The Role of Memory in MHP/RT: Organization, Function and Operation

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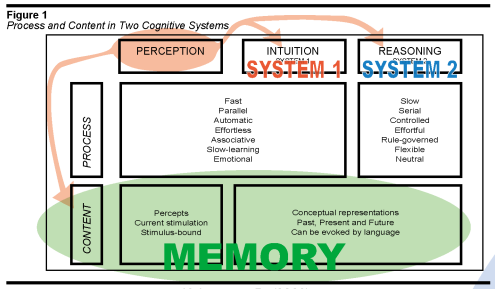
Abstract: To develop a unified theory of human decision-making in daily behavior selections, the authors propose an architecture model called Model Human Processor with Real Time constraints (MHP/RT) (Kitajima & Toyota, 2012). This model integrates the established theory of decision-making by Kahneman (2003), Two Minds, and the idea that human behavior is organized in the ever-changing environment (Newell, 1990) into a construct that is capable of simulating such daily behavior as driving a car or watching a baseball game at a stadium. Kitajima and Toyota (2012) proposed that MHP/RT operates in one of four modes that are defined by the active components of MHP/RT at a specific time. Kitajima and Toyota (2011a) demonstrated that at a specific moment MHP/RT is processing one of four aspects of a certain event. This paper demonstrates how memory is used in the four operation modes and the four processing modes of MHP/RT.

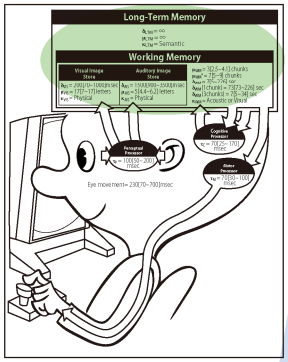
References:
Kahneman, D. (2003). A perspective on judgment and choice. *American Psychologist*, **58**(9), 697–720.
Kitajima, M., & Toyota, M. (2012). Simulating navigation behaviour based on the architecture model Model Human Processor with Real-Time Constraints (MHP/RT). *Behaviour & Information Technology*, **31**(1), 41-58.
Kitajima, M., & Toyota, M. (2011a). Four Processing Modes of in situ Human Behavior. In *Proceedings of the Second Annual Meeting of the BICA Society* (pp.194–199).
Newell, A. (1990). *Unified Theories of Cognition*. Harvard University Press.

Two Minds



Kahneman, D. (2003).
A perspective on judgment and choice. *American Psychologist*, **58**(9), 697–720.

Model Human Processor



Card, Moran, and Newell. (1983).
The Psychology of Human-Computer Interaction.

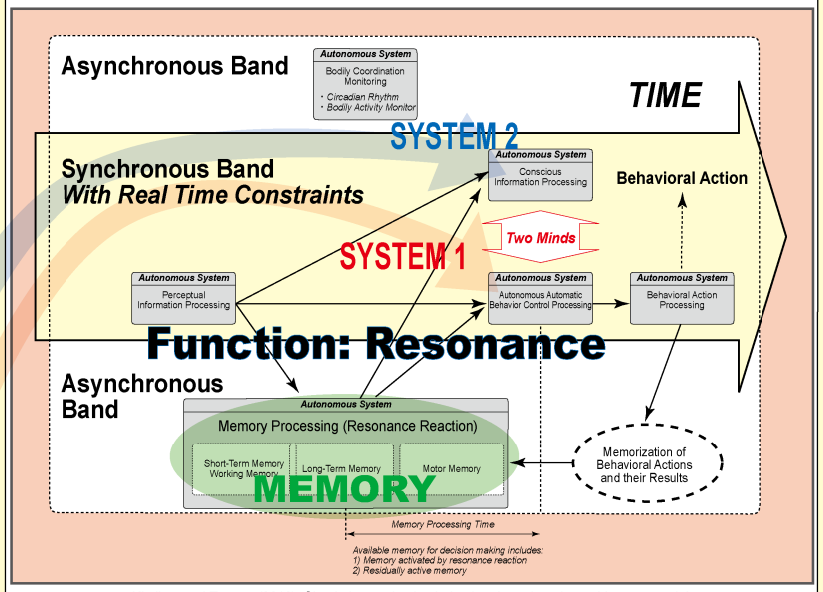
Time Sale of Human Action

Scale (sec)	Time Units	System	World (Theory)
10^{7}	months		Social Band
10^{6}	weeks		
10^{5}	days		
10^{4}	hours	Task	Rational Band
10^{3}	10 min	Task	
10^{2}	minutes	Task	
10^{1}	10 sec	Unit Task	Cognitive Band
10^{0}	1 sec	Operations	
10^{-1}	100 ms	Deliberate Act	
10^{-2}	10 ms	Neural Circuit	Biological Band
10^{-3}	1 ms	Neuron	
10^{-4}	100 µs	Organelle	

Interactive Organic Activity
Habitual Organic Activity
Habitual Bodily Activity
Internal Activity

Newell. (1990). *Unified Theories of Cognition.*

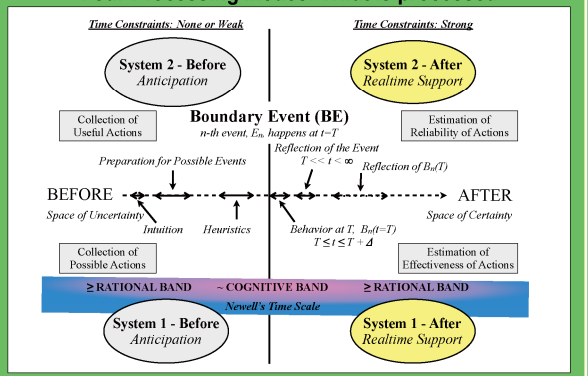
Model Human Processor with Real-Time Constraints



Kitajima and Toyota. (2012). Simulating navigation behaviour based on the architecture model
Model Human Processor with Real-Time Constraints (MHP/RT). *Behaviour & Information Technology* , **31**(1), 41-58.

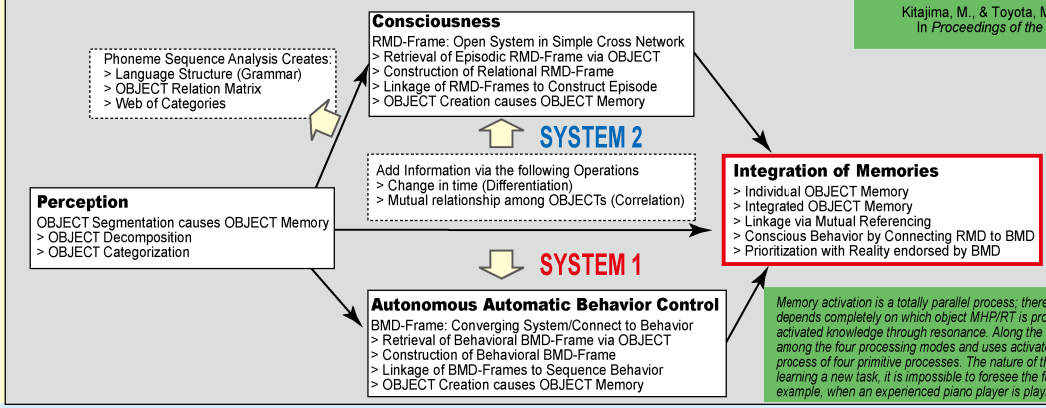
Operation: Pipelining

Four Processing Modes: What is processed



Kitajima, M., & Toyota, M. (2011). Four Processing Modes of in situ Human Behavior.
In *Proceedings of the Second Annual Meeting of the BICA Society* (pp. 194–199)

Organization: MD Frame



Four Operation Modes: How processed

	Synchronous Mode		Asynchronous Mode	
	Mode 1	*Mode 2*	*Mode 3*	*Mode 4*
Behavior Control	System 1	System 2	System 1 & 2	System 1 & 2
Working Memory	Shared by System 1 & 2	Shared by System 1 & 2	Weakly Shared by System 1 & 2	Separated *different areas used*
Example	*riding a bicycle on a familiar road*	*learnig how to drive a car*	*picking up a cell phone when it rings while reading a book*	*talking with a friend by using mobile phone while riding a bicycle*

Memory activation is a totally parallel process; therefore, there is no way of knowing which part of activated memory is used. It depends completely on which object MHP/RT is processing. MHP/RT's resonance process makes available the relevant part of activated knowledge through resonance. Along the time dimension, MHP/RT, working in one of four operation modes, switches among the four processing modes and uses activated knowledge through resonance. MHP/RT's processing is a pipeline process of four primitive processes. The nature of this pipelining may change depending on the nature of the task. When learning a new task, it is impossible to foresee the future; therefore, past/conscious processing may dominate. In contrast, for example, when an experienced piano player is playing a well-practiced tune, future/unconscious processing may dominate.