TDT4137 - Cognitive Architectures

Assignment 1

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1-A: Scientific approaches to investigating the mind

1.1 Artificial intelligence

Artificial intelligence tries to simulate or mimic human-like intelligence. They try to create models which can simulate a human brain.

1.2 Cognitive Science

Cognitive science is a combination of philosophy, psychology, artificial intelligence, neuroscience, linguistics, and anthropology which try to understand how the brain processes perception, memory, language and problem solving. It uses many different techniques to understand the mind, but often using computational models and psychological experiments.

1.3 Neuroscience

Neuroscience concerns itself around how natural minds work on a biological level. They investigate how firing of neurons and zones in the brain contribute to mental processes.

1.4 Robotics

Robotics concerns itself around building and controlling artificial bodies. They try to optimize how the mind controls such bodies, but are also influenced by other parts such as cognitive science so that robots can mimic human behavior.

1-B: Cognitive Science

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The technological methods are magnetic and positron scanning, where scientists have directly put electrodes into nonhuman brains, and fire individual neurons. These advancements have identified brain regions, such as which part of the brain processes mental imagery and word interpretation.

1-C: What is a 'Cognitive Architecture'?

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The *invariant structure* means that a cognitive architecture implements the core principles, mechanisms and processes that are constant in the different cognitive tasks. Such tasks can be everything from perception to reasoning and language comprehension.

1-D: Turing Test

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Critics mean that a computer can be built to think, but not have a mind of its own, which means it is not true artificial intelligence. One other criticism is that the Turing test only recognizes

intelligence in things that can have a conversation with a human, we often perceive intelligence in actions or functions, not only language.

1-E: Beyond Newell's and Simon's two classical hypotheses

1.8: Hypothesis 1

The first hypothesis is the *Physical Symbol System hypothesis*. To achieve an intelligent system, you need a formal system which can encode, manipulate and interpret symbols.

1.9: Hypothesis 2

The second hypothesis is the *General Problem Solver hypothesis*. It states problem solving involves a search though space of states or symbols, which are generated by mental operators.

1.10: Hypothesis 3

The later, third hypothesis is the *Social Cognition hypothesis* which states intelligence can not happen in isolation. A agent needs to be able to understand and reason other agents mental states, to be intelligent.

1-F: Learning

1.11: knowledge

Knowledge is a information from our experiences and theoretical learning. It contains element such as facts, concepts or data.

1.12: skills

Skills are practical abilities, such as riding a bike or reading. It is developed though learning and practicing.

1.13: values

Values are beliefs and principles that an agent consider important. They shape an agents decision making and moral.

1.14: behaviors

Behaviors are actions and responses which other agents observe. Learning can teach an agent to modify its ways of acting.

1.15: attitudes

Attitudes are an agents way of acting towards other agents or ideas.

1.16: preferences

Preferences are an agents personal choices or desires towards other agents or objects.

1-G: Attention

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A mobile robotics application needs attention for self-preservation to detect potential obstacles or dangers around it. For example a stock-keeping robot needs attention to focus its resources onto detecting humans, such that it can can prevent collision.

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For efficiency reasons it needs to be able to allocate its resources where it is most needed. In the same example as the stock-keeping robot, if it does not detect any humans around it it can direct its resources into speed and efficient navigation, however if it detects humans it needs to allocate more resources into path finding and collision avoidance.

1-H: Association Making

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Association making is a fundamental mechanism and a core capability of neural networks. It is an efficient method of information retrieval and links old information into new problems. It also allows to bridge concepts and facilitates understanding and creativity.

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This is because we can efficiently retrieve old experiences and link it to new information. We can also generalize ideas and can encourage exploration instead of only exploitation.