A robot that communicates to learn
www.makerobotstalk.nl

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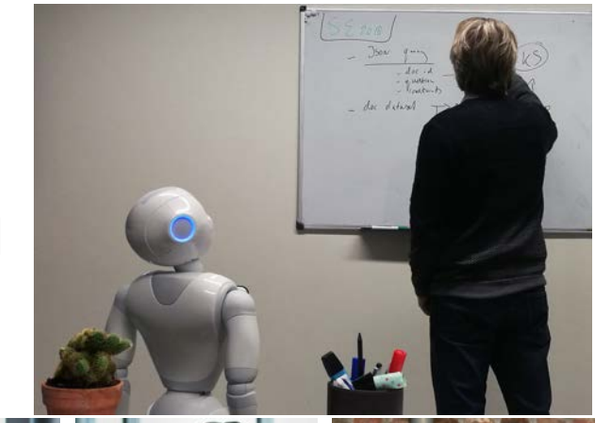
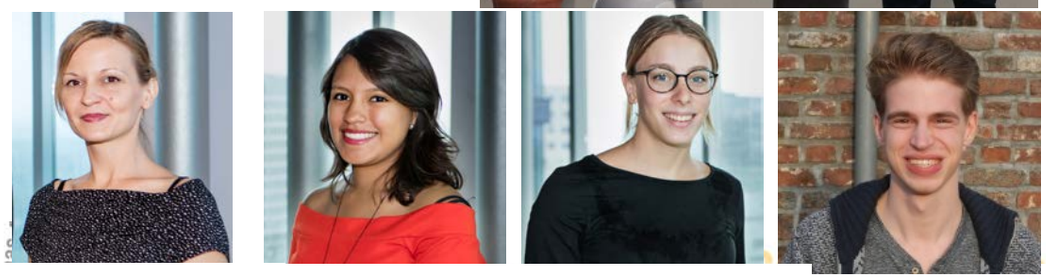
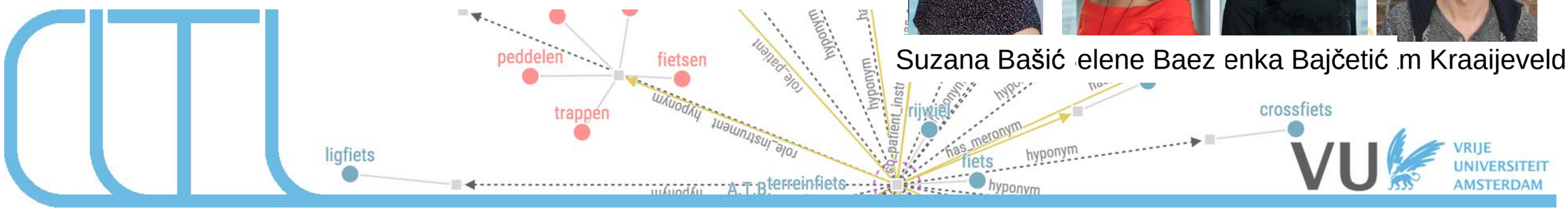


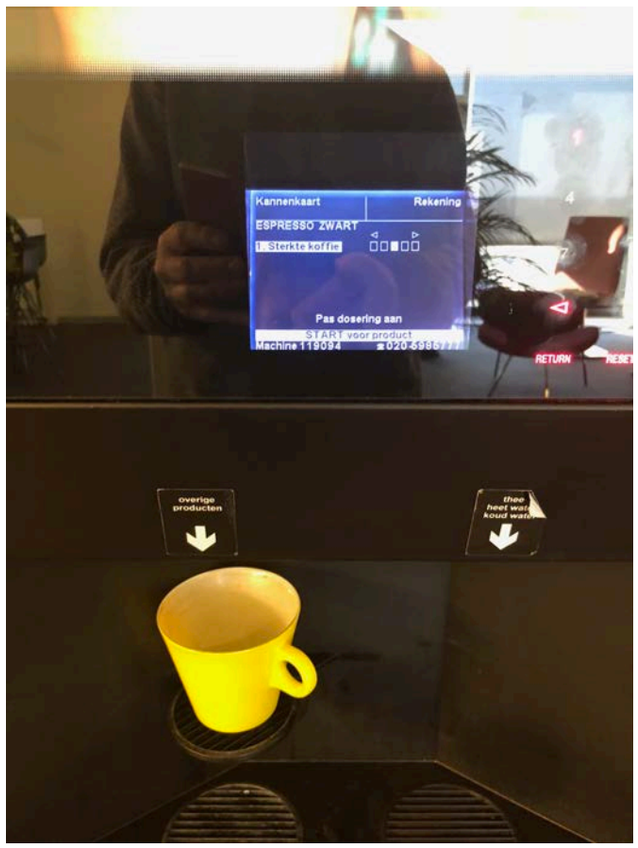


Suzana Bašić elene Baez enka Bajčetić m Kraaijeveld

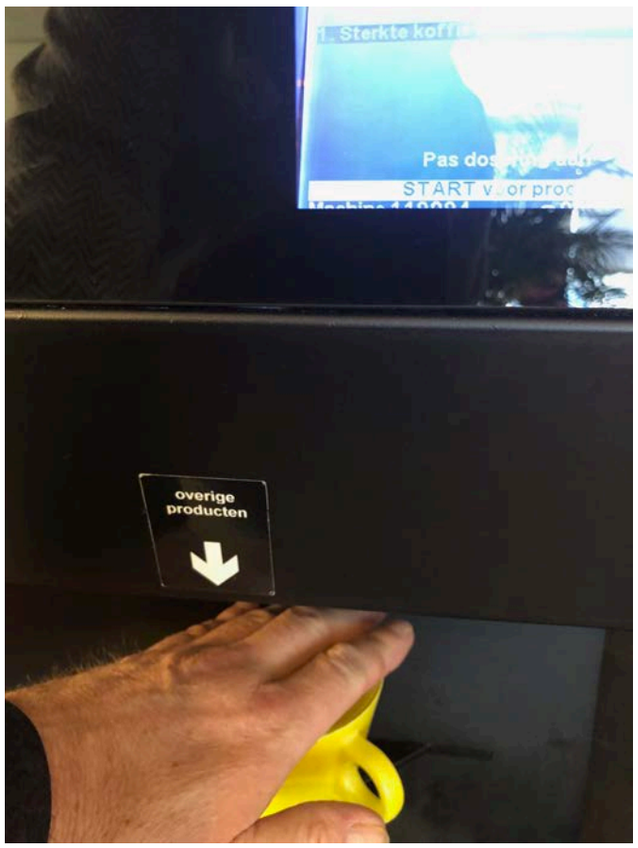


There is no such thing as a perfect machine

My daily life with machines



There is no cup



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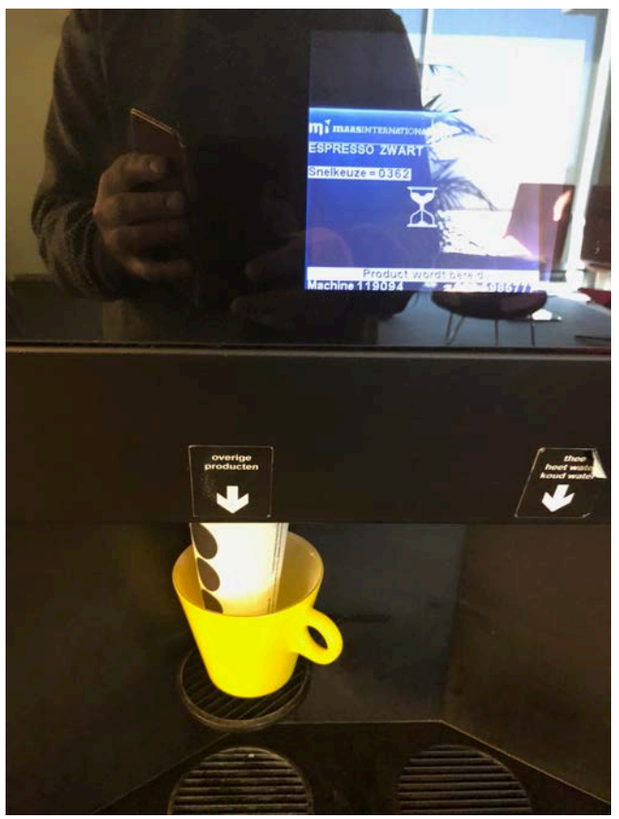
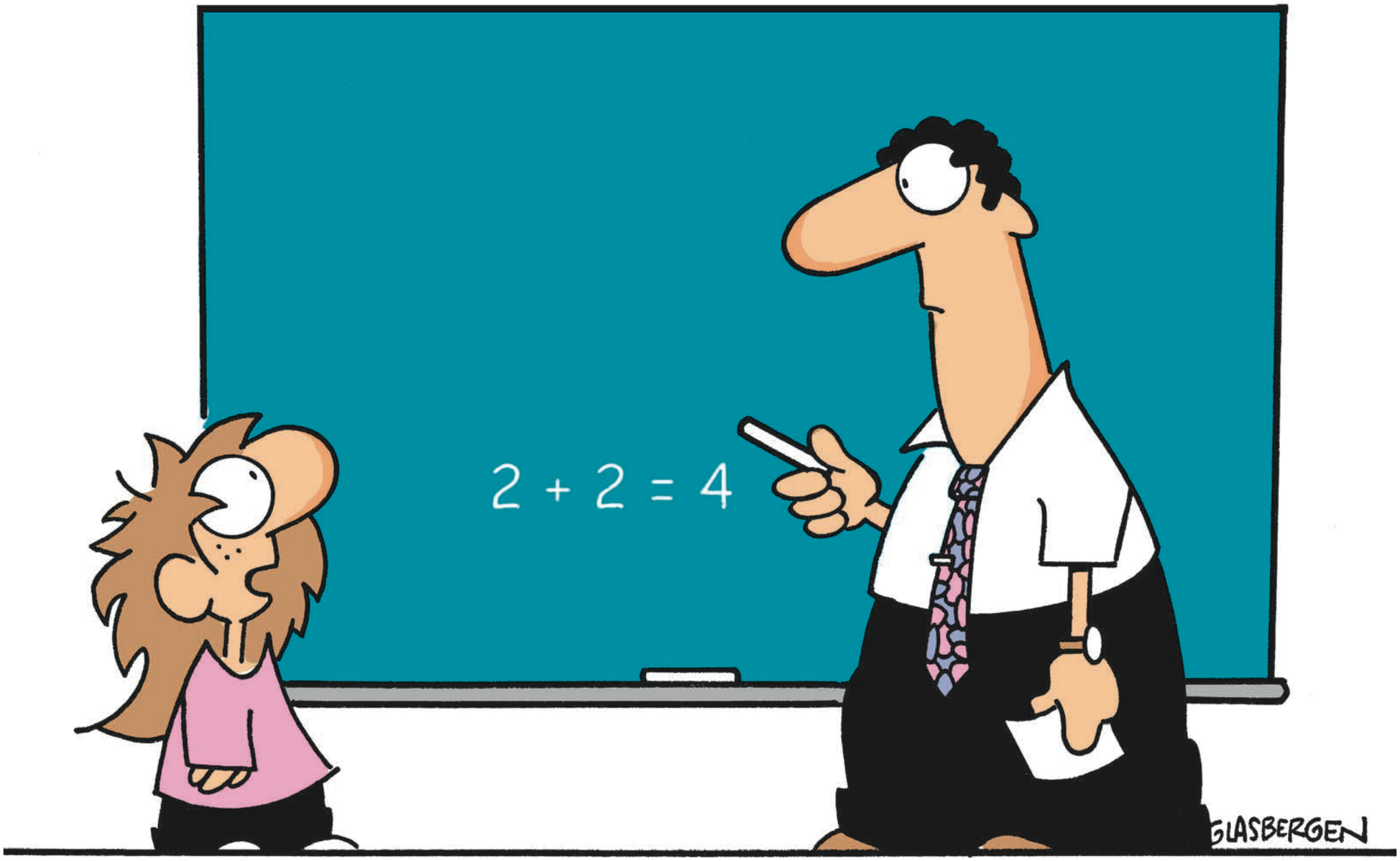


There is no cup

There is a cup

Our mission: to build a robot with curiosity that learns about the world through communication



“How can I trust your information when you’re using such outdated technology?”

Reasons for (Robot) learning

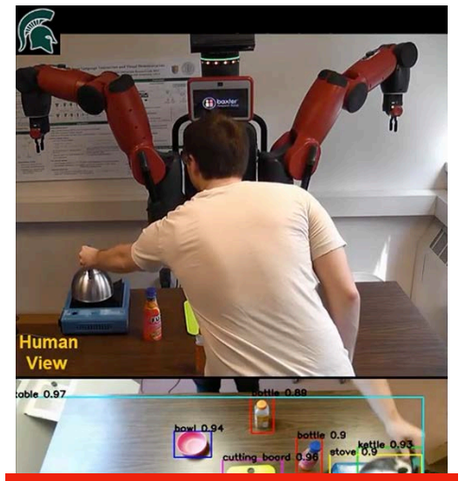
- Correct: provide feedback on errors, uncertainty, conflicts
- Teach: instruct by giving abstract relations & properties that explain the world, fill gaps, deepen knowledge
- Negotiate: try to reach consensus on goals and plans
- Curiosity is the drive: continuously check the status of knowledge (robot brain)

Learning using Language

Many sources of information and ways to learn

Experience grounding

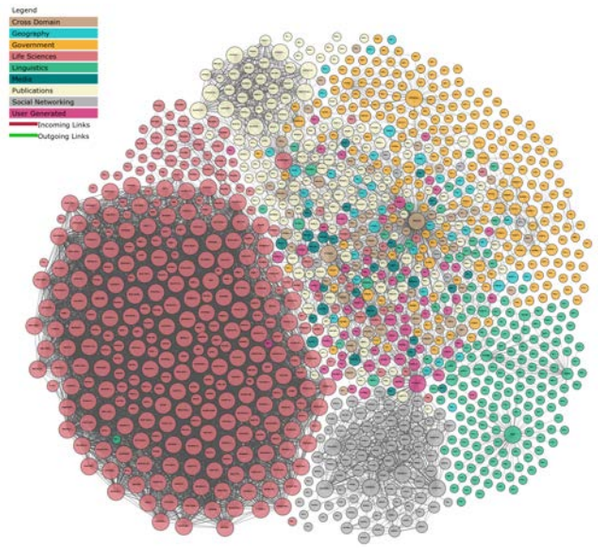
Reinforcement Learning



She & Chai (2017)

Symbolic relations

Semantic Web

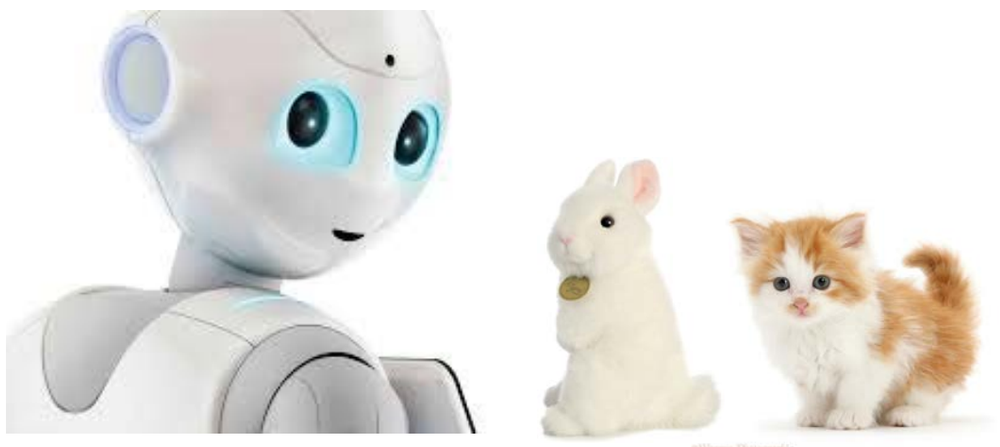


Symbolic stories

The news

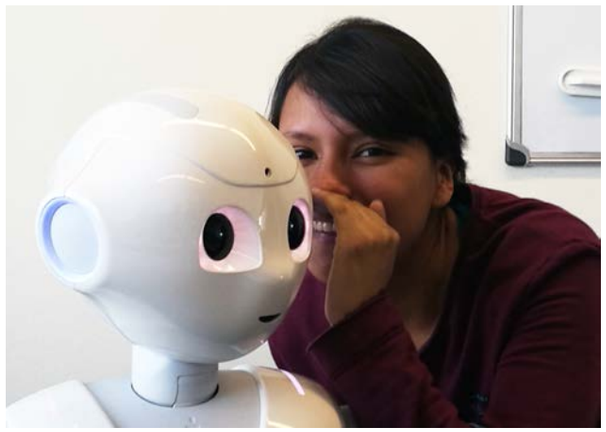
Sensory Observation

What are the things in my office?



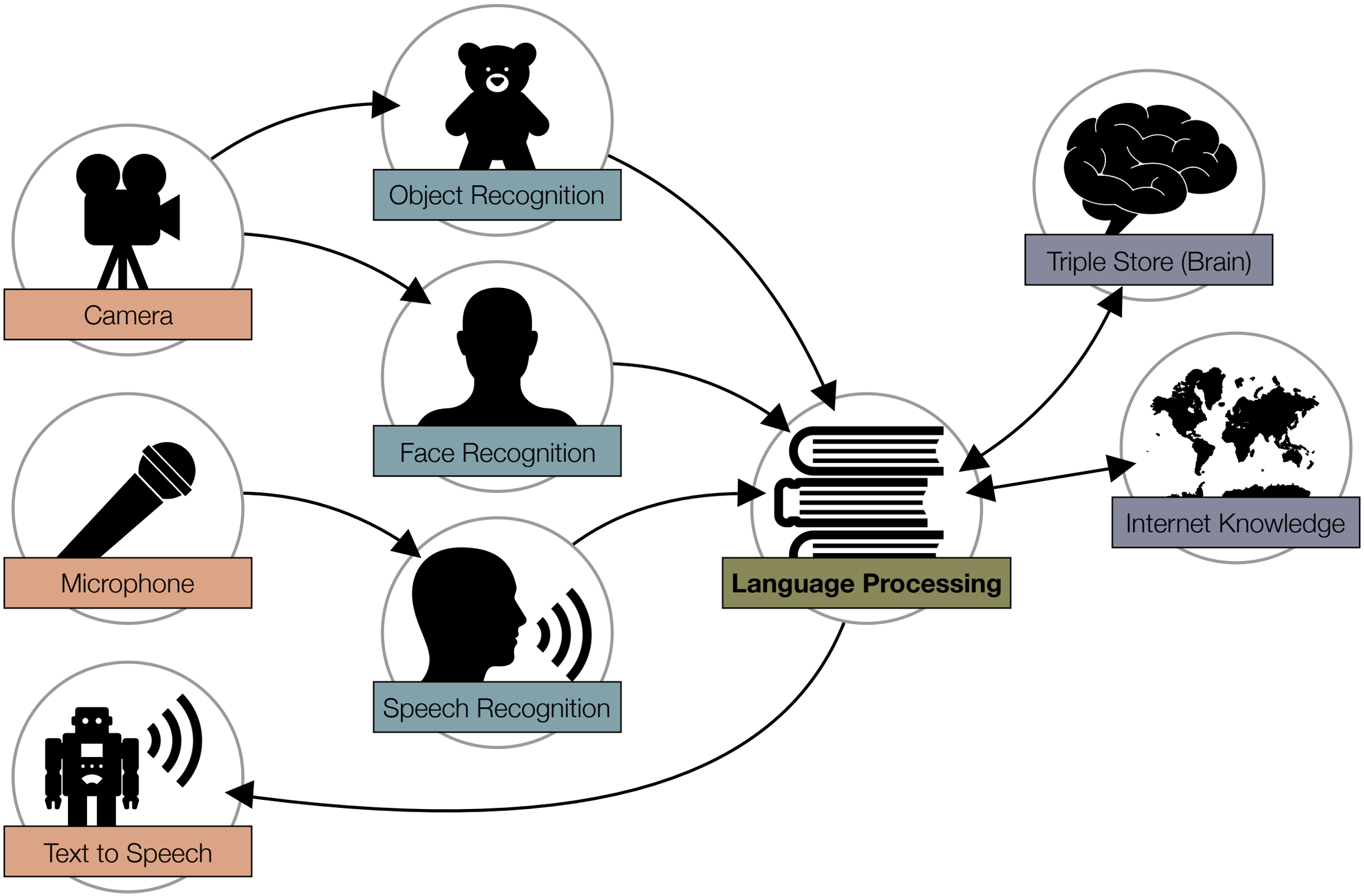
Symbolic properties

Talk

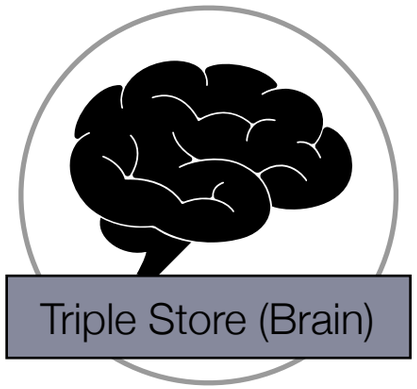


How to Enable Robot-Human Conversation?

Breaking it up in components



Growing a Brain



"Bram likes soccer"

Utterance

20180512T**10:05**am.

Perspective

confirm, uncertain

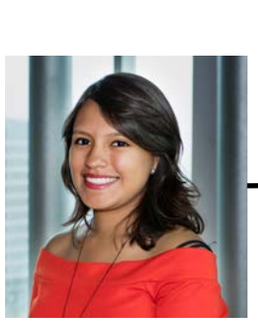
Claim

Instance	Property	Value
Bram	likes	soccer

"You are right, he does not"

Utterance

20180512T**10:07**am.



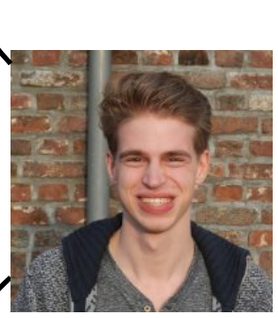
"No, Bram hates soccer"

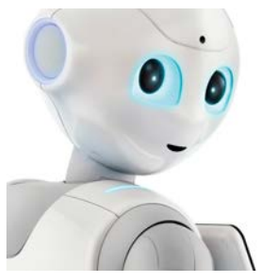
Utterance

20180512T**10:06**am.

Perspective

denial, certain





Perception

mood-detection

20180512T**10:05**am.

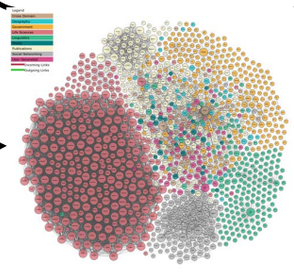
Perspective

confirm, uncertain

Claim

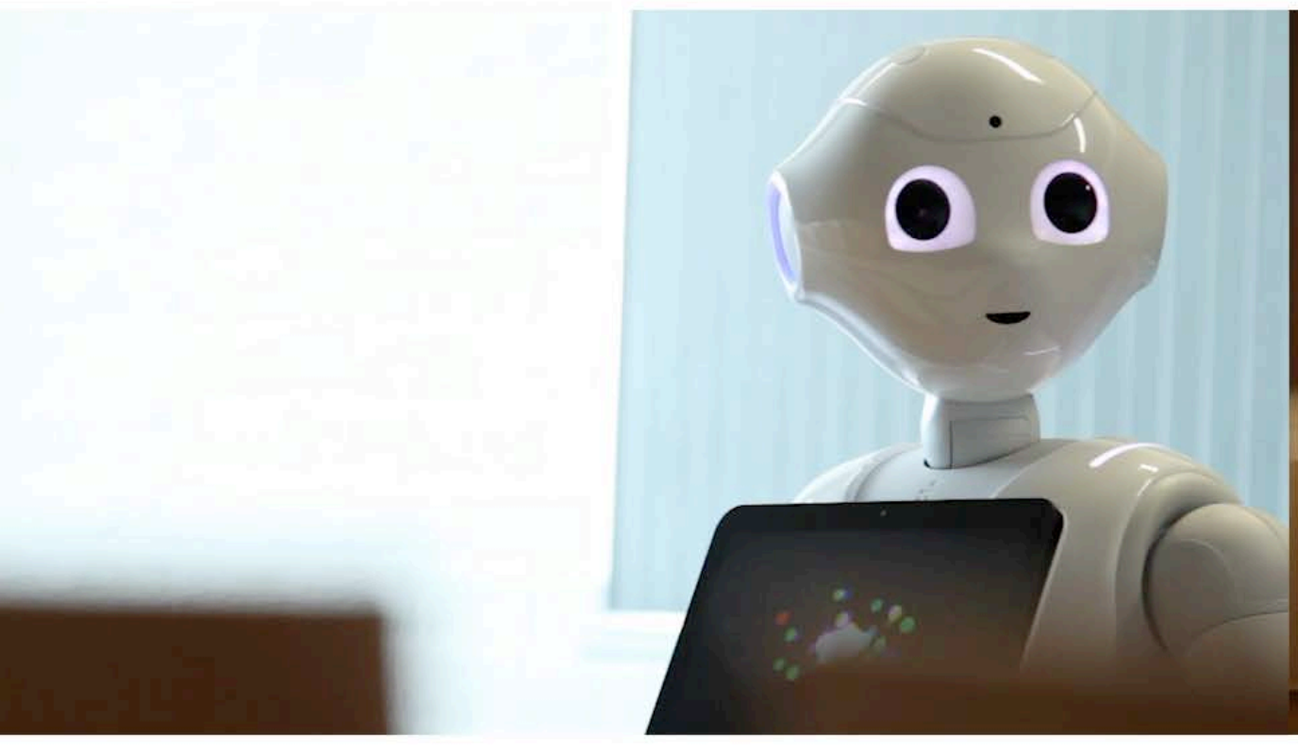
Instance	Property	Value
Bram	hasMood	joy

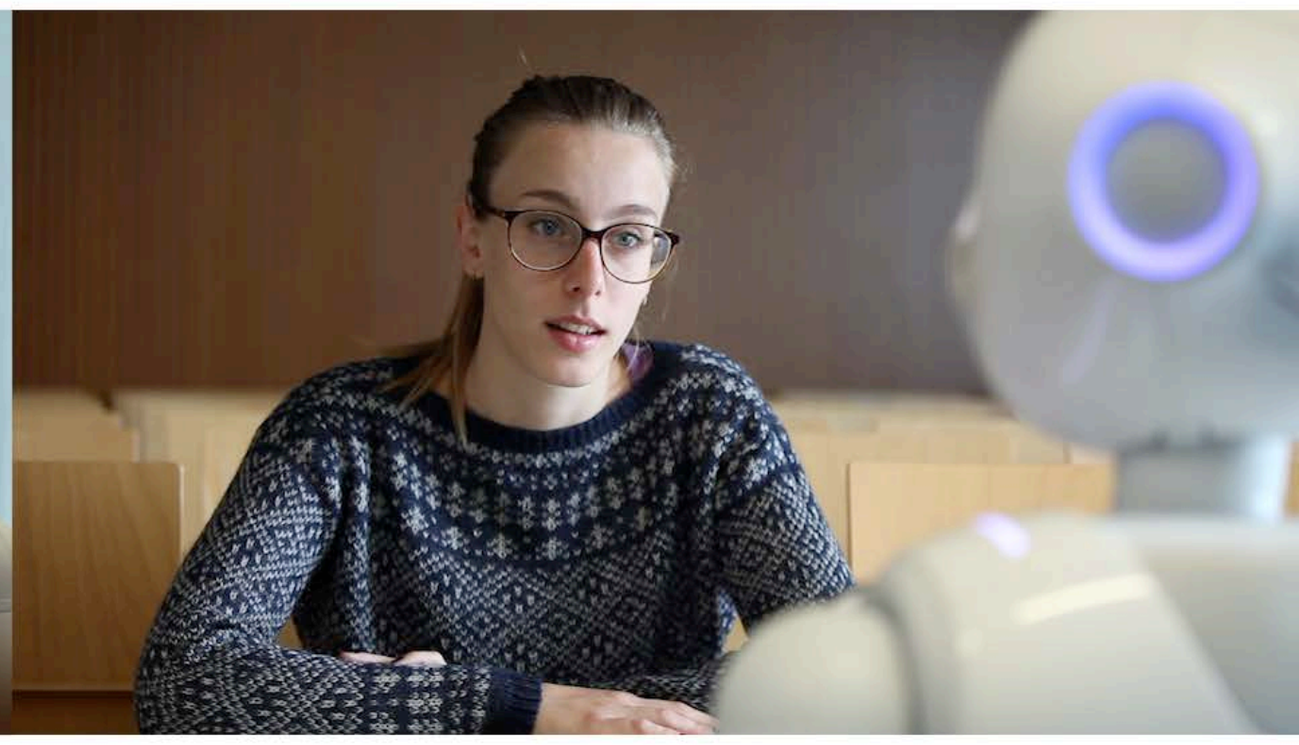
consult-semantic-web



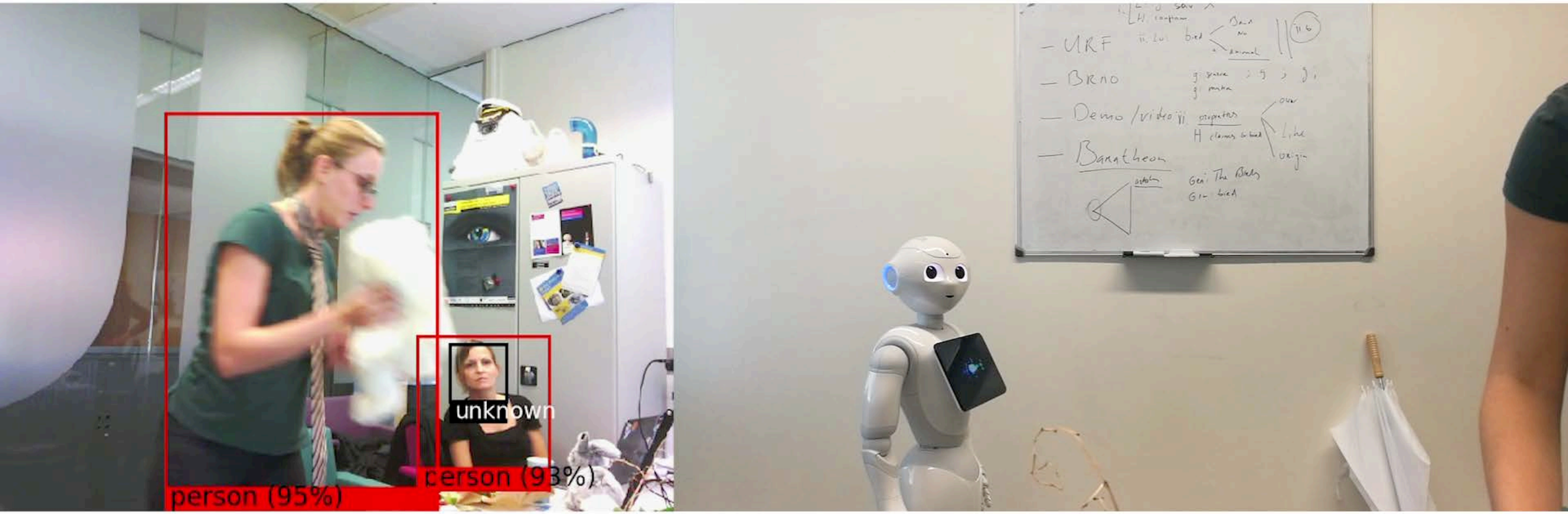
Instance	Property	Value
soccer	typeOf	game

Know the people that tell her things
Getting to know you by face and name

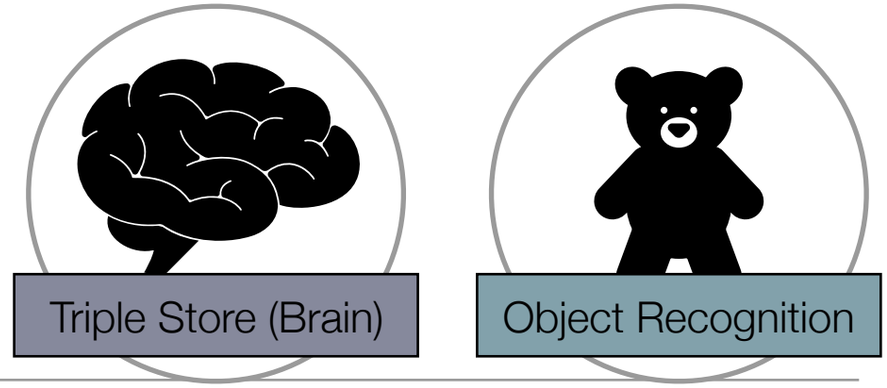


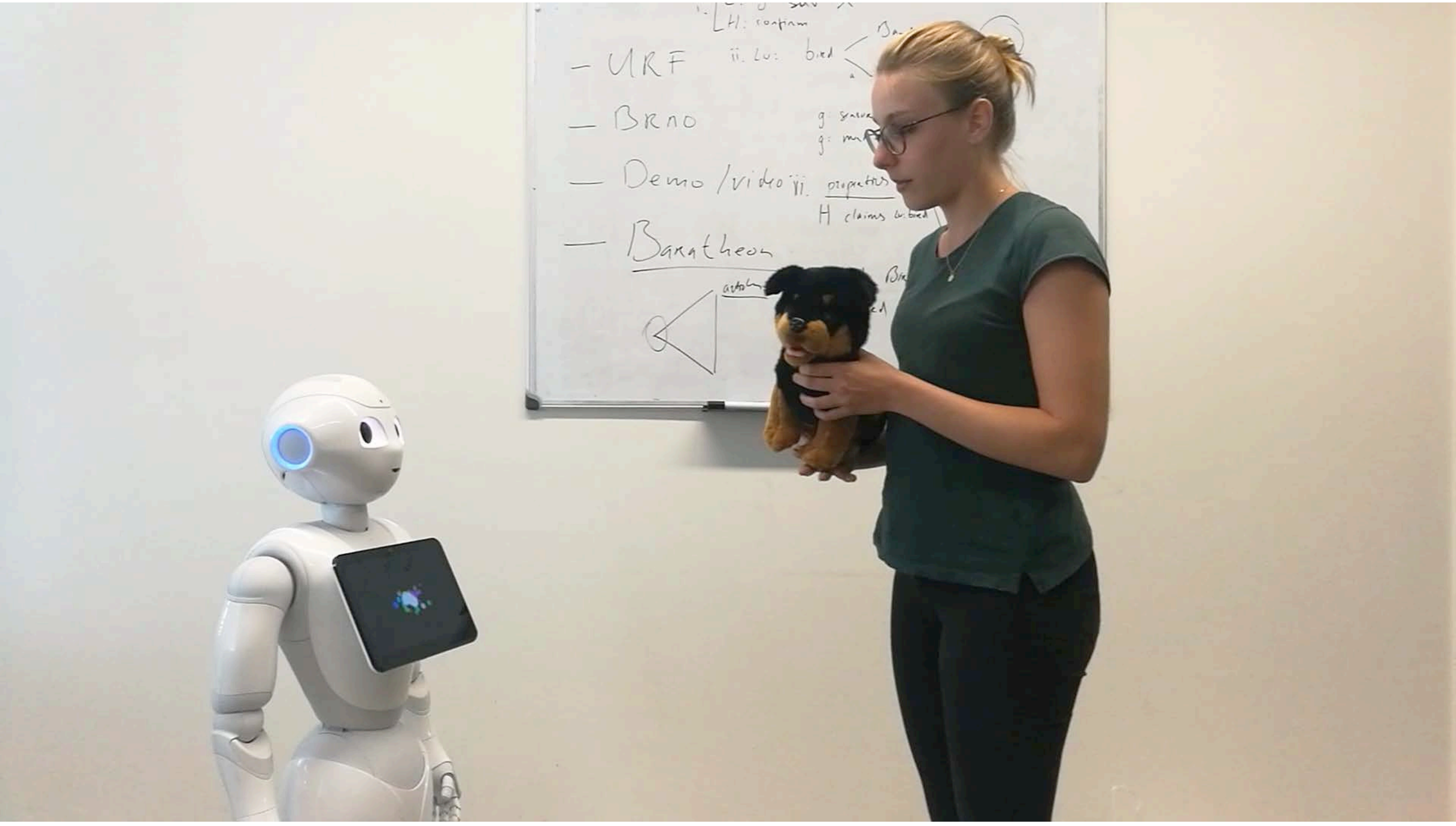


Perceiving the world

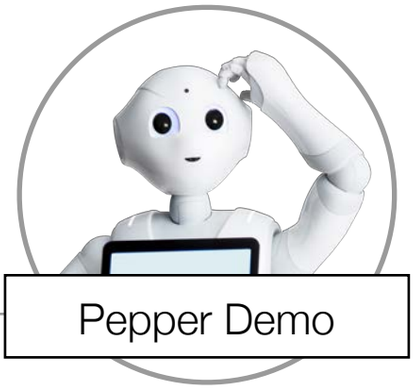


Learning about the world





Disagreeing about properties

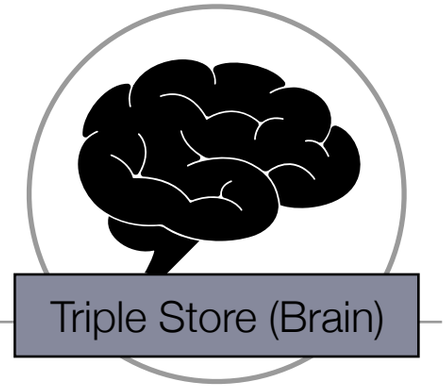


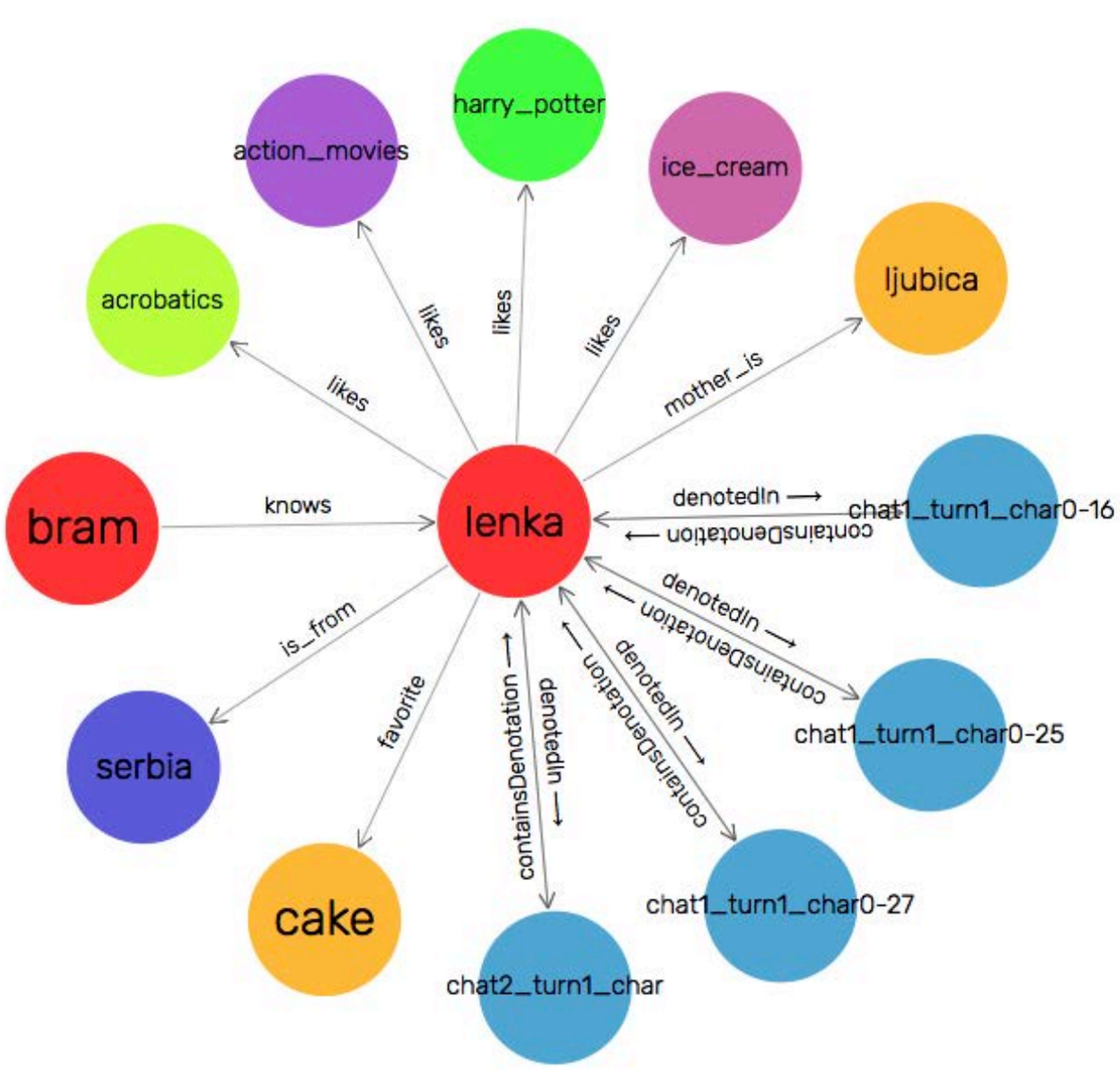
Open-ended learning from conversation

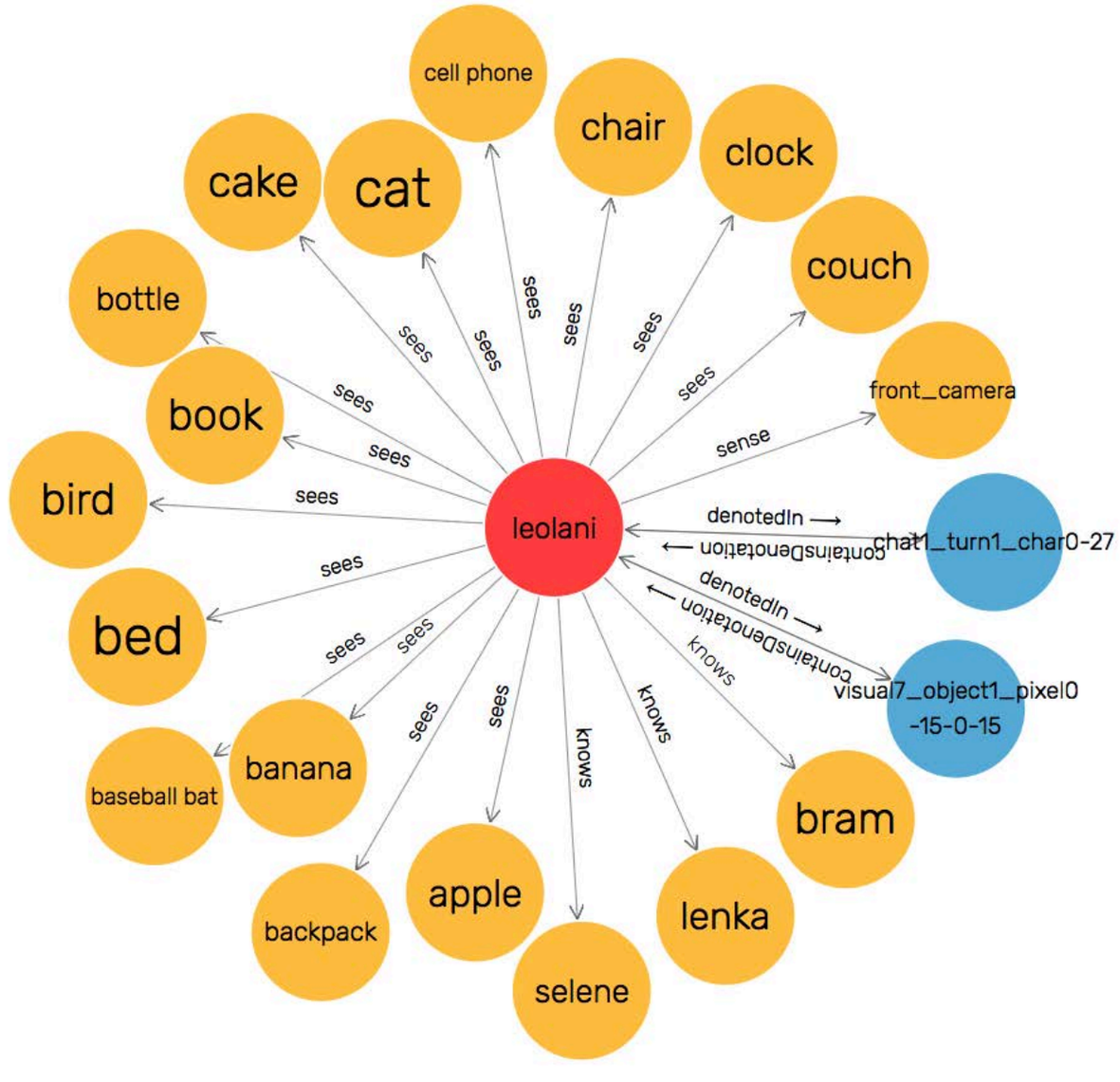
Pepper's Brain has a predefined set of properties

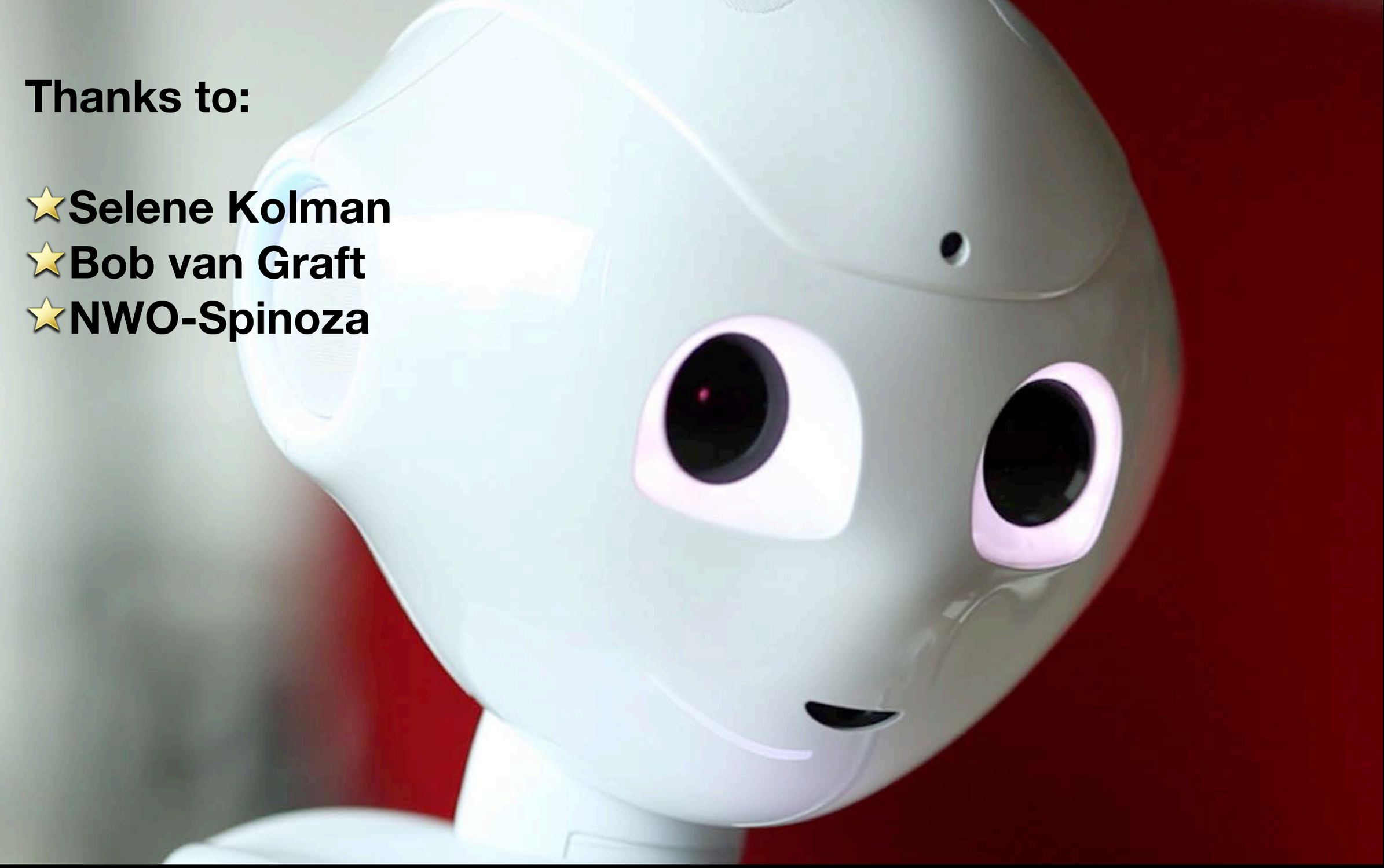
- **Perceived objects (whatever object recognition can handle):**
  - Learning about perceived objects from the web: ***a dog is a mammal***
  - Telling her what an observed object is: ***a dog is also a pet***
- **Any string can be the value as an object of a predicate** *(no slot type constraints)***:**
  - Bram likes romantic movies, science fiction movies, chocolate, pizza, ….
    - Next Leolani tries to learn from people or the web what the object is: ***chocolate, pizza*** subClassOf ***food***
- **Process "*X can do-action Y/X can have-property Y*" phrases to learn new properties (possibly of new objects)**
  - You ***can*** ***eat chocolate,*** You ***can*** ***send/receive email***; shirts ***can*** ***have colour***
- ***"X is same as Y"* used to learn synonymous expressions:**
  - *mail* ***sameAs*** *send*

Some Knowledge stored in her Brain









Thanks to:

- ★Selene Kolman
- ★Bob van Graft
- ★NWO-Spinoza

Reference:

- P. Vossen, S. Báez, L. Bajčetić, and B. Kraaijeveld, (2018) “Leolani: a reference machine with a theory of mind for social communication, invited keynote speech,” in *Proceedings of TSD-2018, Brno.*
- www.makerobotstalk.nl