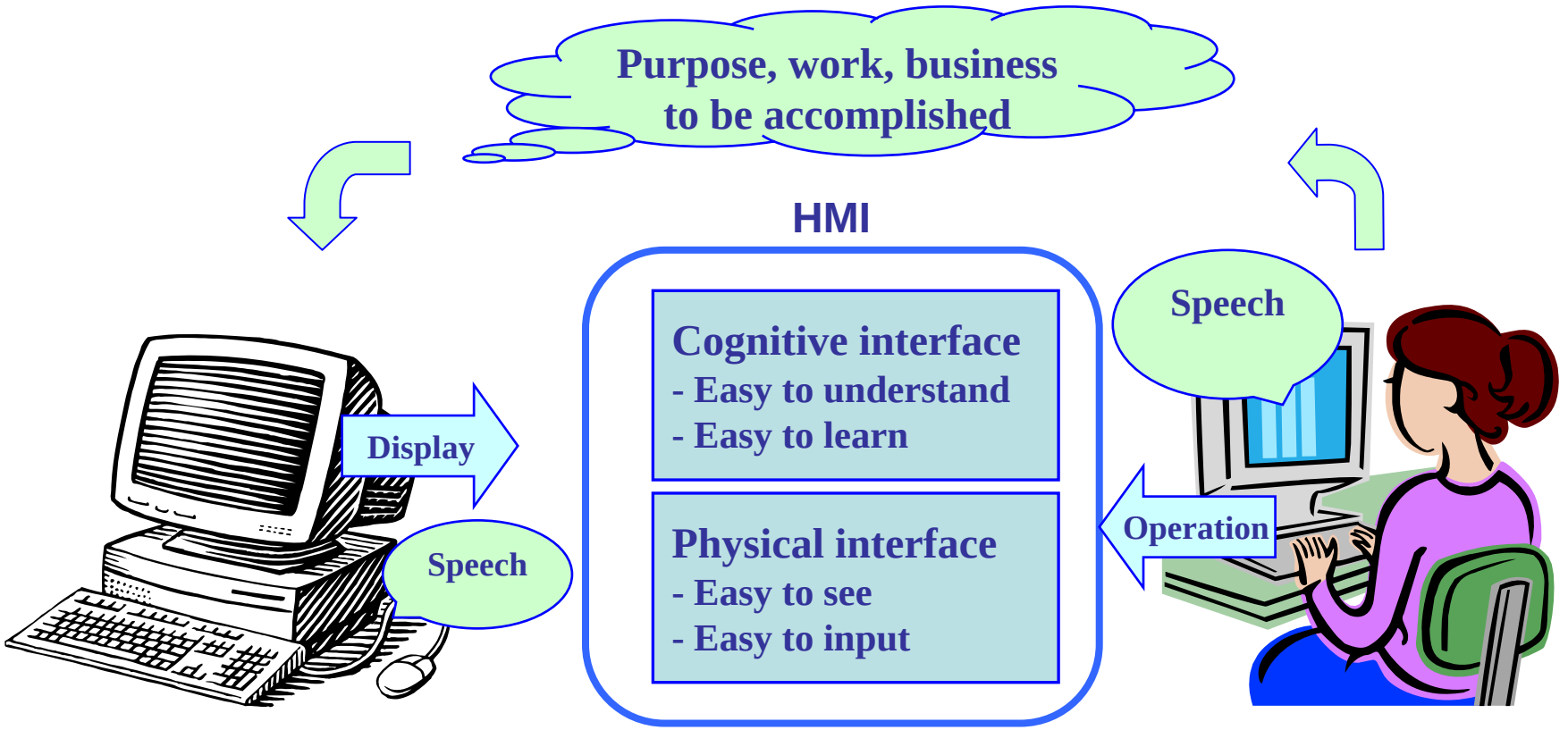
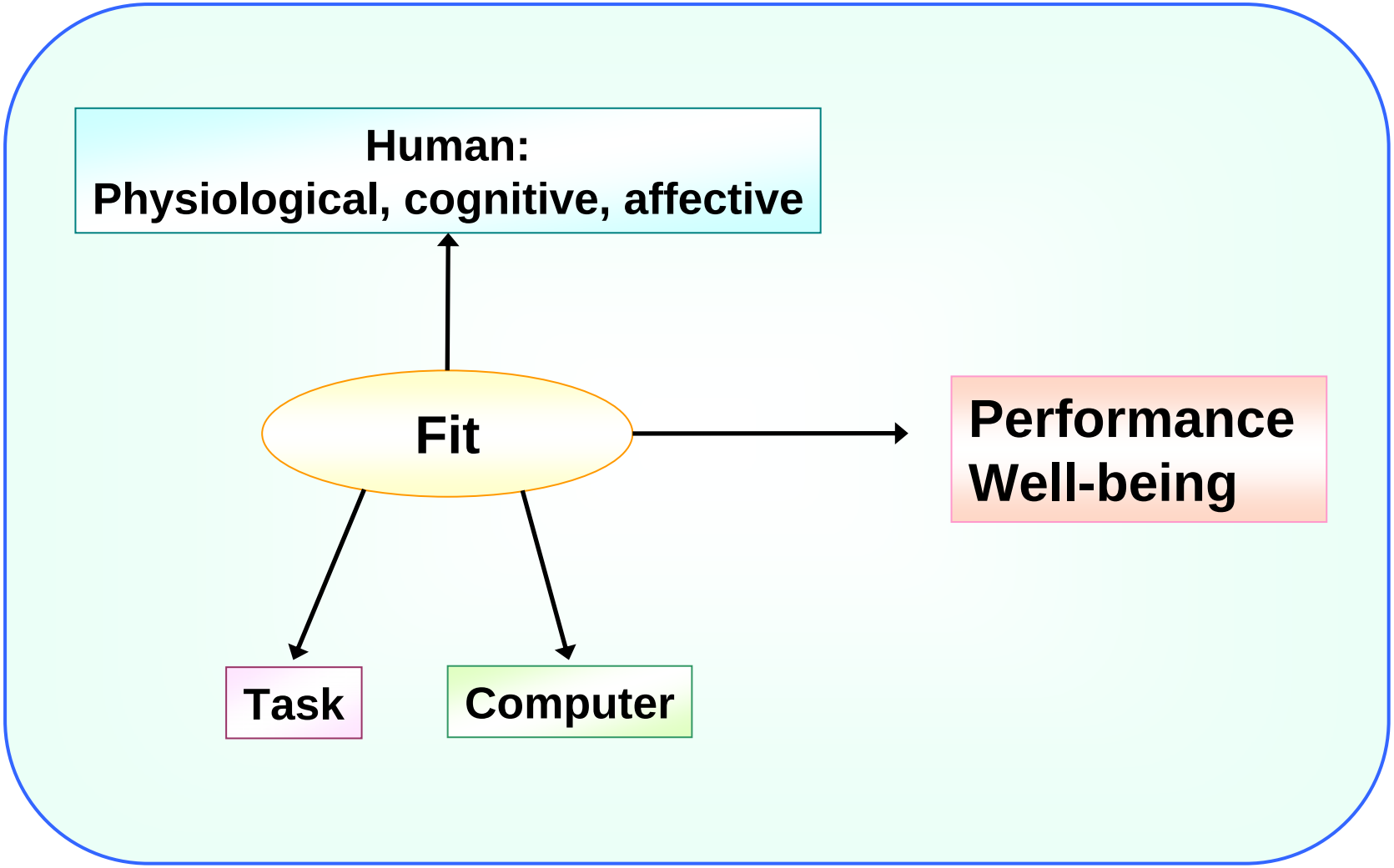



# HMI between human and computer (HCI)

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



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

## Cognitive Engineering

**Cognitive characteristics**

- Understandability
- Learnability

**Emotional characteristics**

- Pleasure
- Desirable
- Joy

## Human Engineering

**Physiological characteristics**

- Eye resolution
- Body shape
- Motor skill

**Physical characteristics**

- Easy to distinguish
- Easy to handle
- Easy to hold

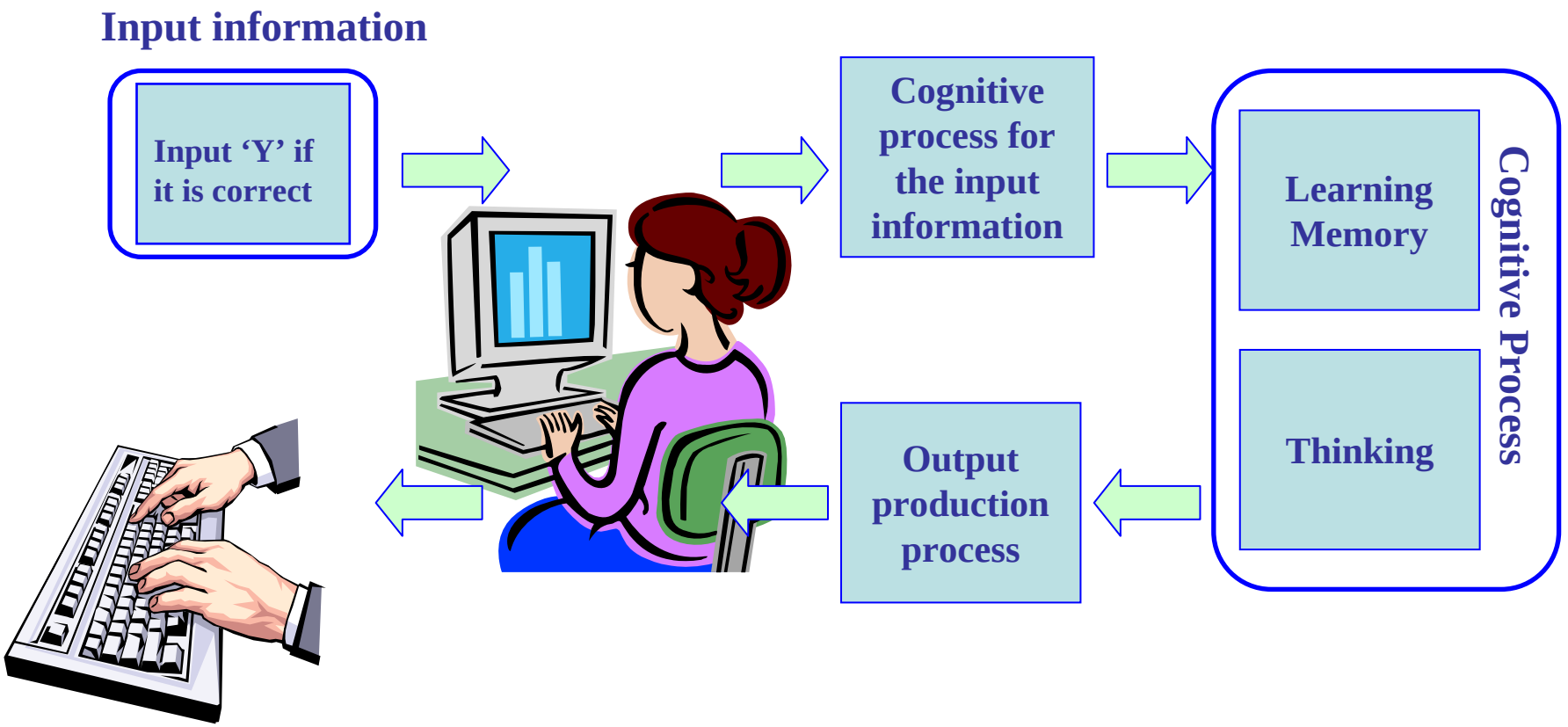
Cognitive aspect

Physical aspect

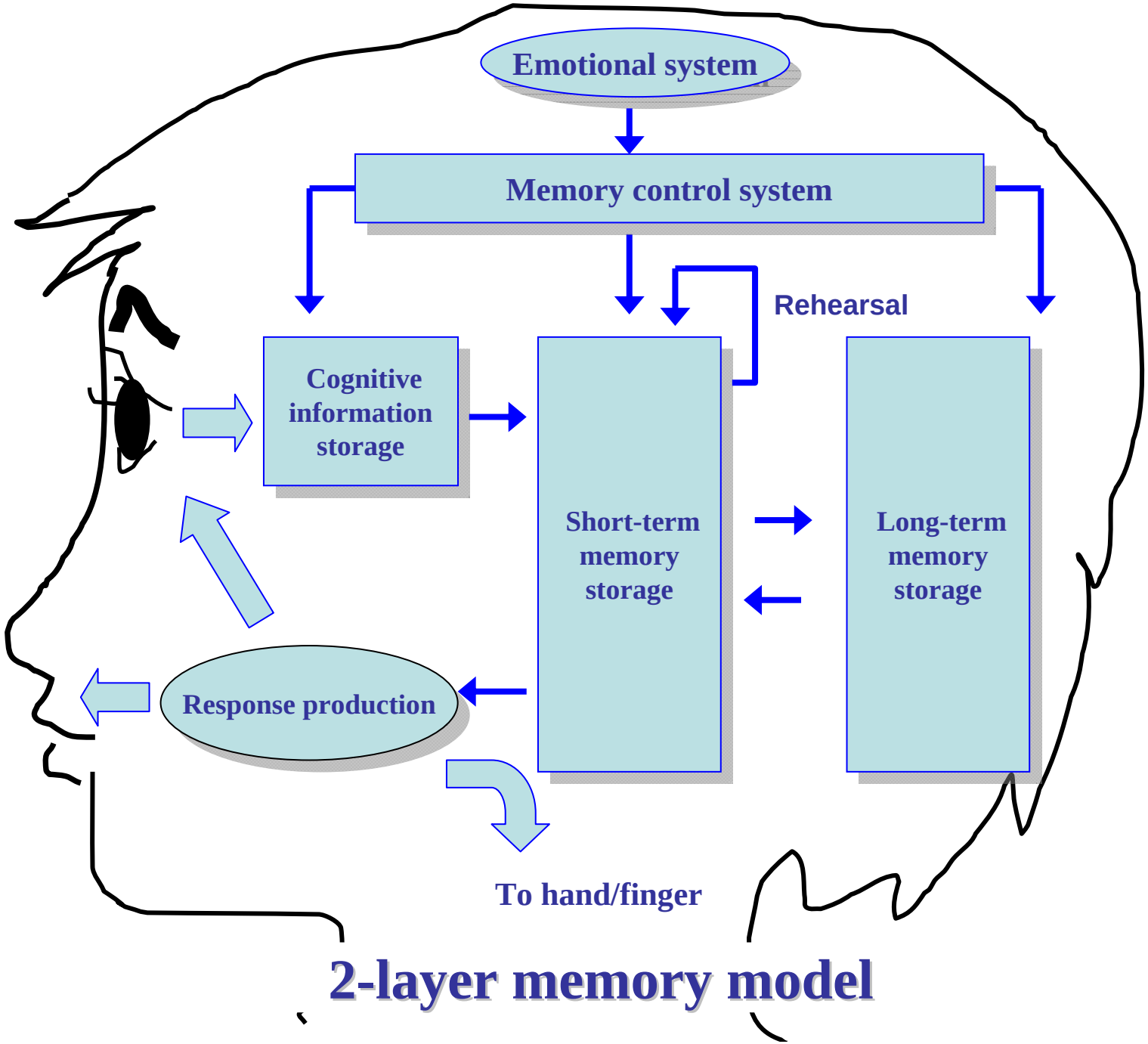
# Keywords to understand humans

# Examples of measuring items for usability

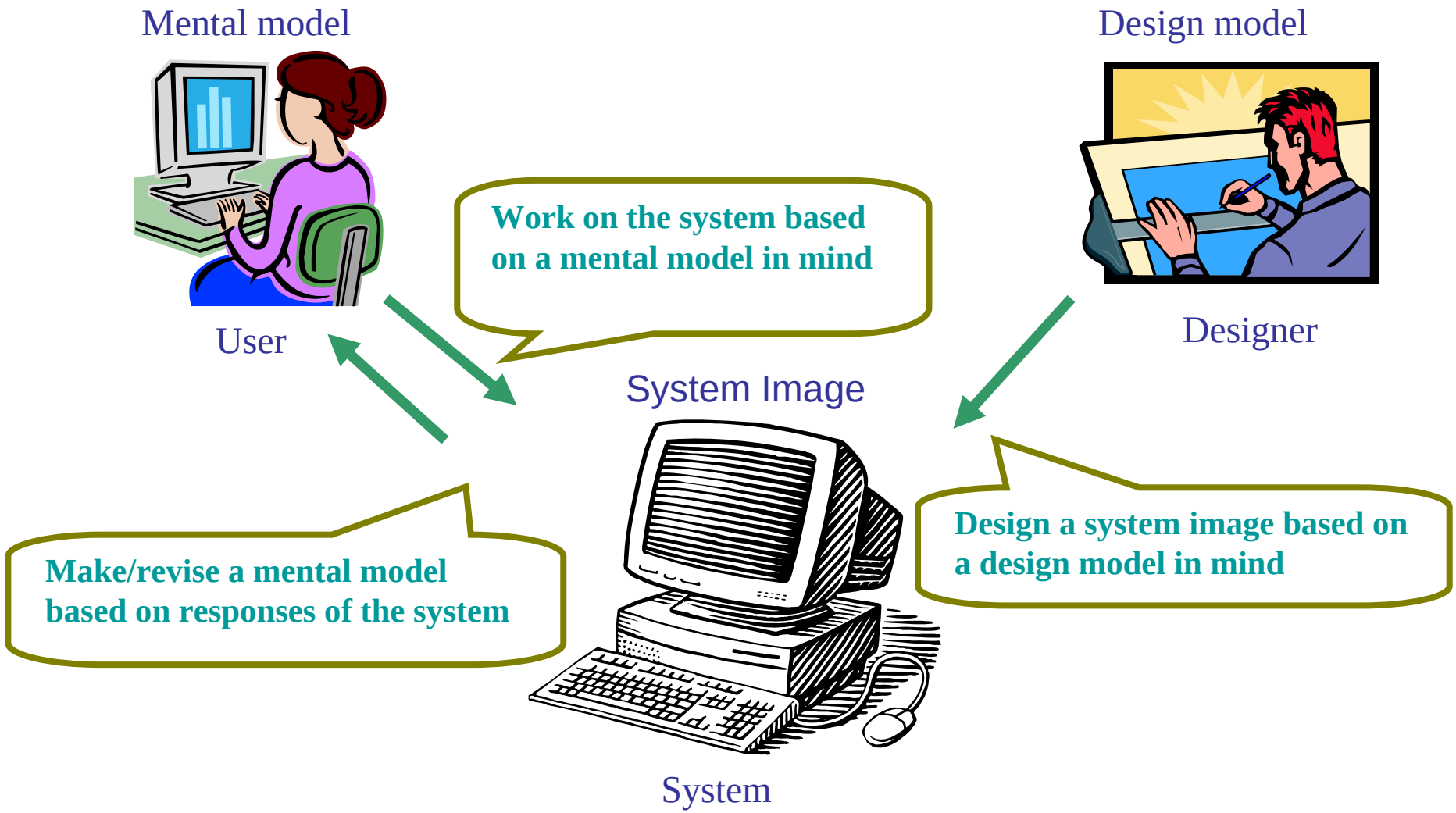
| Indexes | Items |
|---|---|
| Effect | Task completion ratio<br>Ratio of successful and unsuccessful works<br>Number of repetitions of unsuccessful commands<br>Number of successes and failures<br>Number of times that the user was mislead<br>Number of backtracks<br>Number of times that user was interrupted<br>Number of times that user lost control of the system |
| Efficiency | Time to complete a task<br>Ratio of completed tasks per unit time<br>Time spent in errors<br>Number or ratio of errors<br>Number or ratio of getting lost<br>Number of commands used<br>Number of commands not used<br>Frequency of help and document use<br>Time spent in help and document use |
| Satisfaction | Number of favorable/unfavorable user comments<br>Number of users preferring the system<br>Number of times the user found problems during a task<br>Number of times the user was satisfied or unsatisfied |




# Outline of human information process

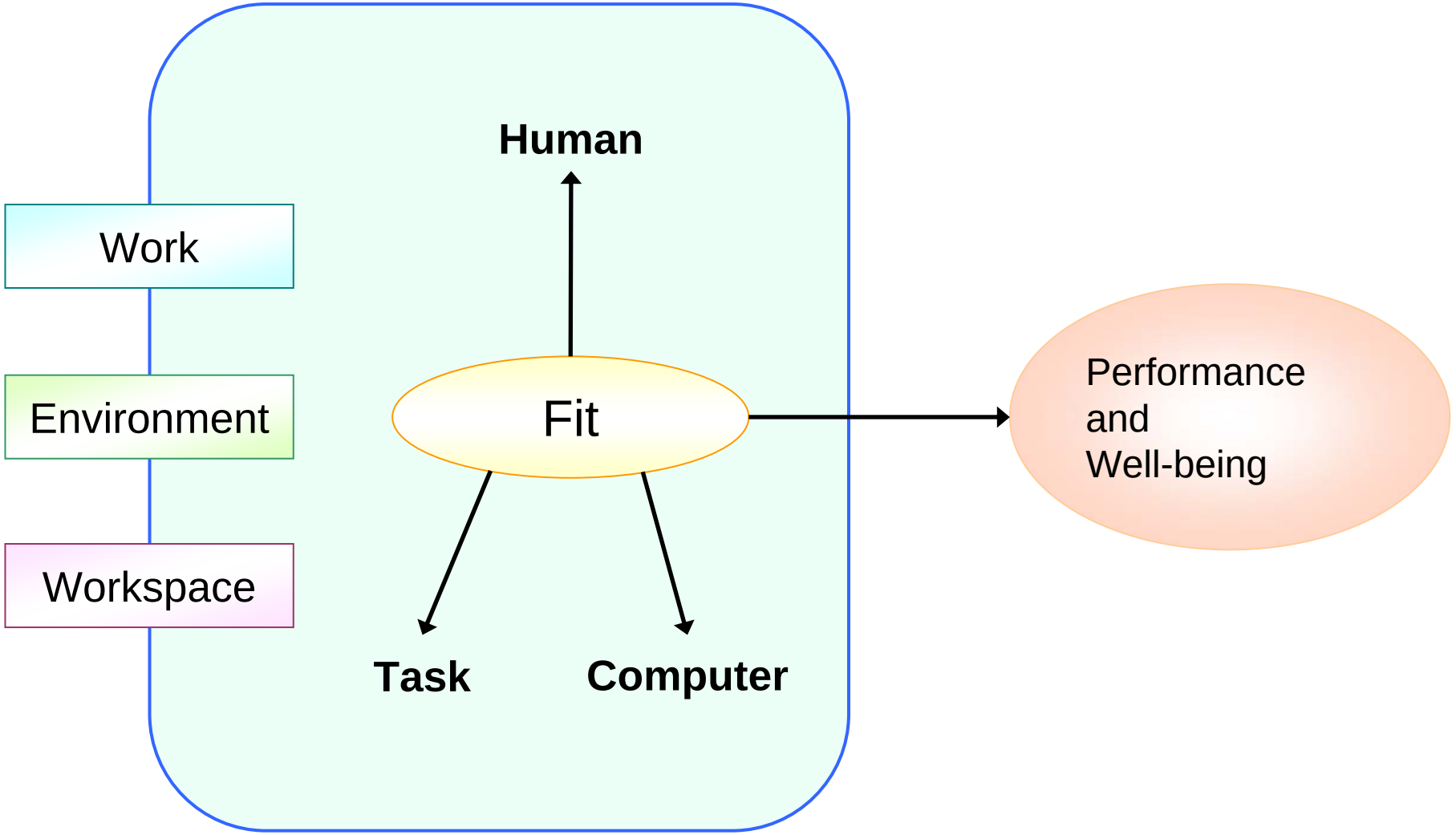



# 2-layer memory model

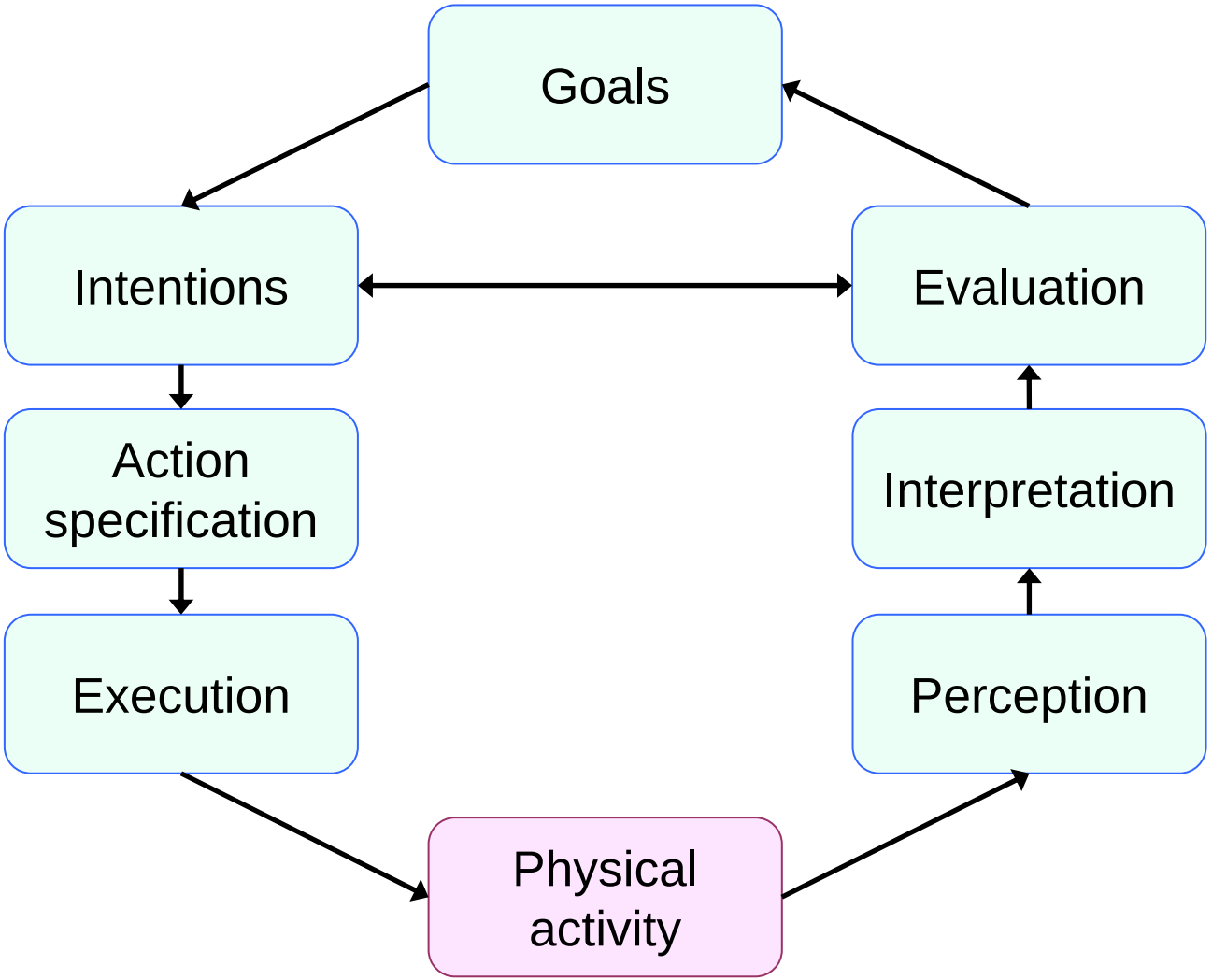


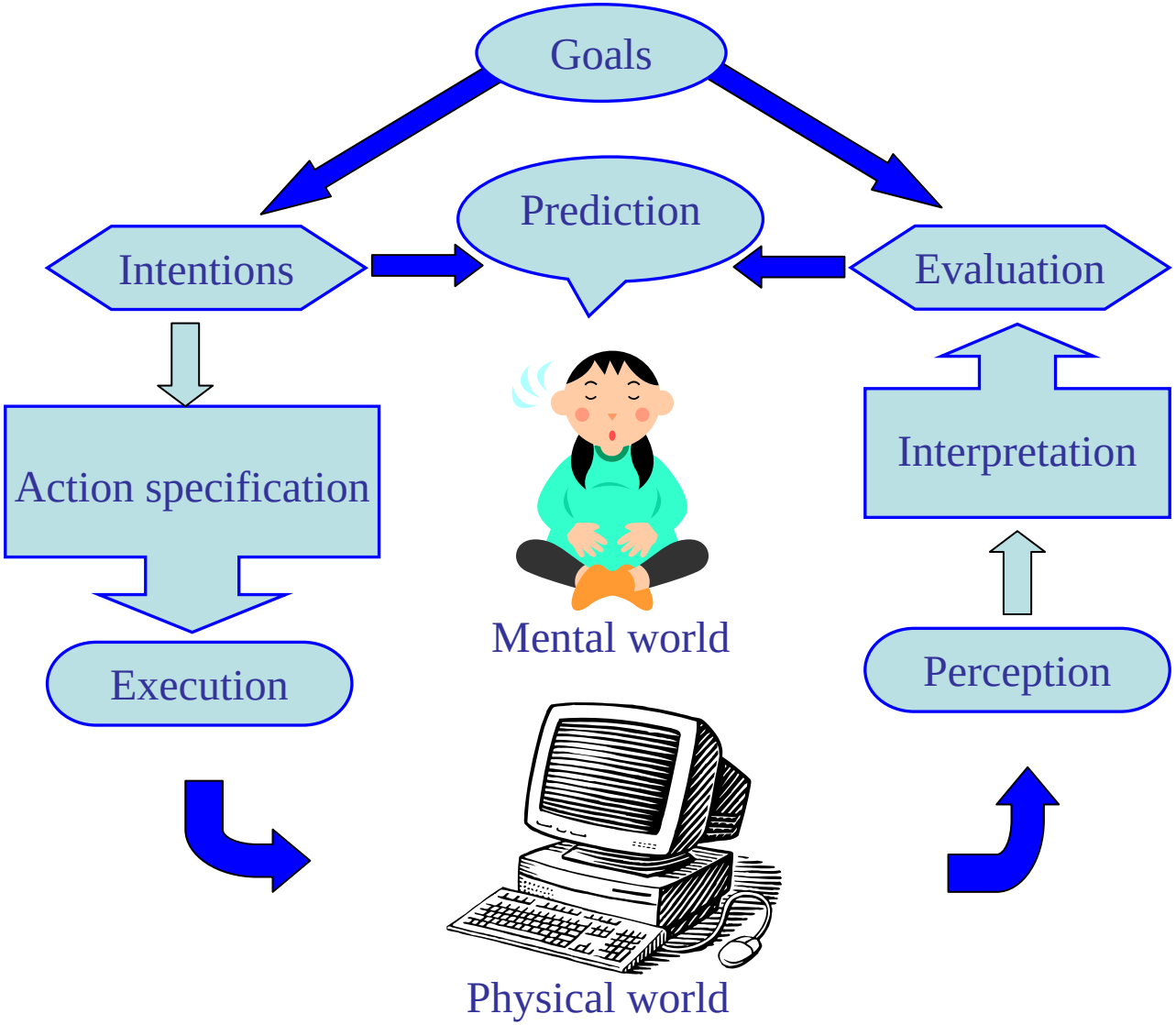

# Mental model and design model

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



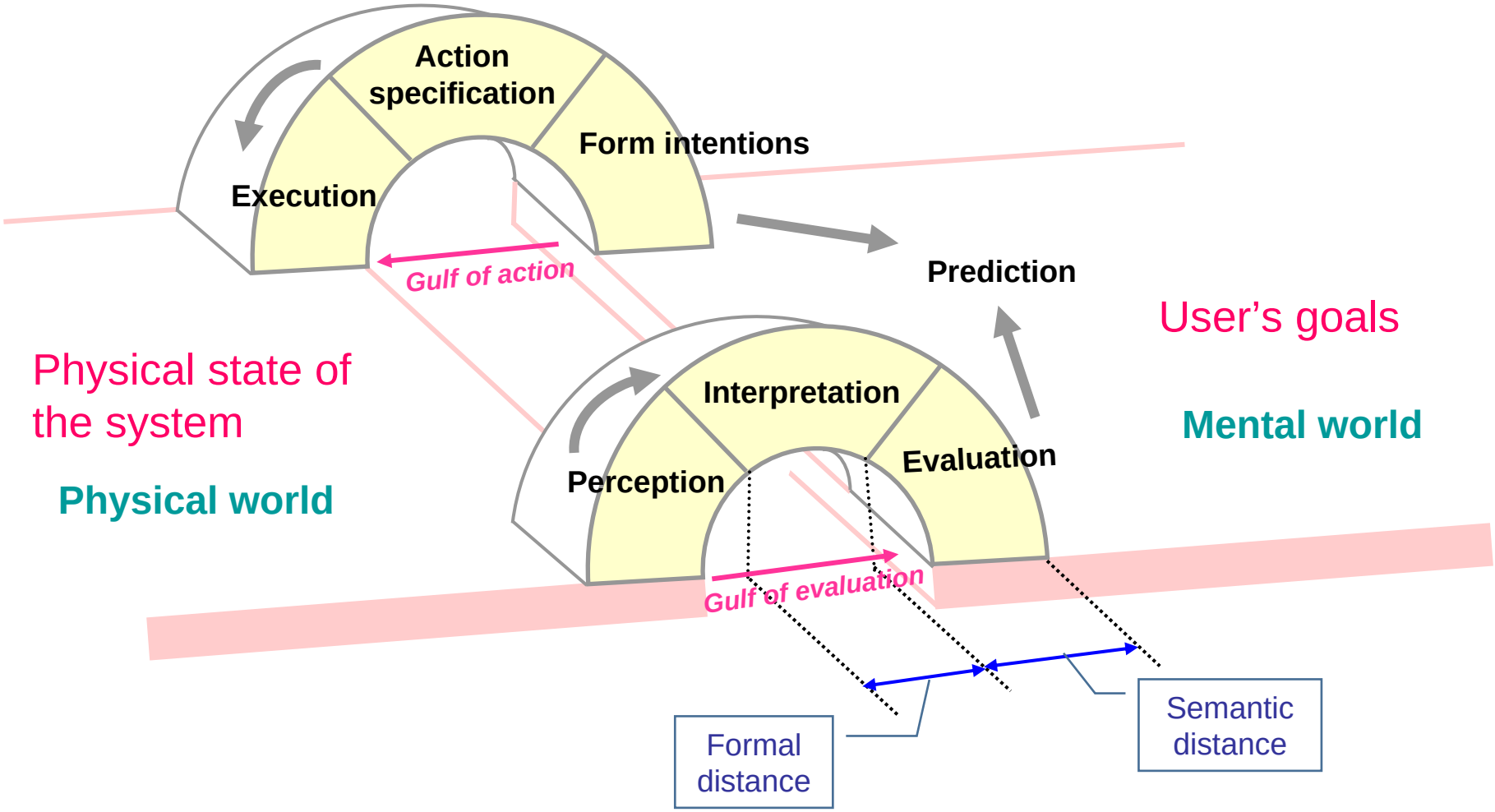
# Norman’s seven-stage model of user activity.





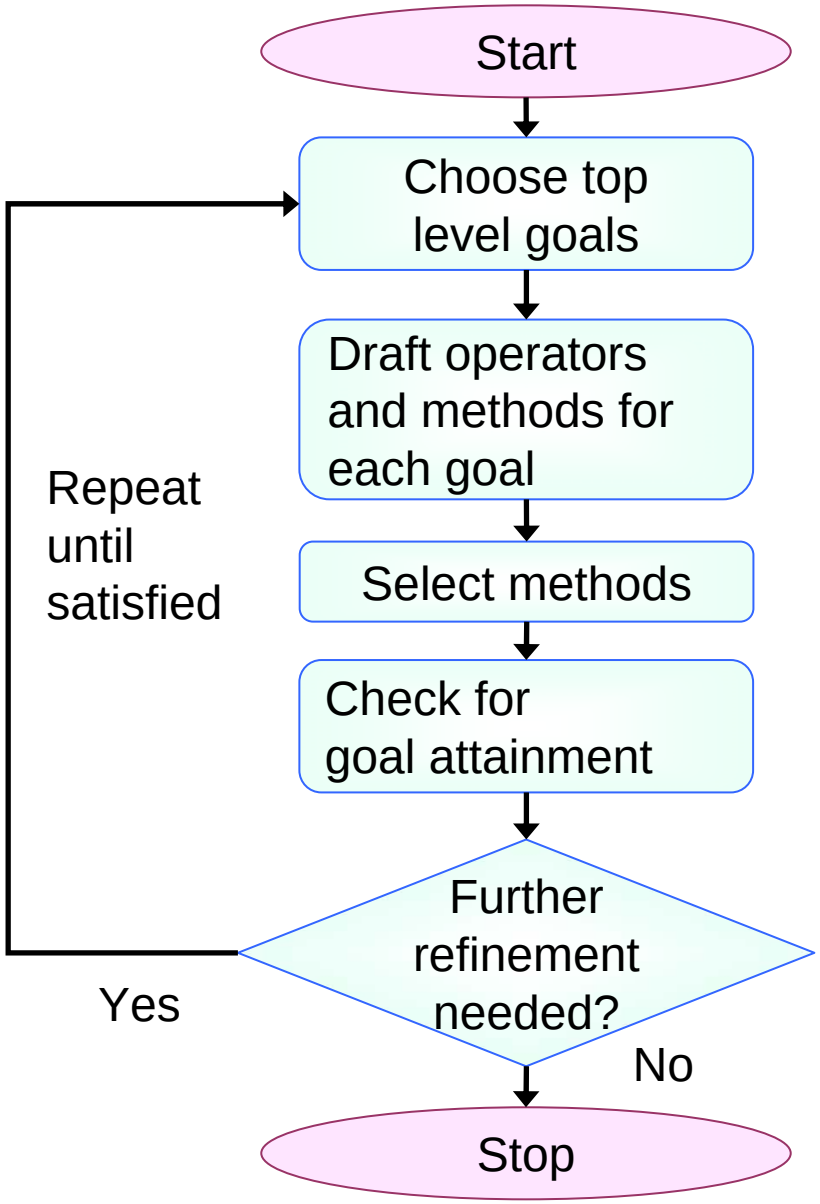

# 7- stage model of interaction

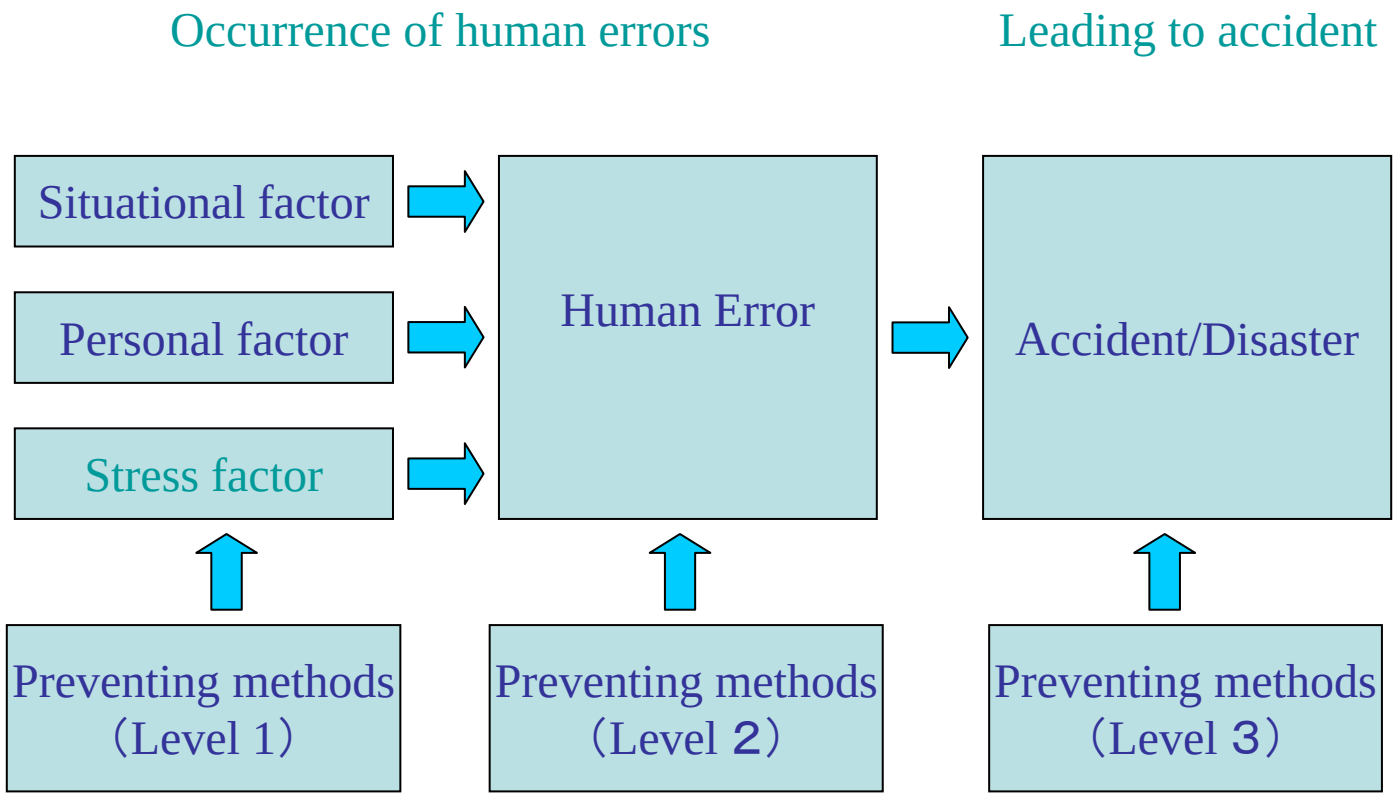
# 7-stage model of behavior



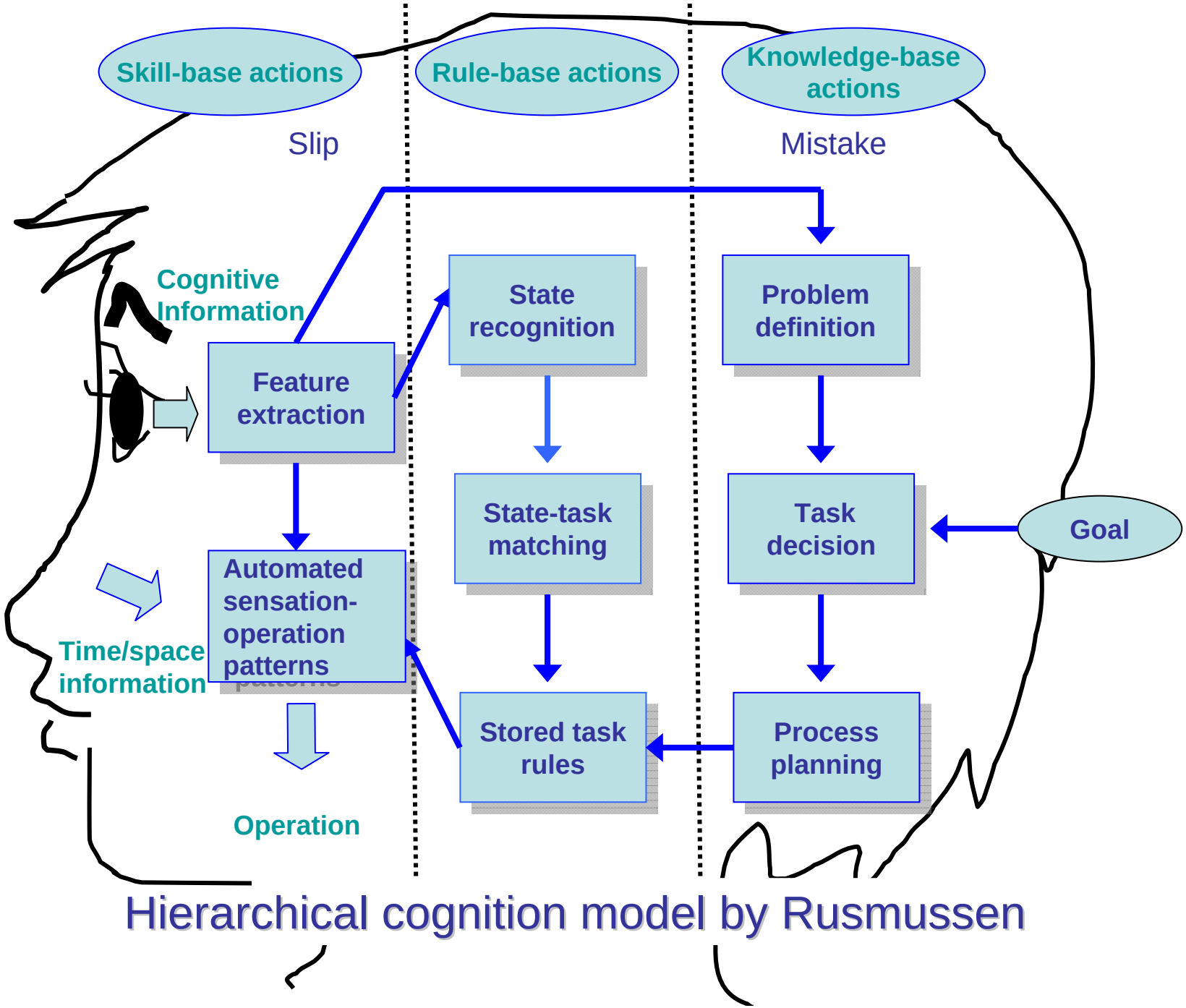

（*Gulf of action* and *gulf of evaluation* can be expressed as 'semantic distance' which represents the correspondence between the user's intention and the expressed meaning of interface language, and 'formal distance' which represents the correspondence between the expressed meaning of interface language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

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

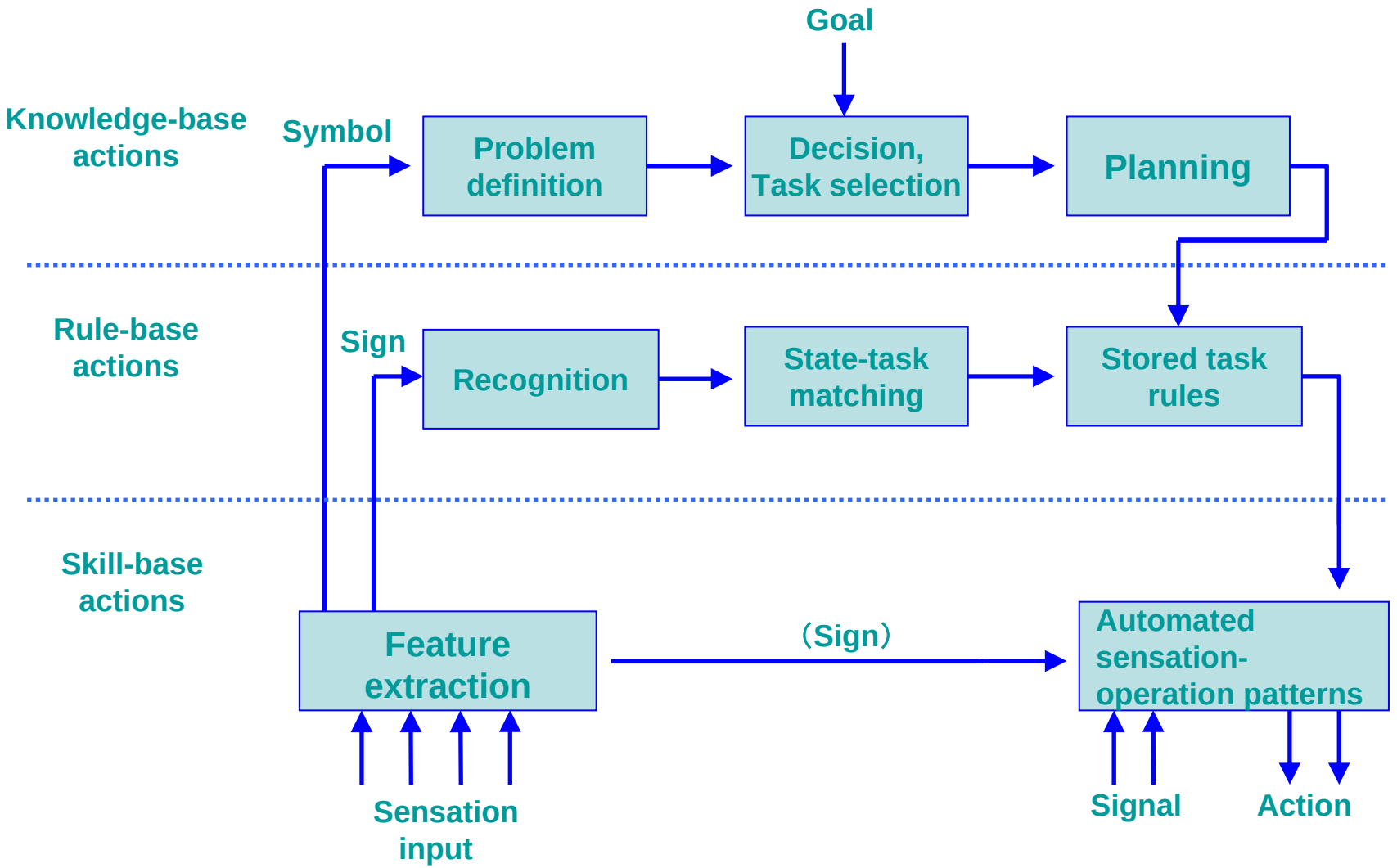




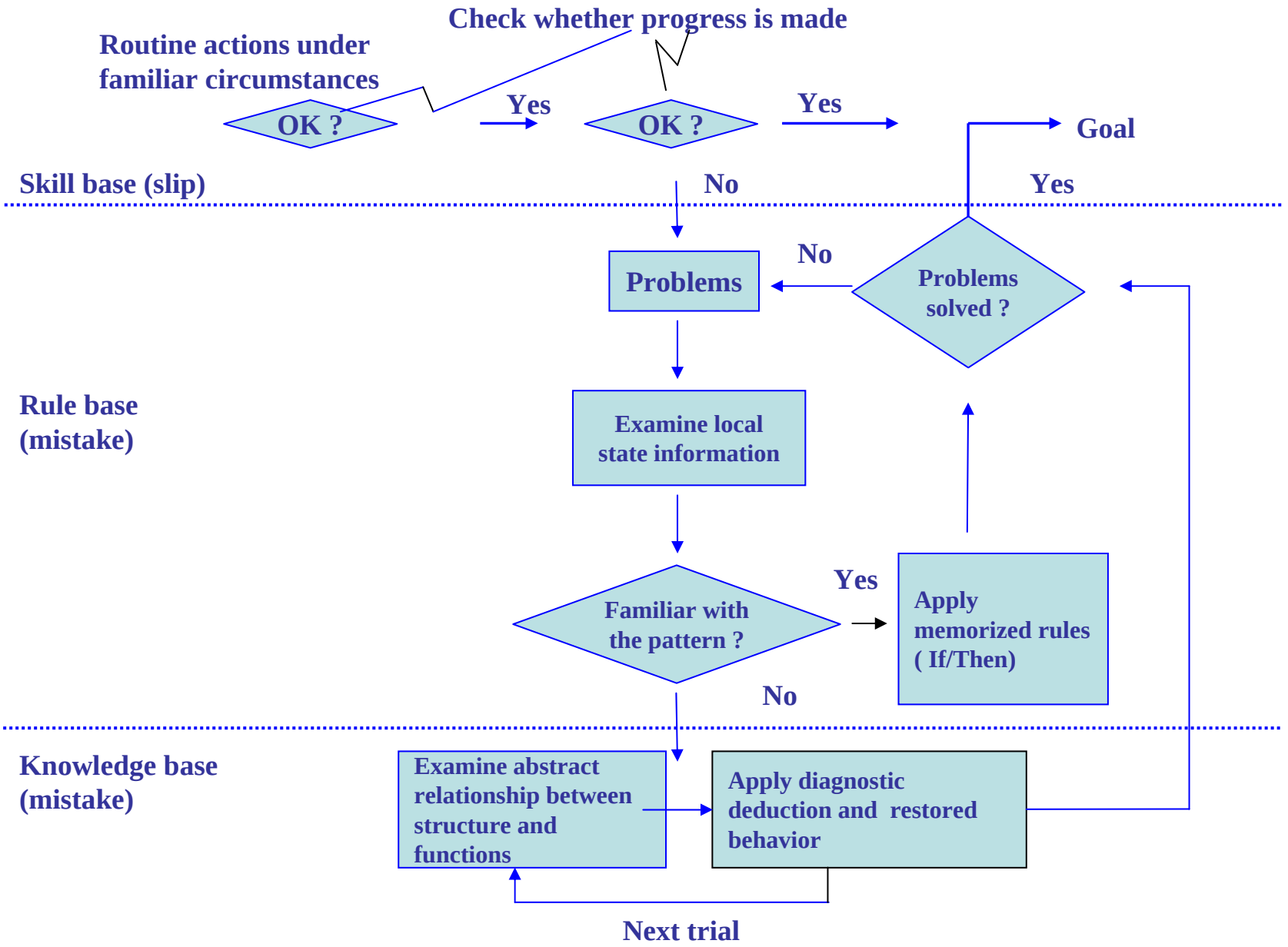

# From occurrence of human errors to development to accident



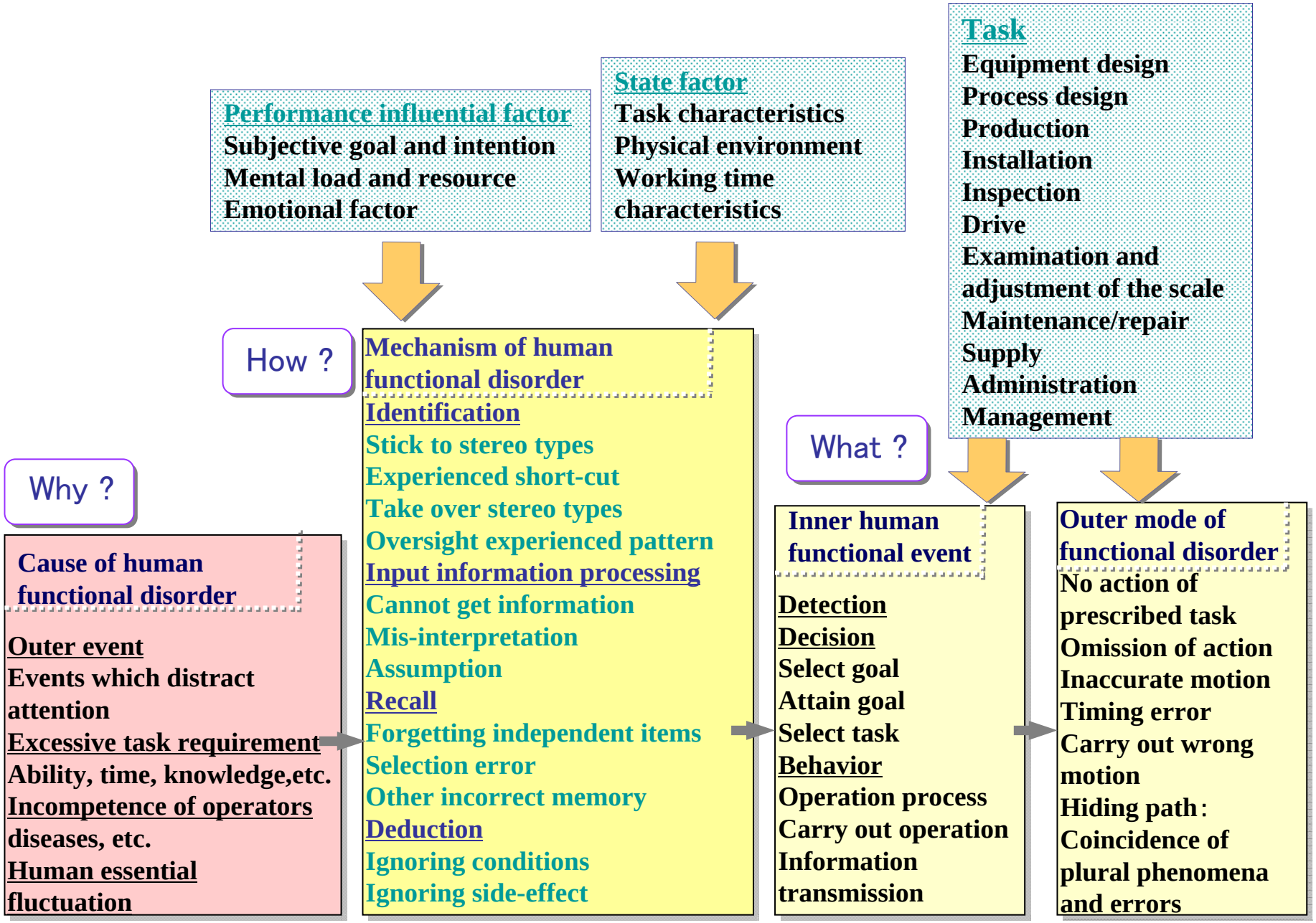

Hierarchical cognition model by Rusmussen



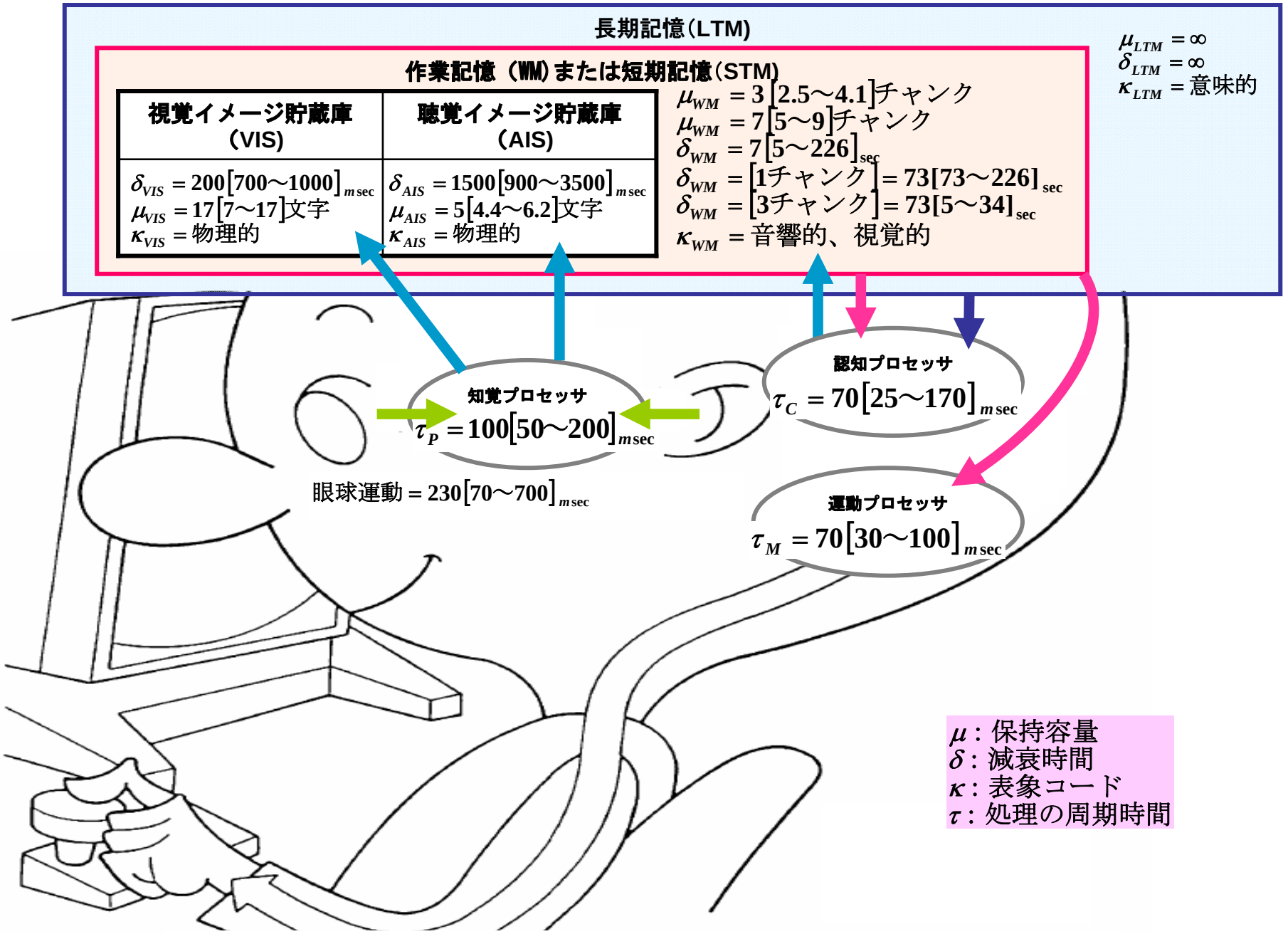

# Rasmussen's 3 level human behavior control model




# Reason's GEMS model




**Versatile description of phenomena Including HE**




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