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# FROM STATE- TO MEASUREMENT-ORIENTED THEORY: DEGENERACY OF A PROPER NOUN

## 1. INTRODUCTION

Traditional scientific theory prevailing over various fields including biology and physics is the state-oriented theory. The axiom of this system is complete identification of a state, which leads to neglecting the process following the completion of identification. In other words, one cannot talk about any measurement process in the state-oriented theory. Whenever one talks about measurement in this theory, one has to determine a specific procedure to complete identification process because any process is completely identified with a specific operator, rule or function in this theory. This attempt entails to a paradox in its own right, because there possibly exist many operators following a specific state and one cannot uniquely determine a specific operator. In mathematical context the cardinality of a set of operators is not equipotent to that of operands, which entails to a paradox such as Gödel and Tarski's theorem of incompleteness.

In spite of this circumstance one has to talk about measurement process when one talks about biological systems. In using some biological terms such as evolution, morphogenesis, origin of life and/or autonomy, one can refer to the concept of necessity on a consequence. One can comprehend the necessity on a consequence, only when one can understand how measurement following a consequence proceeds. It suggests the epistemological shift from state to measurement. In the state-oriented theory, assuming complete identification of a state can lead to incompleteness of measurement process. When one focuses on measurement, one can talk about degeneracy of a state by assuming measurement process. This perspective is called measurement-oriented theory. A paradoxical structure is used as the model with respect to which one can refer to measurement in measurement-oriented theory. The

subject in this theory is to talk about the degeneracy of structures which are regarded as a priori existence in the state-oriented theory. A degenerated structure is an individual agent in which divergent functions are comprehended, such as DNA. That is why we metaphorically call it a proper noun. Double property consisting of a specific state and various functions is comprehended in the concept of measurement. This can necessarily reduce a proper noun, which is individually operated on one hand, and with respect to which one can refer diverse conditions on the other hand.

## 2. STATE vs MEASUREMENT

When one examines the concept of biologically motivated computing in state-oriented theory, it inevitably follows a paradox (e.g., Pattee 1989; Gunji & Konno 1991; Gunji 1994, 1995). First, we can define the state-oriented theory as follows. (1) In state-oriented theory a symbol, $X$, is a priori given. Physically $X$ is regarded as a consequence resulting from measurement, while measurement process is not mentioned according to the definition. It is defined that $X$ is observed by an external observer. This $X$ is called the concept of state. (2) When one dilates this concept to process, one can determine a rule or a map $f$ with respect to which one can refer to the process. (3) Due to the procedure of dilation, one can obtain a pair $<X, f_x>$ for any $X$, such that $f_x$ follows a consequence denoted by $X$, independent of the internal structure of $X$. If $X$ is a rule, $f_x$ means a rule of rules. This pair $< X, f_x >$ implies that a rule $f_x$ is a model for the concept of state $X$. One cannot uniquely determine a rule following $X$, however one can use $f_x$ as one of rules following $X$. Finally one can always explain $X$ by using a model $f_x$, while one cannot designate $f_x$ by $X$. This definition is natural because it is assumed that one can explain nature by a concrete model in ordinary science.

Second, we define the naive realism as follows. In naive realism one postulates that (1) a symbol $X$ indicates a real entity (that is why $X$ is called an indicator), and that (2) one can uniquely determine a measurement process following a consequence $X$ or a measurement instrument by which one can obtain a representation $X$ (Gunji 1992). Naive realism is different from state-oriented theory in terms of pragmatism. In state-oriented theory one can just refer to something real by $X$, and one cannot talk about the relation of symbol $X$ and something real, on one hand. In naive realism the real entity is designated by determining a unique measurement process, on the other hand. Coupling the state-oriented theory and naive realism can lead to a paradox. In state-oriented theory, for $X$, one can obtain $f_x$ fc'lowing $X$, however once both $X$ and $f_x$ are determined, both rules following $X$ and $f_x$ are uniquely determined according to naive realism. If a rule following $X$ or $f_x$ is expressed as

$f_x'$ or $f_x$ respectively, it is destined to be $f_x = f_x'$ and $f_x' = f_x(f,x)$. It leads to $f_x = f_x(f_{fx})$. Because this equation holds for any measurement $f_{fx}$, it implies a paradox.

When one talks about biologically motivated computing, one can obtain a paradox in the state-oriented theory without naive realism. Because one can focus both on intra-cellular and inter-cellular processes in biological systems (Conrad 1984), he is faced with the same situation resulting from coupling state-oriented theory and naive realism. He obtains a state of a cell expressed as $X$ and an inter-cellular process following $X$ expressed as $f_x$. Simultaneously, he obtains an intra-cellular process resulting from $f_x$, which is expressed as $f_x'$. An external observer has to determine the relationship between $X$ and $f_x'$, because both of them result from $f_x$. In this situation $X$ is a model for $f_x'$ and vice versa. Then, one obtains $X = f_x'(X)$ which implies a model $X$ is the same as a model $f'$ whose model is $X$, and the result is as same as $f_x = f_x(f_{fx})$.

This type of paradox is mathematically as same as Cantor's diagonal argument and Gödel and Tarski's paradox in terms of the existence of self-referential property (Lawvere 1969; Soto & Varela 1984; Gunji 1993, 1995). One can give a model $f_x$ (operator) for $X$ (operand), and the cardinality of a set for operator is larger than that for operand, however one has to assume the cardinality of operand is larger than one of operator (this assumption is called self-referential property) if it is assumed that one can uniquely determine a model for $X$. In the state-oriented theory it is assumed that measurement process following a complete state concept is neglected, while an external observer identifies not only inter-cellular process with electric impulses transmitted in axon but also intra-cellular process with enzymatic tactile process. (Strictly speaking, axon is not the connection between cells because it is a part of a neuron, and tactile process in a synapse is inter-cellular process. However, compared to programmable computing which mimics biological neural network, we can call reaction in a synapse intra-cellular and signal transduction inter-cellular process). Therefore, an external observer blindly refers to a process following a complete state. When one attempts to consistently describe the relationship between inter- and intra-cellular process called vertical scheme (Conrad 1984, 1992), one is faced with a problem to uniquely determine a process following a state, which is nothing but a paradox (Gunji 1993, 1995).

A paradox resulting from the problem to determine a unique rule for process following a state can be found in biologically motivated computing, while it results not from original feature of biological systems and it is ubiquitous problem. Not only states but also structures are comprehended in the category of state concept, while one forgets the status of given structure and examines the origin of structure. It can give rise to a paradox. Independent of naive realism, one can consider the measurement process and/or origin of structures,

however once one handles this question one can be faced with the problem resulting from naive realism: how can one uniquely determine measurement rule for measurement process. Therefore, this type of paradox results from measurement process.

A paradox resulting from measurement process cannot be proved in the state-oriented theory in its own right. One of ways is to shift the subject of theory from state to measurement. In state-oriented theory assuming a priori state can lead to a paradox of measurement. In contrary we propose the measurement-oriented theory in which assuming measurement process can lead to degeneracy of concept of a state and/or structure. Therefore, we have to construct a model by which one can refer to measurement process. In this context, a paradox in the state-oriented theory can help us to construct such models.

First we examine universal structure of a paradox. It is also significant to see the parallelism between the relationship of state- and measurement-oriented theory, and the relationship of the theory of description (e.g., Frege-Russell; Russell 1937) and a language game proposed by Wittgenstein (1953) or philosophy of performatives (Austin 1875). According to Kripke (1982), one assumes the meaning of a symbol, and e.g., a rule by which one can know how to use "+", as a rule by which one can use the symbol in the theory of description. Kripke shows that the meaning of "+" can be proved both *plus* and *quus* which are defined as follows: For any numbers $x$ and $y$ used in one's own experience the meaning of $x+y$ is defined so as to being consistent with one's experiences both by *plus* and *quus*. For unknown number "51", which is illustrated by 51, 51+1 = 52 by *plus* while 51+1=1 by *quus*. It shows that indeterminacy and/or a paradox results from intrinsic mixture between the use of a symbol and the meaning of a symbol. Once one assumes that the use of a symbol can be uniquely replaced with the meaning of it, one can determine a rule satisfying an experienced condition which is finite and individual. However, by a rule one is destined to refer to infinite and general condition involving inexperienced conditions. Finally, assuming the existence of meaning can lead to the aspect in which one can deduce finite and individual condition toward infinite and general condition. That is why indeterminacy between rules, *plus* and *quus*, can happen.

Proposal of a language game (Wittgenstein 1953) is called skeptic proof by Kripke, because Wittgenstein proves a paradox not in the domain in which a paradox holds but out of the domain. Wittgenstein deconstructs the basic domain of a paradox, by rejecting the assumption of existence of meaning. The use of a language is not founded by the existence of meaning, and it is just used performatively according to Wittgenstein. The concept of the mean-

ing of a word is one of semantics which is constructed for a language game a posteriori. In other words any statement is performative, and we can performatively say that the statement is either true or not (e.g., Austin 1975).

In replacing an experienced condition and a rule reduced from it with state and a measurement instrument following the state, respectively, we can find the parallelism mentioned above. Also, the structure of a paradox is simply summarized by the mixture of individual and general conditions (Gunji et al. 1995). We can replace the theory of description and the idea of a language game with state-oriented theory and measurement-oriented theory, because we can find that state-oriented theory can give rise to a paradox as same as one resulting from naive realism. The perspective in which a proceeding process is regarded as a language game suggests that a proceeding process is measurement process. One can construct a model by which one can refer to measurement process even by adopting the idea of a language game, because one can just reject the model as representation by this idea (also see Paton 1992). This type of model is expressed as the structure consisting of the mixture between individual and general conditions. A paradox in the state-oriented theory has the status of which it should be proved in the domain (state-oriented theory) that a paradox is well-defined on one hand. The same paradox is regarded as measurement process out of this domain. We can regard a paradox as the process in which an internal observer attempts to coincide individual with general condition while it is destined to be fail and this process perpetually proceeds. In this way we can enhance the idea of disequilibration in terms of conservative law (Matsuno 1989), in general form.

## 3. CONCEPT OF EMERGENCE IN THE PERSPECTIVE OF INTERNAL OBSERVER

In the last paragraph of section 2, we introduce the internal observer. The idea of an internal observer is used not in the state- but in the measurement-oriented theory. It refers to distinction between a priori and a posteriori, while an external observer cannot refer to this distinction (Matsuno 1989; Gunji et al. 1996). In state-oriented theory an observer is defined as a *contemplator* which does not affect objects in his own right. That is why he is called an external observer. In measurement-oriented theory an observer is defined as a *participant* affecting a system (object) through his any action. He is called an internal observer, not just because he sits inside of an object but because he can affect an object.

If one admits an internal observer in the state-oriented theory, he also admits that the meaning of a word is perpetually changed, while the mode of change is not definitely determined. In other words, it implies that he gives up

the perspective of state-oriented theory. If one designates the mode of change by a specific form, then it deduces that one can assume an external observer who designate an internal observer. In other words, an internal observer can fabricate "time" by the distinction between before and after his action. The reason why this type of distinction can fabricate time is that this process perpetually proceeds. Something such as meaning is degenerated through an observer's action, because action is nothing but internal choice. This degeneracy is unfolded, which can trigger to descending degeneracy. If the mode of degeneracy is uniquely determined, degeneracy can no longer be unfolded. It implies that time is lost. An internal observer defined with a specific mode of change is an externalistic internal observer. An externalistic internal observer is illustrated as Bazian statistics (Gunji et al. 1986) in which both a-priori and a-posteriori probability are defined, and we cannot adopt this type of model as internal observer's by the reason mentioned above.

However, we do not claim that an observer is just participant and that it is inconsistent with the idea of model and/or theory. If we claim so, all what we claim is that all models and/or theories are based on the theory of description, and that one cannot use any model by which one can refer to participant. Such misunderstanding is frequently appeared in the criticism to Wittgenstein, while Wittgenstein rejects not the use of a language and/or a model but the misunderstanding of which the use of a language is based on the theory of description. Indeed, we use the state-oriented theory in the perspective of the measurement-oriented theory. In other words, this is methodology of the measurement-oriented theory. In following Wittgenstein's idea of a language game, we can see the theory of description itself as a specific language game. It can yield solution for the problem appearing in the theory of description, and for the problem on origin appearing in the state-oriented theory.

We illustrate the change of meaning appearing in a dialogue between *you* and *I* if one describes it dependent on the theory of description. Assume that both *you* and I are theorists of description. At first, *I* uses (*I* is not the same as I, and is the third person singular; also *you*) the term or symbol, [*information*], where a [*information*] means something transmitted.

In this sense; information can be carried like a book. We here express the meaning of [information] as

$$M([information]) = \{\text{something transmitted}\}. \quad (1)$$

Because information is believed as some-thing, it has the status of quantitative content, and I can say the statement such as "I am running short of information". It is believed that the term [*information*] carries M([*information*]). Secondly,

*you* says "Dialogue is information". (2)

*You* does not say "Information is transmitted in a dialogue". According to the meaning (1), [*information*] means some-thing, while *you* uses [*infomation*] as if it implies events. Via *my* experience of hearing (2), *I* discovers the concept of pragmatic mode of a term, which is how to use a term. *My* [*information*] is clearly different from *your* [*information*] in terms of pragmatic mode. Then, *I* defines the pragmatism of a term [*X*] as P([*X*]). When I believes the meaning of (1), as for me P([*information*]) = {to be used as *thing*}. After hearing the statement (2),

P([*information*]) = {to be used as *thing, as event}* (3)

Note that P([*information*]) = {to be used as thing} is found after my hearing the statement (2). In this sense, the concept of P([*X*]) emergently appears through the form of (3). Also, 1 can modify M([*information*]) via (3), by

M([*information*]) = {*something transmitted, event*} (4)

or especially can call event, *I and thou relation.*

If one admits the emergence of P([*X*]), he can find the emergent property of hierarchical upper level. The content carried by [*X*] is connoted by M([*X*]) on one hand, and the action toward [*X*] is connoted by P([*X*]) on the other hand. In the latter case, the concept of observer and observation is comprehended, while by the former case only the concept of object is comprehended. The emergent modification from (1) to (4) is another expression for the emergence of P([*X*]). Whether hierarchical structure is referred or not, the concept of emergence is found in this process.

However, there is no change according to the idea of a language game, because the concept of meaning is rejected in the perspective of a language game. A term [*information*] is just performatively used. Of course by the term "performatively", we do not connote teleology. As far as a dialogue succesfully proceeds, a term [*information*] is performatively used. Otherwise, a term [*information*] is not performative. Also, if a language process succesfully proceeds, *I* could find the emergence. The question arises whether we who observe this dialogue process involving the change from (1) to (4) adopt the perspective of the theory of description or a language game. We have assumed that *I* adopts the theory of description. We also?

Clearly, we adopt the perspective of a language game and look the process performed by theorists of description. If one rerefs to pragmatism of the term [*meaning*], one cannot uniquely determine it. However, one can use the term [*meaning*] as if the pragmatic mode was uniquely determined. According to Wittgenstein via Kripke (1982), there is the condition to make the statement such as "meaning exists" posible in the community which consists of theorists of description. In other words, even the language or performance called the theory of description is just a language game. It is not easy to propose the

evidence by which one can understand that the theory of description is a specific language game. The illustrated dialogue clearly shows the evidence. The concept of emergence is inconsistent with the theory of description in its own right, because the meaning is a priori and invariant in the perspective of the theory of description. Discovery of the concept of emergence shows that actions of language performed by theorists of description is not founded by the theory of description and is just a specific language game. This perspective can be obtained only by one who adopts the perspective of a language game. In other words,

Model (LG) = theory of description as a language game, (5)

where Model (LG) represents the model for a language game. As well as Model (LG), we can construct the model in measurement-oriented theory expressed as Model (MOT) by

Model (MOT) = SOT in MOT (6)

where SOT is the abbreviation of state-oriented theory.

If we do not adopt the model in the measurement-oriented theory in the form of (6), all what we can talk about process is that process is process in its own right, or a participant is a participant in his own right. The concept of a *participant* affecting a system (object) through his any action is also lost. Both designating system and changing it results in the form of (6). Both degeneracy and unfolding degeneracy can be formalized in the form (6).

We demonstrate the emergent structure in morphogenesis in the form of (6) as well as (5) which is sketched as (1) - (4). One staying in the state-oriented theory can describe one phase of morphogenesis as pattern formation. For instance, pattern formation of cell-aggregation is expressed as the pattern resulting from diffusion-reaction system (Turing 1952). In this system, some morphogens (biochemical substrata) are assumed, and they are autocatalytically generated in a cell and are transmitted among cells by diffusion. Through this process, a pattern which consists of cells with high density and ones with low density of some morphogen is generated. Compared to the discussion on model(LG), in this system,

M([*cell*]) = {density of morphogen}, (7)

where by [*cell*] we connote not just a word "*cell*" but any formal and mathematical expression and/or symbol by which one can refer to cells. Via the idea of pattern, morphogenesis is explained such that cells with high density are modified into head and ones with low density are modified into body. We can find the problem of the interpretation of the density of some morphogen (also see Wolpert, 1969, 1982). It is expressed as

M([*density of morphogen*]) = {body, head} (8)

and then putting (7) on (8) leads to

$$M([M([cell])]) = \{body, head\}. \quad (9)$$

It implies emergent hierarchical level. Simultaneously, the form (9) implies the condition on how cells can be used and/or boundary condition triggering the descending phase of cell deformation. Therefore, we can find another expression of (9) as the pragmatism of cells. It is expressed as P([*cell*]), and

$$P([cell]) \cong M([M([cell])]) \quad (10)$$

where the form A ≅ B implies that B is another expression for A and vice versa. In biology, the agent embodying P([*cell*]) is called inductor. An inductor induces the descending process. If there is no inductor, the descending process is not triggered. We express the concept of induction as P([*cell*]) and inductor that is the agent comprehending induction as [P([*cell*])].

Now the next question arises whether the agent of P([*cell*]) or M([M([*cell*])]) is prepared a priori or not. It is in the perspective of the state-oriented theory that it is transcendentally given. This perspective is based on the distinction of, our process of considering from (7) to (9), from real biological process. However, as far as one adopts measurement-oriented theory, one cannot distinguish measured object from measuring object. Then the agent taking M([M([*cell*])]) appears not only in observer's performance of measurement but also in biological process. In spite of it, one can say this type of agent is transcendentally given. He can say that the shift from the first phase called pattern formation to the second phase called interpretation is programmed.

Generally, biologists say that a phase shift of $X_1 \rightarrow X_2 \rightarrow .. X_i \rightarrow ..$ is programmed where a map from $X_i$ *to* $X_{i+1}$ is expressed as $f_i$. This type of program does not imply whole sequence of $X_1 \rightarrow X_2 \rightarrow .. X_i \rightarrow ..$, and only if the pair of $< X_1, f_1 >$ is programmed then this sequence is recursively generated. This idea is also descriptive fallacy. In order to identify the designation of a pair, $< X_i, f_1 >$, with this whole sequence, one has to show the foundation of the designation of $f_1$ for $X$. Designating a map $f_1$ is designating a duration in which $f_i$ is performatively used. It implies that one can ignore any process in this duration. For example, one can describe process proceeding in this duration as, $X_1 = X_{11} \rightarrow X_{12} \rightarrow .. \rightarrow X_{1n-1} \rightarrow X_{n1} = X_2$. That is why one can express $f_1(X) = X_2$. However, if one argues that $f_1$ is necessarily true in fact, then one has to show the foundation by which one can neglect the process expressed as $X_{12} \rightarrow .. X_{1n-1}$. Then he has to show the unique relation between $X_{12}$ and $f_{12}$. Finally this procedure falls into infinite regression. Therefore, biologists cannot say that the relation of $< X_1, f_1 >$ is uniquely determined, and that a phase shift of $X_1 \rightarrow X_2 \rightarrow .. \rightarrow X_i \rightarrow ..$ is programmed.

Phase shift is a posteriori, as or an observer and biological process. It implies that the degeneracy of an agent of P([*cell*]) or M([M([*cell*])]) results from

internal measurement. Also, if one admits the perspective of state-oriented theory, one is faced with the problem of

$$M([cell]) \cong M([M([cell])]) \quad (11)$$

because the meaning of a cell is both (7) and (8). The first phase called pattern formation and the second phase called interpretation are not transcendentally distinguished from each other. Hence, cell in the first phase cannot be distinguished from cell in the second phase, a priori. In other words, we cannot express M([*cell*2]) and M([M([*cell*1])]) where by cell1 and *cell*2 one can refer to cell in the first and one in the second phase respectively. That is why we obtain the expression (11). Through the expression (11), one can constitute the phase transition resulting from internal measurement process of morphogenesis. Readers can note that the form (11) and/or

$$[cell] \cong M([cell]) \quad (12)$$

is another expression of the mixture of operand and operator, or of the concept of state and measurement process following a state.

As well as that Russell solves this type of paradox by inventing type theory, and/or that a paradox as a fixed point is logically proved by inventing a new logic in which a fixed point as a new symbol is defined, one can logically prove the paradox resulting from the mixture of operand and operator (Lawvere 1969; Soto & Varela 1984). However, the puzzle to which we refer by the form (11) is much more universal and serious (Gunji 1894; Gunji et al. 1995; Gunji & Toyoda 1996). Because the puzzle results from the mixture of individual and general conditions, symbolizing the concept of generality is not proof for the paradox. Even if one can constitute the concept of [*cell*] satisfying the form (11) not to give rise to a paradox, the problem remains such that why [*cell*] is individually operated as (7) in the first phase and as (9) in the descending phase. It implies that the concept of time or distinction of a priority and a posteriority has to be transcendentally prepared. Then, what is time? Who distinguishes the first phase from the descending phase?

The idea that logically constructing the structure satisfying (11) and/or (12) without appearance of a paradox is just an error. One can connote inductor appearing in the descending phase by the form (11), while one cannot connote both inductor and morphogen by the form of (11). The meaning of inductor has the status of M([M([*cell*])]) and at the same time it is M([*cell*]). In other words, with respect to the expression P([*cell*]) we connote the structure of M([*cell*]) ≅ M([M([*cell*])]) and we obtain

$$[P([cell])] \cong [M([cell]) \cong M([M([cell])])] \quad (13)$$

We here question degeneracy of inductor or the structure of M([*cell*]) ≅ M([M([*cell*])]). The sketch of a specific language game called theory of de-

scription from (7) to (10) can yield one example to express the process following degeneracy of M([*cell*]) ≅ M([M([*cell*])]).

This process is sketched as if it was described by an observer who stays in the state-oriented theory, however, once he finds emergent property in the form of P([*cell*]), his stance is inconsistent with the state-oriented theory. We can sketch that the concept of P([*cell*]) emergently appears in the process of description by one who stays in the state-oriented theory. It is possible because we can sketch based on the measurement-oriented theory, and can sketch actions of a state-oriented theorist as measurement process. This is that Model(MOT) = SOT in MOT. If one focuses on the emergent property in morphogenesis and/or self-organizing process following the perpetual distinction of a-priori and a-posteriori, one cannot separate actions of a state-oriented theorist as measurement process from measurement process of morphogenesis.

We propose more formal expression of Model(MOT) = SOT in MOT. The degeneracy of M([*cell*]) ≅ M([M([*cell*])]) and/or [*cell*] ≅ M([*cell*]) are comprehended more formally. In order to prepare this method, we estimate the status of the expression M([*cell*]) ≅ M([M([*cell*])]) and/or [*cell*] ≅ M([*cell*]) in the next section. They are metaphorically called proper nouns.

## 4. PROPER NOUN AS AN INDIVIDUAL AGENT CARRYING DIVERSITY

Whether M([*cell*]) ≅ M([M([*cell*])]) or [*cell*] ≅ M([*cell*]) is taken, it shows nested structure. In other words, it implicates that [*cell*] is both an individual singular thing and the relationship between one thing and the other. Clearly the latter implies function, or how to use this individual thing or pragmatic mode of this thing. With respect to this structure one can connote an individual agent comprehending pragmatic mode. According to weak theory of description, [M([*cell*]) ≅ M([M([*cell*])])] is an agent carrying both its meaning and context in which a specific meaning appears. It is important that function, pragmatic mode or context is an open problem, which implies that one cannot definitely identify the meaning of [*function*], [*pragmatic mode*] or [*context*]. In other words, the individual agent carries infinite general conditions.

That is why we call an agent, by which one can connote [*cell*] ≅ M([*cell*]), a proper noun. A proper noun is not an abbreviation of description. If one attempts to determine a list of meaning or a proper noun, it falls into infinite regression. Then the concept of abbreviation cannot hold in terms of a proper noun. Is a proper noun an indicator? Kripke (1980) argues that a proper noun indicates a proper noun itself and is a rigid designator. The term, rigid designator, implies that a proper noun designates nothing and is performatively used in its own right. If one says that a proper noun [*moon*] designates a sat-

ellite revolving round the earth, it implies that one can uniquely determine the correspondence between [*moon*] and this satellite. Determining the correspondence uniquely implies yielding the foundation of the correspondence. Therefore, it is realized via theory of description in which one can choose the most important characters represented by [*moon*]. As mentioned above one cannot uniquely determine the most important character for any designator. Because one cannot choose this character, a proper noun indicates nothing.

Readers may be confused, because we use a symbol, [*cell*], as if it indicated real cells. We argue that [M([*cell*]) ≅ M([M([*cell*])]) is a form of inductor or is a proper noun as if it indicated a real inductor and a proper noun. However, we use a symbol [*cell*] with respect to which one can refer to a cell. There is no foundation of the correspondence between [*cell*] and a cell. A symbol [*cell*] is an instrument and/or tool through which one can comprehend a cell. As a result of a language game, one can find the correspondence. It also shows that positivism is not founded by naive realism and/or theory of description (indication). A positivistic science is just a language game, or a positivism as a specific language game makes to say that one can estimate a theory from positivism possible.

A proper noun is not only an individual agent but also a carrier of infinite general function. Also, this individuality and generality by which one can connote infinity are inevitably connected with each other. Especially on this second point, we call the form [*cell*] = M([*cell*]) a proper noun. For example, imagine the doll for a little girl. This doll is singular for her. Even if this doll becomes dirty and is broken, she never gives up this doll. This singularity depends on the relationship between the doll and her or doll's function. One can say that doll's function is communication between the doll and her. Communication is open ended. It comprehends not only all communication between them in the past but also one in future. As far as it holds, a little girl never gives up the doll. Only in this situation we express the doll as

$$[[doll] \cong M([doll])]. \tag{14}$$

Note that [*doll*] ≅ M([*doll*]) is the expression for [*doll*] used by this little girl. It is not the expression for a general [*doll*].

Compared with [*doll*], imagine the relationship between a pen and a man. If a pen is broken, then he uses another one as soon as possible. A pen is replaceable because the relationship between a pen and a man is at most finite and almost unique, namely a pen is a tool to write down. Even for a pen, the function is not uniquely determined a priori. However, it is possible to say that a pen has finite number of functions. Therefore, we can refer to finite number of meaning by M([*pen*]). It is possible to assume that it is unique, and is to write down. Because M([*pen*]) is assumed to be finite and countable, we can-

not express [*pen*] ≅ M([*pen*]). The form of [*pen*] ≅ M([*pen*]) is clearly just category mistake. When one assumes M([*pen*]) ≅ {tool to write}, one can give another tool satisfying {tool to write} by [*pencil*]. Readers note that *plus/quus* problem (Kripke 1982) mentioned above results from the assumption of unique correspondence between [+] and M([+]) = {*plus, quus*}.

Is there a paradox in terms of the form [*doll*] ≅ M([*doll*])? Even at this case we can say that it is just category mistake. However, a paradox has not only the status to be solved whether it can be solved or not but also the status of a tool by which one can refer to ontology in spite of this ambiguity. At the latter case, one can refer to ontology that it is destined to be expressed as a paradoxical structure. In naive realism, theory of description and state-oriented theory, a paradox has unique status to be solved, while in measurement-oriented theory it is a tool by which one can refer to ontology. Whenever we refer to ontology with respect to a proper noun, we adopt the form [*doll*] ≅ M([*doll*]). As a result, one can refer to infinity in terms of M([*doll*]). The reason why we can express [*doll*] ≅ M([*doll*]) is not to refer to infinity of M([*doll*]). In contrary, it is not that we can find simple category mistake in [*pen*] ≅ M([*pen*]) because M([*pen*]) is finite. we here give an argument on [*pen*] as one of example that we do not have to pay attention to ontology, while this type of necessity is not founded by any theory.

We here use a proper noun in the form of [*doll*] ≅ M([*doll*]) both as a metaphoric model for measurement process and as an agent which is called a proper noun such as inductor. In state-oriented theory [*doll*] is distinguished from M([*doll*]), and M([*doll*]) is definitely determined. For example, M([*interaction*]) in which one can refer to specific biological interaction by [*interaction*] is uniquely determined as a specific map in state-oriented theory on one hand. M([*interaction*]) is not completely identified in measurement-oriented theory on the other hand, and it implies that ontology of interaction is expressed both M([*interaction*]) and M([M([*interaction*])]). That is why we adopt the expression of M([*interaction*]) ≅ M([M([*interaction*])]) by which one can comprehend ontology of interaction. In other words, this ambiguous expression is the model for interaction as measurement process or the model in measurement-oriented theory. This perspective can give the degeneracy of a proper noun as an agent by which one can connote M([*interaction*]) ≅ M([M([*interaction*])]). Hence, degenerated agent is expressed as [M([*interaction*]) ≅ M([M([*interaction*])])]. Of course it does not imply degenerated agent is uniquely determined. An agent also comprehends possibility of unfolding degeneracy.

In the argument within the forms (1)-(4) or the forms (7)-(10), we can use the term [*X*] and/or M([*X*]) as definite symbol because this notation is dependent

on theory of description. Through actions of theorists of description who use [*X*] and/or M([*X*]), we can demonstrate that it is a specific language game. The evidence of a specific language game is argued by examining how they use [*X*] and/or M([*X*]), which is outside of [*X*] and/or M([*X*]). Our more formal way is to connote usage of [*X*] and/or M([*X*]) by theorists of description in the ambiguous form both of [*X*] and M([*X*]), while it is not imply a specific definite structure.

## 5. DEGENERACY OF HIGHER LEVELS (PROPER NOUNS) IN MEASUREMENT-ORIENTED THEORY

We here express ontology of metabolic process by *m-process*. Also, we express metaphoric expression with respect to which one can refer to *m-process* as [*m-process*]. Therefore, [*m-process*] can be arbitrarily chosen from mathematical structures, diagrams, symbols and terms. Compared to models of state-oriented theory, we here connote the concept of indefinite collection of some structures by [*m-process*]. In state-oriented theory, [*m-process*] is identified with a finite set of states indicating metabolic process, and then M([*m-process*]) is identified with a specific rule or a map. We express the latter as >*m-process*<. For example, metabolic process is identified with a specific map, *f*, from a set *D* to *D*. At this case >*m-process*< implies a map *f* or a specific rule, [*m-process*] implies indefinite collection and/or an infinite set, and M([*m-process*]) implies a collection of maps from a set *D* to *D*.

In order to regard metabolic process as measurement process, we constitute a paradoxical structure consisting of [*m-process*] and M([*m-process*]) from the perspective of measurement-oriented theory. This aspect is denoted by <*m-process*> and paradoxical structure is denoted by

$$[m\text{-process}] \leftrightarrow \mathrm{M}([m\text{-process}]). \qquad (15)$$

Note that instead of the expression <*m-process*> or [*m-process*] $\leftrightarrow$ M([*m-process*]), the expression >*m-process*< as a specific rule is adopted in state-oriented theory. Expression (15) implies the perpetual dynamical transformation between [*m-process*] and M([*m-process*]). Therefore, it also implies that a metabolic process cannot be uniquely determined as a specific map and that if one forces to determine it then one is faced with one-to-many type mapping, while metabolic state is determined as time proceeds. If one describes the aspect of (15) in terms of static concept, then the expression is destined to be [*m-process*] $\cong$ M([*m-process*]) which implies a paradox.

We sketch our perspective for this metabolic process as shown in Fig. 1. First, metabolic process is expressed as <*m-process*> and we construct the interaction between [*m-process*) and M([*m-process*]) expressed as [*m-process*] $\leftrightarrow$ M([*m-process*]). This interaction is expressed as perpetual

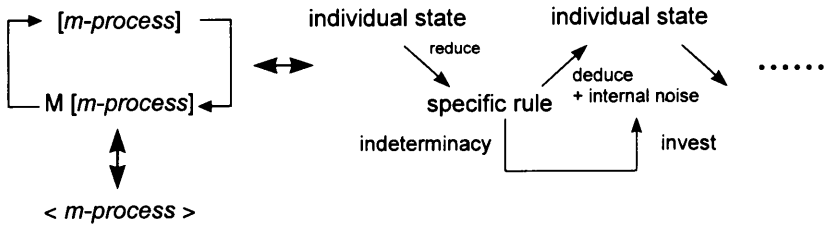


Fig. 1. Schematic diagram for the formalization of internal measurement process of <*m-process*>. We here formalize it as the coherent process between [*m*-process] and M([*m-process*]). In mathematical sense, if *m-process* is formalized as a map f : D→D, then [*m-process*] and M([*m-process*]) are expressed as *D* and Hom(D, D) = {f | f : D→D}. In order to evoking the difference of status between *D* and Hom(D, D), we generally define *D* as an infinite set of finite symbols and define D' in Hom(D', D') as an infinite set of infinite symbols. See text for further discussion.

transformation between metabolic states by which one can refer to metabolic process and rules following the metabolic states. For example, imagine that at first [*m-process*] is prepared as a sequence of $x_1$, $x_2$, $x_3$ and $x_4$. One determines a rule following this sequence by a map *f*, that belongs to M([*m-process*]), where $f(x_1) = x_2$, $f(x_2) = x_3$ and $f(x_3) = x_4$. However, one determines $f(x_4)$ by the definition of a map *f* in spite of ignorance of the following metabolic state. Imagine that $f(x_4) = x_5$, and that $g(x_1) = x_2$, $g(x_2) = x_3$, $g(x_3) = x_4$ and $g(x_4) = y_5$, where $x_5 \neq y_5$. It implies that one arbitrarily chooses a map *f* as a rule following $x_1$, $x_2$, $x_3$ and $x_4$ although there exist both *f* and *g* following $x_1$, $x_2$, $x_3$ and $x_4$. In other words, one can re-choose *f* from *g* if [*m-process*] is prepared as a sequence of $x_2$, $x_3$, $x_4$ and $y_5$. This re-choice or perpetual choice by an internal observer succeeds infinite times, and that can be another expression of a paradox of [*m-process*] = M([*m-process*]).

Compared to a specific language game on morphogenesis in section 2, we can sketch the degeneracy of [*m-process*] = M([*m-process*]). This expression also implies paradoxical structure, while we do not use this expression, [*m-process*] = M([*m-process*]), just as a paradox which possesses a status to be solved. Instead, we use it as a proper noun. The structure [*m-process*] ↔ M([*m-process*]) has ability to maintain metabolic process against intrinsic instability in its own right. However, it is convenient to use an enzyme stabilizing metabolic process, or to construct a boundary of a system (e.g., cell membrane) to maintain metabolic process. At this case, an enzyme or a cell membrane stabilizing metabolic process is used as a proper noun.

A proper noun is here defined as [[*X*] = M([*X*])]. Imagine that one talks about a man and says "He is clever and drunken...". Also imagine that in the process

of talking about the man one has to refer to the other man and says "He is not clever and drunken...". After that one has to talk about both the man and the other. Therefore, any statement may be erroneous because the statement can be proved both for the man and the other. One of the best way to prove this confusion is to introduce a proper noun or to name two men. A name is an instrument that is individually handled, and in which all statements labeled by a name can be comprehended. That is why it is expressed as [[*X*] = M([*X*])]. We emphasize again that a proper noun does not teleologically appear. If a proper noun does not appear then a talk on two men can be absolutely confused and be terminated. Otherwise, the talk successfully proceeds. As a result we can find teleology of the appearance of a proper noun. However, this teleological status is invented a posteriori and is not transcendent concept.

Necessity as a consequence is called necessity. This is the necessity in terms of history. As well as that the appearance of M([*cell*]) ≅ M([M([*cell*])]) is necessary, the appearance of [*m-process*] ≅ M([*m-process*]) as a specific enzyme or a membrane is necessary. However, this proper noun is expressed as

$$<[m\text{-}process] \cong M([m\text{-}process])>, \tag{16}$$

in its own right, because this degenerated agent is not a definite symbol. The meaning and/or pragmatic mode of this agent is opened and/or indefinite. Now we can express an agent by which the expression (16) can be referred as <*stabilizer*>. Once an agent called <*stabilizer*> appears, measurement process consists of the interaction between <*m-process*> and <*stabilizer*>, or among [*m-process*], M([*m-process*]) and [*m-process*] = M([*m-process*]). Then <*stabilizer*> is also expressed as a paradoxical structure between [*stabilizer*] and M([stabilizer]), and is given as

$$[stabilizer] \leftrightarrow M([stabilizer]) \tag{17}$$

where both of them are expressed as

$$[stabilizer] \cong [[m\text{-}process] \cong M([m\text{-}process])] \tag{18a}$$

$$M([stabilizer]) \cong M([m\text{-}process] \cong M([m\text{-}process])]). \tag{18b}$$

Therefore it can lead to another upper level expressed as

$$\begin{aligned} &<replicator> \\ &\cong <[m\text{-}process] \cong M([stabilizer])> \\ &\cong <[m\text{-}process] \cong M([M([m\text{-}process])])>, \end{aligned} \tag{19}$$

where it is defined that M[[*X*] ≅ M[*X*]] ≅ [M[*X*] ≅ M[M[*X*]]], and that if [[*X*] ≅ M[*X*]] ≅ [M[*X*] ≅ M[M[*X*]]] then [[*X*] ≅ M[M[*X*]]]. We here sketch that the first level of <*m-process*> can lead to the degeneracy of the upper level of <*stabilizer*> and it can also lead to the degeneracy of the second-ordered upper level of <*replicator*> (Fig. 2). Compared to the perspective of state-oriented theory, we

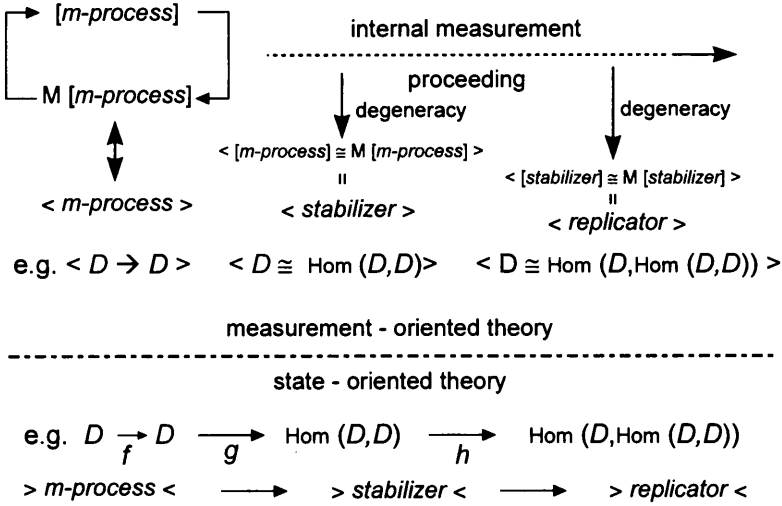


Fig. 2 Schematic diagram for the degeneracy of hierarchical structure. The coherent process between [*m-process*] and M([*m-process*]) is paradoxical in its own right because it implies the mixture of [*m-process*) and M([*m-process*]), and it can lead to the degeneracy of <[*m-process*] ≅ M([*m-process*])> which looks as if a paradox that held before the degeneracy of <[*m-process*] ≅ M([*m-process*])> could be improved. Paradoxical aspect and coherent process can lead to emergent upper level of <(*m-process*) ≅ M([m-process])>. The concept of emergent property results from descriptive fallacy, however we can talk about emergent property in this way. We can "dynamically" sketch how emergent upper level is descriptive fallacy, and it implies that how "erroneous" emergent upper level can be degenerated.

can comprehend that the hierarchical structure defined in the state-oriented theory is not transcendentary concept, and that hierarchical structure is comprehended as the degeneracy resulting from internal measurement.

It is adequate to call <[*m-process*] ≅ M([M([*m-process*])])>, <*replicator*> in the context of biology. In biological sense, upper level of stabilizing and/or repair process is replication of a cell, texture, and/or organelle. We here evoke another perspective for the second-ordered upper level. It can be a metaphoric expression for identity. By the first-ordered upper level <*stabilizer*> one can refer to whole event of metabolic process. We can comprehend that the concept of proto-form of "self" and/or self of metabolic process appears in the form of an agent, enzyme. By the emergent second-ordered upper level one can refer to whole event of stabilizing process. In other words, this concept implies that the second "self" encompasses toward the first "self" being in a universe. This implies that concept of the self consists of considering "self" and considered "self". Therefore, degeneracy of the second-ordered upper

level implies degeneracy of "identity" that is an agent which attempts to unify considering "self" and considered "self".

One can understand that wherever the process of replication is degenerated, the identity of cell is established as a consequence of degeneracy. Imagine that you are a theorist of description and that you designates the most important attributes of a cell or important states of a cell. Does replicator replicate this important attributes or states of a cell? The replicator DNA cannot replicate states of a cell, because it cannot transcendentally designate initial and boundary conditions under which the same state as important state of the cell can appear. In other words, the replicator replicates not individual but universal concept for this cell. We observers call this universality of the concept of this cell the identity of a cell. A replicator, DNA, replicates the identity of a cell. For whom the identity of a cell is? If an observer observes a cell from the perspective of internal measurement, then the measurement process cannot be separated from an observed cell in its own right. Then the identity of a cell appears not only for an observer, but also for a cell itself. It can lead to that we observers can find that there is a replicator as a specific structure, DNA, with respect to which we can find the identity of a cell.

We cannot separate the identity of a cell from a replicator replicating the identity. Whenever one finds a replicator replicating a unity *X*, he can find the identity of *X*, such as the identity of a cell, the identity of an individual and the identity of a population. We can find the identity of a population as a social insect such as an ant. In this population, a queen ant plays a role in replicating population, and it is nothing but a replicator for a population. In this sense, both brain and gonad are replicators and they replicate different identity for an individual. Gonad replicates the identity for an individual in terms of gonad, in the form of a different individual. Brain replicates the identity for an individual in terms of a brain, in the form of an image of individual and/or an image of the outside of an individual. In other words, this function of replication of a brain is called consciousness. We can imagine and/or consider ourselves by the consciousness. That is why brain is replicator and the consciousness is its function of replication for identity.

We do not declare that dualism of mind and body is a priori concept, and that mind can take the ability to unify mind and body. A question of which the dualism between mind and body should be overcome cannot hold. Compared to 'descriptive' fallacy (Austin 1975), one can understand this aspect. The degeneracy of a specific word, "meaning", results from a performative language game. First one says, "I understand". The term "understand" is used just as an intransitive verb, and then one can use the term "understand" as a transitive verb by which one can refer to the direct object or a noun. That is why one in-

vents a word by which one can refer to the concept that is understood or the concept that appears by understanding, and it is called meaning and/or sense. Finally, when one understands what the other says, one can say: "it makes sense". However, once this word, meaning or sense, is performatively used, individuals using a language become to believe that any statement has meaning, and that a language is possible because of existence of meaning. It is the case of 'descriptive' fallacy. Also this fallacy cannot be proved in its own right in the domain of theory of description.

As well as the degeneracy of meaning, once mind is degenerated, one can believe that our communication is possible because of the existence of mind, and one starts to consider how this mechanism is consistently described. Mind has emergent property. Before mind is degenerated, the concept of proto-self is inconsistent because it has ambiguity of considered self that is a term, [*self*], and considering self that is M([*self*]). The degeneracy of mind implies that this paradox is improved In the form of the structure, [*self*] ≅ M([*self*]). However, it looks as if a paradox could be improved by this structure, [*self*] = M([*self*]), and this type of sketch is, just a semantics for the consequence of degeneracy. Because mind can be referred not by the definite and/or consistent structure [[*self*] ≅ M([*self*])], but by indefinite structure <[*self*] ≅ M([*self*])>, the degeneracy of mind can give rise to emergent problem of upper level structure. This is mind-body problem.

Degeneracy of an emergent hierarchical upper level is relevant for indefiniteness of degenerated upper level and/or ability of which more upper level can be degenerated. That is why hierarchical structure is not transcendent structure or state and is the ability taken in internal measurement process. Mind is degenerated as if proto-(thou and I) problem could be improved by this degeneracy, however this degeneracy can be unfolded and can give rise to another thou and I problem. All what we can talk about is to sketch this process, and is not to improve thou and I problem. This is a way to talk about mind and/or consciousness.

As mentioned above, one can talk about internal measurement as a verb, and this process can degenerate a noun and a proper noun. The concept of food is not transcendentally determined. Animals take anything into their mouth and it is transmitted to stomach, and something can be digested in stomach. Something that can be digested is called food. This concept of food is not only for an observer who estimates the content of stomach, but also for an animal itself. Through this process, the preference of food and/or digestive ability is degenerated, and it can give rise to the perspective of theory of description of which an animal can eat its own food. The process as verb is articulated into ambiguous concept of [*food*] and M([*food*]). Then, strictly speak-

ing, if it is argued that animals take anything that can be took into their mouth, it sounds erroneous. That is why it is not sufficient to refer to internal measurement by a term, verb. Also, we emphasize that the process of ([*food*] M([*food*]) giving rise to the structure of <[*food*] = M([*food*])> is same process as the degeneracy of <[*self*] = M([*self*])>.

Naive realists, who can doubt the foundation for naive realism, paradoxically argue that mind cannot be talked about. They regard any model as a representation for real entity, and they cannot accept the perspective from which any model is metaphor and/or moment by which one can refer to ontology. From this perspective of naive realism, any model is impossible in its own right. However, they say that ordinary models are possible because they are models for simple objects while a model for mind is impossible because it is complex. It can give rise to special status for the aspect in which one cannot talk about mind. Note that this process acted by naive realists is internal measurement. Therefore, it can give rise to the degeneracy of a proper noun by which one can refer to the aspect of which one cannot talk about mind and/or nobody knows mind. As well as the statement that nobody knows implies that only god knows, the aspect nobody knows mind can give rise to the concept of god in naive rèalism who only knows mind. It is just vitalism. Against naive vitalism, we have to constitute a metaphoric model with respect to which one can refer to mind.

## 6. DISCUSSION AND CONCLUSION

From the perspective of internal measurement, one can talk about the degeneracy of meaning and/or emergent upper level. This perspective is similar with a metaphoric model in which any process can be referred by a verb and a noun is degenerated a posteriori (Sattler 1990). If one accepts only this type of model, all what one can do is to formalize the structure of a noun compared with a verb, or to formalize process taking the ability to generate a noun. In the former attempt, a researcher concentrates on how a paradox is improved in a newly constructed logic. Scott shows that a paradox formalized as a fixed point in a logic can be embedded in a new logic, and generally shows how to construct this new logic (Scott 1972).

For example, predicate logic can be invented from a paradox in propositional logic by this way. First, a paradox resulting from infinite operation of $\cup$ or $\cap$, which is expressed as $\cup^{\infty}$ or it is given in the form of a fixed point, that is illustrated as $\cup^{\infty}a = (\cup^{\infty}a)\cup b$ or $\cup^{\infty}a = f(\cup^{\infty}a)$, where $f(x) = x\cup b$ and $b$ is any element and then $\cup^{\infty}a = f(\cup^{\infty}a)$ implies a paradox. If one defines how to use this new operation of $\cup$ in a new logic in which the operation of $\cup^{\infty}$ is consistent, then one can argue that $a$ fixed point of $U^{\infty}$ is embedded in a new logic. In this

way one can define the quantifier $\forall$ and $\exists$ as new operations resulting from $\cup^{\infty}$ and $\cap^{\infty}$ respectively. Soto and Varela (1984) focuses on this general method, and call metaphorically the process from propositional to predicate logic, evolution.

However, they do not refer to the process itself from a logic to a new logic. They only argue that a paradox can be embedded. However, from the perspective of a language game, nothing has happened. It does not imply that a paradox is improved and embedded. Internal measurement process is independent of the procedure to improve a paradox, while it looks as if a paradox was improved as a consequence. In other words, the internal measurement process is independent of the process in which a paradox is improved. It does not imply that a paradox is embedded and consistent universe can be achieved although a structure of $<[X] \cong M([X])>$ is degenerated. Therefore, they refer only to the structure degenerated, not to the process of degeneracy.

Because abstract structure of a proper noun is expressed as $<[X] \cong M([X])>$, one can concentrate on the process enhancing complexity with respect to the degeneracy of a proper noun. Also, one can constitute metaphoric model by which one can refer to the process enhancing complexity. Ehresmann & Vanbremeersch (1994) propose a model called Memory Evolutive System, based on category theory. They express the process enhancing complexity through binding and folding as a colimit functor. This functor transforms $[X]$ into $M([X])$, and then it can lead to degeneracy of meaning. Also they formalize a net of competitive internal centers of regulation (CR) which consists of a pattern of components of the same level along specific links to communicate observations. Therefore, colimit functor perpetually generates emergent upper level such as $M([X])$, $M([M([X])])$, ... , on one hand, and this emergent upper level implies $[X] \cong M([X])$, $M([X]) \cong M([M([X])])$, ... , because of the existence of CR. In other words, degenerated upper level can be united in a network due to CR. Thom (1990) also proposes the similar perspective called pregnance process, by which an object is united in a system and M([object]) is degenerated by the pregnance.

Clearly, models proposed by Ehresmann Vanbremeersch (1984) and Thom (1990) are beyond realism, and they can refer to ontology of a system and/or process through metaphoric models. They concentrate on the process from $[X]$ to $[X] \cong M([X])$, or from $[X]$ to $M([X])$. However, we argue that their models are not expressed as the model in the form of (6), Model (MOT) $\cong$ SOT in MOT. They lack the concept of internal choice and/or coherent process between $[X]$ and $M([X])$, which is expressed as $([X] \leftrightarrow M([X]))$. Instead, they concentrate both on $[X]$ and the transformation of $[X]$. It sounds as if degeneracy of emergent upper level resulted from the rule, expressed as colimit functor

and CR, or pregnance process, while it does not imply the existence of a rule. With respect to a term, degeneracy, we evoke the necessity in process and/or history. The concept of necessity can be replaced neither with determinism nor teleology. If one express this process of degeneracy as a specific rule, one cannot express the difference in terms of status between determinism and necessity.

Coherent process can lead to degeneracy of upper level, and one can refer to internal choice which sounds paradoxical by this process. Degeneracy of emergent upper level is relevant for paradoxical and indefinite aspect of lower level. The ability of degeneracy of upper level cannot be separated from paradoxical aspect of focal level (Matsuno 1992; Gunji et al. 1996). That is why internal choice and/or coherent process plays the most intrinsic role in evolution. If one express this ability as a specific form, then one can separate them.

We have concentrated on the relationship between paradoxical aspect of internal measurement and the ability of enhancing complexity or degenerating emergent property (e.g., Gunji 1994, 1995). Recently, Gunji et al. (1995) and Gunji & Toyoda (1996) demonstrates that emergent upper level taking $<[X] = M([X])>$ is degenerated through proceeding internal measurement or coherent process. Coherent process of $[X]$ and $M([X])$ can be expressed as the coherent process between determining an individual state and choosing a rule which follows this identical state. Of course, if one chooses a specific rule by which one can designate a given state, then one cannot justify a specific rule because one has to refer to general all possible states by a rule on one hand, and all what one can observe s a given individual state on the other hand. Individual specific experiencing cannot cover all possible general conditions. It can lead to perpetual coherent process. In this model (Gunji & Toyoda 1996), we emphasize the difference of status between individual condition and general condition, by defining individual condition in a logic in which one cannot refer to infinite operation and defining general condition and/or rule in a logic in which one can refer to infinite operation as a specific form. As a result, the difference of status between $[X]$ and $M([X])$ is enhanced, and it can lead to degeneracy of an emergent structure of $<[X] = M([X])>$.

Soto & Varela (1985) argues the positive significance of fixed point or a paradox. A fixed point $f(X) = X$ generally implies a paradox where $f$ is a contraction map, however if $X$ is fractal or a self-similar set and then $f(X) = X$ holds because self-similar set is invariant with respect to contraction. That is why fractal takes positive significance of a fixed point, and one can improve this type of paradox by introducing fractal. In our model, $<[X] \cong M([X])>$ is expressed as a self-similar cantor set, where $X$ is a local rule. In other words, by the structure of $<[X] \cong M([X])>$ one can refer to emergent global rule by which

one can also refer to local rule. This emergent upper level can take downward causation (Küppers 1992). Also, before degeneracy of $<[X] \cong M([X])>$, it is just a paradox. The structure of $<[X] \cong M([X])>$ is impossible and is prohibited. In spite of this prohibition, this structure is degenerated. It implies that it is emergent property.

Coherent process is formalized whenever one focuses on the model expressed as Model(MOT) = SOT in MOT. In this formalization, one can talk about category mistake and descriptive fallacy, and then one can manifest performer's choice or internal choice resulting from this paradox which sounds dilemma for an internal observer. Resolving a dilemma invests another dilemma, and this process can give rise to degeneracy of emergent structure. When performance of external measurement can be sketched from the internal perspective, one can talk about origin of state and structure, evolution, emergent property, and/or necessity in history that cannot be talked only from the external measurement. We call this sketch from the internal perspective measurement-oriented theory, compared to state-oriented theory. Expanding this method from the internal perspective we can constitute the metaphoric model for mind and/or consciousness.

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