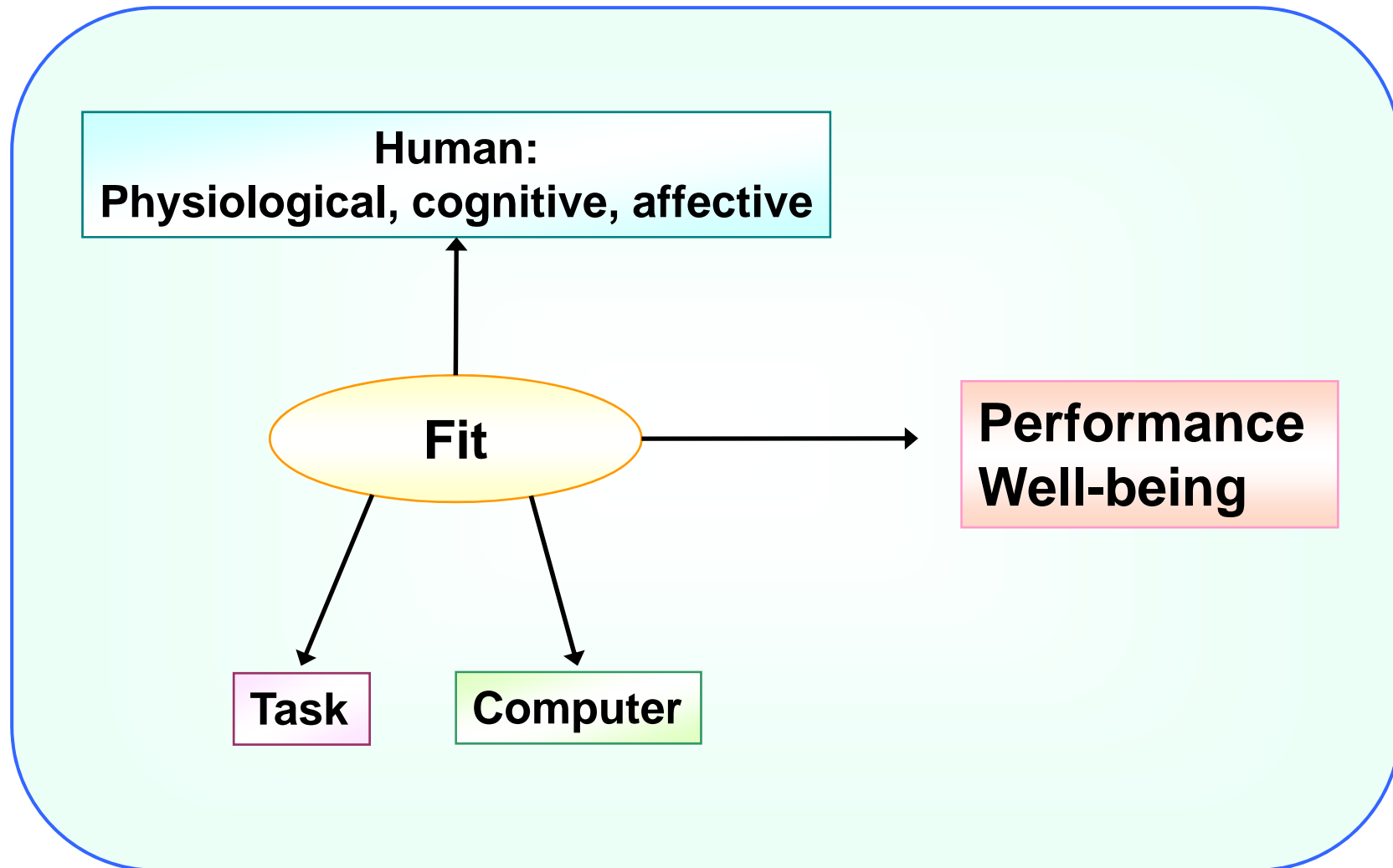


**HMI between human and computer (HCI)**

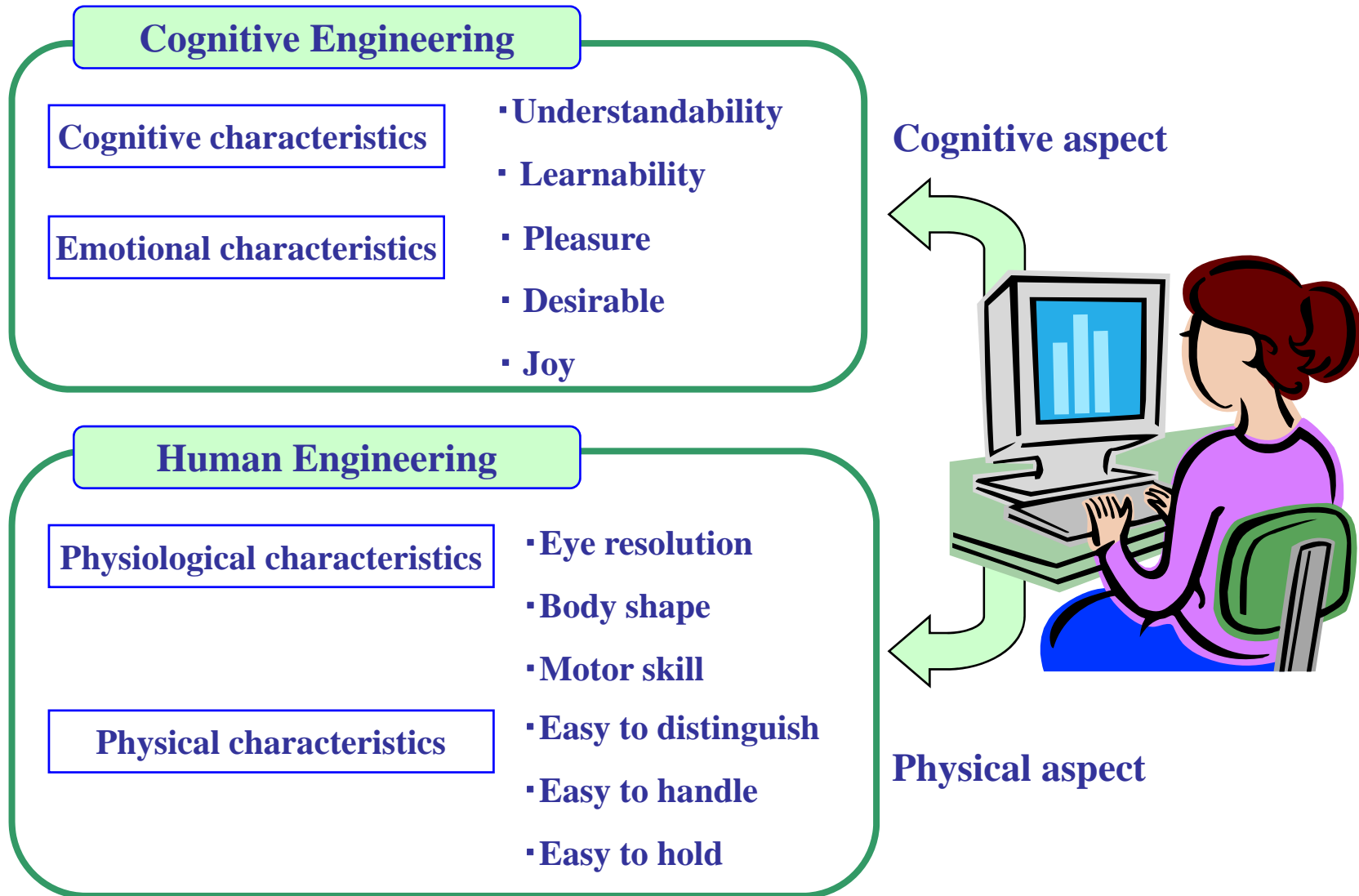
Affect, as well as physiology and cognition, impacts both performance and well-being.

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## Information processing capacity of human and computer

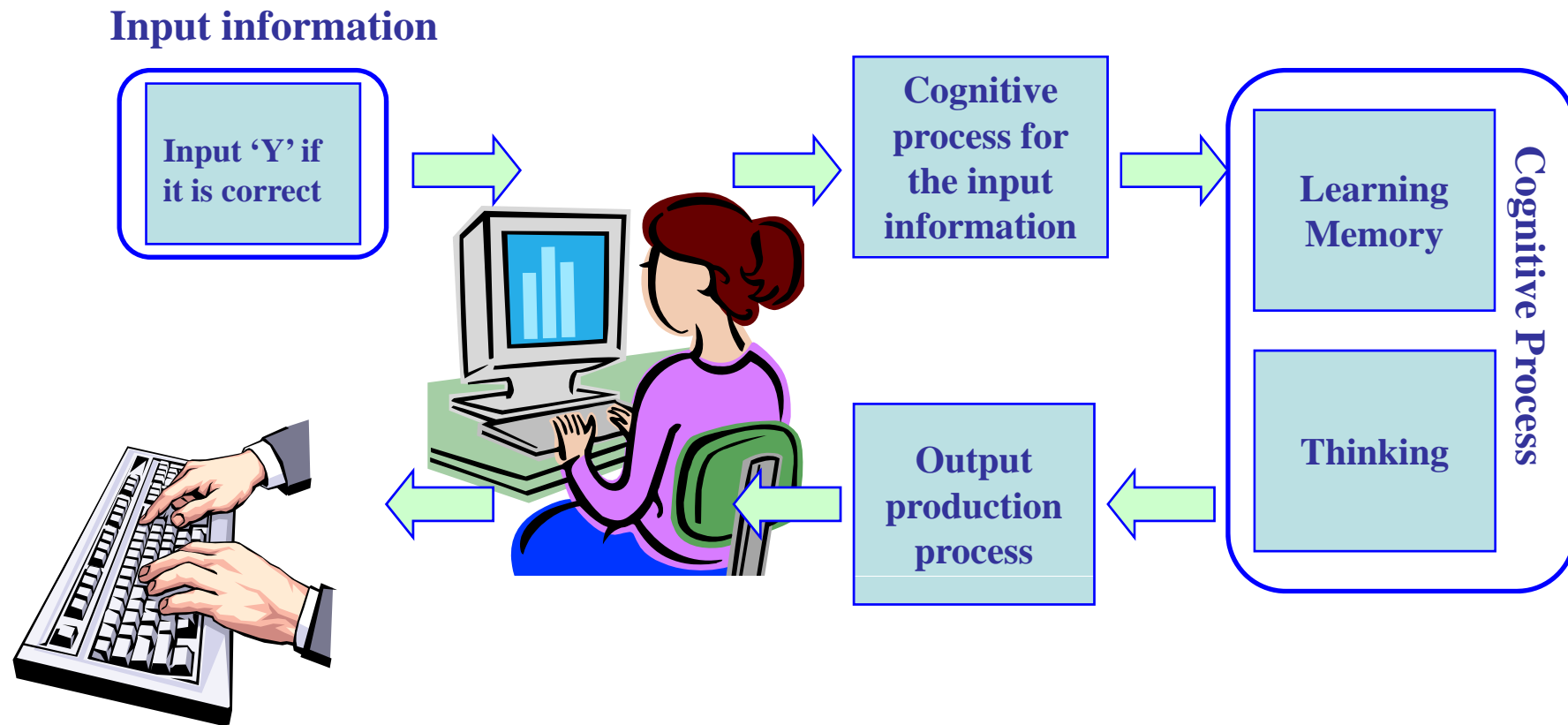
Items	Human	Computer
<b>Thinking</b>	Inductive Good at grasping general meaning	Deductive Understanding of meaning by algorithms
<b>Computation</b>	Slow, Error-prone Efficiency reduction by continuous work	Fast, Precise Constant efficiency
<b>Memory</b>	Small capacity, Error-prone Association	Large capacity, Precise Retrieval by location
<b>Others</b>	Not good at simple repetition Capacity is increased by motivation	Good at simple repetition Efficiency is increased by improving algorithms



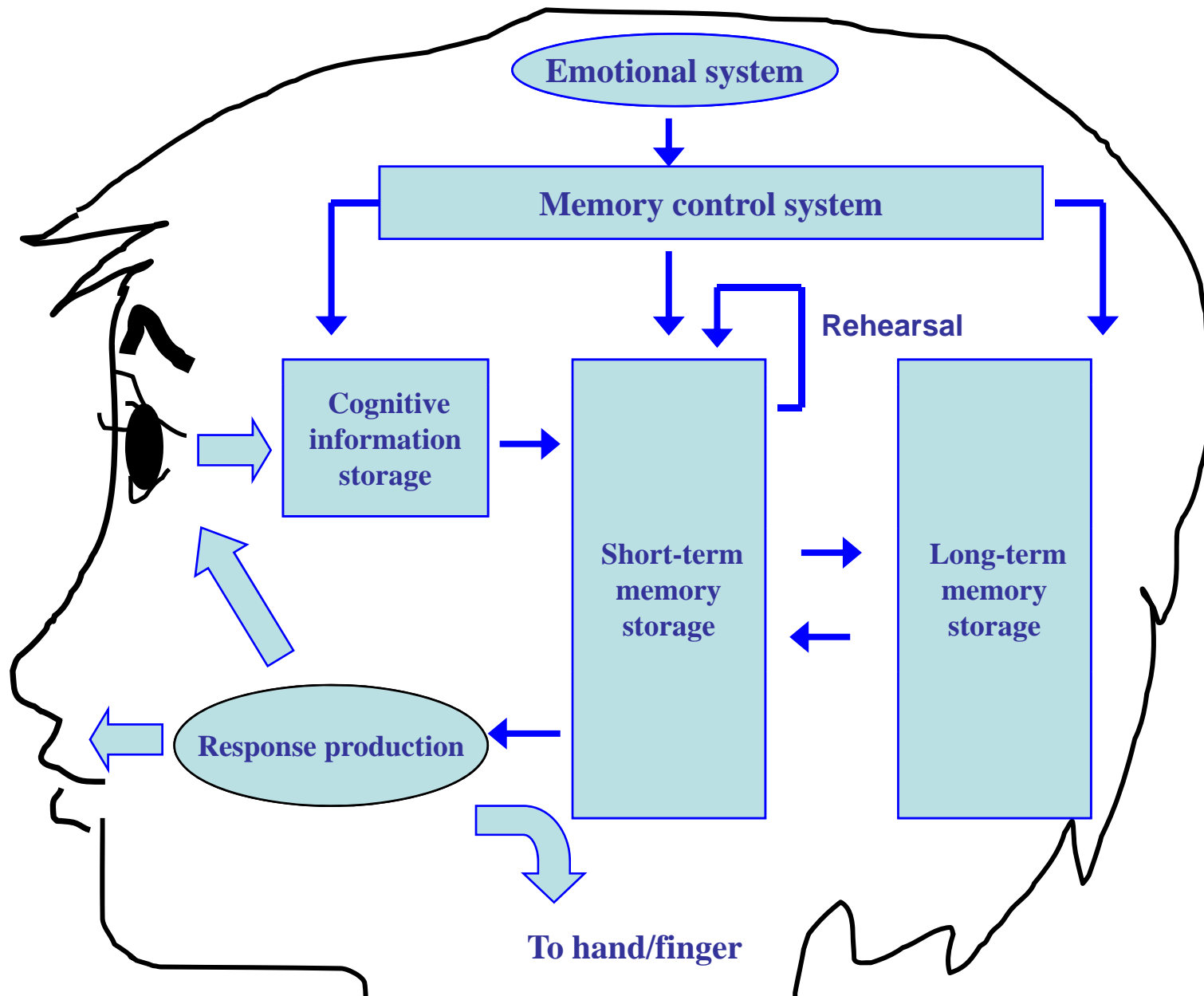
**Keywords to understand humans**

# Examples of measuring items for usability

Indexes	Items
Effect	<ul style="list-style-type: none"><li>Task completion ratio</li><li>Ratio of successful and unsuccessful works</li><li>Number of repetitions of unsuccessful commands</li><li>Number of successes and failures</li><li>Number of times that the user was mislead</li><li>Number of backtracks</li><li>Number of times that user was interrupted</li><li>Number of times that user lost control of the system</li></ul>
Efficiency	<ul style="list-style-type: none"><li>Time to complete a task</li><li>Ratio of completed tasks per unit time</li><li>Time spent in errors</li><li>Number or ratio of errors</li><li>Number or ratio of getting lost</li><li>Number of commands used</li><li>Number of commands not used</li><li>Frequency of help and document use</li><li>Time spent in help and document use</li></ul>
Satisfaction	<ul style="list-style-type: none"><li>Number of favorable/unfavorable user comments</li><li>Number of users preferring the system</li><li>Number of times the user found problems during a task</li><li>Number of times the user was satisfied or unsatisfied</li></ul>



## Outline of human information process



**2-layer memory model**

Mental model



User

Work on the system based on  
a mental model in mind

Design model

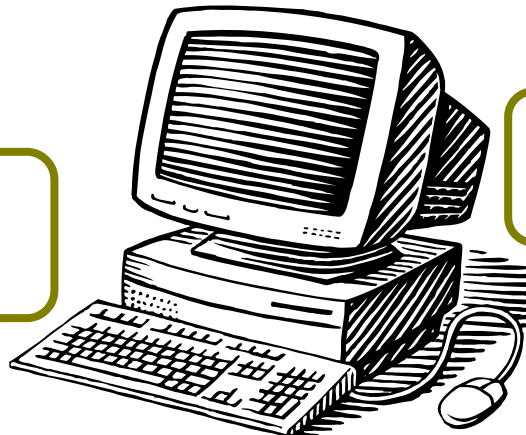


Designer

Design a system image based on a  
design model in mind

Make/revise a mental model based  
on responses of the system

System Image

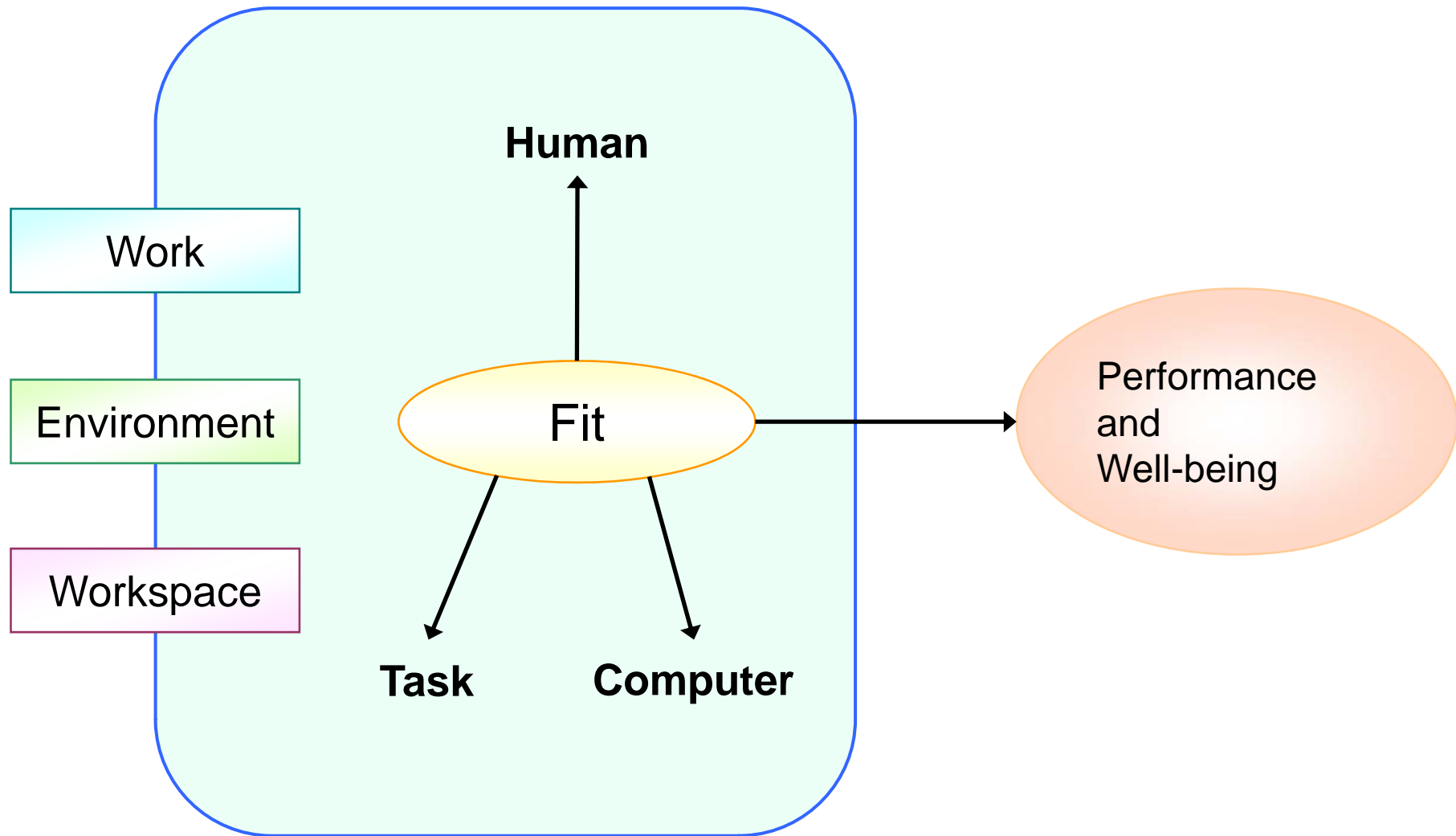


System

**Mental model and design model**

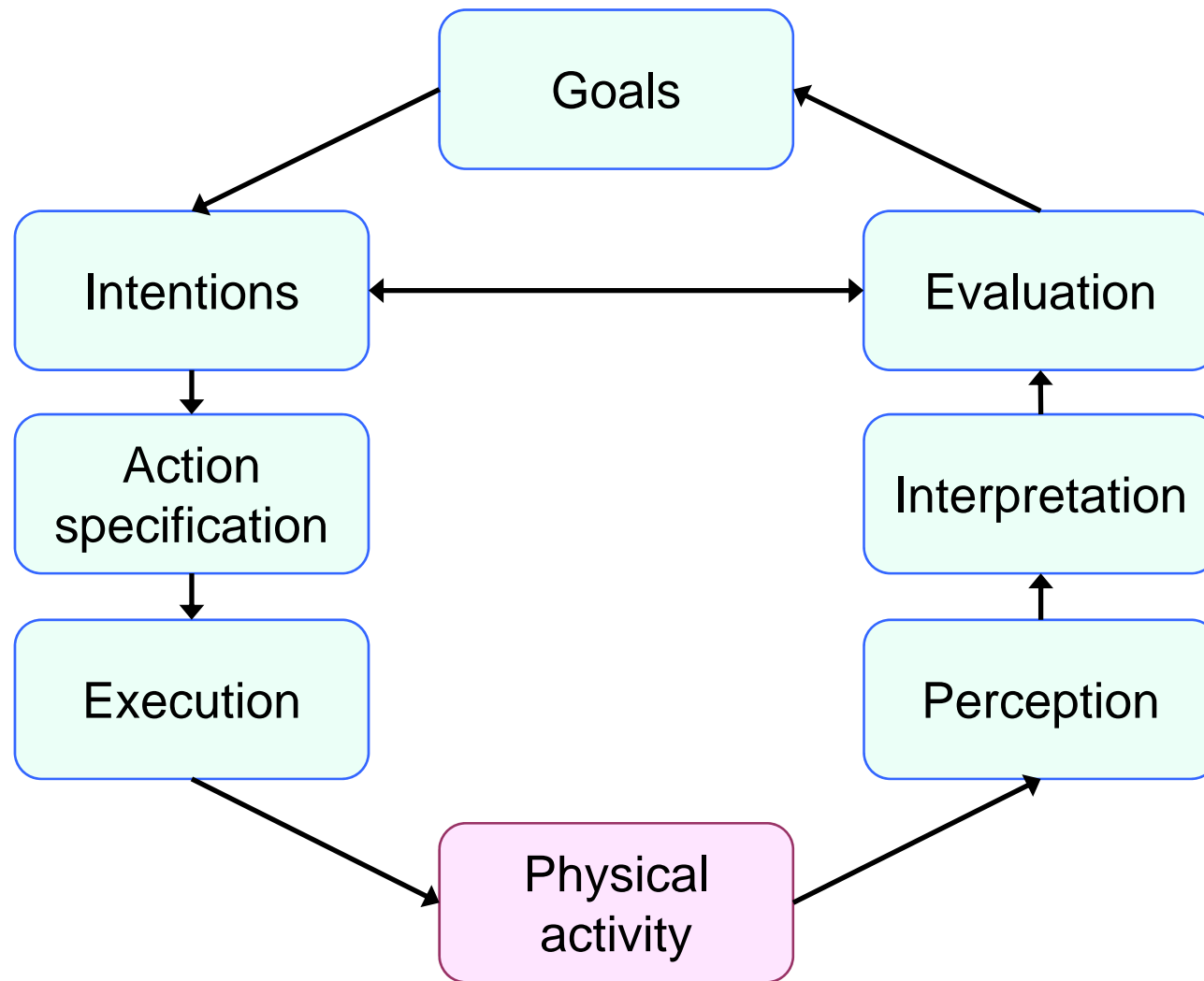


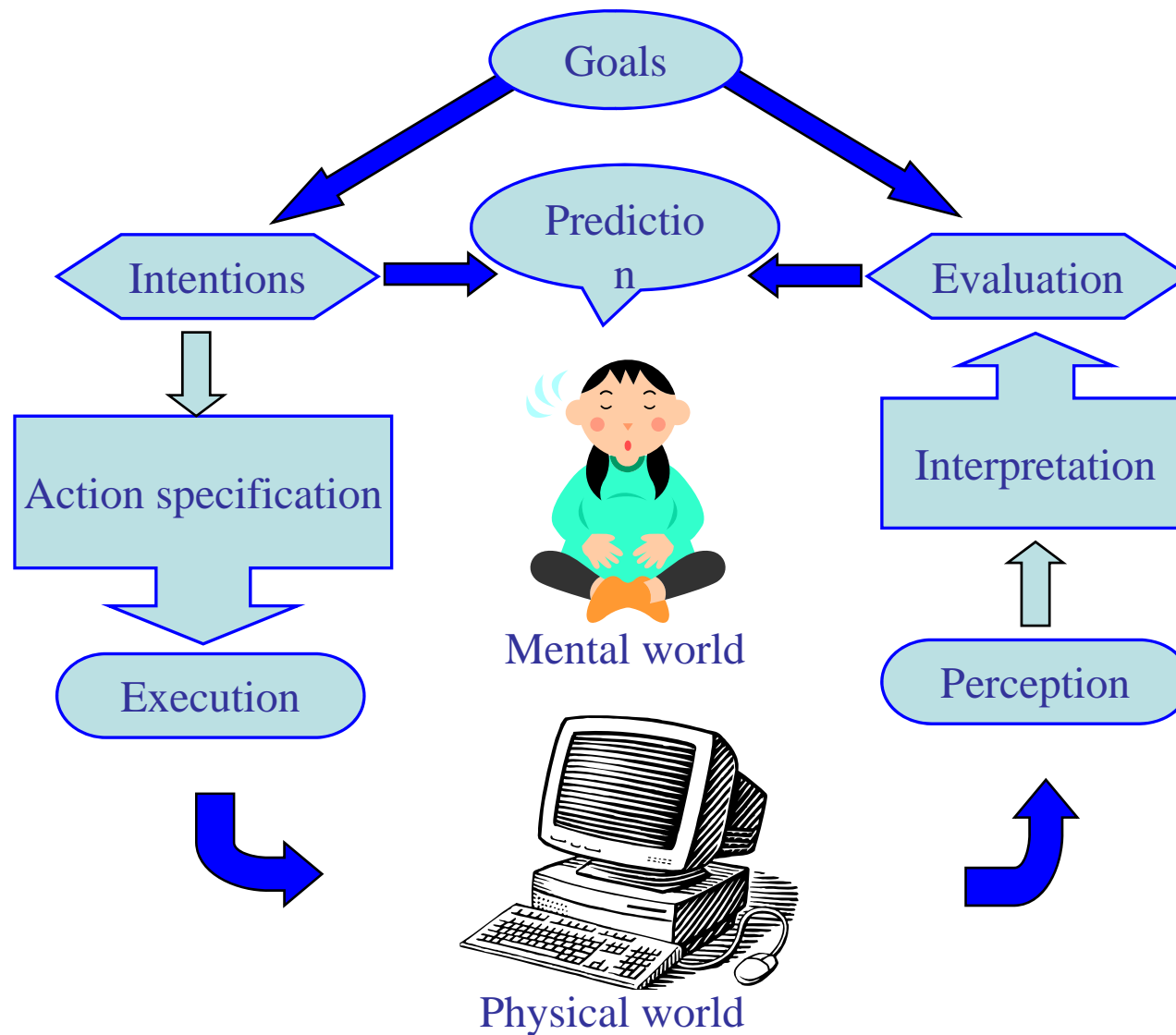
The expanded fit between human, task and computer in the work context.



## Norman's seven-stage model of user activity.

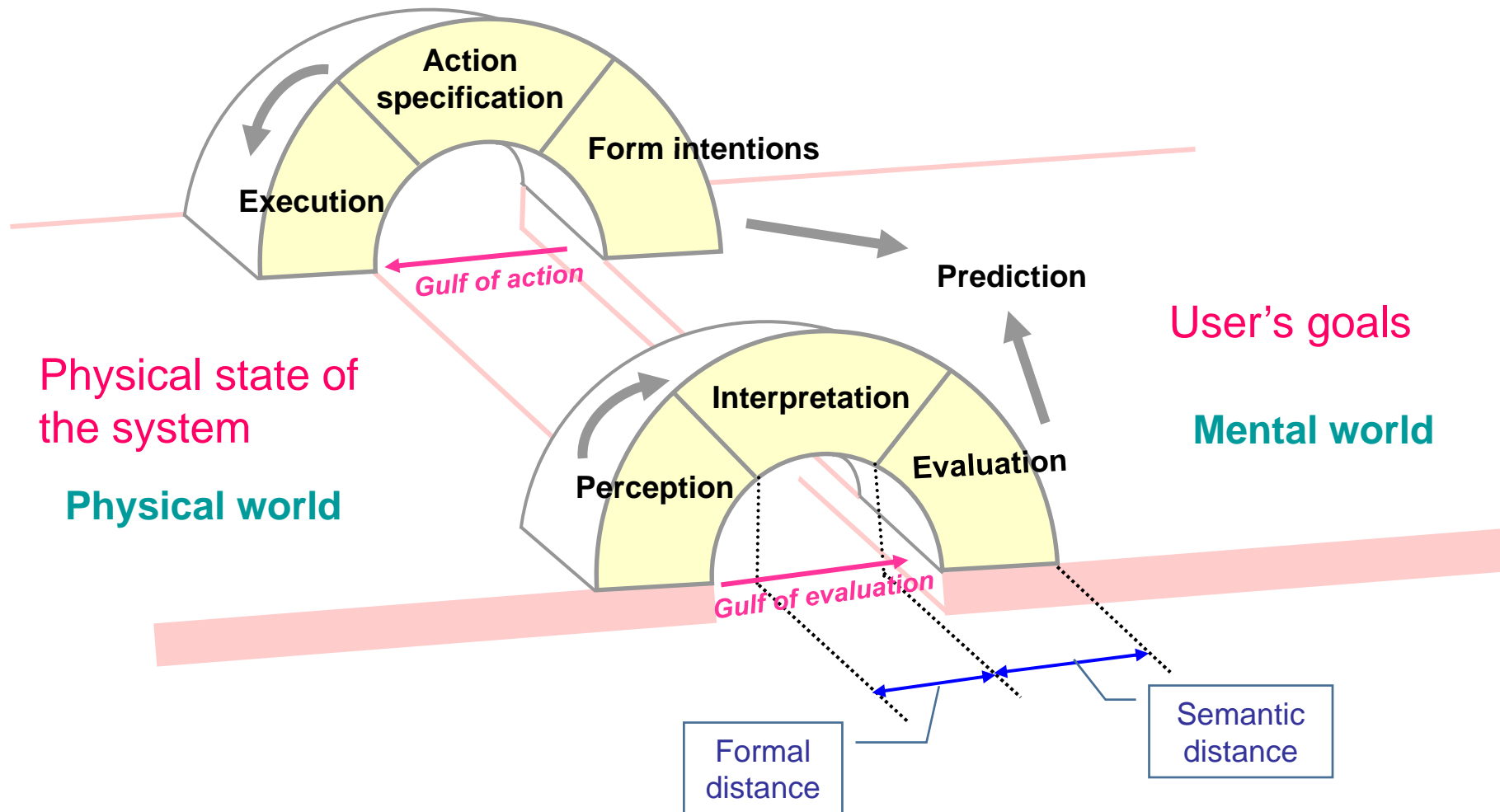
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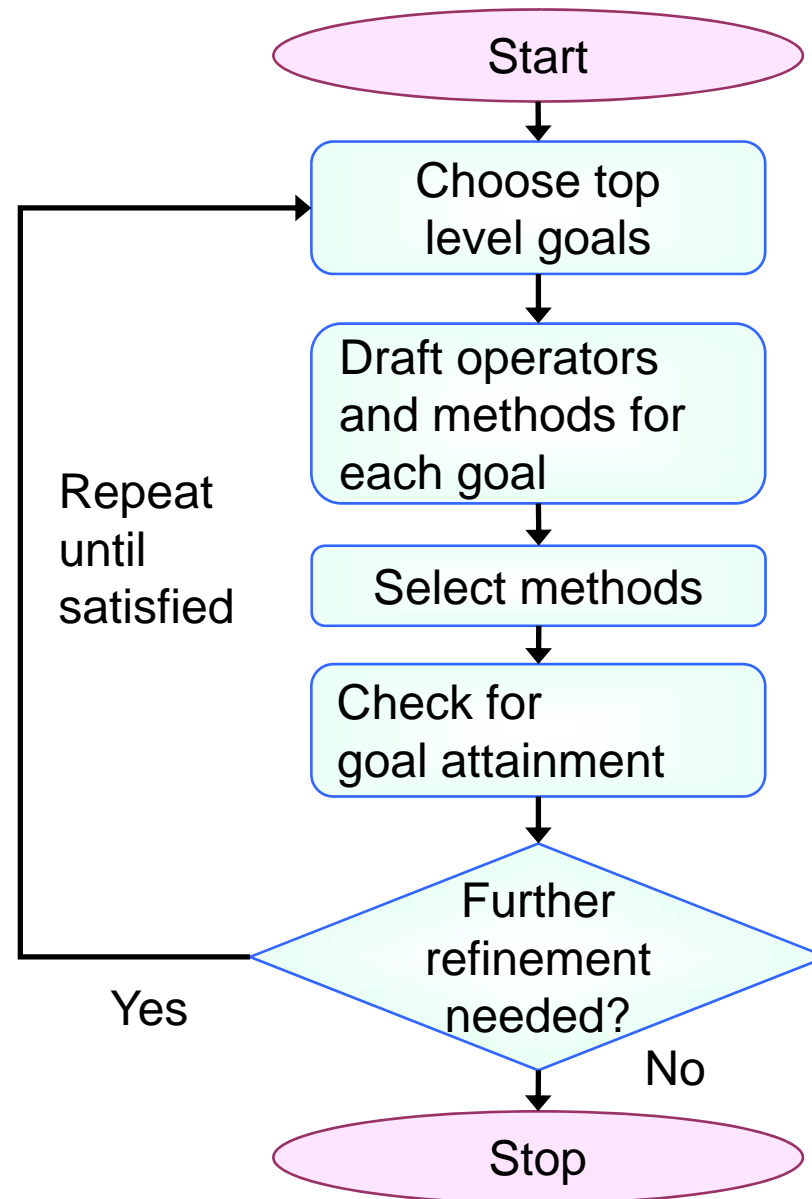
## 7- stage model of interaction

# 7-stage model of behavior



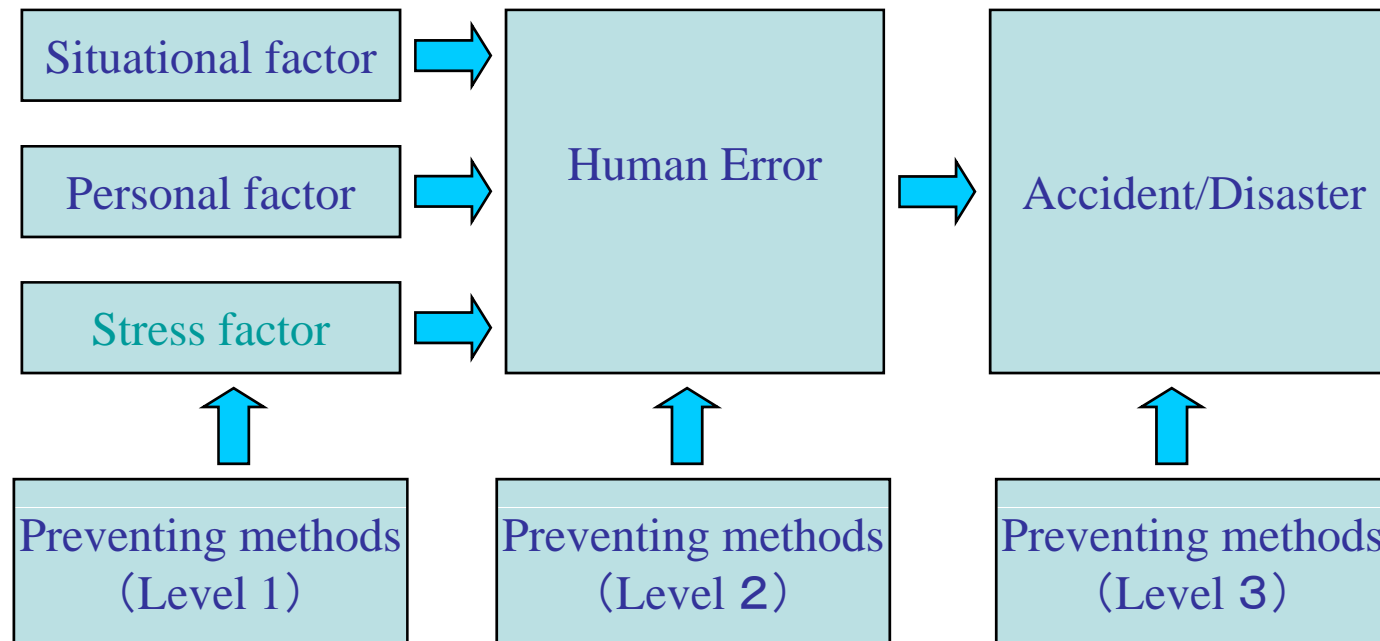
(*Gulf of action* and *gulf of evaluation* can be expressed as 'semantic distance' which represents the correspondence between the user's intention and the expressed meaning of interface language, and 'formal distance' which represents the correspondence between the expressed meaning of interface language and actual phenomena)

# A flowchart for building GOMS (Goals, Operators, Methods, and Selection rules)

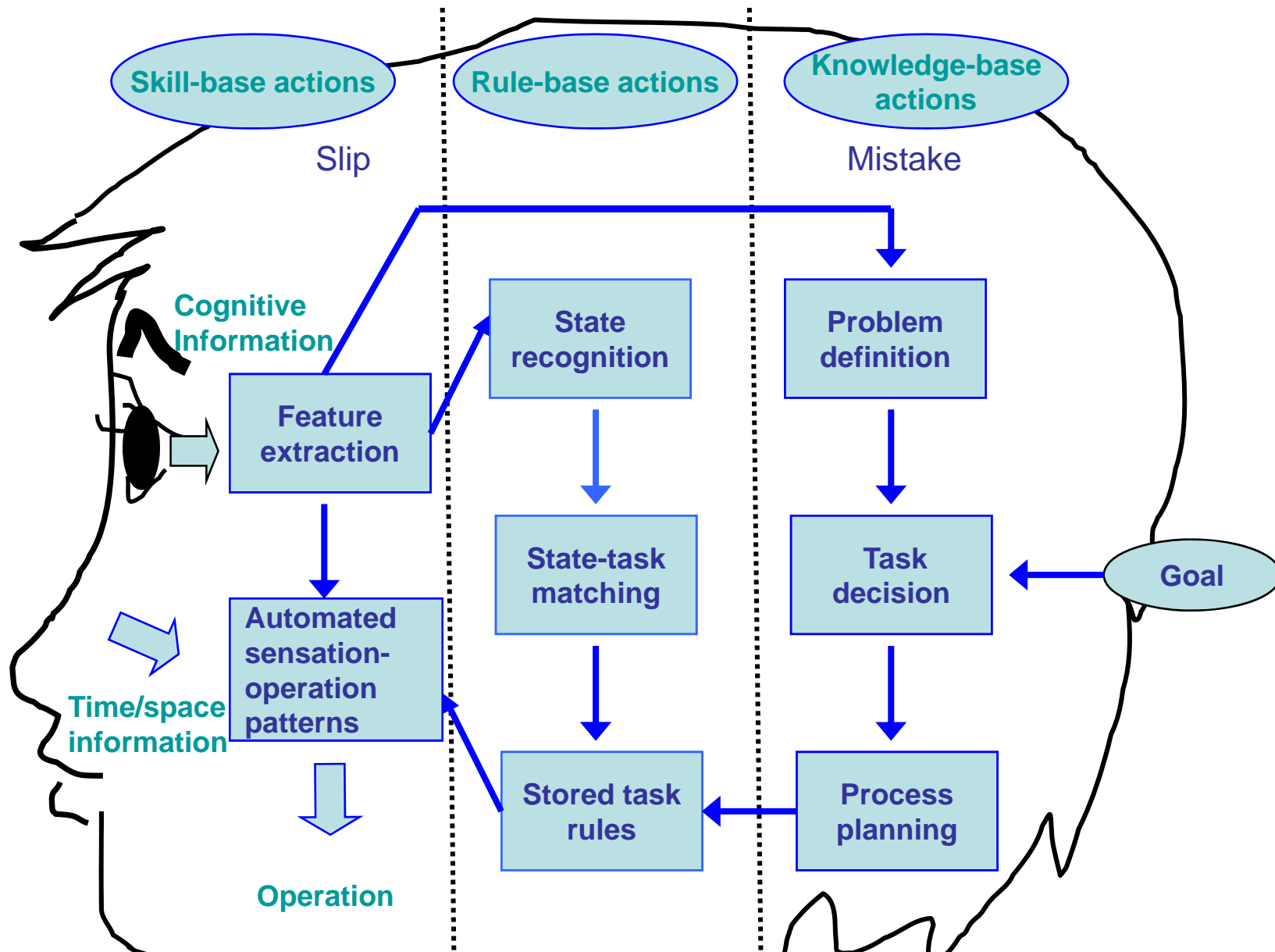


Occurrence of human errors

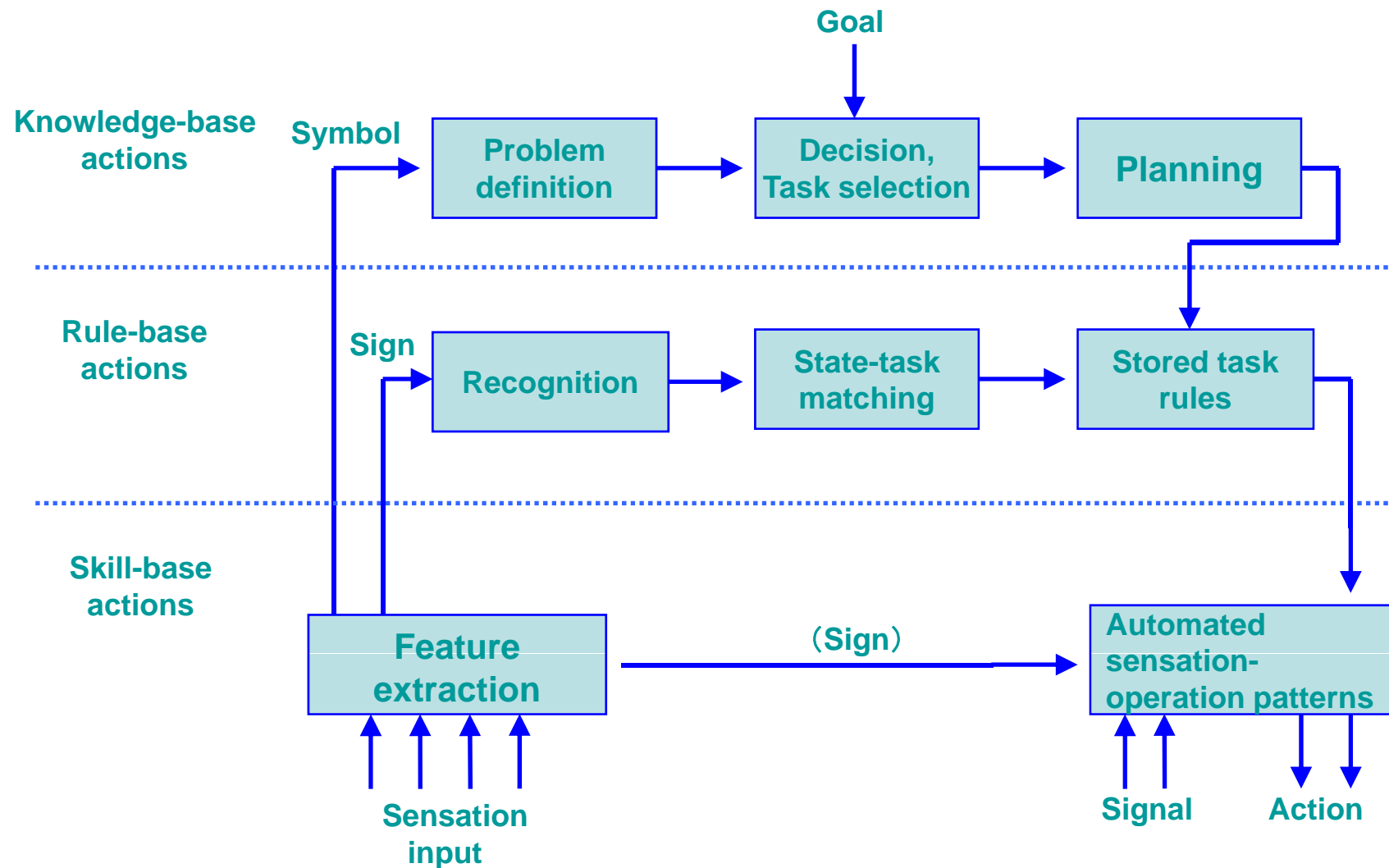
Leading to accident



**From occurrence of human errors to development of accident**

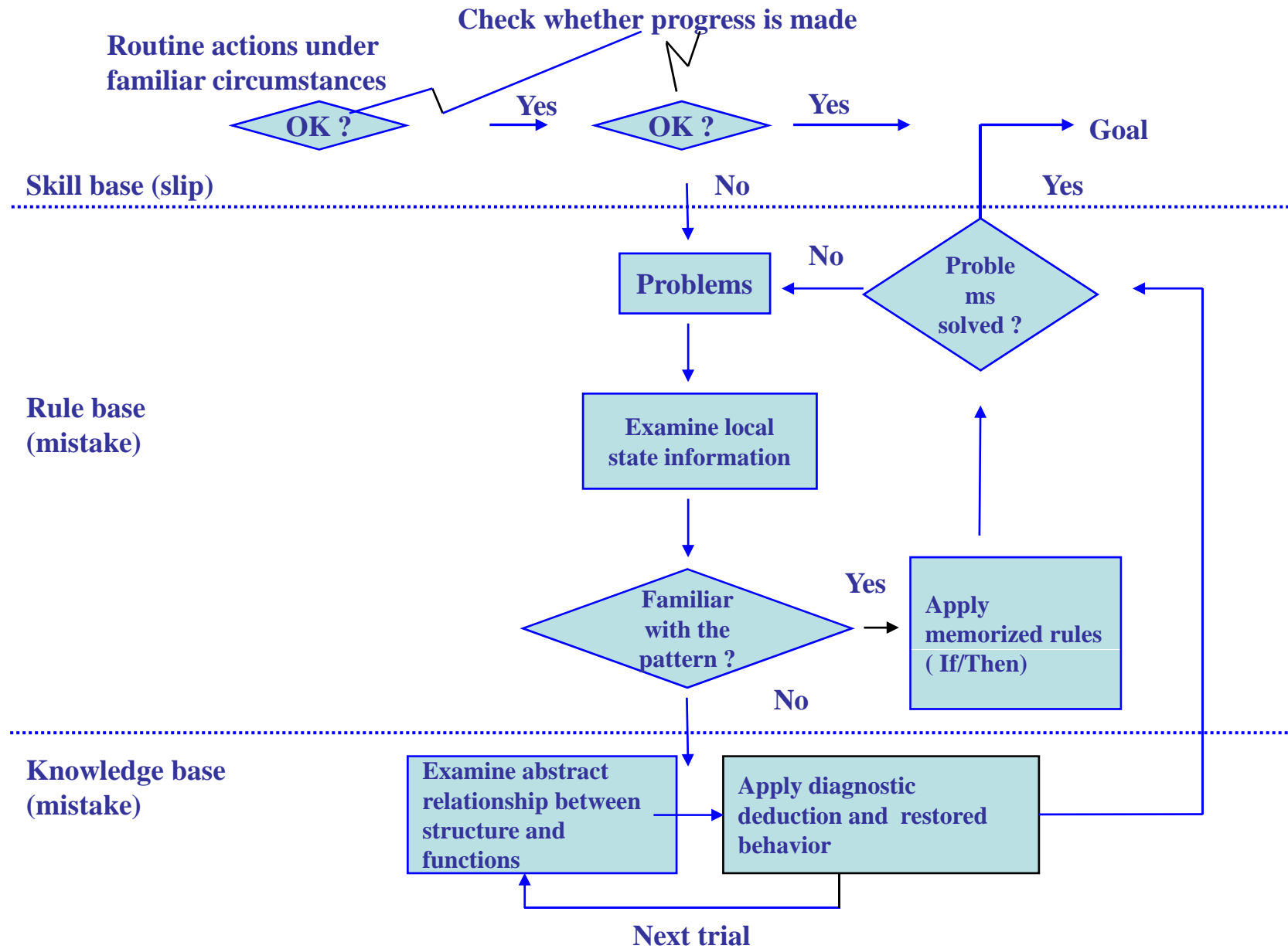


Hierarchical cognition model by Rasmussen

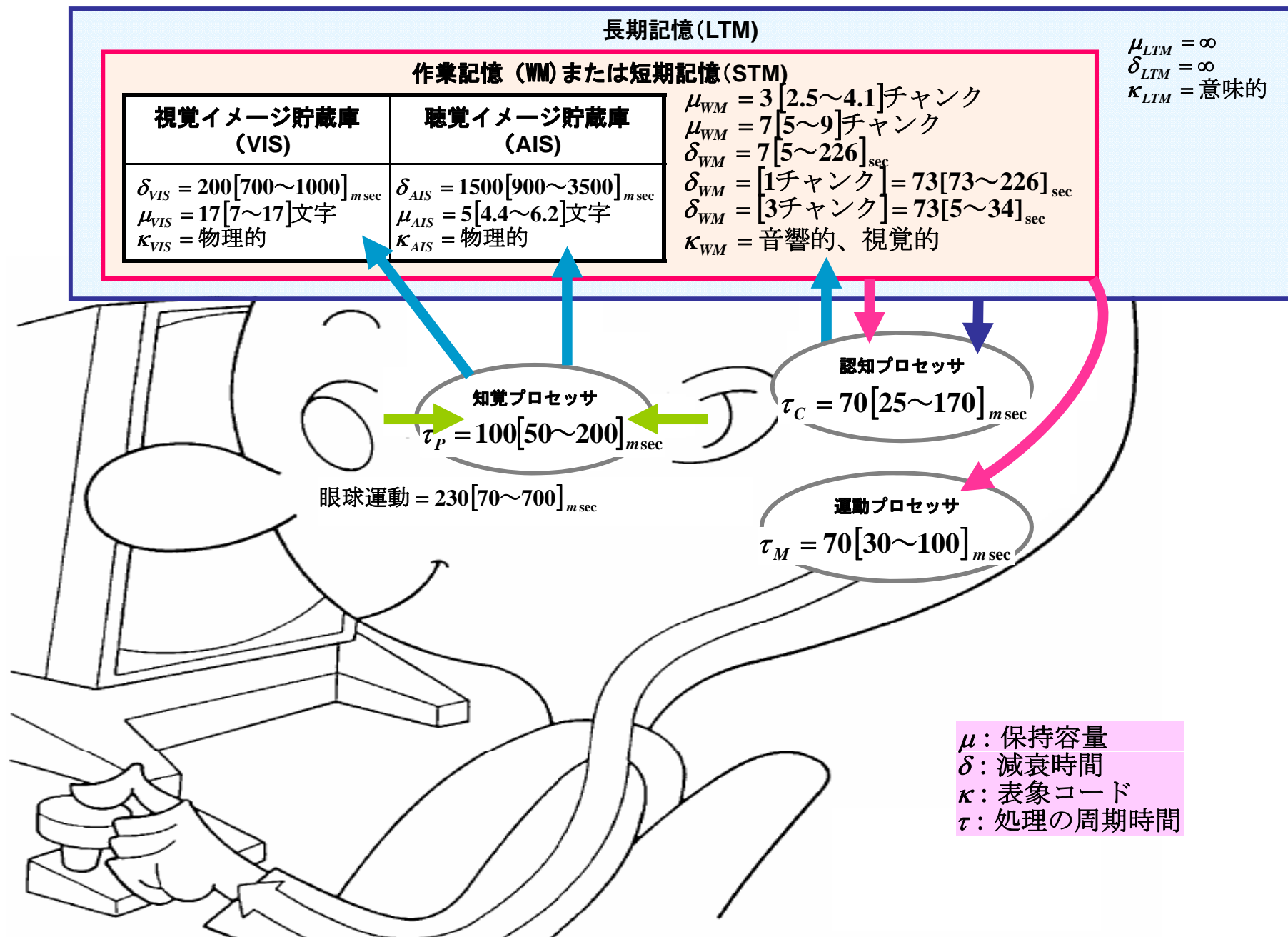


**Rasmussen's 3 level human behavior control model**





## Reason's GEMS model



Model human processor by Card et al. [Card et al. 1983]