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## Robots show that brain activity is linked to time as well as space

Humanoid robots have been used to show that that functional hierarchy in the brain is linked to time as well as space. Researchers from RIKEN Brain Science Institute, Japan, have created a new type of neural network model which adds to the previous literature that suggests neural activity is linked solely to spatial hierarchy within the animal brain. Details are published November 7<sup>th</sup> in the open-access journal *PLoS Computational Biology*.

An animal's motor control system contains a functional hierarchy, whereby small, reusable parts of movements are flexibly integrated to create various action sequences. For example, the action of drinking a cup of coffee can be broken down into a combination of small movements including the motions of reaching for a cup, grasping the cup, and bringing it to one's mouth.

Earlier studies suggested that this functional hierarchy results from an explicit spatial hierarchical structure, but this has not been seen in anatomical studies of the brain. The underlying neural mechanisms for functional hierarchy, thus, had not yet been definitively determined.

In this study, Yuichi Yamashita and Jun Tani demonstrate that even without explicit spatial hierarchical structure a, functional hierarchy can self-organize through multiple timescales in neural activity. Their model was proven viable when tested with the physical body of a humanoid robot. Results suggest that it is not only the spatial connections between neurons, but also the timescales of neural activity, that act as important mechanisms in neural systems.

### Journal reference:

Yamashita Y, Tani J. **Emergence of Functional Hierarchy in a Multiple Timescale Neural Network Model: A Humanoid Robot Experiment.** *PLoS Comput Biol*, 2008; 4(11): e1000220 DOI: 10.1371/journal.pcbi.1000220

For more information, please contact:

Lab. for Behavior and Dynamic Cognition  
RIKEN Brain Science Institute  
2-1 Hirosawa, Wako, Saitama, 351-0198 Japan

Contact:

Jun Tani

Yuichi Yamashita

Phone:

+81-48-467-6467

RIKEN Public Relations Office

Email: [koho@riken.jp](mailto:koho@riken.jp)