The Innovative Culture in Japanese Macaques

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Introduction

It is no secret that living primates such as *Homo sapiens*, possess great diversity in culture exhibited all over the globe. However, humans tend to only make up for a fractional margin of all living primates today. That begs the question, for the vast majority of primates that belong in the category of non-humans, do they possess culture on an observable level as well? Exploring a particular species regarding that question, there has been an extensive series of studies and research conducted on *Macaca fuscata,* otherwise known as Japanese macaques, in Japan (Huffman et al., 2013). The results have continuously proven that Japanese macaques do indeed have the ability to possess and transmit culture, though to a much lesser extent as compared to *Homo sapiens*.

Background

Culture is defined to be a set of behaviours observed by a population that can be transmitted or modified, and can be expressed in forms of two main clusters. Material culture is a cluster where it involves direct physical manipulation of resources. On the other hand, social behaviour distincts from material culture as it focuses on a standpoint of social relationships between individuals and populations.

As part of early Japanese primatological research, Japanese macaques have been studied extensively in both a provisional and wild non-provisional context ranging in multiple territories in Japan (Huffman et al., 2013). Japanese macaques are extremely valued for researching purposes as they inhabit a wide range of regions from mountains with snow to subtropical areas (Schofield et al., 2017). Throughout decades of observations, there have been events that are created, modified, and passed on by Japanese macaques considered to be a product of culture (Huffman et al., 2013). In fact, these cultural activities fall in both categories of social culture and material culture.

Social Culture

As with the social interaction and social 'circles' humans might be familiar with, what Japanese macaques experience is not set to be so different after all. Upon uncovering a forgotten treasure of data gathered by other researchers, there has been enough evidence to support that social relationships in extra-large resting clusters are a form of social culture of Japanese macaques (Zhang and Wantanabe, 2007). In addition, an observed difference in a physical embracing behaviour across different populations of Japanese macaques contribute further to the concept of Japanese macaques possessing social culture (Huffman et al., 2013).

The extra-large clusters in Japanese macaques were observed in Shodoshima Island of Japan. Findings in Shodoshima showed that the size of the resting clusters were reflected as a product of the temperature (Zhang and Wantanabe, 2007). On the other hand, the sizes found in Takasakiyama, Japan, remained constant (Fig. 1). In winter, when the temperature drops to its lowest limit, the average cluster size in Shodoshima is drastically larger than those in Takasakiyama (Fig. 2). In fact, the largest clusters in Shodoshima exceed the size of a hundred Japanese macaques and such large sizes are unique to this region (Huffman et al., 2013). From an adaptive standpoint, the more bodies of mass, the better protection against the cold. However, this adaptive behaviour is not responsible for the extra-large resting clusters as Shodoshima is a relatively warm site for the macaques to survive in (Huffman et al., 2013). The reason behind the large resting cluster, is the sustaining tolerant social relationships of the Japanese macaques. Despite the aggression posed by many individuals in the cluster, female macaques in Shodoshima displayed counter-aggression on a much more frequent basis than those in Takasakiyama (Huffman et al., 2013). In order for the clusters to continuously remain large in size, the counter-aggression behaviour must have spread within the population. As a result, this tolerance in social relationships is evidence for social culture.

A phenomenon involving physical hugging observed in Japanese macaques called 'hug-hug,' is another potential for social culture in Japanese macaques. The purpose for

‘hug-hug’ is to drop tension and form a connection for mutual allogrooming between the macaques (Huffman et al., 2013). The patterns in this behaviour differ within different populations but share many same foundational features while delivering the same purpose. For instance, the Kinkazan populations of macaque execute this behaviour in a ventro-ventral position while the Yakushima population incorporated a ventral-lateral position in addition (Huffman et al., 2013). The differences across multiple populations cannot be explained by the environment nor the genetics. It has been concluded, these are most possibly cultural differences (Huffman et al., 2013). Thus, this behaviour suggests a strong call for it to be social culture. However, there is no solid evidence reported regarding the aspect of social learning for ‘hug-hug’ (Huffman et al., 2013). Due to the lack of social learning in ‘hug-hug,’ it does follow the model of culture and currently remains only as a strong theory for it to exist as social culture.

Material Culture

In the other cluster of culture, one of the earliest evidence provided for material culture in Japanese macaques, was their ability to clean food with a variety of methods. In a provisioned environment set in Koshima, an island in Japan, a population of macaques were provided with two staples: unwashed sweet potatoes and unhusked wheat grains (Schofield et al., 2017). While the population of macaques were cleaning the food supplies by brushing with their hands and body hair, a particular individual discovered a way to incorporate bodies of water into this process. This individual was a juvenile Japanese macaque named Imo (Schofield et al., 2017). The two year-old macaque’s new innovative technique then quickly spread among her group.

The first instance of this new behaviour was observed in 1953, when ‘sweet potato washing’ was first introduced by Imo (Fiore et al., 2020). There were four phases of transmission for this behaviour (Schofield et al., 2017). Initially, Imo’s technique was quickly

learned by those other young macaques around her. Soon after, that behaviour was adapted by the parents of those individuals and those adults then spread it to more following adults. The final phase of transmission was the technique being passed on to newborn generations of Japanese macaques (Schofield et al., 2017). As the sweet potato washing technique was first innovated, it was a simple procedure that merely involved dipping the potato in a stream of freshwater and brushing it. However, over a period of more than sixty years, the behaviour was diversely modified (Table 1).

Apart from sweet potato washing, Imo also discovered a way to use water to clean the wheat grains scattered all over in the sand (Fiore et al., 2020). The beginning version of this technique emerged in 1956 (Schofield et al., 2017). Imo collected a handful of wheat that was covered in sand, and carried it over to a body of water where she would then toss it in. As a result of her clever innovation, the sand would separate from the wheat grains as the sand would sink to the bottom of the water while the wheat would remain floating. Similar to the sweet potato washing technique, the wheat washing behaviour followed an identical transmission process and underwent modifications (Schofield et al., 2017)(Table 2).

Another form of material culture possessed by Japanese macaques is stone handling, a form of manipulation of stones purely for play with no purposes attached. Unlike the food washing culture, which comes with the reward of clean food with enhanced flavouring, stone play is only known to be self-rewarding (Nahallage et al., 2016). This form of play was first observed in 1975, in Takagoyama, Japan. Soon after a young individual started repeatedly fiddling with rocks, those surrounding young monkeys including siblings and playmates, usually under the age of three, imitated and embraced this behavior themselves (Huffman and Quiatt, 1986). As these monkeys develop into adulthood and reach their reproductive stage, the acquired stone play is then passed on to their offspring. Infants as young as three weeks old begin to show interest and follow the footprints of their older siblings and parents

(Huffman and Quiatt, 1986). Over time, with the tradition being acquired by newborns, innovation in the play opened the door for new changes, bringing in a diverse variety of ways to manipulate stones.

The evidence obtained from food washing and stone play can be analyzed to conclude that the Japanese macaques possess material culture. Since food washing and stone play can be transmitted across the population and into new generations, followed by the proof of them being able to be modified, it satisfies the condition to be considered as culture. Therefore, it is proven that there exists material culture flowing in the population of Japanese macaques.

In contrast to the idea of Japanese macaques carrying material culture, it is not out of the box that these behaviours were simply a result of human experimentation. In fact, there have been arguments made by some critics that these findings should be disregarded because they emerged from provisioning (Schofield et al., 2017). From a provisional standpoint, it means that these cultural approaches discovered and modified by the Japanese macaques were only triggered by artificial opportunities. Without the settings introduced by humans, the macaques would only have encountered what is natural. They would not have come across resources such as sweet potatoes for them to have an innovative culture derived from it. Furthermore, in the wild, animals would spend most of their time scavenging food, finding shelter, and avoiding predators. Likewise, without supplies and protection provided by humans, the Japanese macaques would not have had the time to fiddle with rocks and develop a stone-handling play culture.

Despite the claim that Japanese macaques developed culture in a provisioned environment holds true, it is far-fetched and unjustified to conclude that the species do not have the ability to embrace culture otherwise. For instance, although the sweet potato washing culture was innovated as a product of human contribution, humans have only done so much to influence the Japanese macaques. Other than providing a small amount of supplies

not belonging to the macaque's habitats, which only consist of a small percentage of their diet, the majority of what they experienced during provisioning were natural in a free range environment (Schofield et al., 2017). Therefore, the effects of provisioning is merely a small scale change introduced by humans and the Japanese macaques simply took advantage of this opportunity to apply what they are naturally capable of, thus, inducing culture. Ultimately, humans cannot hand out culture to Japanese macaques as if they were handing out resources. The only explanation for the macaque's ability to innovate and transmit such behaviours, is because they are capable of embracing culture.

Conclusion

In conclusion, Japanese macaques have been proven to possess both social and material culture. From a simple manipulation of rocks to a well balance in social relationships, the behaviours discovered and acquired by individuals have successfully spread across their population and into new generations. Following that, this behaviour would undergo modifications into diverse varieties. Although some evidence of material culture emerged from provisioned environments, it does change the fact that Japanese macaques have the ability to apply culture. Presently, the behaviour of 'hug-hug' remains only as a potential for culture as it lacks social learning between the macaques. Perhaps with the passing of time, with more evidence and innovations, 'hug-hug' will be proven to be a culture of Japanese macaques, along with other new means of culture.

Figures and Tables

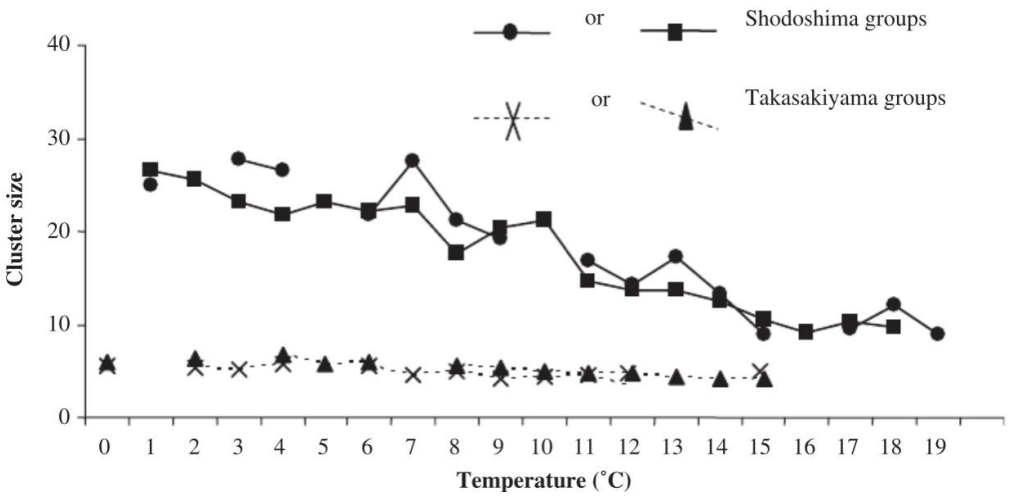

Fig. 1, Clusters sizes with respect to temperature (Zhang and Wantanabe, 2007: Fig 3)

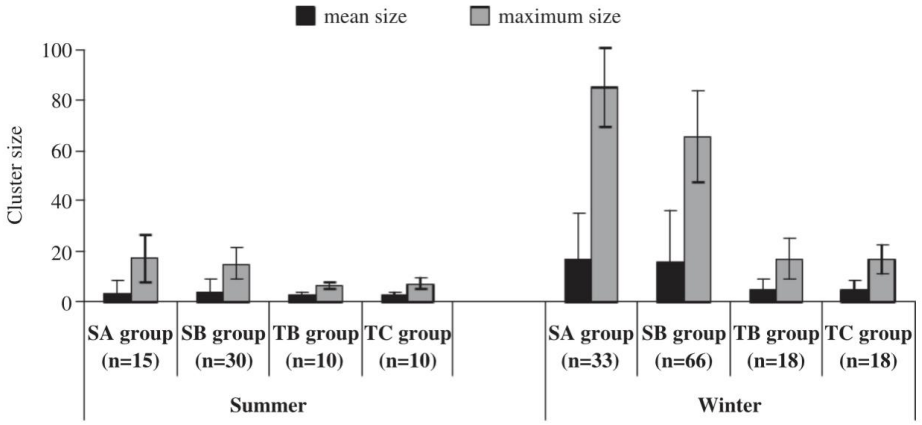

Fig. 2, Clusters sizes from Shodoshima and Takayashima, 'n' represents sampling times (Zhang and Wantanabe, 2007: Fig 2)

Stages of apparent cultural change	Year first observed	Description of acts	Cumulative improvement
1. Brush	1952	Brush sand brush off with hand or fur	Cleaner foodstuff reduces wear on teeth from sand. Hygienic treatment may reduce risk of parasites
2. Dip and brush	1953	Dip potato in stream with one hand, and brush sand off with other	Washing more effective at removing sand, grit and soil than dry 'brush' variant
3. Immerse and roll	1955	Potato immersed and rolled underwater in stream	More vigorous treatment more effective at removing sand, etc. than variants 1 and 2
4. Rinse saltwater	1957	Wash potato in sea water	Wave action removes more sand, grit and soil. Flavour of potato enhanced (gustation)
5. Dip and gnaw	1958	Dip potato in sea water between repeated bites	Flavour of potato further enhanced bite-by-bite
6. Scavenge	1983	Gather pieces dropped/discarded by others	Reduced labor as less time and energy spent washing. Less risk of food being pirated?
7. Plunder	1983	Attack/threaten rinser and rob of cleaned potatoes	Reduced labor as less time and energy spent washing. Bigger portions of potatoes than 6
8. Private pool	1983	Dig own separate, more secluded pool for rinsing potato	Solitary eating decreases risk of scavengers/plunderers. Less stress means less hurried eating

Table 1, Modification of sweet potato washing (Schofield et al., 2017: Table 1)

Stages of apparent cultural change	Year first observed	Description of act	Cumulative improvement
1. Throw	1956	Carry and drop sand/wheat mixture into water, separating wheat from sand. Skim floating wheat off surface	Grains separated from grit, so more easily consumed. Cleaner foodstuff saves wear on teeth and may reduce risk of parasites
2. Attack and plunder	1959	'Muggers' threaten and attack wheat washer and take grains	Labor-saving, as less energy expended collecting and washing
3. Scavenge	1962	Collect wheat grains floating downstream or in sea	Labor-saving, as less energy expended collecting and washing
4. Dribble	1970	Grasp sand and wheat mixture in hands, then repeatedly drop small amounts into water to prevent snatching by others	More secure processing against attacker/plunderers. More controlled to reduce loss of grain in water current or waves
5. Sweep	1971	Sweep wheat grains next to water's edge by hand into water	Labor-saving: less energy expended collecting and washing
6. Screen	1974	Grasp mixture in hands, then shake in water. Sand removed with grains remaining in clenched fists	More controlled than throwing. Increased security against attacker/plunderers
7. Mobile screen	1974	Walk into water while grasping mixture in hands while screening	More controlled than throwing. Increased security against attacker/plunderers
8. Private pool	1983	Dig small depression in sand, then sweep wheat grains into resulting pool and skim off surface	Increased security against scavengers/plunderers. Labor-saving, and more controlled than the other variants—loss of wheat grains prevented

Table 2, Modification of wheat washing (Schofield et al., 2017: Table 2)

Bibliography

An article from a journal:

Fiore, A.M., Cronin, K.A., Ross, S.R., and Hopper, L.M. 2020. Food Cleaning by Japanese Macaques: Innate, Innovative or Cultural?. The Folia Primatologica 91: 433-444.

A book:

Huffman, M.A., Nakagawa, N., Go, Y., Imai, H., and Tomonaga, M. 2013. Monkeys, Apes, and Humans: Primatology in Japan. Tokyo: Springer Japan

An article from a journal:

Huffman, M.A., and Quiatt, D. 1986. Stone handling by Japanese macaques (Macaca fuscata): implications for tool use of stone. Primates 27: 413-423.

Nahallage, C.A.D., Leca, J.B., and Huffman, M.A. 2016. Stone handling, an object play behaviour in macaques: welfare and neurological health implications of a bio-culturally driven tradition. Behavior 153: 845-869.

Schofield, D.P., McGrew, W.C., Takahashi, A., and Hirata, S. 2017. Cumulative culture in nonhumans: overlooked findings from Japanese monkeys?. Primates 59: 113-122.

Zhang, P., and Wantanabe, K. 2007. Extra-large cluster formation by Japanese macaques (Macaca fuscata) on Shodoshima Island, central Japan, and related factors. The American Journal of Primatology 69: 1119-1130.