Self-Organization of Subjective Time and Sustainable Autonomy in Mind Time Machine

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Extended Abstract

It is time to bring artificial life in silico into the real world. Different from artificial or simulated environments, the real world presents many unexpected and complex encounters; and living systems essentially adapt to the real world's complexities. Any agent must deal simultaneously with various kinds of sensory flows while sustaining its own identity and autonomy. In this paper we introduce our recent project of making a special machine that self-organizes its own "subjective" timescape in an open environment.

We made a machine called MTM (Mind Time Machine), which runs in the real world all day long without losing its complex dynamics. As the result of this longtime sustainability, we argue that the system's own temporal structure is organized.

We presented this MTM for the first time at the Yamaguchi Center for Arts and Media in March, 2010. The machine consists of three screens: right, left and above, displayed at the corner of a cubic skeleton 5.400 meters per side. Fifteen cameras attached to each pole of the skeleton photograph things that happen in the venue. These images are decomposed into frames and chaotic neural dynamics control other macro processes that combine, reverse and superpose them to make new frames. We presented the MTM as artwork, but at the same time we recorded data from the system daily to monitor the diversity of the system's behavior.

The operating principle is to process timeframes of the visual inputs by combining chaotic instabilities from neural dynamics and optical feedback, in order to make autonomous "time-organizing" phenomena. Intake images from cameras were progressively embedded into the network's connections as a memory of the patterns. Visual images are taken in and re-played again and again with recursive modifications. The system itself is completely deterministic and uses no random numbers, but it shows different images depending on its inherent instabilities, environmental lighting conditions, movement of people coming into the venue and the system's stored memory.

This is not a large chaotic dynamical system that updates the visual inputs randomly. Different from the mere chaotic system, MTM is designed as life-like system since its dynamics are controlled by an environment and system has a short and long term memory to sustain its dynamics. Namely, we claim that MTM is "artificial life", since we design it to i) retrieve information from its environment, ii) memorize it in the form of the Hopfield type learning which tunes the parameters of the overall dynamics, iii) generate "episodic memory" , vi) change the network structure by the way of the Hebbian dynamics continuously and v) organize its overall dynamics as adaptation to the environmental changes.

At the conference, we will report how MTM's daily dynamics are varied by weather conditiosn and argue how it is difficult to sustain its autonomy, i.e. both sensitivity to the environment and inherent dynamics, for long periods of time.

References

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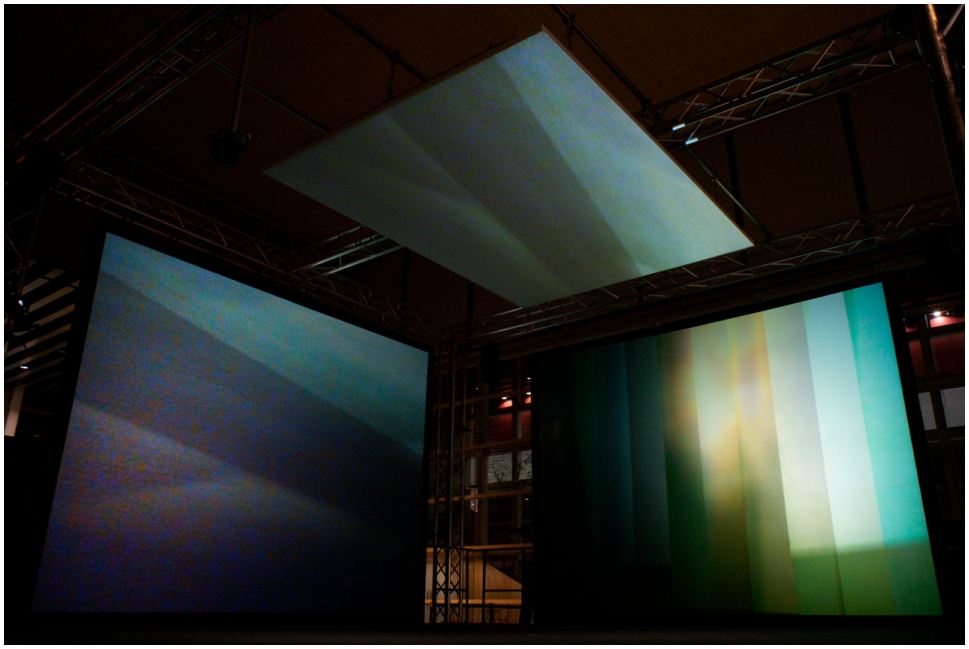

Figure 1: Outlook of MTM displayed at Yamaguchi Center for Art and Media, 2010. (Photo taken by Kenshu Shintsubo)