Osaka Human Sciences, **3**, 83-97
March 2017

AN ONTOLOGICAL ANALYSIS OF THE RELATIONSHIP BETWEEN A MOTHER AND HER CHILD

YASUO NAKAYAMA*

Abstract

From an ontological viewpoint, the relationship between a mother and her child is especially interesting. During a pregnancy, the mother and her child are spatially continuous. After the birth, a separation process between them begins. This process is temporally seamless and coincides with the individuation process of the child. To analyze this separation process, we use an ontological framework, i.e., *Four-Dimensional Mereology* described in Nakayama (2009, in Japanese).

Vertebrate animals take different strategies in order to preserve their own species. Fishes produce a huge amount of offspring, but only some of them become mature. In contrast, mammals produce only a small number of children and bring them up very carefully, so that the survival rate becomes high. For this reason, the mother-child-relationship is especially strong for mammals. As examples of mammals, we describe child rearing of kangaroos and Japanese macaques. We introduce, then, a concept of *system* and analyze the relationship among a mother system ($\mathbf{S_M}$), a child system ($\mathbf{S_C}$), and a mother-child system ($\mathbf{S_{M+C}}$).

For humans, beside the biological process of individuation, we should take a psychological and a social process of individuation into consideration. The biological individuation starts with the birth of a child. However, the psychological and the social individuation take a long time before they are completed. We also discuss death of a child. In a mother-child system, survival of the child is one of its goals. So, the mother continues to perform actions in order to achieve this goal. Thus, when a child dies, the mother-child system totally collapses and the mother loses one of her goals of life.

The discussions in this paper show that it is not appropriate to treat humans as isolated beings. They are often involved in systematic interactions among them. Sometimes, their behaviors can be properly explained by interpreting them as components of one system.

Key words: mother and child; ontology; system; evolutionary strategy; species

---

This article is the English translation of the original one "Nakayama, Y. (2015). An Ontological Analysis of the Relationship between a Mother and her Child. *Bulletin*, **21**, published by Graduate School of Human Sciences, OSAKA UNIVERSITY, 291–307 (in Japanese)".

* Graduate School of Human Sciences, Osaka University, 1-2,Yamadaoka, Suita, Osaka 565-0871, Japan

1. Introduction

The relationship between a mother and her child includes a process of separation of something that was originally one unit, which is interesting from an ontological viewpoint. This paper, using the system concept, aims to demonstrate that the separation process between a mother and her child that begins after childbirth is continuous. This continuous process is important from the standpoints of evolutionary theory as well. Mammals are a type of animal who adopt a strategy of producing only a small number of children and raising them very carefully for the preservation of their species. There is a strong relationship between the mother and her child in such animals, where we can consider the childcare period as a state when the mother and child are not completely separated. The mother-and-child relationship among humans can be also understood as a case of a mammal's mother-child-relationship.

This paper captures the mother-child-relationship as one system and analyzes the system's temporal transformation in a child's development from a viewpoint of philosophical ontology.

2. Function and System Concept of Organisms

To begin, we will stipulate the 2 concepts that are necessary for the analysis in this paper. These concepts are the function concept and the system concept.

2.1. Stipulation of the Function Concept

In biological philosophy, stipulation of a function concept holds significant meaning[1)], and there are two influential theories regarding organisms' function concept. One of them is the dispositional theories on function proposed by Robert Cummins, and the other is etiological theories on function presented by Ruth Millikan (Cummins 1975, Millikan 1989). Cummins' function analysis states that "*x* functions as a φ in *s*, or that the function of *x* in *s* is φ-ing, when we are speaking against the background of an analytical explanation of some capacity of *s* which appeals to the fact that *x* has a capacity to φ in *s*" (Cummins 1975: p. 762; Nagasaka 2014: p. 233). Cummings' dispositional theories are theories in response to the question of "what does it mean for ***x*** to function as ***F***?" while Millikan's etiological theories are theories which explain "what does it mean for ***x*** to have function ***F***?" (Nagasaka 2014: p. 234). In other words, the dispositional theories and the etiological theories explain an organism's functions from different angles, so both theories can coexist.

Millikan's function concept is called the "proper function," and it outlined as follows: "The proper function of something is a function that contributes to preserve the overall system that it

[1] The discussion in Section 2.1 is based on the presentation "Creatures' ontology and artifacts' ontology" from the 47th Philosophy of Science Society, Japan (PSSJ) on November 16, 2014.

belongs to by conducting a specific action, and because of this, the function itself has been selected to survive" (Nobuhara 2007: p. 343; Nagasaka 2014: p. 234f). The characteristics of the "proper function" which Millikan actually gives are recursive, as follows (Millikan 1989: p. 288).

(1) For an item *A* to have a function ***F*** as a "proper function", it is necessary (and close to sufficient) that one of these two conditions should hold.

(1a) *A* originated as a "reproduction" (to give one example, as a copy, or a copy of a copy) of some prior item or items that, due in part to possession of the properties reproduced, have actually performed ***F*** in the past, and *A* exists because (causally historically because) of this or these performances.

(1b) *A* originated as the product of some prior device that, given its circumstances, had performance of ***F*** as a proper function and that, under those circumstances, normally causes ***F*** to be performed by means of producing an item like *A*.

For example, lungs emerged in order to breathe, and hearts emerged in order to circulate blood to the entire body. Therefore, breathing is a proper function of the lungs, and urging blood circulation is the heart's proper function. In an individual body, due to the continuous supply of blood by the heart, the individual can survive, have children, and the heart of the child is able to circulate blood within the child's body.

There is a function ingrained in an individual organism to make its species survive beyond the limits of the individual organism. For example, a placental mammal has a proper function wherein it has placenta which can conduct metabolism between a fetus and its mother. Moreover, a mammal's breasts have the proper function of giving nutritious breast milk to a baby.

2.2. The Concept of the Sustainable System and the Hierarchy System

Both the dispositional theories and etiological theories use the term "system" in their stipulation of functions. The system used as a premise for when visceral organs such as the lungs are explained is human bodies. This section attempts to clarify this system concept. In the past, I have defined the concept of "social organization" (Nakayama 2011b) and "extended action subjects" as four-dimensional (spatiotemporal) individual entity (Nakayama 2011a; Nakayama 2013)[2]. Here, I will define the concept of "sustainable system" in a similar manner. The sustainable system refers to systems that last beyond changes in generations.

(2a) [System] A system is a four-dimensional individual entity and has (four-dimensional) parts. It supports its own activities based on the activities of its parts. Thus, it is possible

[2] Four-dimensional entities are spatiotemporally extended, and they feature the temporal aspects. For more detail, refer to Nakayama (2009, 2014) or Sider (2001).

to describe temporal parts of systems.

(2b) Systems are active. Inactive systems cannot survive.

(2c) [Hierarchy system] A system can include another system as its (four-dimensional) parts. In such cases, upper systems are called the "hierarchical system."

(2d) [Sustainable system] Sustainable systems survive even beyond partial disappearances or partial replacements.

According to this stipulation, each organisms and each cell can be considered a system. Individuals comprised of multiple cellular organisms are not only sustainable systems, but also hierarchical systems. Species like human beings are considered sustainable systems[3]. As mentioned later, groups that the same species form can also be considered a sustainable and hierarchical system.

3. Strategy for Maintaining Species

Organisms have maintained their species by utilizing various strategies. Even just among relationships between a parent and a child of vertebrate animals, one can find many different patterns. This is because these organisms utilize different strategies in order to preserve their offspring. Species only can preserve themselves through procreation. Mammalian animals are types of organisms which maintain offspring utilizing the strategy of bearing a small number of children and carefully raising them. Human beings in particular are a type of organism that places an extraordinary amount of effort in parental care. This form of parental care is not only a biological one, but also involves social and cultural child-rearing as part of the educational process. More specifically to modern humans, they spend a long amount of time and effort for nurturing their children. This section will describe a few typical examples of species preservation strategies taken by vertebrate animals.

3.1. Strategy Utilized by Fish in Order to Preserve their Species

The ocean provides fish with the best-suited environment for catching food such as plankton, as well as for excretion. Because of living in such a favorable environment, freshly hatched fish fries do not have to move around to catch food such as baby planktons. In the case of fish, the female spawns her eggs and the male sprays his sperms on the eggs to fertilize them. Only some of them typically become mature. The types of roes are pelagic eggs and demersal eggs. Pelagic eggs disperse by drifting in the water (Kuwamura 1988: p. 113). The environment in the sea is stable and there is ample food for fries of fishes. Thus, even some of the eggs that are left behind

[3] Michael Ghiselin emphasizes a species' individualism (Ghiselin 1974). His standpoint is close to this paper's ontology. Following the terms of this paper, an individualism of a species means its consideration as a sustainable system with a certain trait (a trait such as the potential to mate with another adult individual organism of its same species).

may hatch, become fries, and mature. Since the percentage of maturity for fish is extremely low, fish bear a huge amount of eggs to maintain offspring. The procreation strategy for fishes is basically "bear a huge amount of eggs and then leave them." However, there are some kinds of fish that show rearing activities, and these activities can be categorized into the following 3 types (Kuwamura 1988: pp. 113–122).

(3a) [Monitoring protection] A demersal egg's survival rate increases when eggs are dropped on favorable locations. Some males have such locations as their own territories to let females spawn there, and the males may sometimes continue to protect these territories. However, if the territory of the male extends over a wide span, the female may monitor the spawn location (e.g. cichlid; balistidae). In the case of "Kuhe," a large cichlid, about 10 thousand eggs are spawned at once. It has been said that monitoring by the female can last as long as 3 months from the state of eggs, hatched fries (hatch 3 days after spawning), until swimmable fries where males are mainly in charge of defense from intruders (Kuwamura 1988: pp. 16–21).

(3b) [Carrying on body] This type of child-rearing is conducted through methods including mouth breeding and adhesion onto the surface of the body. Mouth breeding is a method of rearing the eggs or fries in the parents' mouths (e.g. cichlid; Apogonidae) (Kuwamura 1988: p. 28). As examples of protection through adhesion on the surface of the body, there is adhesion on the ventral surface (male Messmate pipefish), on the side of the body (a type of male frogfish), on the forehead (male Kurtidae), and the brood pouch (male seahorse) (Kuwamura 1988: p. 73).

(3c) [Carrying in body] Fishes under the classification of chondrichthyes, such as sharks and rays, couple and internally fertilize. There are species that lay eggs and those that are embryonic who produce baby fish. The embryonic species provides nutrients from the mother to children in various degrees (Kuwamura 1988: p. 71). However, unlike in the case of birds or mammal animals, fish who internally fertilize hardly ever protect their children after birth (Kuwamura 1988: p. 121).

In any cases, fish do not utilize strategies that require careful nurturing for each individual, and a big part of their survival ratio is dependent upon their environment and chance. Reptiles and birds are shifting towards the strategy of bearing a small number of offspring and raising them carefully, but what is more distinctive is the processes of pregnancy, delivery, and nurturing by mammals that span over a long time and create a strong bonding relationship between mothers and her children.

3.2. Child-rearing in Marsupial Mammals - Kangaroos

In the case of mammals, the number of children that are produced at the time of childbearing

is far less in number than fish. Mammals build a much closer relationship between the child and its mother. An infant mammal is too immature to live without the existence of its mother (or an individual that acts in a mother's place). This greatly distinguishes them from fish.

Mammals can be categorized into Monotremata, and marsupials (metatherian) or placentalia (Eutherian). Monotremata is a category for mammals who engage in oviparity, such as the platypus. Marsupials used to inhabit a large portion of the world, but now mainly inhabit the Australia district (the Australian continent and Papua New Guinea, etc.). First, we will discuss how kangaroos rear their children as a representative for marsupials.

Marsupials do not create placenta during pregnancy, nor do they raise children in wombs. Kangaroos transfer nutrients and waste through gentle contact between the fetus and the womb wall (Nagase 1999: p. 9). A kangaroos' term of pregnancy is short: only 33 days to 36 days. The infant's body length is 2 to 3 cm and weighs less than a gram. Immediately after delivery, the infant independently crawls up the mother's belly and into the pouch (marsupium) by following its smell. A kangaroo's infant grows by sucking on the mammilla in the pouch, and after 6 months or so, starts occasionally leaving the safety of it. In the end, the baby becomes too large for the pouch, and begins living independently (Nagase 1999: p. 13).

In the case of kangaroos, which are a type of marsupial, the baby grows up while experiencing 3 phases of activity: within the mother's inner body, the inside of the marsupium, and the natural environment (outside of the marsupium). If you look at these processes as an individuation of individual kangaroos, you can see that the individuation process of the individual kangaroo is continuous.

An egg before being fertilized can be considered a part of the mother. However, after fertilization, the fertilized egg has a gene sequence that is different from that of the mother, and starts to exist as its own independent organism. The existence of the then-fertilized egg has a dual ontological position as an individual body as well as a co-integrated part of the mother. This state of dualism starts at this point and shifts continuously towards individuation along with the child's growth.

The next big step is delivery. Through delivery from its mother, a baby is spatially separated from her, and gains a certain degree of freedom. However, at this stage in its life, the baby kangaroo stays in the marsupium, receives nutrients through milk from the mother, and is not an independent organism yet.

The next great step is when the baby becomes competent of obtaining food by itself. This is when the baby kangaroo proceeds to take its first step towards independence, and the mother can also become pregnant with another baby and turn her interest to her next subject of nurture.

After this, the next step in the growth of a kangaroo is maturing as an individual with reproductive capabilities. At this stage, the kangaroo completes its cycle of growth.

3.3. Rearing in Placentalia Mammals – the Japanese Monkey

In the case of placentalia mammals, the process of individuation that their children take is not so different from kangaroos. The difference is that there is no period of time spent in the marsupium, and that a fertilized egg grows in a womb by receiving nutrients through a placenta before its delivery. After the delivery, the child is spatially separated from the mother and gains more freedom, but because the child cannot feed itself, its survival has to rely on nurture. The infant is an entity who survives thanks to nurture, and is not yet an independent entity.

There are various types of animals under the umbrella of placentalias, and the intimacy between mother-child-relationships varies depending on the number of children per delivery. Japanese monkeys usually give birth to only one child at a time, while pigs give birth to approximately 10. Children of mammals that bear many children at once start struggling for their existence directly after birth. Unless it is healthy and strong, it is impossible for these newborns to survive if they cannot successfully suck its mother's teat. On the other hand, in the case of animals that only give birth to one child at a time, the mother will carefully protect its baby. For example, a mother of the Japanese monkey will try to cordially nurture their child even if it is deformed, and will never abandon its duty to parental care (Nakamichi 1999: pp. 74–88).

Let's discuss an example of placentalias by examining Japanese monkeys. The Japanese monkeys' mother and child display deep intimate body contact for a while after the child's delivery. A baby will be picked up and held by the mother, and cling spontaneously to the mother's chest area at the same time[4]. The mother grooms, embraces, and gives milk to her baby. The baby clings to the mother, sucks her milk, and spends a large part of the day sleeping (Kimura 1983: p. 200). From the second day, the baby starts preparing to be independent. During its first month, the child shows development in walking, and forms bilateral playmate relationships. The time that the mother and child are in contact becomes reduced to half of the original at 70 days after birth, and plateaus at a certain value 100 days after birth. Around this time, the child starts to actively expand upon its group of playmates (Kimura 1983: p. 220).

The core of Japanese monkey group is formed by many females, their children, and a few males. The periphery of the group is formed by the eldest child monkeys and younger males. Though the word 'periphery' is used here, this doesn't indicate that these monkeys encircle the core group, but that several gatherings of a few males live away from the central core (Nakamichi 1999: p. 113). Each individual has a shared ranking, and the first group only has one individual as the first-ranking male (the alpha male). In the system of monkey groups, the mother-child-relationship corresponds to a component of this system.

A group of Japanese monkeys is a system for procreation, and the mother-child-relationship is positioned as an incredibly important component of it. A mother copulates with a male, bears

[4] A Japanese monkey's baby has a strong grip in all fingers and toes on all 4 limbs even directly after birth (Nakamichi 1999: p. 30).

children, nurses her children, and puts special effort into raising her child for the 3 months after delivery. After that period, the child grows to spend more time apart from its mother during the day time to mingle with other children (Nakamichi 1999: p. 39). As her child grows, the female remains in the center of the group, but the male joins a peripheral group with other males. In this way, the relationship between mother-child monkeys continuously changes and becomes less intimate. Once a child grows old enough to have competency in reproduction, the monkey is mature, and it is possible for them to become a parent. This completes the monkey's cycle of growth.

4. Ontological Analysis of Placentalia Mammals' Mother-Child-Relationship

This section will describe placentalia mammals' mother-child-relationship as discussed above, using a framework of four-dimensionalism from an ontological viewpoint.

4.1. Analyzing the Mother-Child-Relationship System

Four-Dimensionalism captures a concrete object as expanding in a four-dimensional space time, and it states that concrete objects can possess temporal parts[5]. This section uses the following codes from the perspective of four-dimensionalism:

$\mathbf{S_M}$: Mother (as a four-dimensional object)
$\mathbf{S_C}$: Child (as a four-dimensional object)
P: Placenta (as a four-dimensional object)
+: Mereological sum between four-dimensional objects
$\mathbf{S_{M+C}}$: Mother-child-relationship system (as a four dimensional object)
$\mathbf{s_x(t)}$: Temporal part of the system **Sx** at time zone **t**

Let us explain what mereology means[6]. Mereology is a general theory of part and whole, and includes the following ontological statement: if ***x*** and ***y*** are entities, then ***x+y***, which is the fusion of ***x*** and ***y***, is also an entity. Thus, accepting the theory of mereology means that one accepts that an exorbitantly large amount of things exist.

Now, we will describe mother-child-relationships during the period between the mother's pregnancy and the child's infancy using the codes listed above. When a child reaches the weaning period, the dependency of the child on the mother drops dramatically. Thus, we will focus on the period of the child's infancy. The next description is applicable to any placentalias.

5 Please refer to Nakayama (2009, 2014) and Sider (2001) for four-dimensionalism and Mereology
6 For a compilation of papers on mereology and ontology of ancient to modern eras, please refer to Matsuda (2014)

(4a) [State in pre-pregnancy (time zone $\mathbf{t_0}$)] $\mathbf{s_M(t_0)}$
Before becoming pregnant, only the would-be mother exists. Furthermore, $\mathbf{s_M(t_0)}$ is a system.

(4b) [State during pregnancy (time zone $\mathbf{t_1}$)] $\mathbf{s_{M+C}(t_1) = s_M(t_1) + P + s_C(t_1)}$
During the pregnancy, $\mathbf{s_{M+C}(t_1)}$ is a system. $\mathbf{s_M(t_1)}$ and $\mathbf{s_C(t_1)}$ are also systems. $\mathbf{s_M(t_1)}$ can survive alone, but $\mathbf{s_C(t_1)}$ cannot. The proper function of Placenta **P** is to exchange nutrients, wastes, and gases between the mother ($\mathbf{s_M(t_1)}$) and the fetus ($\mathbf{s_C(t_1)}$) (Sakai 2015: p. 155). During the period of pregnancy, $\mathbf{s_{M+C}(t_1)}$ forms a single spatially continuous body.

(4c) [State right after delivery (time zone $\mathbf{t_2}$)] $\mathbf{s_{M+C}(t_2) = s_M(t_2) + s_C(t_2)}$
Right after delivery, $\mathbf{s_{M+C}(t_2)}$ is a system. So are $\mathbf{s_M(t_2)}$ and $\mathbf{s_C(t_2)}$. At the time of delivery, $\mathbf{s_C(t_2)}$ spatially separates from $\mathbf{s_{M+C}(t_2)}$. Placenta **P** is removed from the mother right after delivery and completes its given role. Through delivery, $\mathbf{s_{M+C}(t_2)}$ becomes a spatially separated system, and nursing starts after delivery.

(4d) [State in infancy (time zone $\mathbf{t_3}$)] $\mathbf{s_{M+C}(t_3) = s_M(t_3) + s_C(t_3)}$
At the period of infancy, $\mathbf{s_M(t_3)}$ and $\mathbf{s_C(t_3)}$ are systems. $\mathbf{s_{M+C}(t_3)}$ includes both temporal parts that can and cannot be considered systems. In the case of species like Japanese monkeys which live in groups, infants $\mathbf{s_C(t_3)}$ become a partial system within the group system $\mathbf{s_G(t_3)}$. Then, the mother-child-relationship system $\mathbf{s_{M+C}(t_3)}$ likewise becomes a partial system of $\mathbf{s_G(t_3)}$.

(4e) [State in post-infancy] The mother-child-relationship system is a system which aims for the child to be completely independent. Therefore, this system ends at the time the child becomes completely independent.

Systems do not necessarily have to be spatially continuous; however, systems are partially connected in the causal correlational manner to allow them to survive, and this must be how systems' survival is preserved.

The ontological relationship between a mother and her child can be expressed as in Figure 1. One can see from this Figure that $\mathbf{S_M = s_M(t_0+t_1+t_2+t_3+t_4)}$ and $\mathbf{S_C = s_C(t_0+t_1+t_2+t_3+t_5)}$ are both true[7].

Sentence expressions of the relationships indicated in Figure 1 is as follows.

(5a) $\mathbf{s_{M+C}(t_1)}$, $\mathbf{s_{M+C}(t_2)}$ and $\mathbf{s_{M+C}(t_3)}$ are temporal parts of $\mathbf{S_{M+C}}$.

(5b) $\mathbf{s_M(t_0)}$, $\mathbf{s_M(t_1)}$, $\mathbf{s_M(t_2)}$ and $\mathbf{s_M(t_3)}$ are temporal parts of $\mathbf{S_M}$.

(5c) $\mathbf{s_C(t_1)}$, $\mathbf{s_C(t_2)}$, $\mathbf{s_C(t_3)}$ and $\mathbf{s_C(t_5)}$ are temporal parts of $\mathbf{S_C}$.

(5d) $\mathbf{s_G(t_3)}$ is a temporal part of $\mathbf{S_G}$.

[7] When expressed as "**t1**+**t2**," "+" refers to the mereologic sum of **t1** and **t2**. This treatment is justified, because the four-dimensional mereology accepts temporal objects as four-dimensional concrete objects. For details, please consult Section 3 in Chapter 2 of Nakayama (2009).

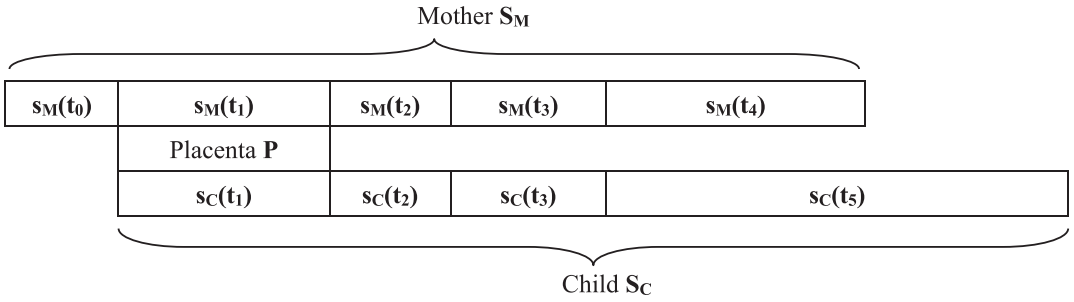

FIGURE 1. Temporal description of the ontological relationship between a mother and her child

A mother-child-relationship system in placentalia mammals is strongest between the mother and her child during pregnancy, and the connection gets weaker after delivery. This phenomenon can be confirmed by looking at the decreasing rate of temporal parts that function as a mother-child-relationship system.

In order to appropriately describe a mother-child-relationship system, we will introduce the concept of a "system having temporal gaps."

(6a) For a time interval **t**, **s(t)** is a system with a temporal gap if and only if there is a time interval **t*** such that **t*** is between $\mathbf{t}_1$ (the beginning of **t**) and $\mathbf{t}_2$ (the end of **t**), both $\mathbf{s(t}_1\mathbf{)}$ and $\mathbf{s(t}_2\mathbf{)}$ are systems, and **s(t*)** is not a system.

(6b) **s(t)** is referred to as a "dense system", when there is no time interval **t*** such that **t*** is a part of **t** and **s(t*)** is a system with a temporal gap.

In period **t**, when the child monkey is protected by the mother monkey, the child and mother are both dense systems; however, the mother-child-relationship system has temporal gaps. This is because, within this period of time, there are also times when the child monkey plays with other child monkeys.

4.2. Analyzing the Breast Feeding Period

A child monkey during its period of being breastfed has intimate contact with the mother monkey, especially when being nursed or when it is clinging to its mother. On the contrary, when playing with other child monkeys, the distance from the mother is relatively far away. In this way, the child monkey repeats contact and separation, and the time of separation becomes longer along with maturity (Figure 2).

During the pregnancy, nutrients, wastes, and gases are exchanged through placenta. After delivery, only the nutrients are supplied to the child monkey through breast feeding. During this time zone of breast feeding, the mother and child monkeys are integrated as a mother-child-relationship system. During this time zone, the circulation of causal action regarding substance

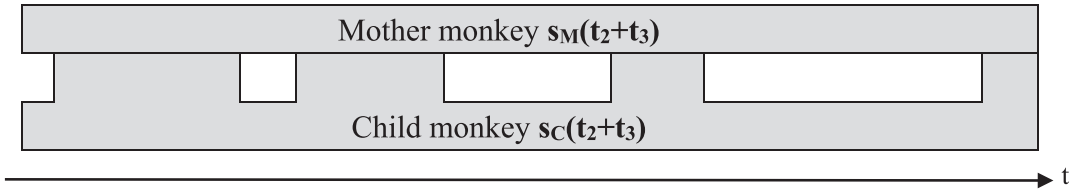

FIGURE 2. Spatial contact and separation between mother and child monkeys in the breast feeding period

metabolism has been formed in the mother-child-relationship system. This paper uses an individual concept that the child monkey has started its process of individuation and started its individual existence since its mother's fertilization. However, the child monkey's existence is twofold at this time, so we can discuss of the child monkey as taking part in both systems of an individual ($\mathbf{s_C(t_1)}$) and of being in a mother-child-relationship system ($\mathbf{s_{M+C}(t_1)}$). Furthermore, during the pregnancy, the mother monkey establishes two systems, as an individual mother ($\mathbf{s_M(t_1)}$) and the mother-child-relationship system ($\mathbf{s_{M+C}(t_1)}$).

Under the state of breast feeding, there are multiple systems which coexist with respect to the mother and child: the system of the mother as an individual monkey ($\mathbf{s_M(t_2)}$), the child as an individual monkey ($\mathbf{s_C(t_2)}$) and the mother-child-relationship system ($\mathbf{s_{M+C}(t_2)}$). For the individual mother monkey, it is not directly beneficial to rear a child monkey. However, looking at this from the perspective of the inclusive system, which perceives this act to be for the continued existence of the species as a result of the mother-child-relationship, this inclusive system is beneficial. Thus, the mother monkey that acts during the process of breast feeding is considered to be acting as a part of the mother-child-relationship system. Due to this type of activity, the species of the Japanese monkey has been maintained, which can generally be applied to all mammals.

For mammals that utilize the strategy of bearing a few numbers of offspring and raising them carefully, the self-sacrifice that the nurturer displays is an important central trait for the species' self-preservation.

5. Ontological Analysis of Human Mother-Child-Relationship

The ontological stipulation for humans follows the form of placentalian, where the relationships described in Figures 1 and 2 are true. However, psychological and social factors are additionally incorporated into the biological factors for humans. This means that when it comes to humans, the separation of infants and the individuation process must be considered not only spatially but also psychologically and socially. In actuality, a researcher of childhood psychosis, Margaret Mahler, has already paid attention to the psychological birth of infants. The physical separation of a baby from its mother through childbirth does not coincide with the psychological

understanding of the baby. The individuation process of an infant includes a psychological process called self-understanding formation, and it overlaps with the long separation process that begins with childbirth.

> "An infant's biological birth and its psychological birth do not temporally coincide with each other. The former is dramatic and visible, which is enough of a definable event, but the latter is a psychological process that progresses slowly." (Mahler et al 1975: Japanese translation p. 10)

Before a child can become independent as a system, the mother-child-relationship system is activated and supports the child's survival. During pregnancy, the mother-child-relationship system was automatically maintained through a biological mechanism. After birth, the mother-child-relationship system is controlled by the mother's intentions. In other words, the mother *intentionally* supports the baby's survival. Or we can put it in another way: that the baby can only survive with the mother's intentions. Immediately after delivery, the maternal system and the mother-child-relationship system dominates the situation, and especially in humans' case, the system of the child as an individual baby functions only insufficiently. In short, a mammals' child comes into the world as an extremely immature organism.

When a mother rears her child, she intentionally positions herself as an instrumental entity in order to maintain the life of her child. In general, humans use other things besides themselves as tools; however, the relationship between tools and a nurturer gets reversed under the circumstance of childcare. A nurturer sets their child's survival as his or her goal and positions himself or herself as a tool for that goal. In order to sustain a baby's life, a mother starts living her life with her child at its center, instead of herself. This inclination plays an extremely important role towards the survival of a species. This attitudes of mothers as self-sacrificing can be seen among mammals, and it is one distinctive biological characteristic.

The child's eventual independence releases the mother from her childcare role. Once a child progresses to independency, the mother must also become independent at the same time and release herself from the role of an instrumental entity to pave a path toward her own goals. Thus, the child's process of growing up is simultaneously the mother's process of retrieving herself as an individual. In the past, mothers bore as many as 10 children, and the childcare period would last as long as 20 years. In a time when the human lifespan was much shorter, the mother's period of childcare dominated almost the entire second half of her life, and she might have never had to become independent from her child. With the trend of lower fertility rates continuing to develop, mothers now have longer independent lives after the completion of their child-rearing period.

6. Grief after Losing one's Child

In the case of humans, a child $\mathbf{S_C}$ and a mother $\mathbf{S_M}$ become partial systems of the family $\mathbf{S_F}$. At this stage, the mother-child-relationship system, $\mathbf{S_{M+C}}$, becomes a partial system of the family $\mathbf{S_F}$. As long as a family is comprised of one system, a death of a family member means a crisis for the system. In particular, a death of child during the childcare period inflicts a huge amount of loss to the mother. This is because a loss of a child means an absolute collapse of the mother-child-relationship for the mother, who had made herself instrumental for the child's survival.

A psychoanalyst, John Bowlby, states the typical process which adults experience when someone important to them dies, as follows (Bowlby 1979: Japanese translation pp. 117–119).

(7a) [Period of numbness] A period when the fact that someone important passed away cannot be accepted. Generally, this lasts for a few hours to a week. It might be discontinued by extreme grief or an explosion of anger.

(7b) [Period of longing and search for the lost] This stage surfaces a few days after the announcement of the death, to a week or two. It often lasts several months to years.

(7c) [Period of devastation and desperation] Many fall into depression or become emotionally unstable.

(7d) [Reorganization period] Levels of symptoms vary from individual to individual.

According to the examination in Section 5, people do not live alone, but rather with others in a system. The life of an individual is connected to the preservation or change of systems that include the individual. The death of someone important to the individual often involves a large change to the system that one belongs to, and this change influences and spurs individuals to change what it is that they live for.

This is especially true when the death is of one's own, young child. A young child is an entity whose life is maintained only thanks to the system of the nurturer. As stated in Section 5, the nurturer positions his or her existence as an instrument for the child's survival. If the child dies under this condition, it is natural that the nurturer would feel a strong sense of loss. The nurturer is bound to lose his or her meaning for life (at least for a while).

In other cases, such as a death of a family's breadwinner, this greatly impacts the maintenance of a family system. It poses the question of "Who will have to play the breadwinning role?" to those remaining (Bowlby 1979: Japanese translation p. 141). This situation also involves social factors. In modern society, maintaining a family system is deeply entrenched in financial factors. A wife who loses her husband young faces the question of how to manage funds to maintain her family system and continue childcare (in the society in which she lives). The family system is a partial system which belongs to the overarching social system, and the survival of the social system is heavily connected to financial factors.

The sense of loss when one loses a child from an accident or disaster unexpectedly can be explained from an ontological viewpoint. Since modern humans bear fewer children and foster them with care to maintain society, the significance of a child's existence is huge for today's parents.

7. Concluding Considerations

What analysis of ontology in mother-child-relationships shows is an insufficiency in consistent understanding of humans as an isolated entity. A mother-child-relationship system has a biological origin. From a biological perspective, a child works on its process of independence from the mother for a long time, and the mother gradually completes the separation process from her child. Humans' mother-child-relationship system also involves psychological, social, and financial factors. I have criticized the primordial nature of self of individual existence that Descartes used as a premise in Nakayama (2015). An image of an individual who hides a primordial nature of self and makes decisions independently through one's own thinking is a myth that modern Europeans have created. Humans live in many kinds of systems. This paper can be positioned as an attempt to describe relationships with others for humans existence from biological and ontological perspectives.

Acknowledgement

The research for this paper was supported by the Human Science Project in 2015 "Promotion of human science in altruism" and the Science Research Grant, basic research (C) (task number: 24520014, 2012–2016). I would like to express my gratitude here.

References

Bowlby, J. (1979) *The Making & Breaking of Affectional Bonds*, Tavistock Pub. (Translation supervised by T. Sakuta (1981) Seiwa-shoten).

Cummins, R. (1975) Functional analysis, *The Journal of Philosophy*, vol. 72, no. 20, pp. 741–765.

Ghiselin, M.T. (1974), A radical solution to the species problem, *Systematic Zoology*, 23, pp. 536–544.

Kimura, M. (1983) Chapter 7: Social behaviors of immature individuals of Japanese monkeys, T. Hidaka (ed.) *Meaning of Animal Behaviors*, Tokai University Press, pp. 197–221, (in Japanese).

Kuwamura, T. (1988) *Child Rearing and Society of Fishes*, Kaimei-sha, (in Japanese).

Mahler, M.S., Pine, F. and Bergman, A. (1975) *The Psychological Birth of the Human Infant*, Basic Books (Translated by M. Takahashi et al (1981) Reimei-shobo).

Matsuda, T. (2014) *Mereology and Ontology: its History and Actuality*, Syunjyu-sha (in Japanese).

Millikan, R.G. (1989) In defense of proper functions, *Philosophy of Science*, 56, pp. 288–302.

Millikan, R.G. (2002) *Varieties of Meaning*, MIT Press (Translated by Y. Nobuhara (2007) Keiso-shobo).

Nagasaka, I. (2014) Ontology of functions, in Matsuda (ed.) (2004) pp. 229–259, (in Japanese).

Nagase, K. (1999) Kangaroo, H. Nigi (ed.) (1999) *Pregnancy, Delivery, and Child Rearing of Animals*, Medica Pub., pp. 8–13 (in Japanese).

Nakayama, Y. (2009) *The Construction of Contemporary Nominalism: Its Application to Philosophy of History*, Syunjyu-sha, (in Japanese).

Nakayama, Y. (2011a) From metaphysics to study of sciences and technologies, in T. Todayama and Y. Defuchi (eds.) *For Learners of Applied Philosophy*, Sekaishiso-sha, pp. 60–70, (in Japanese).

Nakayama, Y. (2011b) *Norms and Games: An Introduction to the Philosophy of Society*, Keiso-shobo, (in Japanese).

Nakayama, Y. (2013) The extended mind and the extended agent," *Procedia Social and Behavioral Sciences*, vol. 97, Elsevier, pp. 503–510.

Nakayama, Y. (2014) Ontology of organisms and ontology of artifacts, an oral presentation in the *47*th *Conference of Philosophy of Science Society, Japan* (in Japanese).

Nakayama, Y. (2015) Philosophical analysis of altruism and Kyosei (coexistence), *Mirai Kyosei: Journal of Multicultural Innovation,* vol. 2, pp. 49–62, (in Japanese).

Nakamichi, M. (1999) *Mother and Child of Japanese Monkeys*, Fukuhara Pub, (in Japanese).

Nobuhara, Y. (2007) A commentary by the translator for R.G. Millikan's *Varieties of Meaning*, Keiso-shobo, pp. 339–361, (in Japanese).

Sakai, S. (2015) *The Birth of Mammalian*, Koudan-sya, (in Japanese).

Sider, T. (2001) *Four-Dimensionalism: An Ontology of Persistence and Time*, Oxford University Press.