Do Human Science (2)

Yutaka Saeki

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

- Conditions for psychological theories 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 in problem solving and the new things which are acquired 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.

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, utterance et al.) are correlated to knowledge behind.
  - Intellectual framework：” framework”, “ scheme”, “ script” (said later “affordance”）
- The place for intellectual activity was seen in daily situations more often than in the laboratory.
  - Analysis of daily conversation, ecological validity, field work

and it caused the birth of Cognitive Science.

What Kind of Freedom Can Cognitive Science Create?

Freedom from…

- Constraints of research methodology
  - Objectivity, verifiability , 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 in the way how you want."

What Makes Cognitive Science "Science"?

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

  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 Context

It is good that it's interesting、

Even if it is true, or not.

Well,

To purse "it is interesting"

means to pursue "it is true."

(This covers content dealt with the last time.)

“Milestones” of “Cognitive Science Series”

- 1979 Cognitive Science Society was established in the U.S.
- 1980 「Japan-U.S. Symposium about cognitive science
- 1983 Japan Cognitive Science Society was established.
- 1984 First conference of Japan Cognitive Science Society
- October, 1985 University of Tokyo Press started the publication of “Cognitive Science Series” which had 24 series and concluded in May 1992.

  (The first phase of publication -a total of 10- was concluded in February 1987, and most of them were published in less than a year.

- A representative of a bookstore come to consult with the publisher, so Saeki gave a lecture about how they should be arranged.

In the Publication of "Cognitive Science Series"

- ･･･we adopt editorial an policy as follows. First, we will not fix the domain of cognitive science. Innovative knowledge often comes from the periphery and where we don't expect it to come from.. **Consequently, we have no questions about the domains of researchers who would have strong interest in work of human interest and would have an original point of view through secure research activity.**
  - First phase member of editorial board
    Masanao Toda, Hiroshi Azuma, Giyoo Hatano, Makoto Nagao, Yutaka Saeki
  - Second phase member of editorial board
    First phase member ＋ Yukio Otsu, Junichi Tsujii

Vol.	Title	Authors	Age
1	Points of View	Kiyotaka Miyazaki Naoki Ueno	35 35
2	Inference of Ordinary Language	Shigeru Sakahara	35
3	Pattern Recognition of Computers	Makoto Nagao	49
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The Leading Motive of Cognitive Science in the 1980's "Schema" Theory"

Why can we have "understanding"?:
Because we have "scheme"
(Conceptual framework) in the mind.

Understanding is to Assemble The Jigsaw Puzzle Known as “Schema”.

- “Schema”

  ＜Grammar (general strategy)＞

  ＋＜situated background＞

  - Example：

    “Taro put a box on the desk.”

- “Script”
  - 日The drama scenario of daily situations

Note：We can see the scripts as a kind of schema.

“Knowledge Representation” is the Focus of Artificial intelligence.

- We make computers with ‘knowledge’
  Expert systems
  （Computers with professional knowledge)

Edward Feigenbaum *“The Fifth Generation: Artificial Intelligence and Japan's Computer Challenge to the World”* transferred by Shigeru Kimura in Japan. TBS Britannica Co., Ltd.1983

- (And, it was stuck.）

What is “Knowledge”?

- Knowledge is something in the mind of each person.
- Thinking is the process of information processing which ‘programs’ process serially on base of “memory” (database).

These are called “Representationalism.”

Criticism of "Representation"

- Affordance theory
- Connectionism
- Situated theory

★Common view equals relationalism

That is,

Relationalism Evolution

J. J. Gibson

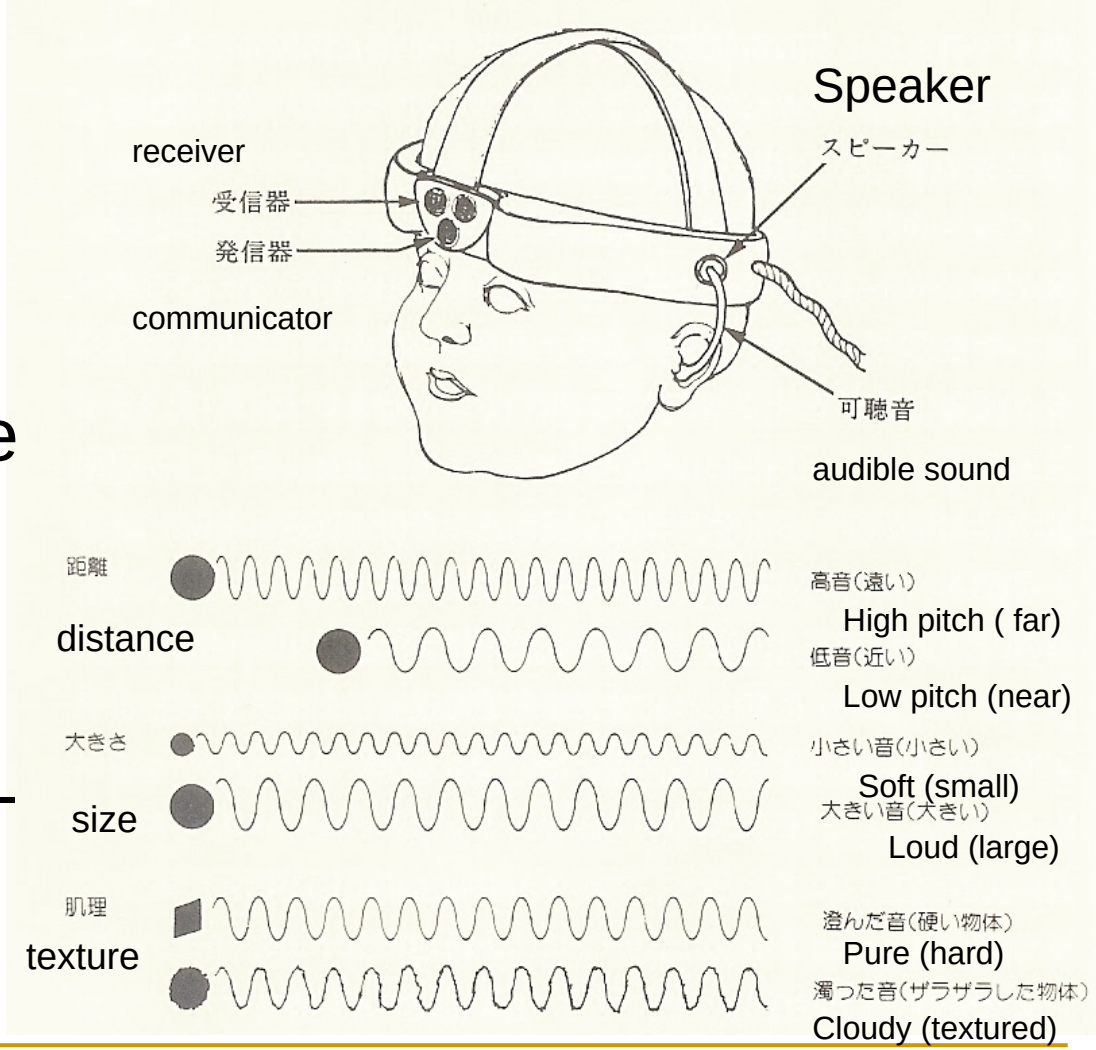
- J. J. Gibson (1904-79)

  The father of Ecological Psychology. He proposed “affordance” (coined terms) , which is the information inviting the active behaviors in the circumstances. It is perceived by coupling with the behavior and the whole sense,not by the mediation of “representation” .

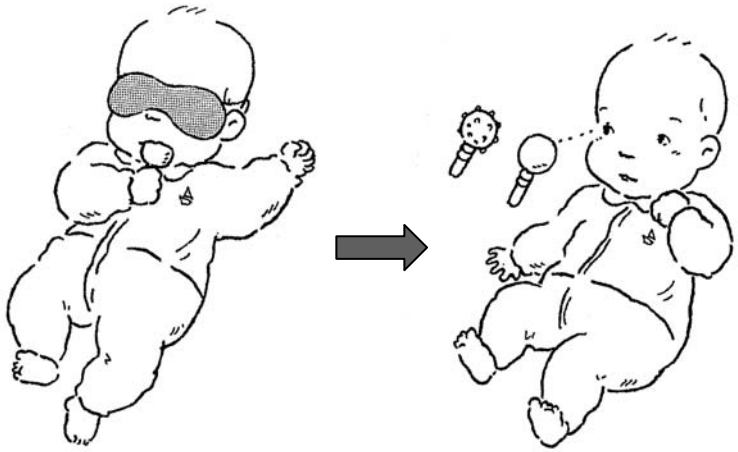
What is “Affordance”?（1）

“SONIC GUIDE”

Five Congenitally blind babies who had no experience reaching (about 1 year old) reached for toys in front of them after 10-odd-times trial.

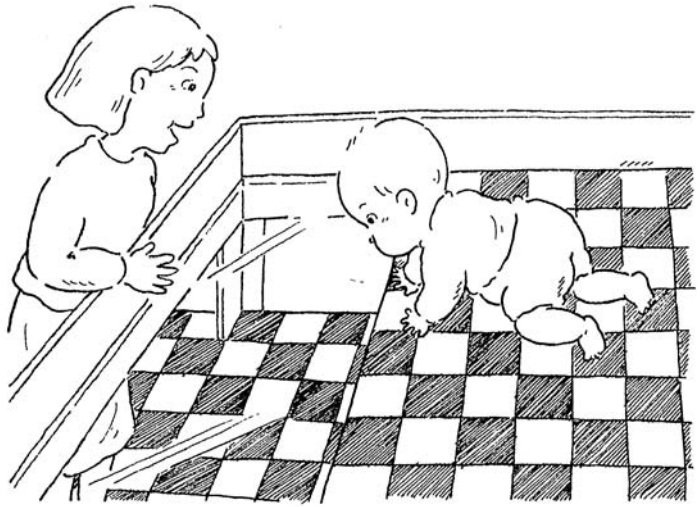


What is “ Affordance”?(2)



- Meltzoff, A. N., & Borton, R. W. 1979 “Intermodal Matching by Human Neonates.” *Nature*, 282, 403-404.（the picture in S. Simojoh, “The Birth of the Eye” Shinyosha, 1998)

Gibson, E. J., & Walk, R. D. 1960 The “Visual Cliff.” Scientific American, 202, 64-71.（the picture in S. Simojoh, “The Birth of the Eye” Shinyosha, 1998)



What Does Affordance Bring?

- The discovery of " circumstances"
  - Satisfaction with the information of affordance
- Coupling with behavior and perception
- De-Representationalism

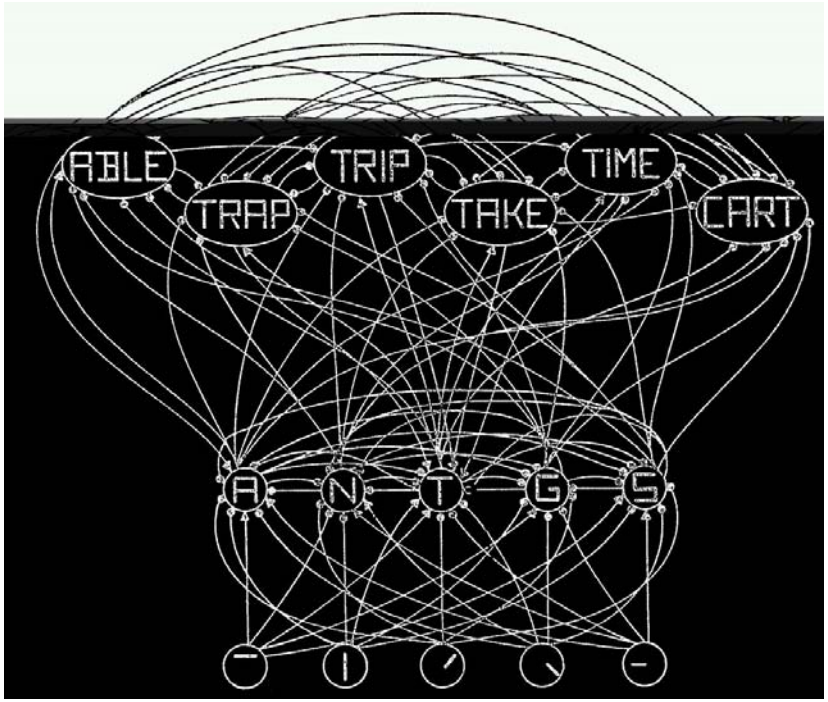
- The designing of "easy-use tools"
  - Study of human interface
- Distributed Intelligence
  - "Wisdom" is the interaction with something outside

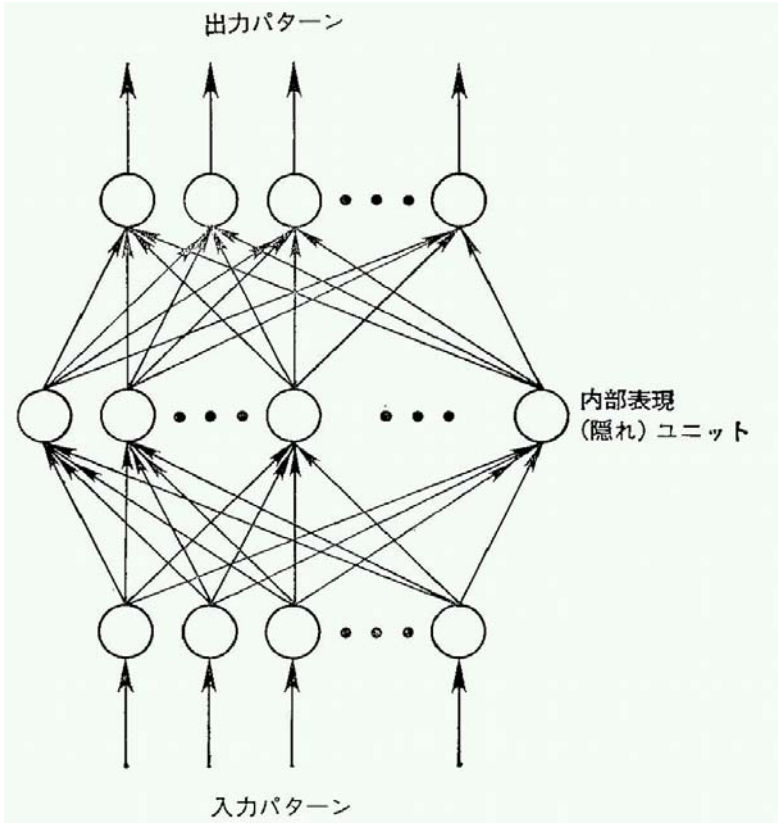
The Birth of Connectionism

How Did D. Rumelhart Reach PDP ?

- It began with the study “Schema of Motion.”
- The idea of Parallel Distributed Processing
- It is similar to Neural Networks.
- It is connected with mathematical/ engineered study about traditional “neural networks” (after perception)
- The birth of Connectionism

What is Connectionism?





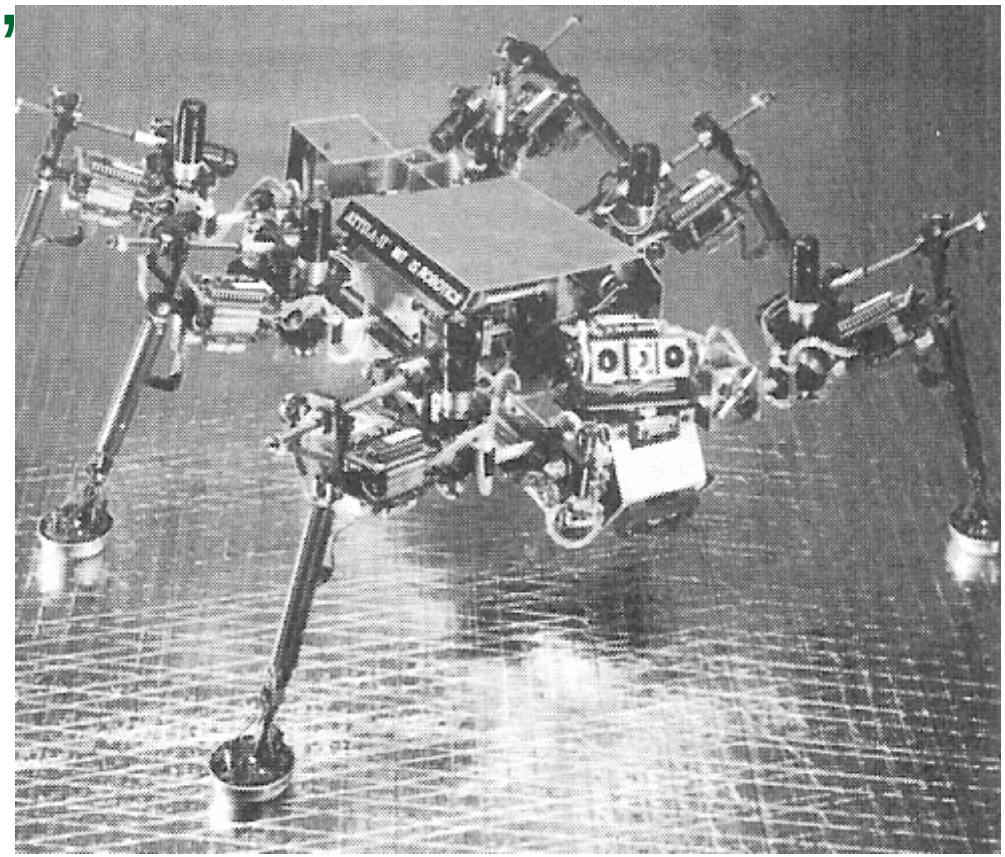
D. Rumelhart et al.(1986) “Parallel Distributed Processing” , translated into Japanese, Sangyo-tosyo, 1989

What Connectionism Bring?

- Dramatic development of robot engineering
  - Perception and judgment cannot be separated from the body and the motor nervous system.
  - Motion is from the interaction with the circumstances.
- Collapse of naïve psychology
  - Human beings don’t always make an inference from proposition/rule.
  - Connection with affordance (ecological psychology)

Connection With "Affordance" and "Connectionism"

- Brooks, insect robot (Creature)
  - Avoids obstruction
  - Wanders
  - Aims at objects



M. Sasaki " *Affordance – New theory of Cognition"*- Iwanami Science Library, Iwanami Shoten Publisher. 1994

17:20 あと30分

Vygotsky Renaissance

The Beginning of Situated Theory Evolution

- Michel Cole`s Lecture at Tokyo University 1984

  Thinking of human cognition from the point of view of culture
- Who is an implicit enemy ?
  - Piaget's theory of development: Human ability of recognition develops from immature (concrete and self-centered) cognition to mature (formal and common) cognition by steps following living creatures' growth .
  - Personal constructionism: Cognition of the world depends on the function of the mind in the cognition body.
    - No bodies interacting with something outside
    - Function in the mind equals information processing equals representationalism

The Study "Logical thinking" in Adults by Kupell

- Experimenter: A spider and a black deer always eat together. Now, the spider is eating. Is the black deer eating?
- Participant: Are they in the bush?
- Experimenter:Yes, they are.
- Participant: They eat together, right?
- Experimenter:Yes
- Participant: ‧‧‧‧‧‧‧

They Cannot Think Logically?

- Experimenter:……（He repeated the question.
- Participant: I don't know because I was not there.
- How can I answer the question?
- Experimenter: Can't you? Can you know the answer even though you were not there?
- Participant: Oh, yes. The black deer is eating!
- Experimenter: Please tell me the reason.
- Participant: Because the black deer is walking around in the bush all day and has a little rest and stands up to eat.

The study: Farmer's intelligence of Central Asia

- Participant: Shell, 60 years old, non-literate.
- The task: to categorize 4 words.

  "Hammer", "Saw", "Log", "Ax".
- Shell: I can bring this four together! We use saws to cut the logs and a hammer is necessary to nail things together and I need an ax to cut down things and a hammer is helpful in doing that. So, I can divide them. There is nothing to cut away.

  (snip)

Necessity of Acquiring "Idea" ? (Formal Thinking)

- Experimenter: Someone said that a log is not similar to the others.
- Shell: Why did he do that? If we put one of them aside because it is dissimilar to the others, that is what we have got another thing. It is because they are necessary for logs!

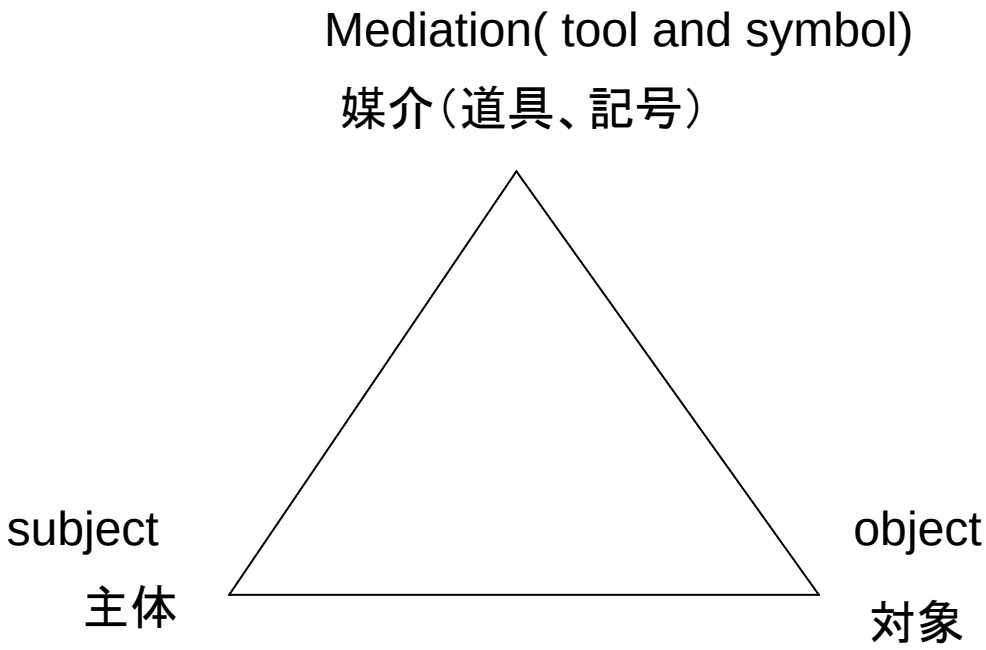
（A. R. Luria, *"Historical Development of Decognition"*, pp.87-88 translated by Shuichi Morioka in Japanese. Meijitosho Shuppan Corporation,1976,）

L. S. Vygotsky

- L. **S**. **Vygotsky**
  （1896-1934）
  - Born in Russia, graduated from Faculty of Law, Moscow University in 1917. At the some time, he studied history and philosophy at the Citizen's College, and tutored Marxism pedagogy and psychology privately by Bronsky.
  - The same age as Piaget. Piaget died in 1984, 84 years old. Vygotsky died at 37 years old.
  - Marxism, critical psychology.
  - Especially, criticized experientialism

The Mediation of Thinking

- Thinking is mediated by tools and symbol (including word) et. al.



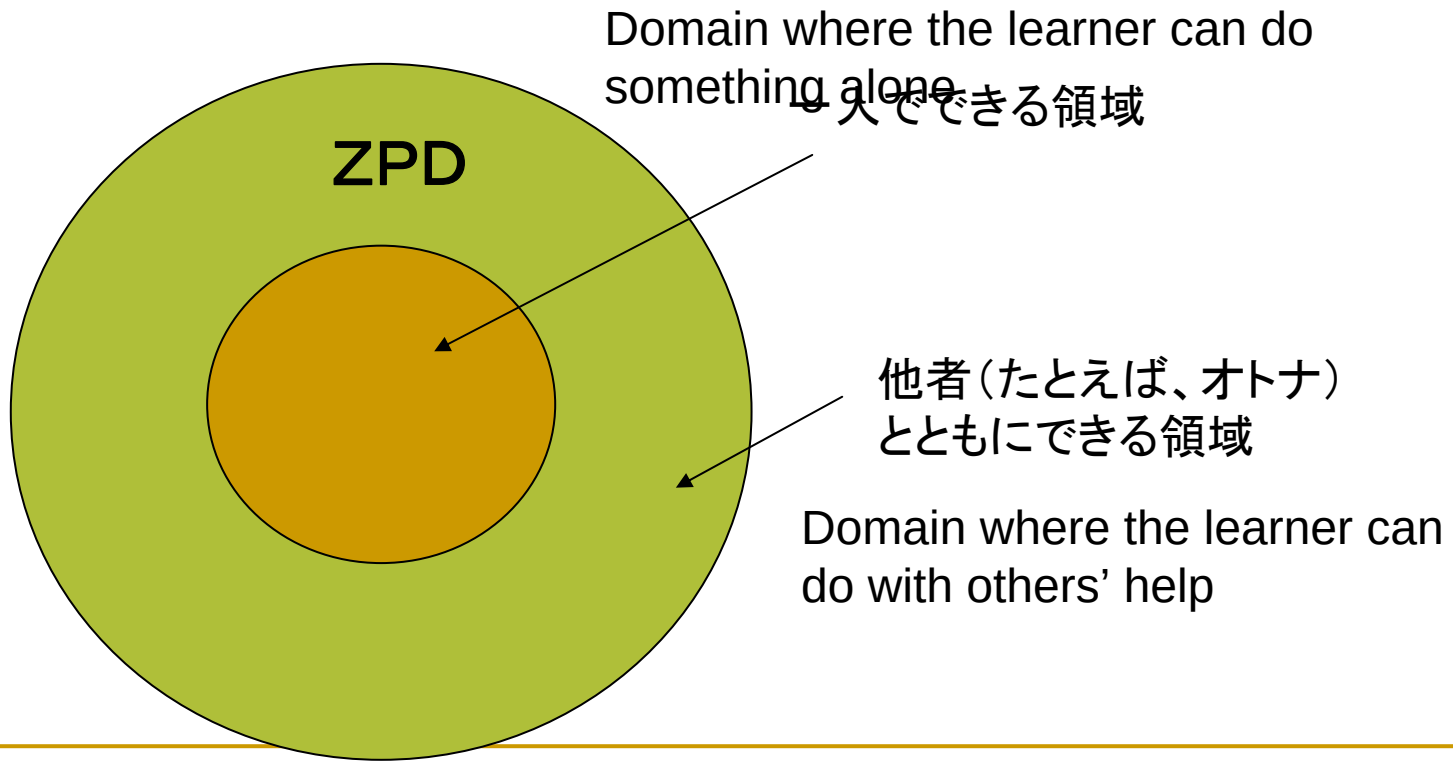
Development Occurs in Two Stages.

- “Any higher mental function appears twice in child development. At first, it appears as inter-mental function, and then, secondly, as personal activity, the way in thinking, inner-mental function. “

  （” Thought and Language” , p.170）

Zone of Proximal Development

- Zone of Proximal Development: ZPD



"Education Really Welcome"?

(Traditional Interpretation of ZPD)

- With others' help and cooperative relation with others, children learn to do what they cannot do alone.
  - It means as much as we can help we could make children do something unthinkable.
- Vygotsky is regarded to have said that the proper degree of approach encourages children to show better performance than they have at the time, and the encouragement helps children learn actively for themselves.
- Consequently, it is regarded that "Education plays a leading role in child development"(anti-Piaget)

Exact Interpretation of "Zone of Proximal Development"

- Human beings utilize various resource and have practical behavior. "mediation" (tools, symbols) .
- First, they come to utilize "internalized mediation" by internalizing externalized mediation .
  - This changed the inter-mental function into inner-mental function.
- That enables them to appropriate new "mediation".
  - Once again, inter-mental function work outs.
- As a result, what they can do among others or with other resource increases.

Relation Logical Change About Developmental Study. - The Meaning of Vygotskian Psychology -

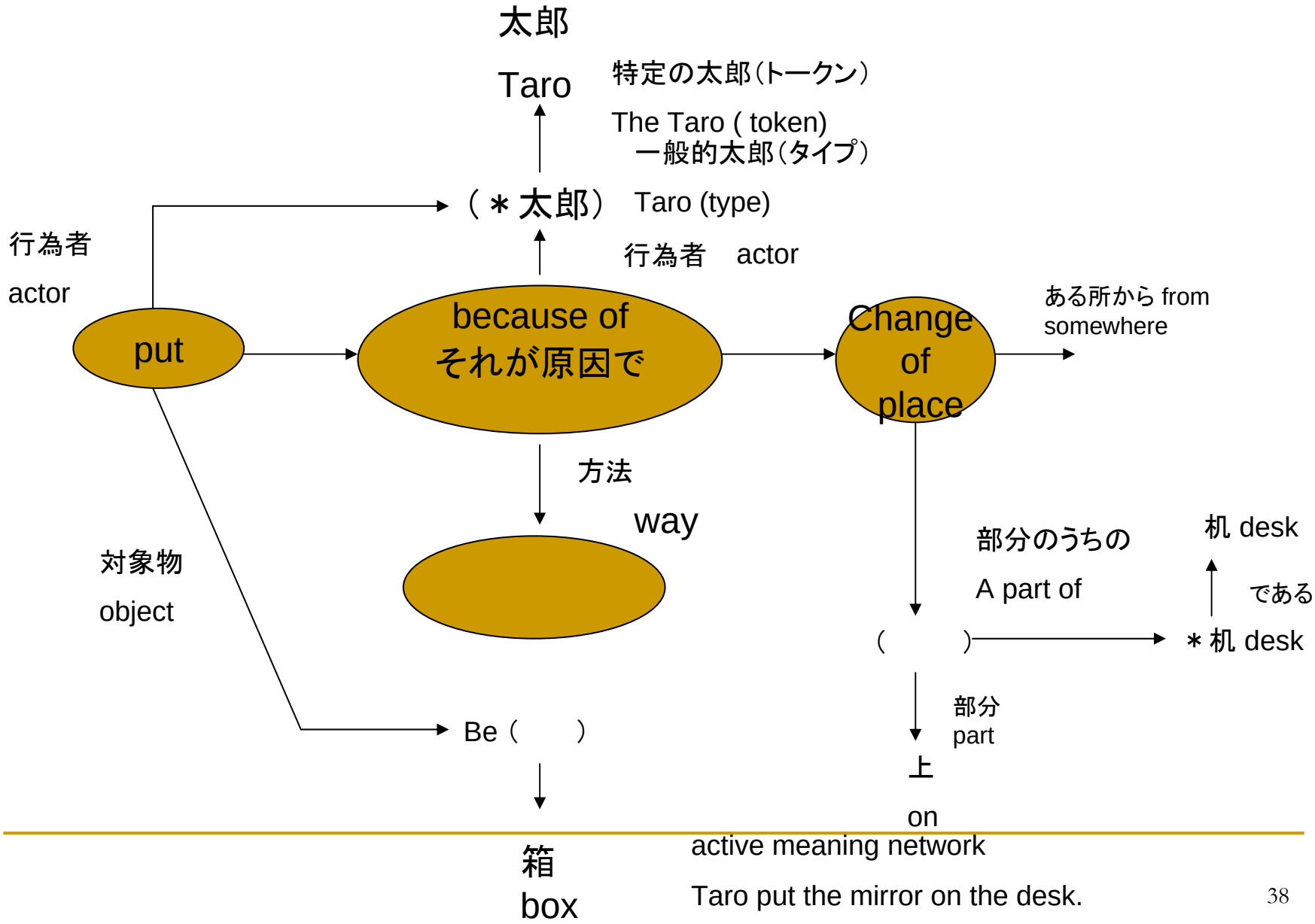
- Development raises in relation.
  - Relation logical interpretation of ZPD
- To study development, study relational logic.
  - Not giving back to “personal ability”
  - Not giving back “thinking” to the operation in information processing (de-representationalism)
- Human beings (including babies) are surrounded by human beings, things, tools and language, and live in the interactions with them.

Every Cognition is "Situated" !

- Dieter's mathematics
- Shopper's mathematics
  - J.Lave, *"Everyday Cognition: Its Development in Social Context"* Shinyosha Corp., 1995
- Tailor's Apprenticeship of Vai and Gora in west Africa.
- J.Lave＆E･Wenger ―
  - Legitimate Peripheral Participation: LPP
- Every cognition equals behavior is situated.

Appendix

Schema of Sentence

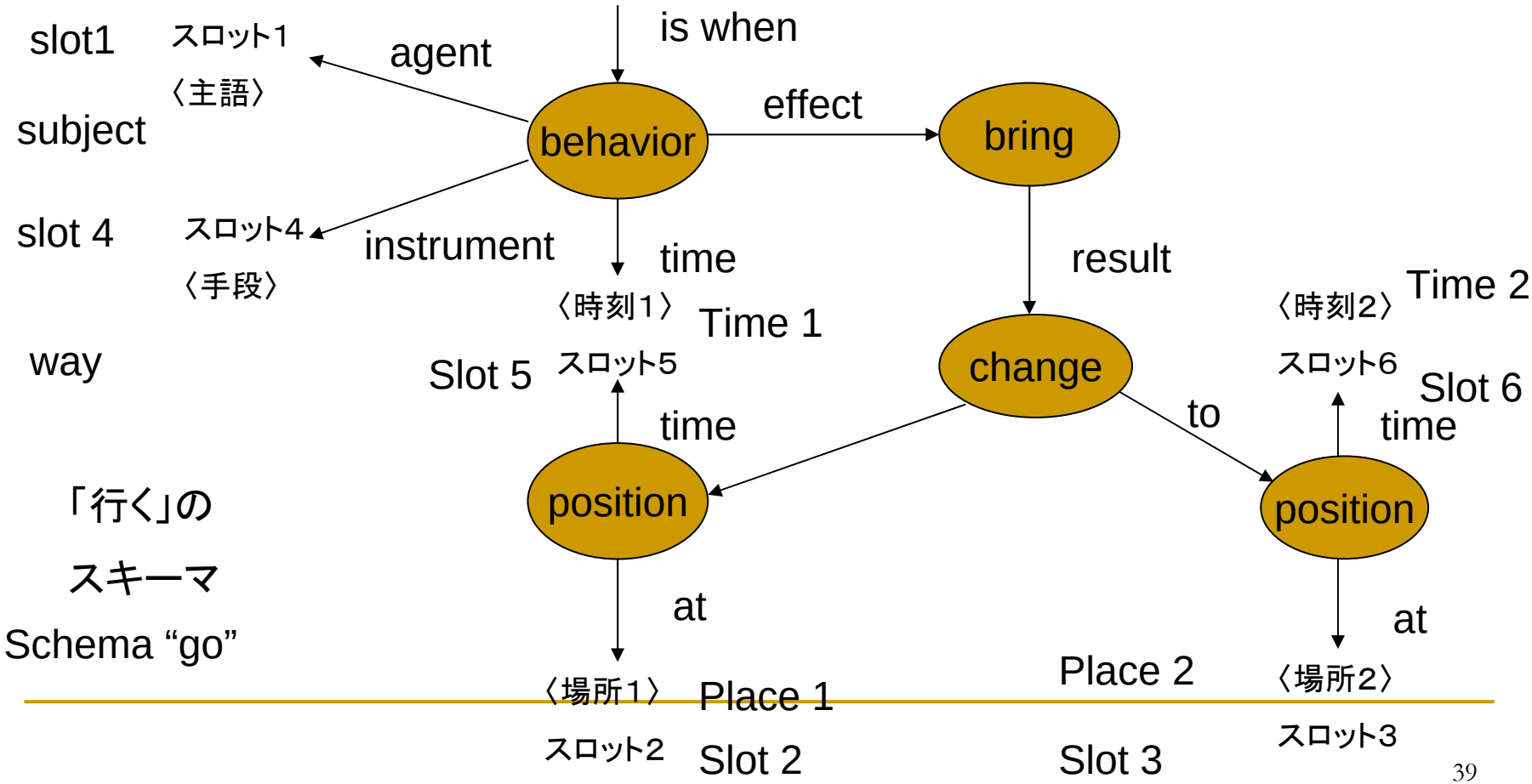


active meaning network

Taro put the mirror on the desk.

What is a “Scheme” ?

・Conceptual framework：the construction which includes somewhat and decided the connection with other ideas



Restaurant Script

- Made referring to Shank & Abelson (1977) and Bower, Black & Turner (1979)
- Script：restaurant
- Tools：table, menu、cooked dish, invoice money
- Cast：customer, waiter, cock, checker, owner
- The conditions：The customer is hungry.
  The customer has some money
- The results: The customer has less money.
  The owner has more money.
  The customer became non-fasting.

- Scene 1：Enter the restaurant
  - The customer enters the restaurant.
  - The customer look around the restaurant.
  - The customer decides where to sit.
  - The customer goes to the table.
  - The customer sits down.
- Scene 2 ：Order
  - The customer takes up the menu.
  - The customer looks at the menu.
  - The customer decides which dish to order.
  - The customer signals the waiter.
  - The waiter comes to the table.
  - The customer orders a dish.
  - The waiter goes to the cook.
  - The Cook cooks the dish.（cooking script）
- Scene 3: Meal
  - The cook hands the dish to the waiter.
  - The waiter serves the dish.
  - The customer eats the dish.
- scene 4: Leave the restaurant
  - The waiter fills in the bill.
  - The waiter goes to the customer.
  - The waiter hands the bill to the customer.
  - The customer goes to the cashier.
  - The customer pays the money to the cashier.
  - The customer leaves the restaurant.