A Multi-Level Cognitive Architecture for Self-Referencing, Self-Awareness and Self-Interpretation

Jan Treur1 and Gerrit Glas2,3

1Social AI Group, Vrije Universiteit Amsterdam
2Epistemology and Metaphysics Group, Vrije Universiteit Amsterdam
3Anatomy and Neurosciences Department, Amsterdam University Medical Center

ABSTRACT

In this paper, a multilevel cognitive architecture is introduced that can be used to model mental processes in clients of psychotherapeutic sessions. The architecture does not only cover base level mental processes but also mental processes involving self-referencing, self-awareness and self-interpretation. To this end, the cognitive architecture was designed according to four levels, where (part of) the structure of each level is represented by an explicit self-model of it at the nest-higher level of the architecture. At that nest-higher level, states rely part of the structure of the level below; these states have a referencing relation to it. In this way the overall architecture includes its own overall self-model. The cognitive architecture was evaluated for a case study of a realistic type of therapeutic session from clinical practice.

MULTILEVEL COGNITIVE ARCHITECTURE: OVERALL VIEW

USES OF A NETWORK’S SELF-MODEL

- Monitoring and analysis of network evolution by a dynamically updated self-model over time:
  - adding connections from base states to self-model states
  - adding connections from self-model to other analysis states
- Network adaptation by a dynamic self-model determining the base network characteristics used:
  - adding connections from self-model states to lower level states
- For example:
  - A network with adaptive connection weights: a specific downward connection from \( W_{X\rightarrow Y} \) to \( Y \) for using the value of \( W_{X\rightarrow Y} \) as actual connection weight for the connection from \( X \) to \( Y \).
  - A network with adaptive excitability thresholds: a specific downward connection from \( T_{X} \) to \( Y \) for using the value of \( T_{X} \) as actual excitability threshold for \( Y \).

EXAMPLE SIMULATIONS

During therapy, often the client’s knowledge and awareness of her or himself is enhanced and can become useful to his or her benefit:
- Getting familiar with one’s own personal characteristics
- Being aware of important aspects of oneself
- Being able to interpret one’s behaviour in relation to other aspects of oneself
- Based on such insights being able to manage oneself more effectively

Three important notions for a therapeutic context:
- Self-referentiality
  - behaviors by themselves ‘say’ (signify, indicate) something about the person having them
- Self-awareness
  - awareness of an aspect of oneself or of oneself as a whole
- Self-interpretation
  - the way people understand (perceive, value) themselves

NETWORK STATES VERSUS NETWORK STRUCTURE

Network nodes or states

- Informational view on the network
- For example, sensor, sensory representation preparation, emotion states
- Have activation levels that change over time within a given network structure

Network structure characteristics

- Structural view on the network
- For example, connection weights and excitability thresholds
- Have values and determine the activation levels of the states over time
- For an adaptive network they can change

NETWORK REIFICATION: INCLUDING A SELF-MODEL FOR A NETWORK

Refecation states are added that represent or refer to the network’s structure characteristics; for example:
- Self-model for its connections:
  - states \( W_{X\rightarrow Y} \) that refer to the weight of the connection from \( X \) to \( Y \)
- Self-model for its excitability:
  - states \( T_{X} \) referring to the excitability threshold of state \( Y \)

REFERENCES

