamental findings to improve the interaction between humans and robots
  – Find concepts that enable the robot to act upon its environment – especially with other people

• Start learning each other’s language – or find a common one!
Spilling the beans

Helpful:
• Get rid of the sophisticated language of your discipline
• Try to explain it though your grandparents can understand (not your kids!)
• Question every term that you do not understand
• Consider the context

Most effective:
Find a model of your data/findings to enable you to talk “Math” or any other symbolic language
Spilling the bean – a class on action models

What is a model?
- Formal (mathematical) description of a system
- Characterizing its (changing) states or behavior
How to develop a good interaction model, Dr. Schaal?

“...this is exactly the problem...but at least you are asking the right question!”

Stefan Schaal, USC, 2010

Several possibilities:
- Based on empirical findings
- Based on theoretical considerations
- Optimally both
Human-Machine Interaction

How is the environment perceived?

Perception-Action-Environment Systems

How can we adjust the environment (machine) to account for these findings?

How does the perception shape the action?
Human-Robot Interaction (HRI)

How is the interaction with the robot perceived?

How does perception shape interaction?

How can we implement this model for HRI?

How can we describe (model) this interaction?

How is the environment perceived?

How can we adjust the environment (machine) to account for these findings?
Translation from HHI to HRI

**Human-Like – golden standard**
- Copying human behavior
- Focus on interaction behavior itself

**Advantage:**
- High likelihood of creating intuitive behavior

**Problems:**
- Uncanny Valley
- No White Box Model for human behavior
Translation from HHI to HRI

Ability-Inspired: the I-Phone Idea

- Assumption: Human is very adaptive
- Find intuitive for the interaction with robots (“swiping”)
- Maximize task performance instead of parameters

Advantage:

- Not uncanny
- Free choice of methods
- No need to create a perfect match between HRI and HRI

Problem:

- Finding the intuitive solution
Still: Human-Machine Interaction
Designing Interaction Dynamics

Understanding what is “human-like” or “interactable” interaction

Intuitive Interaction
Acceptance
Trust in Abilities
Safety

Model for autonomous interaction

Trajectory
Timing
Velocity
Adaptation
Designing Interaction Dynamics

7 Degrees of Freedom + Minimum-Jerk

Chose one arm (robot) to work with – or focus on platform independent solutions
Designing Interaction Dynamics

Create Predictable Interaction

Vienna Technical University – available from https://www.youtube.com/watch?v=aF8_VkLdc_g
Designing Interaction Dynamics

Autonomous grasping

At which point do you get the cup yourself?

Design dynamics in a way that the robot can immediately and timely react.
Designing Interaction Dynamics

Here:
Interaction based on coupled oscillator dynamics

Open question:
How to scale adaptation?

Human-like or better Interactable?
Designing Interaction Dynamics - Summary

Do we want:
- human-like behavior?
- merely interactable behavior?

Requirements in both cases:
• Predictable interaction (→ safety)
• Immediate Interaction
• Platform-independent interaction
• Based on human abilities and developed based on human action-perception principles
Some (debatable) ideas

- Translating HHI to HRI
  - Start searching for quantifiable factors shaping human interaction
  - Address the *Cinderella of Psychology* (abandonment of motor control research) (Rosenbaum, 2005)

- Translating Robotics to HRI
  - Consider the user before “making it work”
  - Think platform independent
More translation needed?