The Hong Kong University of Science and Technology

Department of Mathematics

MPhil THESIS EXAMINATION

AIvilization: Explore the Future of Human-AI Coexistence, Co-building a Digital Sandbox for Agent Civilization

By

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ABSTRACT

As large language models begin to power autonomous agents capable of continuous perception, reasoning, and action, new opportunities arise for studying how artificial populations behave within open-ended digital worlds. This thesis investigates two contributions made by the author to the Aivilization project: (1) a continuous-time, action-driven agent framework, and (2) the empirical analysis of emergent social and economic patterns in large-scale multi-agent simulations.

The proposed agent architecture generates behavior through a dynamically managed sequence of atomic actions informed by multi-horizon planning, event-driven replanning, and interaction-aware adaptation. A lightweight mathematical formalization describes how long-term goals, short-term stimuli, and human interventions jointly shape action generation and execution.

Building on this foundation, we examine macro-level dynamics that emerge when thousands of agents interact under decentralized cognition and AMM-driven market mechanisms. Large-scale deployments—including a public experiment involving more than 50,000 human participants—exhibit coherent collective phenomena such as inflationary cycles, supply-chain oscillations, and differentiated social structures. Statistical analyses show that these patterns arise endogenously from micro-level decision processes rather than from any imposed macro rules.

Overall, the results demonstrate that principled agent design can produce stable yet richly structured artificial societies, offering methodological foundations for future research in computational social science and human–AI coexistence.

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Time : 2:30 pm

Venue : Room 4504 (Lifts 25-26)

Thesis Examination Committee

Chairman	**:**	**Prof. Yang XIANG, MATH/HKUST**
Thesis Supervisor	**:**	**Prof. Kani CHEN, MATH/HKUST**
Member	**:**	**Prof. Beifang CHEN, MATH/HKUST**

(Open to all faculty and students)

The student's thesis is now being displayed on the reception counter in the General Administration Office (Room 3461).