Leveraging Memories
for Hybrid Intelligence Collaboration

PhDs: TBD[1], *Annika Kniele*[2] **Supervisors**, *Catha Oertel*[1], *Piek Vossen*[2] *and Max van Duijn*[3]

[1] Delft University. [2] Vrije Universiteit Amsterdam, [3] Leiden University

Human and Agent memories are very different

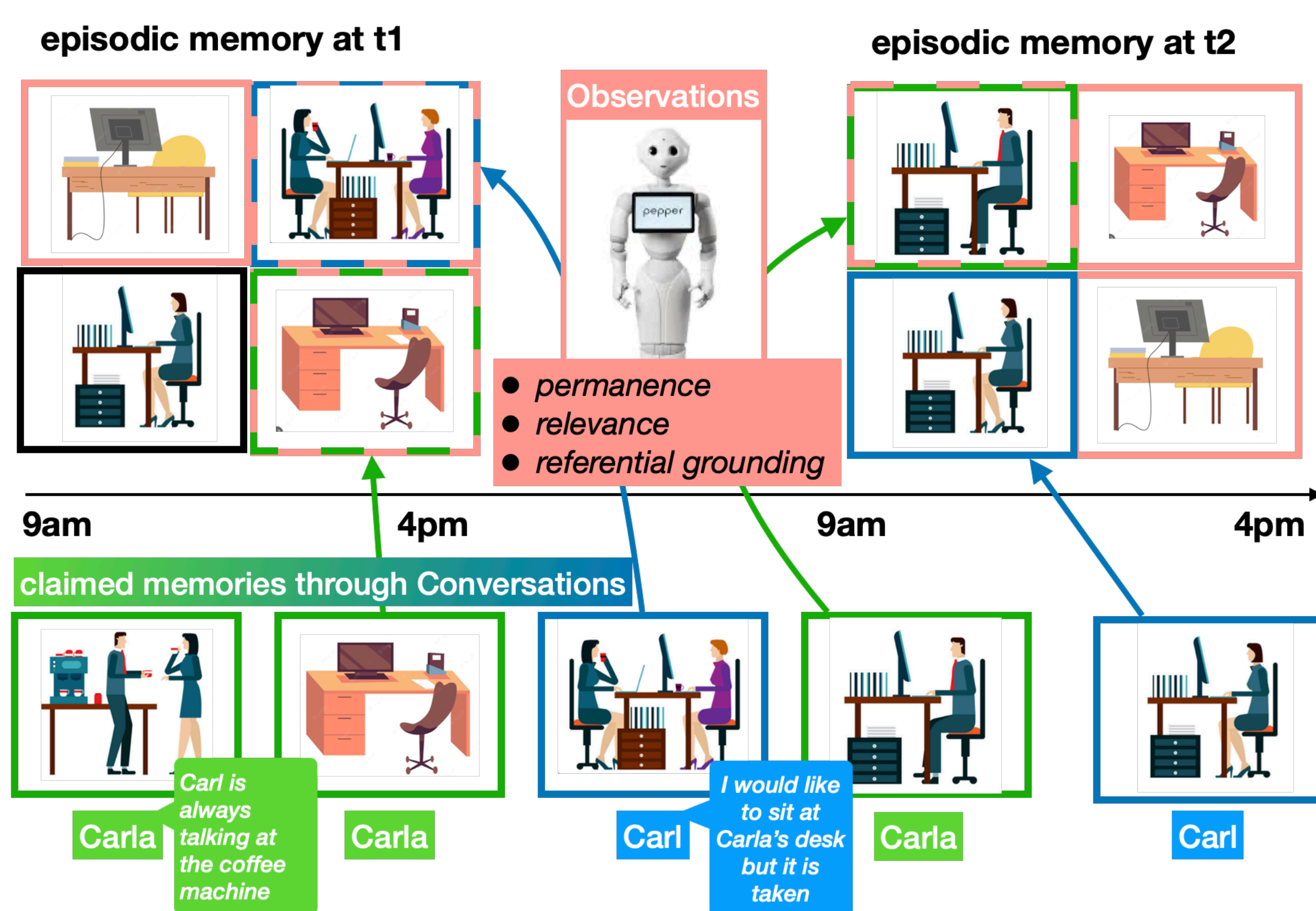| Human Memory	Agent Memory
Conceptualises experiences of the world	Records experiences of the world
Abstracts from details	Keeps all details
Biased and coloured by personal interests and motivation	Systematic and transparent
Limited in capacity (fades)	Practically unlimited
Deep and rich interpretations and perspective	Superficial interpretations
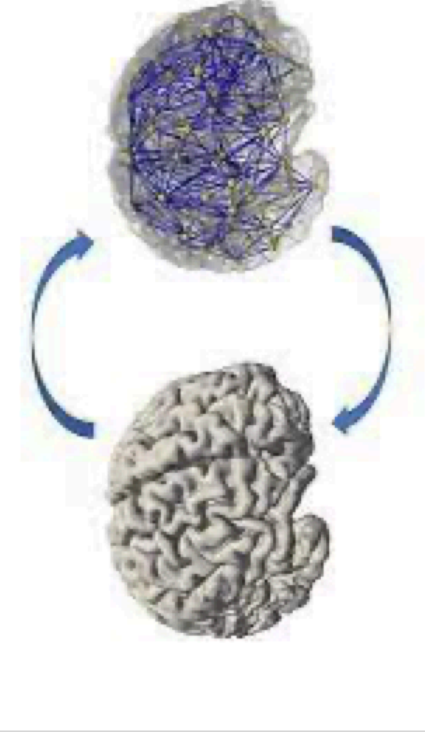
How to leverage both types of memories for hybrid collaboration?

- Memory construction: agent needs to construct memories from observations and communication
- Memory alignment: agent needs to communicate to find out what is the same and what is different (Theory of Mind)
- Both humans and agent need to use the best of both worlds in collaboration

P2.15: Sharing Memories of Activities and Physical Spaces through Conversation

Piek Vossen (VU), Catha Oertel (Delft), Max van Duijn (Leiden)

P2.4 Conversation Memory and Social Emotional Interpretation

Catha Oertel (Delft), Piek Vossen (VU), Max van Duijn (Leiden), Catholijn Jonker (Delft)

Research questions

(1) Creating memories from observation and communication:

a **Record** situations over time and identify the location, objects and people in contexts through observation and communication.
- **Reconstruct** situations through communication from people's experiences.
b **Theory of Mind model:** keep the memories of different sources separated but linked.
c **Evaluate** the quality, status and value of the memory and determine actions to improve: resolve conflicts, uncertainties and gaps.

(2) Aligning memories through communication:

a **Optimise** the communication by personalising referential expressions: reducing ambiguity and variation.
b **Sharing:** determine through communication what is shared and what is different.
c **Leverage:** combine the memories to derive a hybrid memory with added value: complement, confirm, resolve.

### (3) Optimize memories over long-term interactions:

a **Stabilize:** Instead of types of things and situations, the model needs to recognize individual instances of these types and situations.
b **Permanence**: re-identify situations and objects (incl. people) across encounters.
c **Granularity**:: Determine the adequate level of granularity given the communicative setting.
d **Relevance:** select and ignore objects and situations based on memorized experiences, where situation awareness should become more and more focused over time using these memories.

(4) Hybrid memory system:

a System and Human making use of combined memories for collaborative Hybrid Intelligence task.
b Human deliberately influencing the task by providing a personal context.
c Mutual reflection on 4a&b (and implicitly also on points 1, 2, and 3).
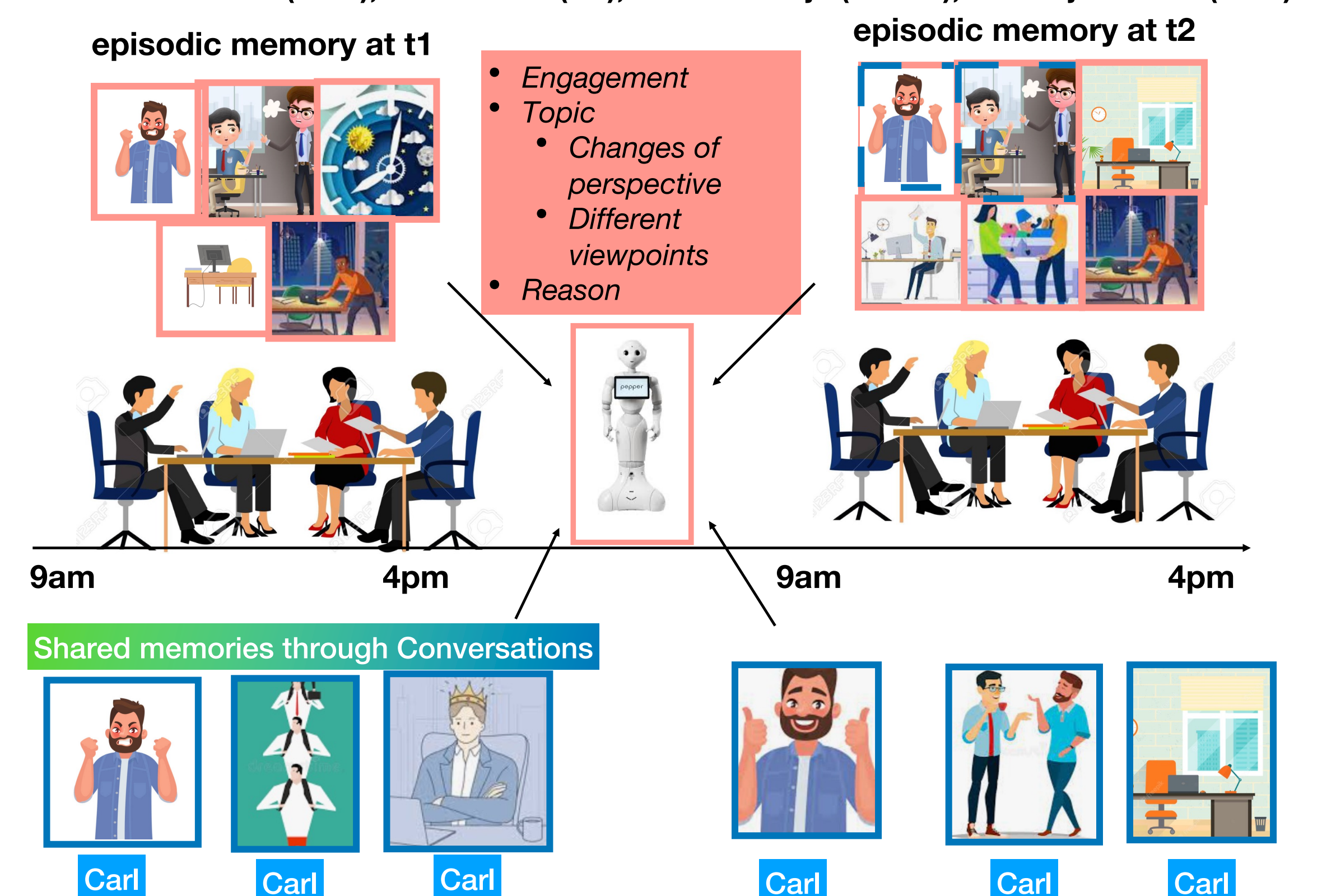
Research questions

(1) System representation of a situation:

a Recordings (as the raw data)
b Inferences based on the interpretation of the recordings: 1) based on theories of human memory (forgetting over time, distortions over time) or 2) on the feedback of the human (e.g., watch for social signals)

(2) System representation of a user's memory:

a Continuous reduction of uncertainty of the system's representation, e.g. by observation.
b By communication, initiated by the system or by the user.
c What the user would have liked to remember (and maybe did not)
d What the user finds important, but doesn't remember: 1) knows it was discussed but can't remember; 2) doesn't recall at all.

(3) Shared memory representation:

a System's initiative: Continuous reduction of uncertainty by communication (1b).
b Human initiative: correction of false system believes, providing elements to memorize on behalf of the user, and providing social-emotional interpretation of the interpretation of a context

(4) Hybrid memory system:

a System deliberately influencing 1, 2 and 3 to increase effectiveness of the Hybrid system of human and AI.
b Human deliberately influencing the system by providing social context and thus enabling the system to reinterpret previously processed instances.
c Mutual reflection on 4a&b (and implicitly also on points 1, 2, and 3).

Contact:

- Catha Oertel: c.r.m.m.oertel@tudelft.nl
- Piek Vossen: p.t.j.m.vossen@vu.nl
- Annika Kniele: a.kniele@vu.nl

Hybrid Intelligence