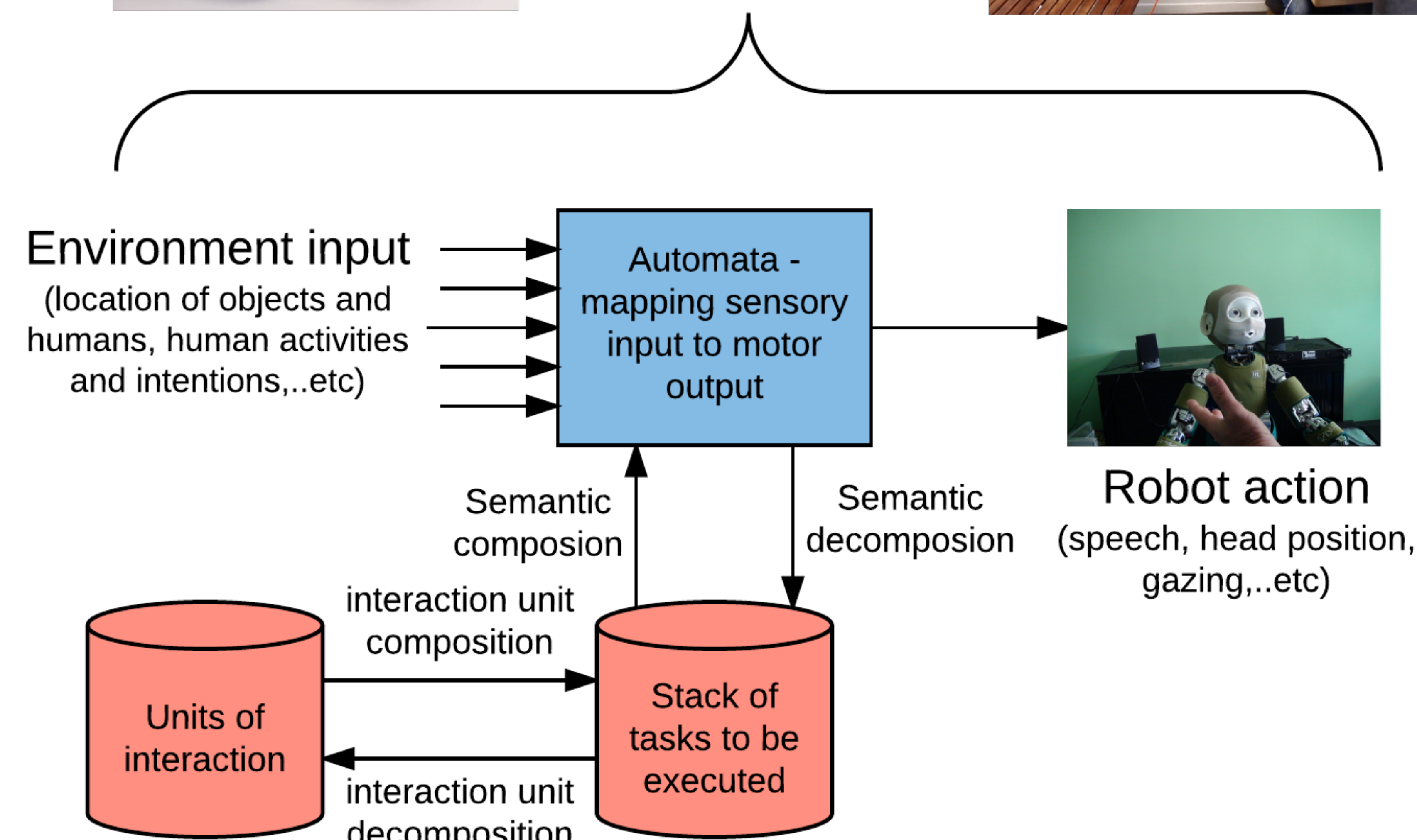# ACQUIRING HUMAN-ROBOT INTERACTION SKILLS WITH TRANSFER LEARNING TECHNIQUES

Omar Mohammed, Gerard Bailly and Damien Pellier

PROBLEM

While there are machine learning algorithms to learn policies for an HRI scenario, once we move to a new scenario, we have to repeat the learning process again from scratch, even though there are common aspects between different scenarios.

A different HRI scenario emerges when we use a different robot, have different people to interact with, or change the task.

HYPOTHESIS

Most of HRI scenarios have common aspects, and they are composed of basic atomic units (we call them 'interaction units').

If we can find the suitable units of interaction from one scenario, we will be able to use them to learn a new scenario.

GENERAL ARCHITECTURE

Environment input
(location of objects and humans, human activities and intentions,..etc)

Automata - mapping sensory input to motor output

Robot action
(speech, head position, gazing,..etc)

Semantic composion

Semantic decomposion

interaction unit composition

Units of interaction

Stack of tasks to be executed

interaction unit decomposition

PILOT STUDY

In order to test our ideas in a simple environment, we chose the 'handwriting synthesize' task to start with

- Sensory input: Letter drawing
- Motor output: Pen movement sequence
- Skills to be learned: Pen strokes

Transfer Learning

- Learn the skills on a subset of the letters
- Use these skills to learn the new/unseen letter faster

E - 3 strokes

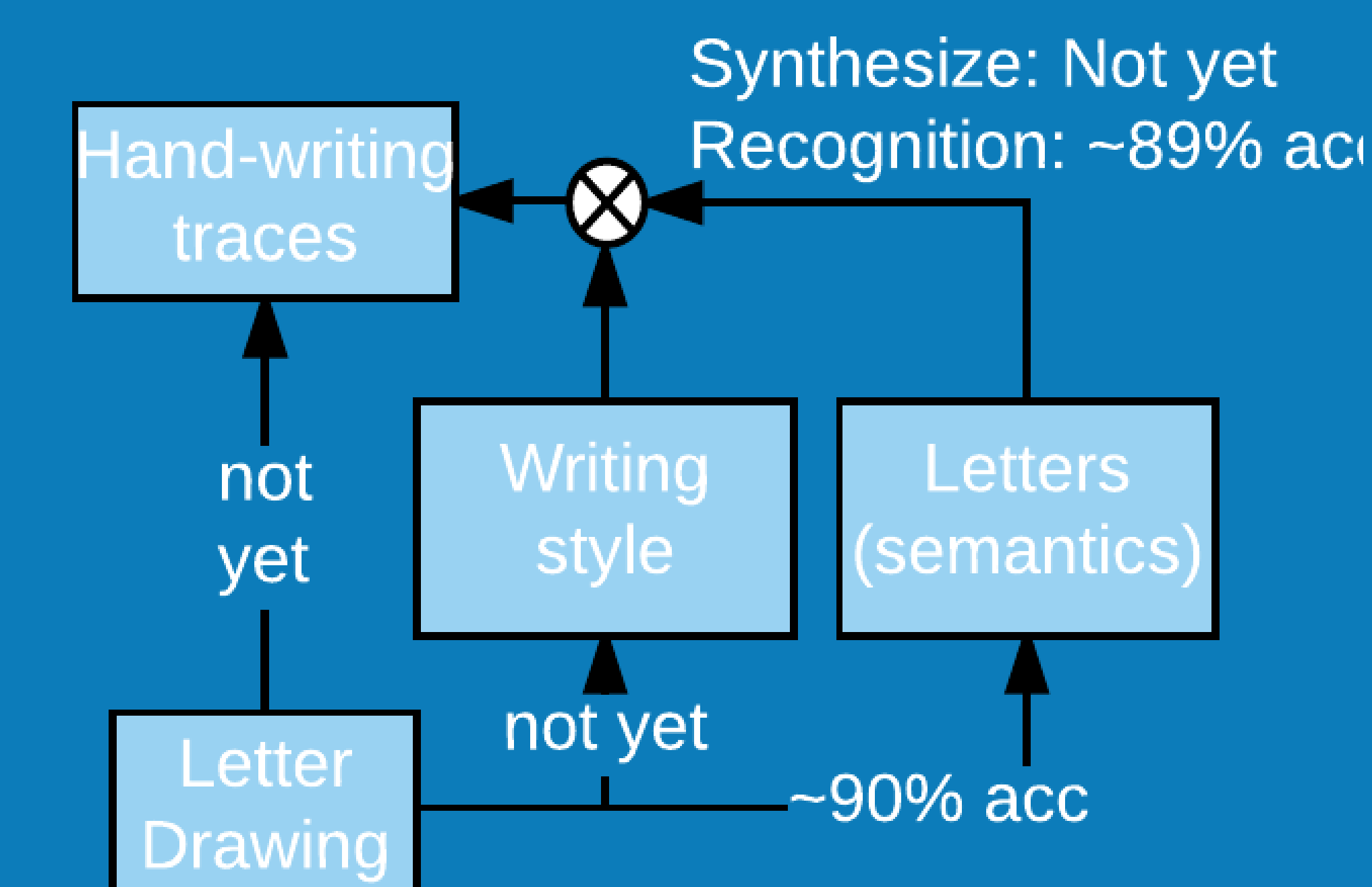|	
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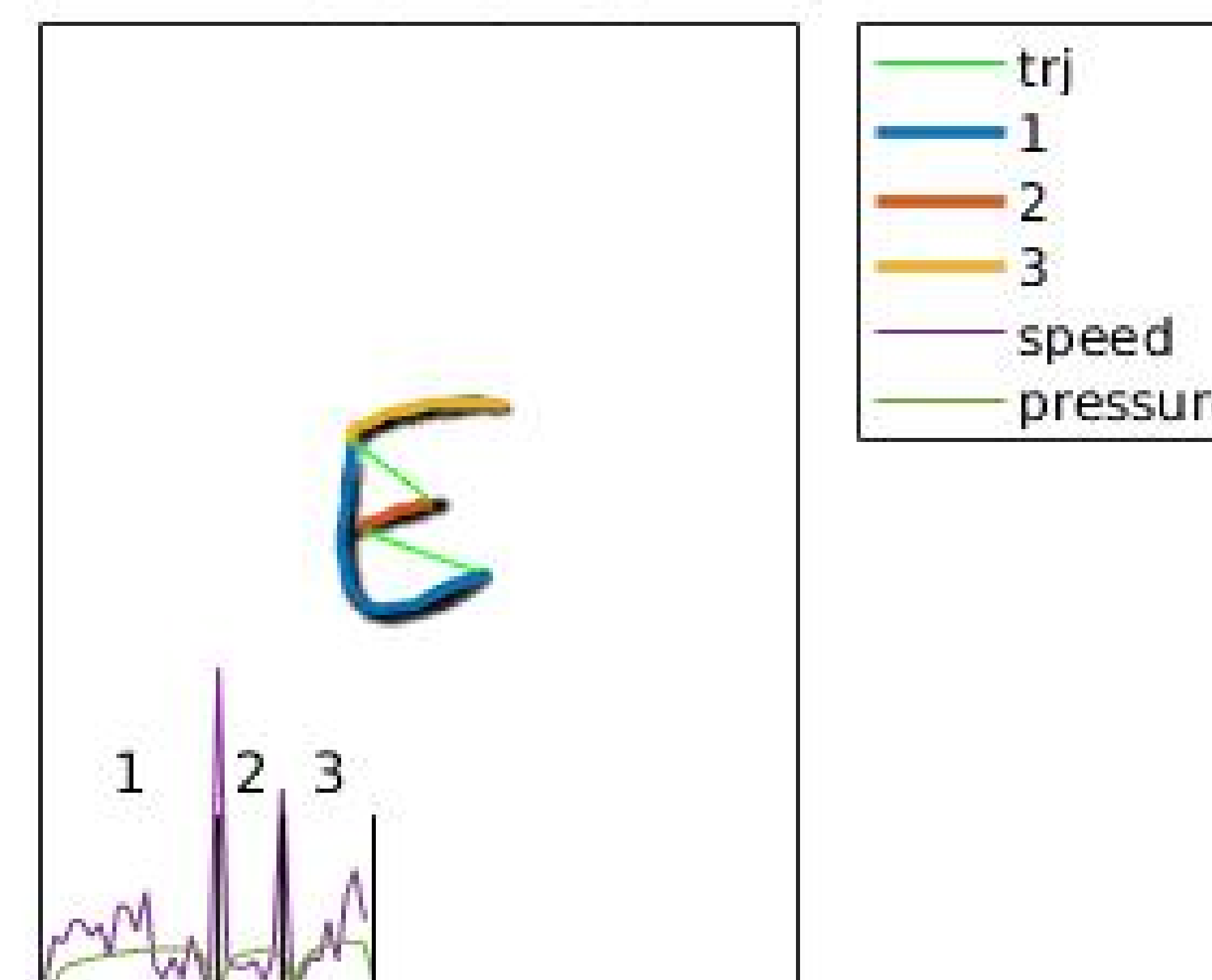
PILOT STUDY DATABASE

- 550 writers
- Data available:
  - Letter Drawing
  - X, Y coordinates of the pen (continuous)
  - Pen pressure (continuous)
  - Pen State (up or down)

RESEARCH QUESTIONS

The challenge of this study is to answer the following questions:

1. How direct mapping between the letter drawing compares to semantic-based mapping?
2. How to automate the process of skill discovery?
3. How to decompose an interaction scenario into a series of tasks?

RESULTS

Synthesize: Not yet
Recognition: ~89% ac

Hand-writing traces

not yet

Writing style

Letters (semantics)

Letter Drawing

not yet

~90% acc

NEXT STEPS

- Continue on the study of skill discovery and transfer learning in the pilot study
- Start collecting multi-modal human-robot interaction data
- Apply the methods used in the pilot study for HRI data