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Newly-acquired Pre-cultural Behavior of the Natural Troop of Japanese Monkeys on Koshima Islet

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INTRODUCTION

The problem of pre-culture in the society of Japanese monkeys (*Macaca fuscata*) was first discussed and given a theoretical interpretation by K. Imanishi (1952). Since then the Primates Research Group has collected various kinds of data. A general view on the pre-culture* of Japanese monkeys was given by S. Kawamura (1956, '58, '59 and '64).

Sweet-potato washing is an example of pre-culture characteristic of the troop of monkeys in Koshima (a small islet in Miyazaki Prefecture, Kyushu). This was already reported by Kawamura (1954, '56, '58, '59, and '64), D. Miyadi (1959), and Kawai (1964). Kawamura and I observed the habit of sweet-potato washing occurred in the Koshima troop in 1953, and since then I have paid much attention to observing the pre-cultural phenomena (Kawai 1964 a, b).

Besides the sweet-potato washing behavior, the Koshima troop acquired some other new behaviors, which can be regarded as the pre-culture peculiar to the troop. I would like to discuss here the sweet-potato washing pre-culture and the new pre-cultural phenomena, especially, their process of acquisition and propagation, their causes, and finally, the meaning of these pre-cultures.

Before proceeding into the report, I should like to show my gratitude for the valuable advice and friendship of those who have long been with me in studying the Koshima Troop: Dr. Syunzo Kawamura of Osaka City University, Dr. Kisaburo Tokuda of Wakayama University, and Dr. Junichiro Itani of Kyoto University. For receiving valuable data and information my thanks go to Mr. Shigeru Azuma, Mr. Kenji Yoshiba of the Japan Monkey Centre, Mrs. Satsue Mito and Mr. Iwasuke Tokito. Furthermore, to Professors Denzaburo Miyadi and Kinji Imanishi of Kyoto University, under whose guidance I have long been, I would like to express my gratitude.

* S. Kawamura and K. Imanishi use the word "sub-culture" instead of "pre-culture." In this paper I will use the latter.

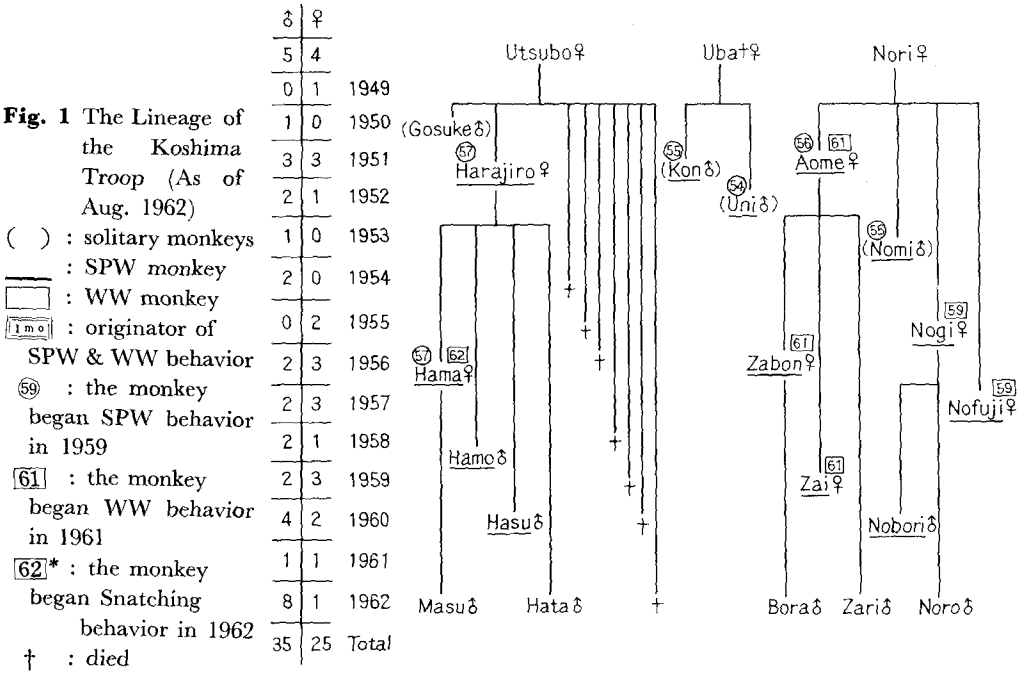


Fig. 1 The Lineage of the Koshima Troop (As of Aug. 1962)
( ) : solitary monkeys
——— : SPW *monkey*
▭ : WW monkey
imo : originator of SPW & WW behavior
(59) : the monkey began SPW behavior in 1959
[61] : the monkey began WW behavior in 1961
[62]* : the monkey began Snatching behavior in 1962
† : *died*

The Koshima Troop

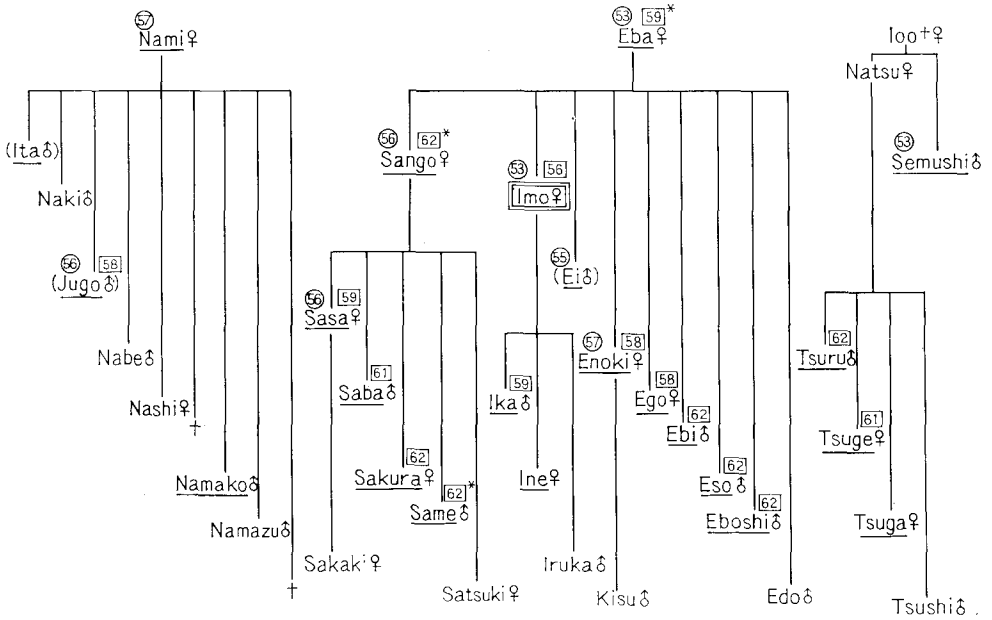
The Koshima troop, surveyed for the first time in 1948 by Drs. Imanishi, Itani, and Kawamura, was provisionized in 1952 (Itani and Tokuda 1958). At that time there were twenty monkeys in all, but in 1962 the number increased to 59*. As a result of the consecutive observations of the troop by several researchers, lineages of the monkeys have been made clear (Fig. 1). The knowledge of lineages has brought tremendous fruits to the sociological study of the troop, and enabled us to analyze fully the problem of pre-culture.

I. SWEET-POTATO WASHING (SPW) BEHAVIOR

1. Acquisition of SPW Behavior

Sweet-potato Washing Behavior is a behavior in which monkeys take the sweet-potato to the edge of the water and wash off the sand on the potato by water. Monkeys dip the potato in water by holding it in one hand, and then remove the sand by brushing the potato with the other hand. This SPW

* *Gosuke*, which is believed to be dead in about 1959, is not included here.



Males born before 1949: *Kaminari* (Leader)
Akakin (Leader)
Mobo (Sub-leader)
Hiyoshimaru
(*Hanakake*)

behavior was begun in September, 1953 by a female named *Imo'*, one and a half years old at that time.* This behavior spread to others gradually, and by 1956 eleven monkeys acquired it. The process of propagation of this behavior until 1956 was reported by Kawamura (1954, '56) and Miyadi (1959).

Table 1 shows those monkeys who acquired the behavior during the period from 1953 to March 1958. Two of the 11 adults (6 males and 5 females), that is, 18.1% acquired SPW behavior, and 15 of 19 monkeys, aged between two and seven (10 males and 9 females), that is, 78.9%, acquired also the behavior.**

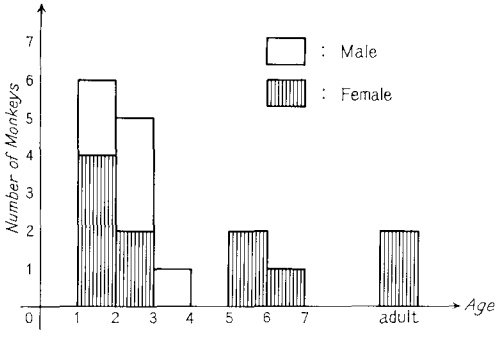
* To all the monkeys of Koshima are given names and numbers. Numbers from 1 to 99 are given to males, three figures to females. To those who were born after 1953, numbers are given according to the order of their birth. The identical initial letters of names indicate, as a general rule, the mother-child and brother-sister relationships. For example, the children of *Eba'* are named *Ei·*, *Enoki'*, *Ego'*. Signs on the right shoulder of names show either sex; A· is male and A' is female.

** Kawamura reported in 1954 that *Naki·* had shown SPW behavior, but in the report of 1956 he excluded *Naki·*. Having never seen *Naki·* do SPW behavior since 1953, I omitted *Naki·* from monkeys of SPW behavior.

Table 1. The Year and Age When SPW Monkeys Acquired SPW Behavior

Year	Age 1-1.5	2-2.5	3	5	6	adult	Total No. of monkeys
1953	*Imo'*	*Semushi·*				*Eba'*	3
'54	*Uni·*						1
'55	*Ei·*	*Nomi·*	*Kon·*				3
'56	*Sasa'*	*Jugo·*		*Sango'*, *Aome'*			4
'57	*Hama'*, *Enoki'*				*Harajiro'*	*Nami'*	4
'58		*Zabon'*, *Nogi'*					2
Total	6	5	1	2	1	2	17
♂	2	3	1	0	0	0	6
♀	4	2	0	2	1	2	11

Fig. 2 Age when monkeys began SPW behavior and number of SPW monkey



By the surveys made in December 1961 and January 1962, almost all monkeys, excepting those adults born before 1950, were observed performing SPW behavior. In August 1962 the same result was observed. As of the last date, 36 monkeys out of 49 monkeys above two years old did SPW behavior (73.4%). Monkeys which do not do SPW behavior were 13 in all (Table 2).

In other words, out of 11 monkeys older than 12,* that is, born before 1950, only two females, *Eba'* and *Nami'*, do SPW behavior. The percentage of adults' acquisition of SPW behavior is very low. Among the monkeys born after 1951, only four do not perform the behavior. It is noteworthy that they are all *Nami'*'s children. They are lacking in the fundamental conditions of acquiring the behavior, to which I will come back later.

* Ages are as of August 1962.

Photo 1. A monkey running to the shore to wash sweet potatoes in the sea water, holding them in both hands.

Photo 2. A monkey washing a sweet potato (SPW behavior)

2. Process of Propagation

The acquisition of SPW behavior can be divided into two periods; before and after 1958. I shall call them the first period and the second period respectively.

1) The First Period (The Period of Individual Propagation)

This is the period when monkeys born before 1956 acquired SPW behavior. The time and process of acquisition are diverse. Adult monkeys which did not acquire the behavior during this period could not acquire it since then.

The acquisition of SPW behavior and the process of propagation during the first period are very interesting. Fig. 1, Fig. 2, and Table 1 show the importance of age, sex, and kinship as the factors of acquiring SPW behavior.

Most competent for acquiring SPW behavior are juveniles of 1-2.5 years old (Fig. 2). Almost every monkey acquired the behavior when they were at

Table 2. Monkeys of the Koshima Troop and Newly-acquired Behavior (As of Aug. 1962)

Year Born	Age	Male	Female	SPW	WW	B	GM	No. of beh. acquired	
								Male	Female
before 1949	over 13	*Kaminari*		0	0	0	++	1	
		Akakin		0	0	0	++	1	
		Mobo		0	0	0	+	1	
		Hiyoshimaru		0	0	0	+	1	
		*Hanakake**		0	0	0	+	1	
			Utsubo	0	0	0	+		1
			Nori	0	0	0	0		0
			Eba	+	S	+	+		4
			Nami	+	0	0	0		1
1949	13		*Natsu*	0	0	0	0		0
1950	12	*Gosuke**		0	0	++△	?	1	
1951	11	*Kon**		+	0	0	+	2	
		*Ita**		+	0	0	+	2	
		Semushi		+	0	0	+	2	
			Sango	++	S	++	++		4
			Aome	++	+	0	++		3
			Harajiro	++	0	+	++		3
1952	10	*Uni**		+	0	0	?	1	
		Naki		0	0	0	+	1	
			Imo	++	++	++	++		4
1953	9	*Nomi**		+	0	0	++	2	
1954	8	*Jugo**		++	+	++△	+	4	
		*Ei**		+	0	0	+	2	

these ages. Almost all of the males acquired the behavior at these ages, but males older than four found it difficult—almost impossible, we might say—to acquire the behavior. Females, on the other hand, could acquire SPW behavior even if they were older than four. For females which acquired the behavior belong to three generations; 1-3 years old, 5-6 years old, and adult.

What is the cause of the difference between male and female in acquiring the behavior? In order to acquire SPW behavior, though the mechanism of acquisition is unknown, close social interaction with those who are in SPW behavior (SPW-monkey) is required at the feeding time. In this lies a difference between male and female due to their social status. When a male monkey becomes four years old, he begins to move from the central part of the troop to the peripheral part, entering into the ordinary male class. Therefore, adolescent and adult male's social interactions with females and juveniles in the central part are very limited. Especially, fearful of the leaders, males feed where theyare not attacked by the leaders. So that they seldom feed

Table 2. (contd.)

Year Born	Age	Male	Female	SPW	WW	B	GM	No. of beh. acquired	
								Male	Female
1955	7		*Nogi*	++	+	+	++		4
			Sasa	++	++	+	+		4
1956	6	*Tsuru*		+	+	+	+	4	
		Nabe		0	0	+	+	2	
			Enoki	+	+	++	++		4
			Zabon	+	+	+	0		3
			Hama	+	+	++	++		4
1957	5	*Ika*		+	+	+	0	3	
		Saba		+	+	++△	+	4	
			Ego	++	++	++△	++		4
			Nashi	0	0	+	0		1
			Nofuji	+	+	+	++		4
1958	4	*Ebi*		+	+	++△	0	3	
		Hamo		+	0	+	+	3	
			Tsuge	+	+	+	+		4
1959	3	*Namako*		+	0	+	0	2	
		Eso		+	+	+	+	4	
			Zai	+	+	++^	+		4
			Ine	+	0	++^	+		3
			Sakura	+	++	++^	+		4
1960	2	*Same*		+	S	++^	+	4	
		Eboshi		+	+	++^	±	4	
		Namazu		0	0	0	0	0	
		Nobori		±	0	+	0	2	
			Hasu	±	0	+	±		3
			Tsuga	+	0	+	±		3

++, + : degree of skill and completeness in conducting the behavior (++>+).
± : incomplete acquisition
0 : not acquired
S : snatching behavior
^ : swimming
* : solitary male

together with females and juveniles. As a result, adolescent males hardly acquire SPW behavior through social interaction.

Females have astrong grouping tendency. Particularly, mother and child often move together. It is among those who have the strong social affinity that co-feeding is possible and mother and child usually co-feed (Kawai 1958; Yamada 1963). Kawamura remarked (1954, '56), suggesting the typical example of *Imo*' and *Eba*', that the propagation of SPW behavior was done through mother-

child relationship. For, though *Eba'* is an adult female, she acquired SPW behavior at the earliest time. The same can be said with *Nami'*, who showed the strongest maternal care of all the females of the troop. Probably she acquired the behavior through *Jugo'*, who is skillful of SPW behavior. The same can also said with the three females who acquired the behavior while they were five or six years old. It is not known whether they acquired the behavior through brothers and sisters or through other members of the troop. But most probably they were always abound in the opportunities of acquiring the behavior as they were in the central part.

Judging from the fact that only two females out of 11 monkeys born before 1950 acquired the behavior, old age is obviously a great obstacle to the acquisition of the behavior. Adults generally have difficulty in acquiring the behavior, unless they are under particular conditions such as a very close mother-child relation or an excellent intellect.

As regards the process of propagation in the first period, there is a remarkable phenomenon during five years after the beginning of SPW behavior (1953-1957). It is that, within the same kinship, the order of the acquisition of the behavior is from the young to the old (Fig. 1); that is, child, rather than mother, and younger brother and sister, rather than elder ones, acquire the behavior. Kawamura once pointed out that propagation of the behavior has two courses; through playmates relations and through kinship. The course of propagation shown in Fig. 1 supports this. In this propagation it is believed that the process is mostly from child to mother, and from younger to elder brother and sister; that is, kinship propagation is from the younger to the older.

As propagation is done, in the first period, through the relationship of individuals, we call this period the period of individual propagation.

2) The Second Period (The Period of Pre-cultural Propagation)

After 1959 aspects of propagation were different from those of the first period. SPW behavior was no more a new mode of behavior to the troop as it was fixed as pre-culture during 1958-59. Monkeys born during this period accepted SPW behavior as a normal feeding behavior and learned it without any resistance at all.

SPW-monkeys eat potatoes at the edge of water. So that the potato skin is scattered around at the bottom of water. Babies, who have the experience of eating potatoes in water at the beginning of the development of feeding behavior, are conscious of the association of potato with water. In the process of learning, eating potato by picking it up out of water is to them equally on a level with eating natural food.

Being always with mothers, babies stare at their mothers' behavior while mothers are doing SPW behavior. In this manner infants acquire SPW behavior through mothers' behavior. Therefore, the process of propagation in this period is, different from that of the first period, always from mother to child.

The process of acquiring the behavior in infant and juvenile I of this

period is as follows:

a) Strengthening affinity to water.

Infants are taken to the edge of water during the period when they are dependent solely on mother's milk for nourishment. While mother is in SPW behavior, they strengthen affinity to water by being dipped in water, or sprashing water by hand.

b) Eating potato in the water.

Infants eat fragmentary pieces of potato that mother dropped in the water. This begins at half a year old.

c) Acquisition of SPW behavior.

Infants acquire it while they are 1-2.5 years old. For example, in December 1961, five monkeys of 2.5 years old (*Zai'*, etc.) acquired SPW behavior in its complete form. But out of six monkeys of 1.5 years old (born in 1960), only *Eboshi·* acquired SPW behavior. By August 1962, of these six monkeys, *Eboshi·*, *Same·*, and *Tsuga'* learned the behavior completely, and *Hasu'* and *Nobori·* incompletely. (Of these six monkeys, *Namazu·* only has not yet acquired the behavior.)

Thus, in the second period the acquisition of SPW behavior begins simultaneously as infant. In the first period, sex and age were important factors facilitating propagation. But in the second period, acquisition or propagation of SPW behavior occurs independently of these two factors. That is, in acquiring the behavior, it is believed, pre-cultural pressure is working. Therefore, I will call the second period the period of pre-cultural propagation.

3. Variations of SPW Behavior

1) From Fresh Water to Salt Water

During 1953-1954 SPW behavior was done on the edge of a brook running into the sea. Monkeys never washed potatoes by salt water, but by fresh water (Kawamura 1954). At the surveys of 1957 and 1958 we discovered many a monkey washed potatoes by salt water. There is no record about the individual monkeys, but among the SPW-monkeys, there was, it seems, none who wash potatoes only by fresh water.* At the survey of December 1961, all the SPW-monkeys washed potatoes both by salt water and by fresh water. But when they used fresh water, there were particular reasons; for example, they were given potatoes by the fresh water, or, subordinate monkeys avoided coming near the sea-shore for fear of the dominant. In other words, SPW-monkeys preferred much salt water to fresh water in the behavior. For one thing, the quantity of fresh water is small. In the draught season the brook which runs into the sea is dried up. (There is always water in the small pool made artificially [ab. 30 cm×60cm], but that is not enough in matters of space for many monkeys to do washing potatoes.) Another reason is that, if

* At the surveys of 1957 and 1958, no individual records were collected whether washing was done by salt water or by fresh water. Surveys of 1958 and 1959 were done by Azuma and Yoshiba, who, we expect, will report their observations.

Table 3. SPW Monkeys Classified by Three Types of SPW Behavior

Year Born	Age	Male			Female		
		B-type	BS-type	S-type	B-type	BS-type	S-type
	over 11				*Eba, Nami*		
1951	11	*Semushi*			*Sango, Aome, Harajiro*		
'52	10				*Imo*		
'53	9						
'54	8						
'55	7				*Nogi*	*Sasa*	
'56	6			*Tsuru*	*Hama, Zabon*	*Enoki*	
'57	5		*Ika*	*Saba*		*Ego, Nofuji*	
'58	4		*Ebi, Hamo*				*Tsuge*
'59	3		*Namako, Eso*		*Zai*	*Sakura*	*Ine*
'60	2		*Same, Eboshi*	*Nobori*			*Hasu, Tsuga*
Total No. of monkeys		1	7	3	10	5	4
			11			19	

monkeys become familiar with salt water, it makes potatoes taste good. These caused monkeys, it is supposed, to prefer salt water to fresh water.

2) Seasoning Behavior

SPW-behavior is, as we have seen above, to dip a piece of potato by holding it in one hand and to brush off sand from it by the other hand. *Imo*,' the originator of SPW behavior, does the typical behavior. But in order to remove sand they do not always brush the potato. Often they let fall the potato in the shallow water and wash the sand off by rolling it with one hand. Among the monkeys of the first period, such monkeys as *Eba*', *Sango*', *Sasa*' more frequently roll the potato than brushing the sand off with one hand. Therefore, there are two types in SPW behavior; brushing type and rolling type.

But during the second period a third type appeared. It consisted in dipping the potato into the water everytime after gnawing it once or twice. This behavior seems quite different from brushing the sand off from the potato. They collect potatoes and take them to the sea-shore. But if this is not for the purpose of washing, what reason is there in this behavior except for seasoning potatoes with salt water? Therefore, I will call this behavior "the seasoning behavior."

But it must be admitted that there is no monkey who does only the seasoning behavior. For example, out of ten tests applied to *Saba*', seven were seasoning behavior, two were rolling wash, and one was brushing wash. Interesting to notice was the fact that, when a piece of potato with full of sand on it was given, he removed the sand by a complete brushing wash behavior. He possesses himself of the technique of brushing wash, but he uses it, it seems, only when he feels its necessity.

Table 3 gives the individual classification of the three types of SPW behavior. Among the thirty monkeys tested (11 males and 19 females), 11 belong to brushing type (B-type), 12 belong to brushing-seasoning type (BS-type), and 7 belong to seasoning type (S-type).* We can conclude from Table 3 that those who belong to B-type, that is, who retain the old style are those who acquired SPW behavior in the first period. And, those who acquired SPW behavior in the later second period show strong inclination towards S-type.

The reason is that, because propagation in the first period, as seen above, was done through individual relationship, B-type behavior acquired in the first period was fixed within the SPW-monkeys. On the other hand, individuals who acquired SPW behavior in the second period are acquainted from their infancy with eating potatoes in water. So that they learn in the beginning to eat potatoes with salt-seasoning or wet with water, and then acquire brushing behavior of removing sand from potato. Hence many BS-types, and S-types, especially, among the younger monkeys.

Another remarkable phenomenon of the propagation of the behavior type is that within the same kinship there is a strong inclination towards the same behavior type. Conspicuous examples are found in the lineage of *Aome'* and among *Tsuru'* and his younger brother and sisters. *Aome'* is skillful in brushing, and her younger sister *Nogi'* and her children *Zabon'* and *Zai'* belong to B-type. That *Zai'* is the only monkey of B-type among the SPW-monkeys of the second period supports the idea of the propagation of the behavior through lineage. The three children of *Natsu'* who are all of S-type support also this idea. Different from these is the lineage of *Harajiro'*. The four SPW-monkeys belonging to this lineage have various behavior types. *Eba''s* family also does not show any marked lineage propagation. Therefore, it is proper to conclude that behavioral type of SPW is propagated either through lineage or through some other course.

We have discussed so far Seasoning behavior as being included in SPW behavior, but strictly speaking, it should not be. SPW behavior is a kind of cookery. If cookery can be classified into physical and chemical processes, SPW behavior is the former, while Seasoning behavior is the latter. Monkeys, we might say, beginning with the physical cooking of removing sand from potato, came to know the chemical cooking of seasoning.

II WHEAT-WASHING BEHAVIOR

1. Wheat-Washing Behavior

1) Acquisition of Wheat-washing Behavior

The Koshima troop has another pre-cultural behavior similar to SPW behavior. It is Wheat-washing behavior (WW behavior).

* Solitary males are not included in this table as their tests could not be done satisfactorily.

Table 4. Age and Year When Monkeys Acquired WW Behavior and Snatching Behavior

Year	Adult	6.0	5.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	total	observer
1956						*Imo'*						1	Kawamura
1957									(*Jugo·*)			(1)	Kawai
1958					*Jugo·*				*Enoki'*		*Ego'*	3	Yoshiba
1959	*Eba'**					*Nogi'* *Sasa'*		(*Zabon'*) *Enoki*(*)		*Nofuji'* *Ika·* *Ego'** *Saba·*(*)		4,4*(1)	Azuma
1961 -'62	*Aome'*		*Zabon'*		*Saba·*		*Tsuge'* (Ebi·)		*Zai'* (*Eso·*)			5,(2)	Kawai
1962 (Aug.)	*Sango'**	*Hama'* *Tsuru·*				*Ebi·*		*Sakura'* *Eso·*		*Eboshi·* *Same·**		6,2*	Kawai
Total	1,2*	2	1			6	3,(2),1*		5,3*		1	19,6*	

( ): incomplete acquition
*: Snatching Behavior only
(*): WW Behavior + Snatching Behavior

When grains of wheat are scattered about on the beach, monkeys eat them painstakingly picking one grain up after another. But once a monkey gathered the grains of wheat together with sand and, by throwing them into water, succeeded in separating grains of wheat from sand. This is called Wheat-Washing behavior, or, due to its resemblance, placer-mining behavior.

This behavior, begun by *Imo'**, was first observed by Kawamura in 1956. *Imo'* was then 4 years old and was well acquainted with SPW behavior.

A survey was made by Yoshiba from November 1958 to January 1959; another by Azuma in June 1959. According to these surveys, three monkeys were found in WW behavior in the former date and four other monkeys were found in the latter date. That is, by June 1959, 8 monkeys did WW behavior.

Between December 1961 and January 1962, 5 other monkeys were added to the 8 WW-monkeys. Three others were observed once or twice doing WW behavior (i.e., *Ebi·*, *Eso·*, and *Hama'*). Their behavior is still immature and is not yet fixed.

According to the survey made in August 1962, WW behavior of the three monkeys above mentioned was found fixed and three other monkeys acquired the behavior. Therefore, by August 1962, 19 monkeys in all acquired this bahavior (Table 4). To 49 monkeys from which one-year-old monkeys are excluded they reach the percentage of 38.7. Seven of the 19 monkeys are male and 12 are female.

2) Process of Propagation

WW behavior was begun when man gave monkeys grains of wheat by scattering them on the beach. In this respect WW behavior was begun under an artificial condition.

* According to Mrs. S. Mito, she made the observation of 8 ♂ doing this behavior in 1954. But as no one has ever seen WW behavior of 8 ♂ since then, we ascribe the origination of the behavior to *Im* '.

Imo', who was the originatior of SPW behavior, initiated also WW behavior in 1956. At the survey I made in 1957, WW-monkey was *Imo*' alone. But in that year, we used much wheat for the wheat-box test in order to analyze the dominance rank order. Because of this monkeys grew familiar with wheat food, which contributed much, it seems, to quicken the growth of WW behavior among the monkeys. (During this period *Jugo·* began, although incompletely, WW behavior.)

Yoshiba and Azuma, noticing WW behavior of *Imo*', gave her conditions to strengthen this behavior by burying the grains in sand, stamping them. This resulted in increasing the number of monkeys who learned WW behavior.

a) Courses of Propagation

The propagation of WW behavior can be considered individualistic up to 1962. We would like to discuss here through what course WW behavior was propagated from the initiation by *Imo*' in 1956 to August 1962, and then what the conditions of acquiring this behavior were.

Lineage and Playmate Relationship

The Process of propagation of WW behavior is the same with that of SPW behavior; that is, propagation is done through playmates and through lineage. Especially conspicuous is the propagation through lineage. Of 15 monkeys (not including one-year-old infants) of *Eba*''s lineage, to which *Imo*' belongs, 13 do either WW behavior or Snatching behavior.* *Nori*''s family also shows high percentage of acquisition. In 1961 this behavior was propagated to monkeys of the *Natsu*' and in 1962 to those of *Harajiro*', and that only a few members of the lineages could acquire it. An exception is, as was with SPW behavior, the *Nami*''s lineage, in which only *Jugo·* does WW behavior but others do not. *Jugo·* began the behavior in 1958, which was quite an early date of this behavior. But the fact that others of *Nami*''s lineage do not do WW behavior suggests that monkeys of this lineage are low in the faculty of acquisition.

Age and Sex

Ages at which the behavior was acquired are shown in Table 4 and Fig. 3. According to these date, WW behavior is most acquired by monkeys aged two, three, and four**.

Judging from the fact that two of six years old, one adult, and one of one and a half years old acquired the behavior respectively, monkeys older than six and one year old are not as good as others in acquisition faculty. Particularly, since none of those monkeys older than 12 (born before 1950) do WW behavior, adults' faculty of acquisition is very poor. The point of this fact is, besides the general low adaptability of adult as was with SPW behavior, whether they were already in adolescent or adult at the time of provisionization.

* Of Snatching behavior see II-2

** Azuma discovered in 1959 the germinal behavior of WW behavior done by *Zabon*'. There is a strong possibility that *Zabon*' acquired WW behavior in 1960, when she was four.

Is difference of sex an important factor in the acquisition of WW behavior? Apparently females give the impression of being superior in the acquisition faculty as out of 19 WW-monkeys 12 are female. But, taking into consideratian the lineage and the playmate relationship, difference of sex is not counted important in juveniles.

However, in adolescent II and in adult difference of sex becomes important. Males in adolescent II move to peripheral part and some of them become solitary males. As a result, they have little opportunities to get WW behavior through social interaction. Adult females, on the other hand, have chances of acquiring the behavior through mother-child relationship. But adult males have no such chances of acquiring the behavior through individual relationship. Because of this there are no adult males who do WW behavior. As seen above, difference of sex can be considered on a level as in SPW behavior.

b) Pre-cultural Propagation

By August, 1962, WW behavior was propagated to four lineages. Monkeys born after 1952, except for *Nami*''s children, will most probably acquire WW behavior sooner or later.

In August 1962 one-year-old *Iruka*· and *Sakaki*' (the only infants born in 1961) were seen several times scratching sand with their fingers while their mothers were doing WW behavior. Knowing not its meaning, they were imitating what their mothers were doing. Probably through this imitative behavior they will acquire WW behavior. Five monkeys of two years old, although they did not do WW behavior yet, were observed at times picking up wheat in the water. But they did not scratch sand as *Iruka*· did.

These facts lead to the assumption that WW behavior was then about to be fixed as a pre-cultural behavior of the troop.

2. Snatching Behavior

1) Snatching Behavior

Some monkeys, keeping watch on WW-monkeys, snatch the grains of wheat when they are thrown into water by WW-monkeys. We call this, Snatching behavior, which was first observed by Azuma in 1956 (personal communication). In July 1959, an adult female, *Eba*', and 2-year-old *Saba*· showed this behavior. *Enoki*' (3)* and *Ego*' (2) did WW behavior, but they showed often Snatching behavior, too. (Table 4, Fig. 3)

During the period from December, 1961 to January, 1962 when I made observations of monkeys, *Eba*' alone performed Snatching behavior. *Saba*' (4.5), reported by Azuma, acquired WW behavior by that time, and *Enoki*' (5.5) and *Ego*' (4.5) did not any more snatch others' wheat, but did WW behavior only.

In August 1962, besides *Eba*', *Sango*' (11) and *Same*· (2) began Snatching behavior. *Eba*' and *Sango*', ranked as No. 1 and No. 2 among the females, are monkeys of high activities. When they approach towards others aggressively, other monkeys run away from them. So *Eba*' and *Sango*' can eat wheat in water

* Numerals in parentheses stand for age; e.g., *Enoki*(3) is *Enoki*, three years old.

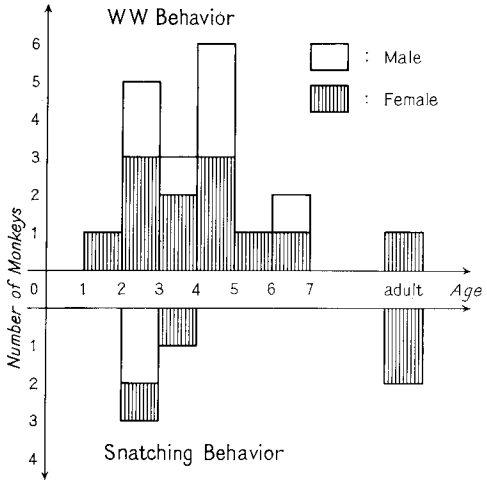


Fig. 3 Age when monkeys began WW behavior and number of WW monkey

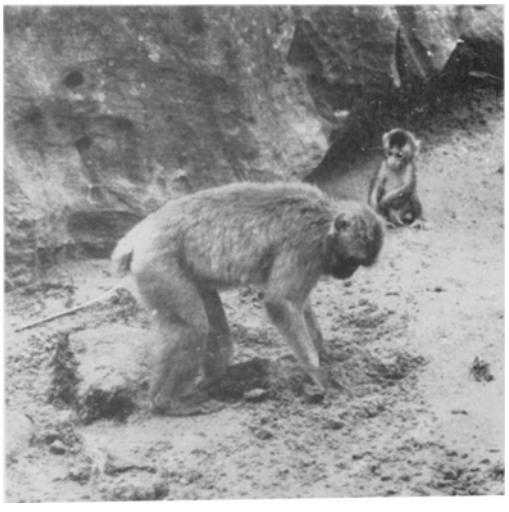


Photo 3. A monkey gathering wheat thrown on the sand. Monkeys throw the wheat and sand into the water and pick up the wheat which comes up to the surface.

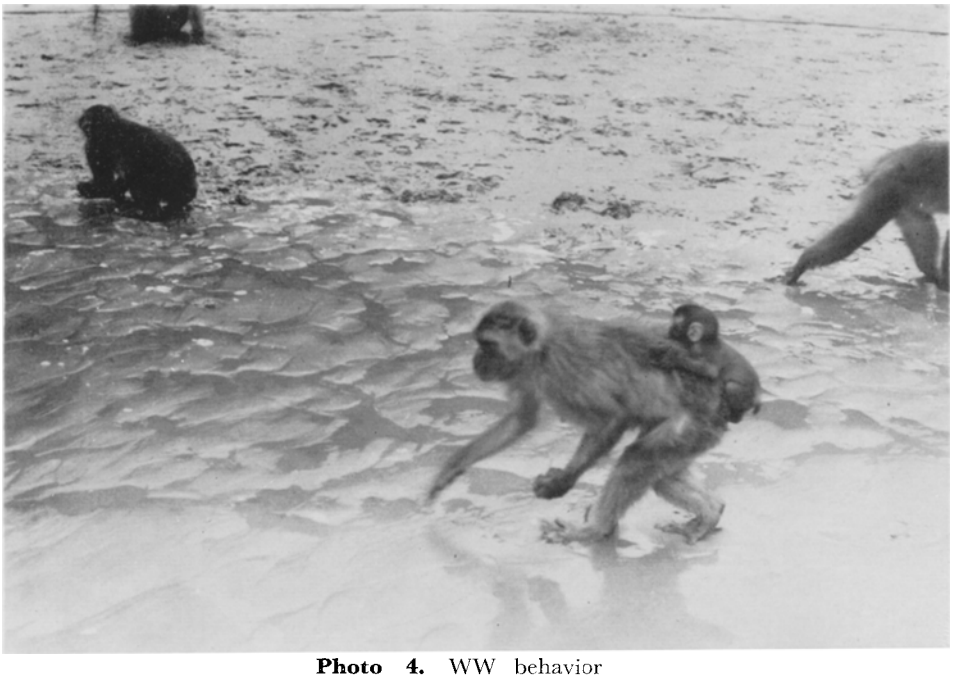


Photo 4. WW behavior

without any efforts. *Same'*, on the other hand, who is given a high tolerance to co-feeding as he is still two years old, comes near monkeys in WW behavior and eats wheat together, or collects the grains floating towards him, or eats left-overs after WW-monkeys are gone.

When grains of wheat are thrown over on the beach, *Eba'*, *Sango'*, and *Same'* keep watch on the movements of WW-monkeys. And when WW-monkeys, taking the wheat to the edge of water, plunge it into water, then *Eba'* and *Sango'* disperse them by making an attack on them and succeed in getting the wheat.

2) Two Types of Snatching Behavior

As suggested above, in Snatching behavior there are two types.

One is collecting the left-overs, as shown in *Same'*'s behavior. This is peculiar to juveniles and develops later into WW behavior. Therefore, this is a behavior at the stage before the acquisition of WW behavior. Azuma observed *Enoki'* and *Ego'* both in WW behavior and Snatching behavior, and later he observed *Enoki'* do the perfect WW behavior, giving up Snatching behavior all of a sudden (Azuma, personal communication). In 1961, they were most skillful in WW behavior.

The other type is plundering, as suggested by the behavior of the two adults, *Eba'* and *Sango'*. They attack WW-monkeys and plunder the wheat by themselves. They do not do WW behavior themselves, but let other WW-monkeys wash the wheat for them. *Eba'* began this behavior in 1959, and during 1961-1962 her behavior became habitual.

Because by plundering they can monopolize the fruit of labor made by WW-monkeys, their behavior is far more effective to them than WW behavior itself. *Eba'* and *Sango'* do Snatching behavior often and importunately. They will, we believe, habitually do the plundering type of Snatching behavior without acquiring WW behavior.

Snatching behavior is worth noticing. For Japanese monkeys usually do not plunder others' food by attack except for special occasions. Therefore, Snatching behavior has an important implication as a behavior to take advantage of others' labor. The behavior of this type has not been observed among other Japanese monkey troops.

III BATHING BEHAVIOR

1. Acquisition of Bathing Behavior

Monkeys of Koshima, although they are leading lives on a small islet surrounded by the sea, never went into the sea. After they were accustomed to salt water by SPW behavior, all that they could do was just to dip their hands and feet in water. None of them bathed in water.

However, in the summer of 1959 Mrs. Mito attracted monkeys to go into the water of Otomari Bay by throwing peanuts in the sea. Since then some

monkeys went into the sea to get peanuts. The first monkey who went into the sea was, it is reported (Mito, personal communication), two-year-old *Ego'*. We call this behavior of going into water Bathing behavior (B behavior).

At the short survey made in the summer of 1960 a few monkeys born after 1954 were observed to bathe. (*Ego'*, *Jugo·*, *Saba·'*, and *Ebi·* were identified, but others were not.)

By the thorough investigations made in January and in the summer of 1962, the following facts were made clear.

1) Of the 49 monkeys available to the investigation, 31 were observed doing B behavior (63.2%).

2) All the monkeys born after 1955, excepting only 2 one-year-old monkeys and *Namazu·*, bathed in the water.

3) Of the monkeys born before 1955, only *Eba'*, *Sango'*, *Harajiro'* and *Imo'* took themselves into water. Other adults not only never bathed in the sea, but also hated to dip even their feet,* with the exceptions of *Akakin·* and *Nami'*, who occasionally dipped their wrists and ankles. Adults who have performed B behavior are 2 solitaries** out of 14 males and 4 out of 9 females.

2. Process of Propagation

1) Age

Monkeys who acquired B behavior in the early date (1959-1960) were, it is reported, *Ego'* (2), *Nofuji'* (2-3), *Jugo·* (5), *Saba·* (2-3), and *Ebi·* (2). There were some others whose names are unidentified, but no adults are found in this group. Therefore, B behavior was begun, it is safe to assume, by juveniles of two or three years old.

The propagating speed of B behavior was fast. Only within three years after the appearance of Bathing-monkeys, almost all juveniles and adolescents acquired the behavior. Adaptability for B behavior is very high in young monkeys. The percentage of acquiring the behavior of those born after 1955, excluding two monkeys born in 1961 and 1962, is 96.1%.

These two monkeys were one year old as of 1962. So that it is difficult, it seems, for one-year-old monkeys acquire B behavior.

The percentage of acquisition of adults is very low. It is only 26.0%, for only 6 out of 23 adults to B behavior.

2) Sex

How is difference of sex related to the acquisition? No particular differentiation due to the difference of sex can be observed in juveniles and adolescents.

In adults the percentages of acquisition are greatly different in males and females. *Jugo·*, who does B behavior, acquired it when he was 5 years old.

* Exceptions are made when they run along the beach in shallow water getting chasing attack.

** *Gosuke·* is believed to be drowned to death when he was trying to swim to the other shore across the sea. *Jugo·* swam to the other shore in 1960 and swam back to the islet in the fall of 1964.

So that, generally speaking, it is very difficult for adult males to acquire B behavior.

On the other hand, 4 out of 9 adult females are familiar with B behavior. Why do they have higher percentage of acquisition than males? It is only in these 4 monkeys who do B behavior and in *Aome*' and *Nami*' that SPW behavior is practiced among all the adult females. In other words, towards a new situation these 4 monkeys have strong adaptive tendency which has been brought up by SPW behavior. As a result, they adapted themselves quite easily to bathing.

Another factor to be taken into account is a mother-child relationship. Mother-child relationship is so close that mothers are easily influenced by children and are led, it is believed, to the acquisition of B behavior.

Quickness of propagation is characteristic of B behavior. In regard to this two reasons can be mentioned. One is that the cause which gave rise to the behavior was to throw in the sea their most favorite food, peanuts. This contributed much, we suppose, to change monkeys' conservatism.

The other is that, different from SPW behavior, bathing is the matter of adaptation to a new habitat. In SPW behavior intellectual factor has to a large extent to do with its acquisition. But acquisition of B behavior is simply a matter of adapting oneself to a new environment and of changing conservatism. This makes us feel a strong interest in monkeys' conservatism, which is especially remarkable in adult male. Adaptability to a new habitat is high in juveniles and adolescent, medium in adult female, but very low in adult male.

3) Pre-cultural Propagation

Infants are offered a very good opportunity in acquiring the behavior because mothers go into the sea with their infants clung on to themselves. But mothers do not pay any particular attention whether or not their children are dipped into water. Often infants are completely under water. In this

Photo 5. Monkeys bathing at the beach of Otomari.

way, not long after their birth, infants are adapted to bathe in water. As a result, infants accept the sea as a habitat and feel no reluctance in bathing. When they come to lead independent lives the sea is already part of their habitat as much as the mountain. Therefore, the acquisition of B behavior is to infants a pre-cultural acquisition. Thus B behavior is easily fixed among the troop.

3. Variation of Bathing Behavior

In B behavior, almost all monkeys do quadrupedal locomotion in the ankle-deep shallows. In the deeper places monkeys do bipedal locomotion. Often they are seen bathing, dipping themselves up to shoulders, or doing quardrupedal locomotion with only head held above water.

In bipedal locomotion, the degree of dipping themselves are different: some up to knees, others up to waist, and others up to breast. In every case they try as far as possible to avoid wetting their hands. Mothers do not pay any attention to bathing their child when it clings on their back or their breast. Even when infants are completely under water and are sometimes about to be drowned, mothers are careless of it.

Monkeys that do swimming are 10 (Table 2); eight monkeys of 2 to 5 years old and 2 solitary males of adult.

Of these swimming monkeys, some juveniles, that is, 2 of two years old and 3 of three years old, began to take a strong interest in bathing itself. They performed diving from rocks and enjoyed swimming. Originally Bathing behavior began as a new behavioral pattern to get food in the sea. But these five monkeys have developed the behavior to get into the sea in order to avoid the heat or just to play in hot summer. Besides swimming, they began to dive under water skillfully and sometimes took sea-weed from the bottom of 1 or 1.5m deep. In other words, out of B behavior to get food in the sea they found new practices of playing and avoiding the heat. As of August 1962, among

Photo 6. Juveniles dive from rocks and dabble in water.

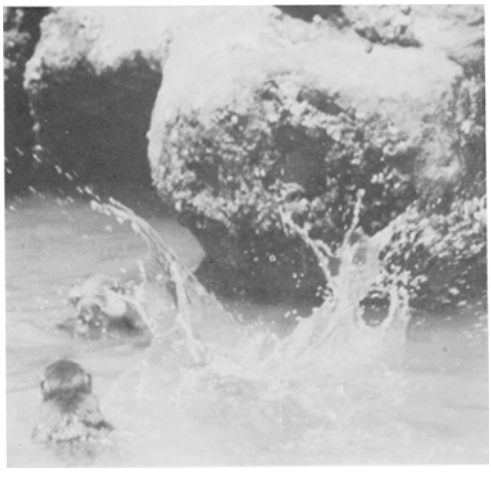


Photo 7. Leaders and almost all of adults do not enter the water. Whatever favorite foods are thrown in the sea, the leader (left) would not enter the sea.

the swimming monkeys, those of 4 and 5 years old do not do these practices. Noteworthy is the fact that this behavior was begun by the most playful juveniles. It will probably be propagated to most juveniles. But how it will be propagated to adolescents and adults is hardly be guessed because this behavior includes two practical purposes that are peculiar to juveniles, that is, play and avoidance of the heat.

IV "GIVE-ME-SOME" BEHAVIOR

1. Give-me-some Behavior

While the observer puts his hand into the pocket to take out peanuts, monkeys wait sitting in front of him, taking the posture of let-me-have-please; that is, with his lower arm raised a little, his forearm held out, and flexed fingers pointing upward (Photo 8). This behavior quite resembles that of a human child when he is given sweets or cookies. We call this Give-me-some Behavior (GM Behavior).

GM behavior is a kind of anticipatory response. The hand showing the attitude of "Give me" is in symbolic process. When the food is offered, the monkey takes it not with the hand which is held out, but with the other hand. For example, when "Give me" posture is made by the right hand, the left hand is always used for taking the food.

There are some variations in GM behavior. In a type the lower arm is kept close to the side of the body and the forearm is held out in a horizontal position. In another, the monkey standing on the feet, both arms are held up. In the other, the lower arm is kept close to the side, while the forearm is raised a little and the palm is turned toward the giver of the food. These behavioral patterns are unvariable within each individual monkey.

The hand used for GM behavior is also almost fixed in each individual monkey*. Of 44 monkeys put under the test, 12 used the right hand in GM behavior, 9 used the left hand, and 7 used either hand as occasion varies.

GM behavior can not necessarily be seen always when monkeys are given food. When they are not psychologically calm, that is, under a situation to be easily disturbed by others, or near the leader or other dominant monkeys, they do not show GM behavior.

2. Acquisition and Propagation

Out of 47 monkeys available to the test, 37 performed GM behavior.** (2 one-year-old monkeys were not tested). The percentage is 78.8, which is higher than the percentage of SPW behavior.

Among 24 males, 19 (79.1%) do GM behavior, and among 23 females, 18 (78.2%) do it. No difference due to sex can be observed in the acquisition of GM behavior.

* Results of this test will be reported in the future.

** This Number includes 3 monkeys who do the behavi r inc mpletely.

Photo 8. A monkey conducting give-me-some behavior. He is waiting for food with his elbow bent.

High percentage of acquisition in adults is characteristic of this behavior. In this respect, this GM behavior is different qualitatively from SPW, WW, and B behaviors. Of 21 adult monkeys, only 3 females do not show GM behavior. It is worth noticing that even leader males, who are very conservative, do GM behavior. In adult, then, it is easier for male to acquire this behavior than for female.

Monkeys who do not perform GM behavior are 10 (5 males and 5 females). Included in them are 3 children of *Nami*' (*Nasi*', *Namako*·, *Namazu*·). We might say that monkeys of the *Nami*'s kin are inferior in the acquisition ability of GM behavior.

The initiator and the first date of GM behavior are unknown. In 1960 Azuma noticed that *Kaminari*·, one of the leaders, did GM behavior (personal communication). Many monkeys must have performed the behavior in the pretty much earlier date. GM behavior cannot be seen unless the relationship between the man who gives the food and the monkey who is given the food is stable, and the monkey is in a calm situation not to be attacked by others. Therefore, it was quite difficult for an observer, it may be supposed, to recognize the behavior as characteristic to a monkey.

The process of propagation of this behavior is unknown. But we suppose that monkeys at the age of two acquire it. For, of the 6 two-year-old monkeys, one does GM behavior, three do it in an imperfect form, and two do not. *Eboshi*· shows only his palm turned up, or raises his hand a little with his palm turned up. *Tsuga*' and *Hasu*' raise their hand just a little—a posture at an early stage of GM behavior. Of the monkeys of three years old, 4 out of five can perform GM behavior pretty well, but the behavior is not fixed well yet. It is in those monkeys older than 4 that GM behavior is fixed well.

These facts lead us to the conclusion that GM behavior is supposed to be fixed at the ages of four or five.

3. Meaning of GM Behavior

GM behavior is a kind of anticipatory response, in which the held-out hand shows the symbolic behavior representing anticipation. As mentioned above, monkeys generally take food in the other hand than the one which represents anticipation. But, in taking the food, only *Mobo·* and *Naki·*, whose intellectual faculty is low, use always the same hand that indicates anticipation. They take the food with the raised hand because they cannot, it is believed, regard the raised hand as symbolic of anticipation.

Why was GM behavior begun, and how was it propagated? Judging from the intellectual faculty of monkeys, the acquisition of this behavior is hardly ascribed to imitation.

GM behavior was born out of the relationship with human beings. After the provisionization, the relationship with man played a large part in the life of the troop. Compared with other monkeys of wild monkey parks, monkeys at Koshima are distinguished in that since the provisionization they have never bitten, attacked, and seldom threaten men. In other wild monkey parks there come a lot of ill-natured sightseers who do not give food gently or tease monkeys. So that monkeys on their turn snatch the food by threatening the visitors or bite at those who tease them. In such places monkeys and men are not always in peaceful relation.

At Koshima, on the other hand, there are few sightseers, and contact with monkeys is made mainly by the local lovers of monkey or researchers of monkey. Since a perfect friendly relationship is established between monkeys and men, monkeys need not snatch the food by threat or attack, and they have learned to wait. In short, what is characteristic of this troop is the gentle, friendly attitude towards men which is fixed in the troop. GM behavior is, it may be said, the symbolic behavior of such an attitude.

DISCUSSION

1. Meaning and Correlation of Newly Acquired Behaviors

We would like to discuss here the meaning and the correlation of the four behaviors newly acquired in the Koshima troop—Sweet-potato Washing, Wheat Washing, Bathing, and Give-me-some behaviors.

1) Bathing Behavior

This behavior, as we have seen above, is an adaptive behavior in relation to enlarging habitat environment or niche, or a behavior that is related to the habit of the maintenance of life.

It is not rare that Japanese monkeys go into the river or the sea. The Ohirayama troop bathes in the brook in summer. Many troops bathe in the river or in the pool; such as the Minoo troop (Kawamura, personal communica-

tion), Arashiyama troop (Hazama, Iwata 1962). The Okinoshima troop was relocated there (an islet) from Shodoshima, and males of from three to five years old began to get into sea water there. An interesting case is the Jigokudani troop, which was observed by Suzuki. At Jigokudani snow falls deep in winter and some monkeys there take a hot spring (Suzuki 1963, '65).

It is considered a general habit of Japanese monkeys to bathe or swim. But, as seen in the Koshima troop, this habit should be noticed as that of the troop rather than of individuals; that is, it is a behavior pattern to be treated within the category of pre-cultural phenomena.

Another point to be noticed is related to the adaptability and the tradition of the troop in Japanese monkeys. Surprising is the strong tradition of the Koshima troop never to have gone in water until then. But we learn through the Koshima troop that once that strong traditional conservatism began to break down by some cause or others, it can easily be removed.

The problems of food habit and territorialism, which have been treated as pre-cultural phenomena, can be considered on a level with Bathing behavior. We should pay attention to the fact that the tradition of the troop society controls individual adaptive behavior.

An experimental study of the propagation of food habit in the Takasakiyama troop, made by Itani in 1958, can be dealt with on a level with Bathing behavior. For the high percentage of getting new food shown in regard to monkeys below three years old—as reported by Itani— corresponds to the percentage of acquiring Bathing behavior.

2) SPW Behavior and WW Behavior

These two behaviors should be noticed as "inventive" behaviors as J. Frisch (1963) mentioned. Among Japanese monkeys any other "inventive" behaviors have not yet been discovered. These behaviors should be oriented as those in the pre-stage of material culture or tool using, or the behavior illustrating the process towards these.

That these two behaviors are of the same quality is shown in the same form of the graph representing the percentages of acquiring them (Fig. 4). The only difference is that in the period of individual propagation the acquisition age of SPW behavior is one and a half or two years old, while that of WW behavior is between two and four years old. This difference is due to the relative difficulty of acquisition. SPW behavior, to be referred to below, is sometimes observed within other troops as individual behavior, and seems to have a possibility of being acquired incidentally.

In WW behavior monkeys have to go through the procedure of collecting wheat by the hand and taking it together with sand and then selecting wheat in the water. In other words, in WW behavior a higher intellectual activity is required than in SPW behavior. WW behavior is more difficult in performance and requires in its acquisition the ages between juvenile II to adolescent.

There are some monkeys who do SPW behavior even in other troops; such

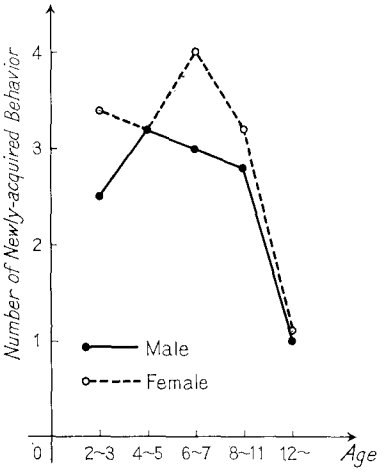


Fig. 4 Correlation between acquisition rate of 4 new behaviors and age of monkeys

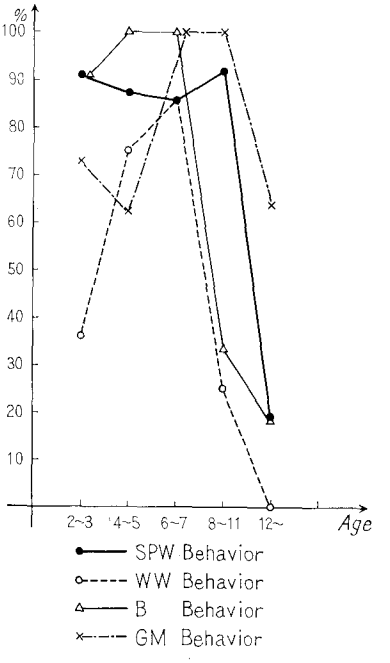


Fig. 5 Correlation between average number of new behaviors acquired to one monkey and age and sex

as Takasakiyama (Itani, personal communication), Ohirayama (Kawai), Arashiyama (Hazama, personal communication), and Gagyusan (Furuya, personal communication). But in these troops the behavior remains individual and is not propagated to other monkeys to form pre-cultural behavior of the troop. WW behavior is not observed in other troops.

Japanese monkeys have neither language nor denoting function, and, as a result, have no ability to teach actively. Mechanism of the process of acquiring SPW and WW behaviors seems to correspond to the "matched dependent behavior" that N.E. Miller and J. Dollard referred to (1941). Macaques are generally believed inferior in the ability of imitation (Yatabe 1945), but, judging from the propagation of these two behaviors, it may be acceptable that in a natural troop imitation through daily lives is made rather intensively.

3) Give-me-some Behavior

GM behavior is different in quality from other three pre-cultural behaviors mentioned above. This behavior is a kind of attitude toward man born out of friendship and composure on the part of monkeys. In other words, characteristic of this troop is the gentle, friendly attitude towards men which is fixed in this troop. For monkeys of this troop have this attitude from their infancy. The friendly attitude of all the monkeys towards men can be taken as a kind of

implicit pre-culture. GM behavior is symbolic of this implicit pre-culture. GM behavior can be witnessed even in other troops, but it remains individualistic and is not a general behavior pattern of the troop representing its relationship to men.

The remarkable difference of this behavior from SPW and WW behaviors is that it is performed by all the adult males and solitary males. This suggests the existence of a fixed behavior pattern in expressing a friendly relation to man. The behavior pattern is believed to be quite general among the species of Japanese monkeys.

Implicit pre-culture of this sort defines the social character of the troop such as cautiousness, tameness, and aggressiveness. In other words, it is greatly related with personality formation of the members of the troop. Therefore, the mechanism of acquiring this behavior has greatly to do with "identification" which Imanishi mentioned (1957).

4) Acquisition and Propagation

In each section we have discussed that the three factors, i.e., age, sex, and kinship, are important in the acquisition and propagation of the four newly acquired behaviors. We would like to take them up here together.

Fig. 4 indicates the acquisition of the four behaviors in terms of ages. The acquisition curves of SPW, WW, and B behaviors belong to the same type, while the curve of GM behavior is in a different form. The acquisition of the three behaviors begins in juvenile, reaches the highest point in adolescent and goes down in adult. On the other hand, in GM behavior the highest percentage of acquisition (100%) is seen in adolescent II and adults of 8-11 years old, and even adults above 12 years old show higher percentage of acquisition than in the other three behaviors.

In Fig. 5 is shown the average number of acquisition within an individual monkey of the four behaviors and the interrelationship of age and sex. In juvenile and adolescent I difference of sex does not count. (In juvenile, females appear to have higher percentage of acquisition than males, but the truth is that among males are included two of the *Nami*'s kin who are inferior in acquisition. We will touch on this point below.) In adolescent II and adult (from eight to eleven years old), males' percentage is lower than that of females. This is due, as have been repeated above, to the difference of status between males and females. That adults older than 12 are inferior in acquisition is illustrated also by Fig. 5.

In each section we have referred to the difference of acquisition caused by lineage. *Eba*"s children are high in intellect or in adaptability, while *Nami*"s children are low. Table 6-a indicates the number of the acquisition of the four behaviors by mothers and children of the *Nami*'s and the *Eba*'s. The *Eba*'s kin acquired on the average 3.6 behaviors, while the *Namis*' kin did 1.6. Tab. 6-b shows the average acquisition numbers of behaviors by lineages. The full mark being four, the *Sango*'s lineage got good mark. Table 6-a also shows the

Table 5 Acquisition rate of new behaviors, classified by age

Age	Newly-acquired Behavior				average no. of new behaviors aquired	
	SPW	WW	BW	GM	male	female
2～ 3	90.9%	36.3%	90.9%	72.7%	2.5	3.4
4～ 5	87.5	75.0	100.0	62.5	3.2	3.2
6～ 7	85.7	85.7	100.0	100.0	3.0	4.0
8～11	91.6	25.0	33.3	100.0	2.8	3.2
12～	18.1	0	18.1	63.6	1.1	1.0

Table 6

	Nami'	*Eba'*
	1	4
1951	2	4
52	1	4
53		
54	4	2
55		
56	2	4
57	1	4
58		3
59	2	4
60	0	4
M.A.B.	1.6	3.6

Figures show number of newly acquired behaviors.

(a)

Lineage (Mothers)	*Sango*	*Eba*	*Imo*	*Aome*	*Harajiro*	*Natsu*	*Nori*	*Utsubo*	*Nami*
Number of babies	4	8	2	2	3	3	4	2	7
M.A.B.	4	3.6	3.3	3.3	3.0	2.6	2.6	1.6	1.6

(b)

M.A.B. : Mean number of new behavior acquired (total number of new behavior members of a lineage acquired by / number of members)

difference of acquisition ability due to lineage.

In the society of Japanese monkeys, mother-child relations are known, but father is hard to discover. Therefore, it is difficult to pursue this genetic problem strictly. Still, it is interesting that the difference of acquisition ability by each lineage is made clear at least in outline. Worth noticing is the *Nami*'s lineage, to which both a monkey of excellent intellectual faculty and a much inferior monkey belong. *Jugo*· achieves a high percentage of acquisition and, judging from other behaviors of his, he has the highest intellectual faculty, while *Naki*· is so inferior that we nickname him a weak-minded boy. This is a consensus views of several observers. It is hard to understand, though interesting enough, that such a monkey as *Jugo*· should have appeared in this lineage.

2 Environmental Basis of Pre-cultural Phenomena

We would like to consider the reasons why particularly among the Koshima troop pre-cultural phenomena developed.

The pre-cultural behavior we have seen above were all born out of obtaining food and the relation to men. That is, they all derive from provisionization.

Provisionization made great changes on the natural life of the troop. In the natural life feeding plays an important role. Being given enough food by men at the special feeding ground had to give a major influence on the natural life of the troop.

Japanese monkeys never have close social interaction with different animals. They were given food through provisionization by men, their greatest enemy, and they became to have a friendly relationship with men. That is, a new, different life environment or niche was introduced to their natural life. Therefore, provisionized monkeys suffered changes in their attitude and value system and were given foundations on which pre-cultural phenomena developed.

Another important factor is natural environment. In Koshima three different environments—that is, precipitous mountains with thick wood, the sandy beach, and the sea—are beautifully integrated. Before they were provisionized, mountains were their only habitat. But after the provisionization they came to know contrastingly different environments such as the sandy beach and the sea, and their natural environment was enriched rapidly. We believe that through the efforts to integrate the contrast their creative exploiting faculty has been formed. For major pre-cultural behaviors of the Koshima troop are connected with the sands and the sea.

In short, pre-cultural behaviors of the Koshima troop were all begun under the conditions of provisionization. It is quite doubtful whether or not such inventive behaviors as SPW and WW behaviors should have been developed in the natural life. We should notice here that in response to the change of environmental conditions monkeys have invented adaptive behavior. The creation of inventive behavior is most important. Behavioral adaptability or plasticity in response to the change of environment will become important when we come to think of the evolution of behavior of the species.

SUMMARY

1. In Koshima Island, Miyazaki Prefecture, there lives a natural troop of Japanese monkeys. In 1953 a monkey began Sweet-potato Washing behavior, which was spread to others and was fixed in this troop as pre-culture.

Among other newly acquired behaviors that were fixed as pre-culture, there are Wheat-washing behavior, Bathing behavior, and Give-me-some behavior. We have made clear the origin and the process of propagation of these four pre-cultural behaviors, considered their meaning and commented upon their significance in the evolution of behavior.

2. Sweet-potato Washing behavior

1) Sweet-potato washing behavior (SPW behavior) was begun by a one-and-a-half-year-old female in 1953.

2) This "inventive" behavior was propagated to others, and by August, 1962, 73.4% of 49 monkeys above 2 years old did this behavior.

3) The propagation of SPW behavior is divided into the first period (the period of individual propagation, 1953-1957) and the second period (the period of pre-cultural propagation, 1958-).

4) In the first period propagation was made through lineage and playmate relationship. Acquisition of the behavior in the first period was made at the age of one or two without any difference due to sex. Monkeys older than five who acquired the behavior are all females. Adult monkeys who did not acquire the behavior could not acquire it even within five years after that period.

5) Propagation in the second period was made from mother to child. Almost all the children born after 1958 acquired SPW behavior.

6) The exception is the *Nami*'s lineage. Only 4 out of 8 lineage members do SPW behavior. This is due to the low intellectual faculty of the monkeys of this lineage.

7) In SPW behavior fresh water was used at first, then gradually salt water was used. Some of the monkeys, who acquired the behavior in the second period, began seasoning behavior with salt water instead of washing sweet-potatoes. Monkeys who perform both SPW and Seasoning behaviors are 12, and those who do Seasoning behavior only are 7.

3. Wheat-washing Behavior

1) Wheat-washing behavior (WW behavior) was begun in 1956 by a four-year-old female.

2) This "inventive" behavior was in the period of individual propagation, the process of which was the same with that of SPW behavior.

3) Monkeys who acquired this behavior are 19. That is 38.7% of the total of 49 monkeys.

4) Acquiring ages were 2, 3, and 4. There was no difference between male and female. Only one adult acquired the behavior.

5) This behavior was beginning to spread through mother-child relationship and the spread will soon shift to pre-cultural propagation.

6) Since 1959 Snatching behavior was witnessed. Young monkeys acquired WW behavior through it, but adults did nothing but snatching. Importance of Snatching behavior lies in the fact that monkeys take advantage of the products of others' labor. Behaviors of this kind have not yet been witnessed among other troops of Japanese monkeys.

4. Bathing Behavior

1) Since 1959 there appeared monkeys who went in the sea. Up to that year monkeys of this troop did not go in the water. As of August, 1962, 63.2% of monkeys older than two bathed in the sea.

2) This behavior was begun by juveniles of two and three years old, and spread quickly among others. The percentage of acquisition of juveniles adolescent is 96.1. In juvenile and adolescent there is no difference of the percentage of acquisition between male and female.

3) The percentage of acquisition of adults is low—26.0. Difference of sex in adult counts much in the acquisition; male 14.2%, female 44.4%.

4) This behavior can be considered fixed in the troop as its pre-culture.

5) Swimming monkeys are 10 (20.4%). Five juveniles bathed themselves in water for playing and avoiding the heat.

5. Give-me-some Behavior

1) Give-me-some behavior (GM behavior) is an anticipatory response.

2) Monkeys who do GM behavior are 78.7%. Differences of sex and age do not count much in its acquisition. Difference from SPW, WW, and B behaviors is the high percentage of acquisition of adults.

3) Many monkeys who do not do GM behavior are found in the *Nami*'s lineage. This suggests that in some lineages the acquisition of this behavior is difficult.

4) GM behavior was born out of the friendly relationship to men. It is a symbolic behavior that represents the fixed attitude of the troop towards men.

6. Meaning of Pre-cultural Behavior

1) Bathing is an adaptive behavior to the environment. That the adaptive behavior is controlled by troop society is worth noticing.

2) SPW and WW behaviors are noteworthy as "inventive" behaviors. They are important for their connection with tool using and material culture or for the consideration of the genesis of material culture.

3) GM behavior is an implicit pre-culture. It will provide an interesting standpoint for evolution in its relation to the problems of value-attitude system and institution.

7. Environmental Factors

1) The newly acquired behaviors of the Koshima troop have been developed by provisionization.

2) Besides provisionization, creative faculty has been cultivated through the process of lives in which completely different environments, i.e., the mountain, the sand beach, and the sea, are integrated. For all the pre-cultural behaviors discussed here are related to the sand beach and the sea.

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