COIS 3270H

Thesis Paper

Fall 2024

Dikshith Reddy Macherla

Student Id : 0789055

Bachelor Of Computer Science, Trent University

COIS 3270H - Philosophy Of AI

Professor : Michael Bruder

4th November, 2024

Thesis Paper

Summary of the Frame Problem:

The frame problem is an issue that I have found particularly fascinating as it arises in cognitive science and artificial intelligence, and it is concerned with understanding how an artificial agent like a robot or an AI system can effectively discern which pieces of information are relevant to its current situation and which are not. The frame problem was originally formulated within logic-based AI, where researchers realized that characterizing which aspects of a state were unchanged after an action was remarkably challenging (Wheeler, 2008, p. 325). From a broader perspective, the frame problem deals with how a system can decide, from an indeterminate set of factors, which of these should affect its beliefs or actions. This problem is crucial because, without a solution, artificial systems cannot function adaptively in open-ended environments, rendering them impractical for real-world interactions (Wheeler, 2008, p. 326).

Wheeler's Position on the Frame Problem:

Wheeler suggests that the frame problem can be addressed, but not by relying on traditional cognitive science approaches. Instead, he proposes a Heideggerian phenomenology-based solution, emphasizing non-representational mechanisms and the concept of thrownness, which refers to agents being embedded in meaningful contexts (Wheeler, 2008, p. 328). He divides the frame problem into two components: the intra-context frame problem, dealing with fluid action within specific contexts, and the inter-context frame problem, which focuses on adapting to open-ended situations with multiple contexts (Wheeler, 2008, p. 330). Wheeler argues that intra-context issues can be resolved using special-purpose adaptive couplings, whereas inter-context challenges require continuous reciprocal causation—dynamic interaction between neural systems and the environment, allowing for adaptability (Wheeler, 2008, p. 331). Wheeler ultimately concludes that intelligence emerges from embodied, situated interactions, rather than relying solely on internal representations (Wheeler, 2008, p. 333).

My Argument Extending Wheeler's Position:

I argue that while Wheeler’s perspective on solving the frame problem is compelling, it can be further strengthened by integrating aspects of machine learning, specifically reinforcement learning. Reinforcement

learning provides a way to develop policies based on experience, which reduces the need for exhaustive representation of every possible context (Sutton & Barto, 2018). This experiential approach supports Wheeler's emphasis on avoiding detailed internal models, allowing agents to prioritize actions effectively. However, reinforcement learning alone may not sufficiently handle the open-ended adaptability needed for the inter-context frame problem. It is often limited by pre-defined reward functions and lacks the capacity for Wheeler's continuous reciprocal causation. By combining Wheeler's embodied, context-sensitive mechanisms with reinforcement learning, agents can benefit from embodied coping strategies while gaining adaptive flexibility through experience, which helps address both intra-context and inter-context challenges more effectively.

In conclusion, I find Wheeler's Heideggerian response to the frame problem by rejecting representational models and embracing situated, non-representational interaction quite compelling. By integrating aspects of reinforcement learning, I believe we could further enhance artificial agents' adaptability. Combining embodied coping strategies with learning from experience could address the intra-context and inter-context frame problems more robustly, leading to an AI that is better able to flexibly navigate real-world environments.

References:

1. Wheeler, M. (2008). The frame problem in cognitive science. International Journal of Philosophical Studies, 16(3), 323-349. https://doi.org/10.1080/09672550802113235
2. Wheeler, M. (2008). Context and cognition: Heideggerian insights into the frame problem. International Journal of Philosophical Studies, 16(3), 326-330.
3. Wheeler, M. (2008). Continuous reciprocal causation and adaptation. International Journal of Philosophical Studies, 16(3), 331-333.
4. Sutton, R. S., & Barto, A. G. (2018). Reinforcement Learning: An Introduction (2nd ed.). MIT Press.