Do Human Science

Yutaka Saeki

Changing Psychology Into Science

- Watson, J. B. "Behaviorism" (1912)

  "The purpose of psychology is to predict and control the behavior and psychology is a part of science that is objective and experimental. This means that we must focus on behavior only, and eliminate its consciousness and introspection. Behaviors consist of an elemental response to a stimulation, and the response consists of muscular movement and gland secretion. Therefore, we explain that every behavior is a chain reaction of elemental stimulation and response by conditioning."

  translated by Saeki;Watson, J. B. 1913" Psychology as the Behaviorist Views It". *Psych. Rev*., **20**, pg.158-177

Birth of "Science of Behavior"
—Skinner(1904-90); Radical Behaviorism —

- Behavior of Organisms are classified Into Two Kinds.
  - Respondent behavior（The behavior that is learned by conditioning of Pavlov）
  - Operant behavior（The behavior that is learned by the operant conditioning of Skinner.)

（The difference between respondent behavior and operant behavior is not physiological /neurological. It is considered to be the "only a real law learned by experience".）

All Behaviors are Formed in "Conditioning", and Controlled in "Conditioning".

- Respondent conditioning
  - When the behavior elicited by unconditional stimulation is with condition stimulation, the behavior is elicited by condition stimulation.
    - Saliva flows when hearing a bell and saliva flows with bait.
- Operant conditioning
  - After a behavior is emitted, the appearance frequency is increased by given the reinforcement.
    - When a mouse can get fed by pushing a button, it learns and its behavior of pushing the button occurs frequently.

“Contingency of Reinforcement” is Everything.

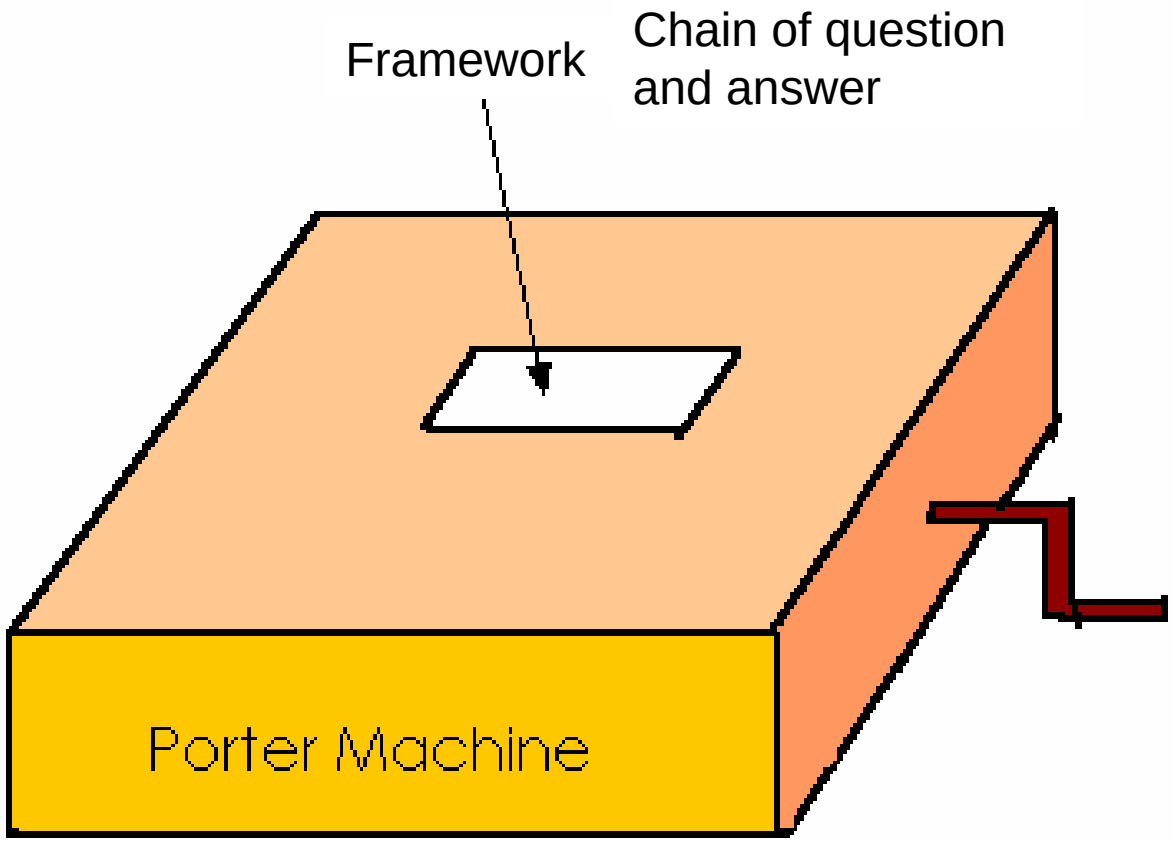
- “Reinforcement” is the stimulation which increases appearance frequency of operant behavior by giving it.
  - It is not necessary to explain the satiability of animals.
  - “Contingency of Reinforcement” is the principle of any behavior, verbal behavior, emotional response, superstitious behavior 、problem-solving behavior, etc.

From Behaviorist Psychology to Creating "Scientific Teaching"

- Skinner was surprised at his daughter`s mathematics class because…
  - It couldn't satisfy the learning condition which was found in the experiments of animals.
  - Ambiguous goals... They don't know "What they can do".
  - Delayed feedback...test results comes back the next day.
  - Much wandering and leaping around, not systematic.
- Thesis of Teaching Machine / Programmed learning*
  - Small-steps
  - Immediate reinforcement
  - Sequential approach

* Skinner, B. F. (1954) "The Science of Learning and the Art of Teaching." *Harvard Educational Review*, 24, 86-97.

Primary Teaching Machine



Education is the Optimized Strategy for "Achievement of Target Behavior"

- Show the learning goals by the learners' word (target value positivism)
  - "Our goal is to make them understand A ."
    ..."Your goal is you can do A'."
  - It enables us to examine whether they can achieve the goal or not.
- Break away from " *tsumori*-only planning- and *hazu* -not checked- education
  - Learning flowcharting
  - Small steps, Steady steps.
  - It becomes possible to judge if successful or not.

The Advance of Programmed Learning

- “Education” and “Engineering”;birth of educational engineering
  - Complete control of “Plan/Do/Check”
- Operationism: measurement and evaluation is everything.
  - Break away from “ *tsumori*-only planning- and *hazu* -not checked-education
  - Bad ;“Our goal is to make them understand A .”
    ...Good;”Your goal is you can do A’.”
  - Target value positivism
- Ideal learning is “ to learn individually”.
  - The difference between premised behavior and the speed in learning
- These are utilized today,
  - CAI: Computer-Assisted Instruction
  - WBT: Web-Based Training

From the Birth of Behaviorism to the Birth of Cognitive Science (1960-70)

- Criticism inside
  - Garcia & Kohling
- Criticism outside
  - Chomsky
  - Newell, Shaw, & Simon
  - Then, Miller, Galanter, and Priblam
- And, Neisser

" What has become of human science,
especially science of 'mind'?"

What makes cognitive science be "Science"?

Internal Criticism Behaviorism
Garcia- Koelling Experiment (1966)

Avoidance learning	Clicking sound and Flashing light	Saccharin-taste and Slightly nasty smell
electroshock	**Success**	**Failure**
scours by strong x-radiation	**Failure**	**Success**

Garcia, J., & Koelling, R. 1966 “Relation of Cue to Consequence in Avoidance Learning.” *Psychonomic Science*, 4, 123-124.

Chomsky's Criticism of Skinner *

*Chomsky, N. 1959 Review of *Verbal Behavior* by B. F. Skinner. *Language*, 35, 26-58.

- Language is creative primitively, and human being constantly hear " new sentences" and can speak new sentences.
  - For example, we have longer sentences than very long sentences.
- What makes a language itself is the "grammar", but we can not acquire the "grammar" by heuristics
  - (a) "Colorless green ideas sleep furiously."
  - (b) "Furiously sleep ideas green colorless."
  - We can find immediately; (a) is a sentence and (b) is not a sentence
  - Probability of combination of words is almost nothing.
- In a different context, even the same phoneme has absolutely different physical properties , and the same physical property has a different meaning.
- Therefore, acquiring the language depends on innate language competence（Language Acquisition Device: LAD）

...impossible to acquire by accumulation of experience

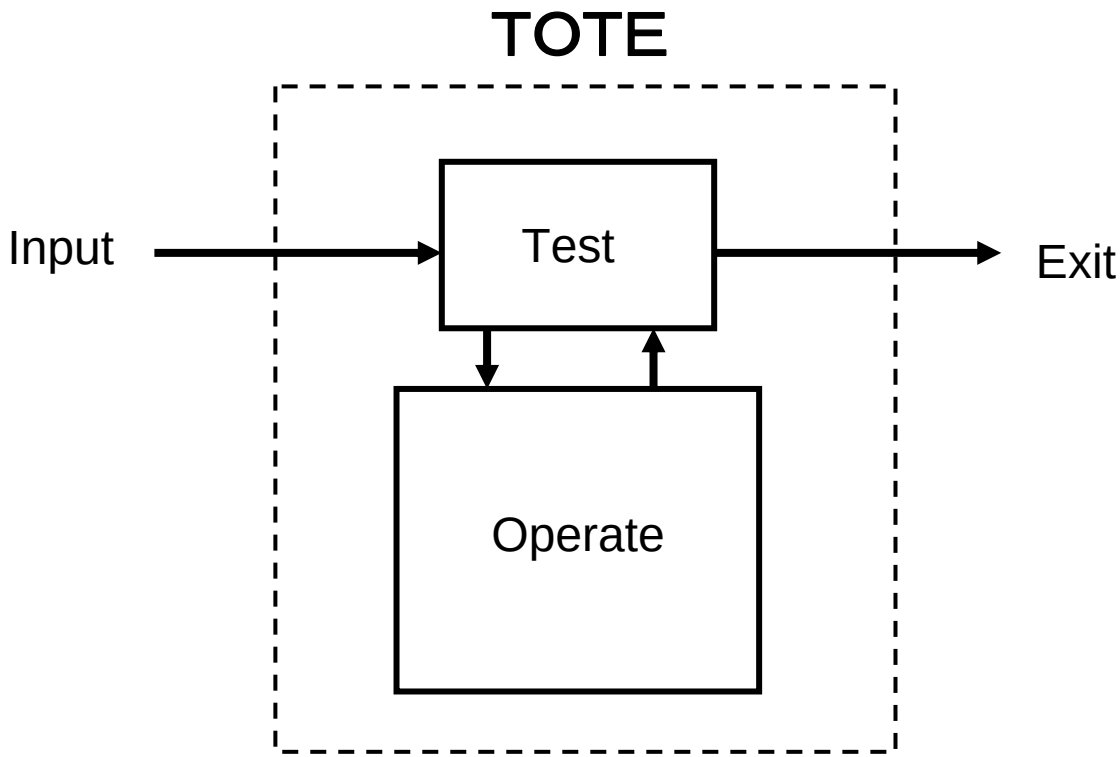
Thinking Simulation as Psychological "Theory"
(The birth of artificial intelligence study ?)

- Conditions to be psychological theory about problem-solving
  - Exact prediction of the problem solver's performance
  - Explanation of the process of problem solving
  - Prediction and explanation of emergence of the aspects in problem solving
  - Prediction and explanation of the variation which the difference of beginning condition brings
  - Prediction and explanation of the way to acquire the skill of problem solving and the new things which is acquire by problem-solving
- Well...
- Computer simulation system " LOGIC THEORIST" clear all these conditions. ... We can say " It is the psychological theory of problem-solving behavior.

Newell, A., Shaw, J. C. & Simon, H. A. 1958 " Elements of a Theory of Human Problem Solving." *Psychological Review*, 65, 151-166.

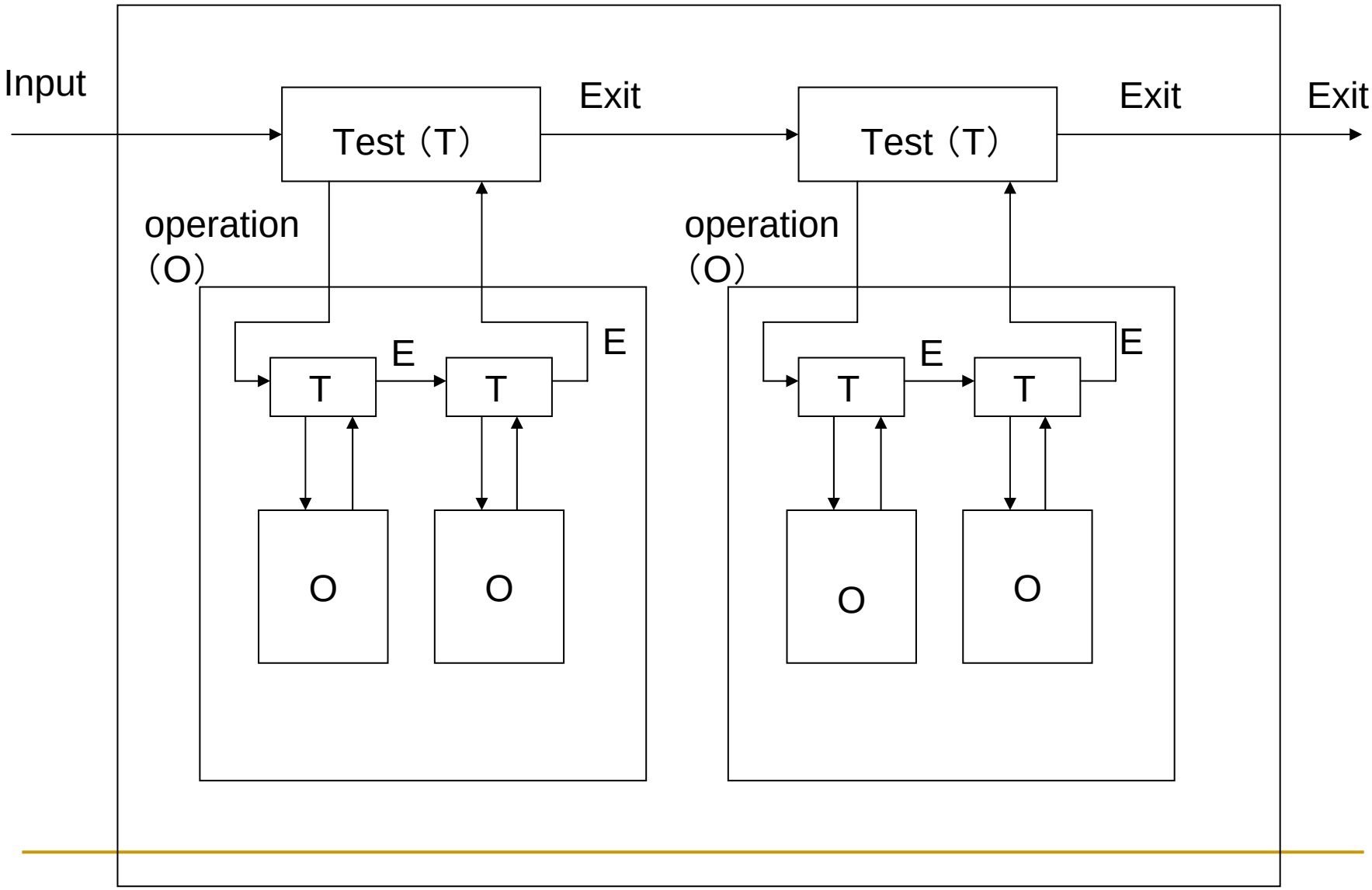
Exploring New Paradigms (1)

—Miller-Galanter - Pribram; TOTE—



Miller, G., Galanter, E., & Pribram, K. H. 1960 *Plans And the Structure of Behavior*. Holt, Rinehart & Winston

TOTE


Input
Test（T）
Exit
Test（T）
Exit
Exit
operation
（O）
operation
（O）
T
E
T
E
T
E
T
E
O
O
O
O

Exploring New Paradigms (2)
Neisser's Analysis-by-Synthesis

Neisser, U. 1967 *Cognitive Psychology*. Appleton-Century-Croft

The Innovation of Cognition;

We can study “understanding”

-Formulation of fusion with psychology, linguistics, computer science philosophy

- Any animal and intellectual construct (computer) can expect , respond and create “meanings.”
  - “Meanings” is context, situation, circumstances, evolutional adaptability.
- Intellectual behaviors (inference, problem-solving, language understanding, utterances et. al.) are correlated to knowledge behind.
  - Intellectual framework：” framework”, “ scheme”, “ script” (said later “affordance”)
- The place for intellectual activity was seen at daily situation more often than the laboratory.
  - analysis of daily conversation, ecological validity, field work

and it caused the birth of Cognitive Science.

Twelve Issues for Cognitive Science.

- Belief system
- Consciousness
- Development
- Emotion
- Interaction
- Language
- Learning
- Memory
- Perception
- Performance
- Skill
- Thought

Norman, D. A. 1981 “Twelve issues for cognitive science.” In D. A. Norman (Ed.) *Perspectives on Cognitive Science*. Lawrence Erlbaum, 265-295.

What Cognitive Science Makes Freedom?

Freedom from…

- Constraints of research methodology
  - Objectivity, sustantivity, repeatability
- Constraints of subjects
  - Previous work, following up well-known studies, etc.
- Constraints of community
  - School, tradition, hierarchical relation

In short,

- " You should do what you think interesting by the way how you want.

What Makes Cognitive Science "Science"?

- Un-fixation about “objectivity”, “verifiability”

Instead,

- Meta-theory with definiteness and generality
  - “ This is what a human being is, isn’t it?”
  - “ Cognition is like this, isn’t it?”
- “Fixation of Belief” by Fodor
  - Brumer says,
- Proacativity beyond domains
  - A new question is born
  - Indeed, we have the same thing in this domain.
- Emphasis relations with everydayness
  - Respect to Daily conversation, daily life scene

    ...importance of field work

Science in a New Meaning

It is good that it's interesting、

Even if it is true, or not.

Well,

To purse "it is interesting"

means to purse "it is true."