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EXPERIMENTAL PRIMATE ARCHAEOLOGY: DETECTING STONE HANDLING BY JAPANESE MACAQUES (*MACACA FUSCATA*)

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*Non-human primates using stones in nature provide a rare opportunity to compare directly the behaviour of use with the resulting lithic artifacts. Wild Japanese macaques (*Macaca fuscata*) customarily do "stone handling" (SH = spontaneous, solitary, non-instrumental and seemingly playful manipulation of stones). Ten populations of monkeys show at least 48 behavioral variants, 13 of which entail repeated stone-on-stone or stone-on-substrate contact that is likely to yield recognizable wear patterns. We collected 10 assemblages of stones after seeing them being used, as well as "control" stones from a nearby hillside. In the first experiment, human subjects of varying degrees of knowledge of SH were asked to separate handled versus non-handled stones. Overall they were unable to do so, but the best-informed subjects were more accurate than the totally naïve ones. In the second experiment, another set of totally naïve subjects was tutored on key points derived from the first experiment. They scored significantly higher, showing that monkey artifacts are distinguishable and that discrimination can be easily taught. Non-human as well as human primates have lithic technology, which means that they too have an archaeological record. This complicates prehistory, at least in places in Africa where apes and hominins likely co-existed from the late Miocene onwards. Distinguishing between the hominin "pre-Oldowan" and its ape counterpart industries is a challenge only recently recognized in archaeology. Primate archaeologists tackling these issues in extant species have available not only the standard theory and methods of archaeology but also the behaviour of the makers and users of artifacts. But are non-human primate lithics discernable in the absence of their observed use? If so, then (in principle at least) we may infer multiple archaeological records, even if they coincide in space and time. If not, then our predicament may be compounded, not improved, by the advent of primate archaeology. The aim of the study reported here is simple: to see if stones used by monkeys can be detected, when the only evidence available is the stones themselves.*

KEYWORDS: *monkey lithics, external validity, actualistic archaeology, cultural primatology*

BACKGROUND

Reliable descriptive reports of natural stone tool use by chimpanzees date to the 1970s and systematic, empirical study to the 1980s (McGrew 1992). Thereafter, detailed and experimental research developed, especially at two sites in West Africa: Bossou, Guinea and Taï, Ivory Coast (e.g., Carvalho et al. 2012; Luncz et al. 2012). In the process, the research perspectives have shifted from biological to anthropological, especially with the advent of cultural primatology.

The same process has occurred more recently with a species of New World monkey, the bearded capuchin (Visalberghi et al. 2009), and an Old World monkey, the Burmese long-tailed macaque (Gumert et al. 2009). Both use stone hammers and anvils in percussive technology to open nuts or shellfish or both. In the latter species, different shapes and sizes of stones are used to process different types of prey, and these extractive activities leave different patterns of wear on the artifacts.

More strictly archaeological efforts remain few, most notable being the pioneering efforts in Ivory Coast that included excavation, radiometric dating, residue analysis, etc. (Mercader et al.

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FIGURE 1. Japanese macaque engaged in stone handling; specific behavioral pattern is "Rub stones together".

2002, 2007). The latter study included a trail-blazing collaboration between archaeologists and primatologists, who tried blind testing to see if stone modifications could be attributed to natural *versus* cultural agency, by-products of nut cracking *versus* systematic flaking, etc. Unfortunately, these studies included no actualistic data, that is, no control artifacts recovered after having been seen to be used by the apes. Thus Mercader et al. (2007) established reliability but not validity.

The latter point has been advanced by studies in the so-called "outdoor laboratory" at Bossou, where wild chimpanzees voluntarily "drop in" to crack nuts under semi-controlled conditions (Matsuzawa 1994). In a clearing in the forest, they are presented with a standard set of natural stones and super-abundant nuts for cracking, and their efforts are videotaped and the stones monitored. The apes show a reliable *chaine operatoire* (Carvalho et al. 2008) and distinct preferences of individual hammer-anvil combinations (Carvalho et al. 2009).

But what about a non-human primate analogue for the pre-Oldowan, especially the use of stone in daily activities? (Haslam et al. 2009; Wynn et al. 2011.) Perhaps the best candidate is stone handling (SH), defined as "spontaneous, solitary, non-instrumental and seemingly playful manipulation of stones" (Leca et al. 2012: 226) (see Figure 1). SH is done with one or both hands, but sometimes also with feet and mouth. It is not tool use, if one follows the standard definition of tool use: "external employment of an unattached or manipulable

TABLE 1. STONE HANDLING BEHAVIORAL PATTERNS THAT INVOLVE STONE-TO-STONE OR STONE-TO-SUBSTRATE CONTACT, THUS LIKELY TO LEAD TO DETECTABLE WEAR. EXTRACTED FROM LECA ET AL. (2012: 234, TABLE 13.1).

Type, Code, and Definition
Move and push/pull (MP): Push/pull stone with one or both while walking forward/backward
Toss walk (TW): Toss stone ahead (repeatedly) and pick up while walking
Gather (GA): Gather stones into pile in front of oneself
Pick and drop (PUD): Pick up stone and drop it repeatedly
Clack (CL): Clack stones together, both hands moving in a clapping gesture
Combine with object (COO): Rub or strike stone with object different from stone, such as food item, piece of wood, metal, etc.
Flint (FL): Strike stone against another held stationary
Pound on surface (POS): Pound stone on substrate
Rub/roll on surface (ROS): Rub or roll stone on substrate
Rub stones together (RT): Rub stones together
Scatter (SC): Scatter stones about on substrate, in front of oneself
Shake in hands (SH): Hold stones in one's open palm of hand and shake stones with hand moving back and forth
Swipe (SW): Swipe stones together, both hands moving in sweeping gesture

Note: Some other patterns *may* leave wear patterns too, e.g.: **Grind with teeth** (GWT): Press and rub with crushing noise one's teeth against stone held in hand.

environmental object to alter more efficiently the form, position, or condition of another object, another organism, or the user itself…" (Shumaker et al. 2011: 5). The function (if any) of SH is unknown.

SH is shown by Japanese macaques in at least 10 populations, both wild and captive (Huffman et al. 2010). This unusual form of lithics was first described 30 years ago at Arashiyama Monkey Park, Kyoto, shortly after its spontaneous invention (Huffman 1984). There, wild monkeys are provisioned daily with grain in a feeding area (Nishie 2002). SH is a constellation of at least 48 different behavioral patterns directed to pebbles, and of the 35 patterns known from Arashiyama, at least 13 involve abrasion or percussion, either by stone-to-stone or stone-to substrate (Leca et al. 2012; see Table 1). Repeated skin-to-stone contact in the other behavioral patterns shown may leave more subtle signs on the stones, such as wear polish.

Furthermore, the monkeys transport stones over the landscape and leave them in re-visited and re-used assemblages ("play stations"), which then present stimulus configurations to other monkeys (Leca et al. 2010) (see Figure 2). In principle, one could excavate such sites, seeking to recover handled stones from the past, hence uncovering a simian archaeological record. But would these stones be recognizable?

FIGURE 2. "Play station" assemblage of handled stones found in forest after discard by monkey(s).

Methods

WM, TM, and MN in one hour collected stones that were handled (*H*) and then abandoned by Japanese macaques (*Macaca fuscata*) on October 2, 2011, at Arashiyama. Thirty-six stones comprised 10 assemblages, each made up of three to six stones. Three assemblages were left by the monkeys in the provisioning area and the other seven were discarded on its periphery (within 75 m). We also collected 36 unhandled (*U*) or "control" stones on nearby, near monkey trails, but away from the provisioning area. We independently covered three areas of hillside with instructions to seek stones eroded out of the hillside and to collect those that looked like the ones seen to be handled earlier. Sixty-four of these stones were randomly assigned numbers 1–64 and marked accordingly with indelible ink covered with clear nail varnish. (Remaining stones were held in reserve, in case any of the 64 were damaged or lost in testing. They also were used in instruction, in Experiment 2. See below.) (See Figure 3)

Stones

Stones were measured (mm) by digital calipers for length (longest dimension), width (longest perpendicular dimension to length), and thickness (longest dimension perpendicular to width). They also were weighed (g) on a digital balance. Each measurement was taken three times, to test reliability. Handled stones were smaller in length [Mean, $H = 36.0$ (SD = 11.8) vs. $U = 43.3$ (SD = 7.8), $p = 0.005$], width [Mean, $H = 24.4$ (SD = 6.10) vs. $U = 30.2$ (SD = 5.8), $p = 0.000$], volume [Median, $H = 13.85$ vs. $U = 21.55$, $p = 0.002$], weight [Median, $H = 13.0$ vs. $U = 19.8$, $p = 0.006$] but not in thickness [Mean, $H = 15.6$ (SD = 4.9) vs. $U = 17.3$ (SD = 4.8), $p = 0.17$]. Thus, handled stones overall were smaller than unhandled ones (see Table 2).

Experiment 1

WM, CP, and FS recruited subjects (41 students or colleagues) to sort the stones into the *H versus U* sub-sets of 32 stones each. Each subject was asked to read and to understand the following instructions:

> "Here are 64 stones, randomly numbered. Half (32) were collected after being handled by Japanese macaques in the provisioning area at Arashiyama; half (32) were collected outside the area, at least 200 m away, in the forest. Please sort them into two equal sets of 32 each: handled vs. controls. Do this by recording next to each stone's number on the data-sheet, one of two codes: H (handled) or U (unhandled)."

No further information was provided, before or after the sorting session.

Figure 3. Experimental array of 32 handled *versus* 32 unhandled stones in testing tray, randomly numbered; 6 additional stones to side used in tuition (see text for details). Scale in cm.

TABLE 2. DIMENSIONS OF HANDLED VS. UNHANDLED STONES ($N = 32_H, 32_U$). ALL LINEAR MEASUREMENTS IN CM, WEIGHT IN G

Stone Type	Length[1]	Width[1]	Thickness[1]	Volume[2]	Weight[2]
Handled					
Mean	3.6	2.4	1.6	Median	Median
SD	1.2	0.6	0.5	= 13.8	= 13.0
Range	18.8–78.1	16.9–40.1	7.4–26.2	2.7–71.0	3.1–73.8
Unhandled					
Mean	4.3	3.0	1.7	Median	Median
SD	0.8	0.6	0.5	= 21.5	= 19.8
Range	33.8–62.2	20.0–50.3	8.6–32.8	6.3–77.6	6.1–71.9

[1] = Normally distributed, so Student *t* test, 2-tailed.
[2] = Not normally distributed, so Mann–Whitney *U* test, 2-tailed.

Before beginning the task, subjects were asked to class themselves on the basis of extent of their knowledge of SH as either: (1) "I have seen Japanese macaque stone-handling, either in person or on film/video" ($n = 10$); or (2) "I never have seen stone handling but have read or been taught about it" ($n = 17$); or (3) "I know little or nothing about stone handling" ($n = 14$). After completion of the task, subjects were asked to write down any cues that they spontaneously had devised and used to sort the stones. Subjects were asked not to discuss the procedure with others after testing but were promised a later de-briefing.

Stones were presented in numerical (random) order in a cardboard tray, illuminated by a 100-watt desk lamp. Subjects freely handled the stones but were asked to do so carefully. (As the experiment continued, even the gentlest handling may well have added "polish" to the stones, presumably making the discrimination of handled vs. unhandled more difficult. See below.) No time limit was set on time taken to complete the task, but duration varied greatly ($N = 38$, mean = 24.8 min, median = 24.5 min, range = 5–60 min).

A perfect detection score would be 32, while failure to detect any handled stone would yield a score of 0. Subjects scoring 23 or above would be accurate at more than chance levels, while those with scores of 11 or below would be inaccurate at more than chance levels. Overall, we expected subjects to perform at chance levels, given their lack of first-hand experience, but we expected degree of knowledge to correlate positively with accuracy (i.e., 1 > 2 > 3).

EXPERIMENT 2

Twenty-eight subjects were recruited from first-year biological anthropology students; all were in class #3, that is, ignorant of SH. All were given exactly the same protocol as in Experiment 1, except that they were given an instruction sheet and allowed to ask questions about it. The instruction sheet was compiled from the cues listed by the 10 subjects in Experiment 1 whose scores were accurate at above-chance levels. The five most frequent types of cues (each noted by at least 4 of the 10 subjects) were summarized in the instruction sheet, "How To Recognize Monkey-Handled Stones":

1. Stones that have been handled have cleaner surfaces, with less clinging dirt or grit.
2. Stones that have been repeatedly handled acquire a smoother, almost polished surface. This can be felt and even seen, sometimes even as a kind of "sheen".
3. Stones that have been handled, especially when this involves stone-to-stone or stone-to-substrate contact, acquire small scratches, nicks, scrape-marks, etc. that are visible with careful inspection.
4. Handled stones seem somehow to be "nicer" to hold and manipulate. This is hard to define, but perhaps it has to do with pleasing shapes to grasp, fewer pointed or sharp edges, etc.
5. Stones that are good to handle must fit the monkey's hands, so size of stone is an issue, especially for younger individuals with small hands. Thus, smaller stones are preferred, especially for handling several stones at once.

Other cues mentioned less often were interesting colour/shape, lack of sharp edges/corners, similar materials, and flat surfaces.

Also, subjects were given three identified handled and three unhandled stones, which they were allowed to inspect until they were satisfied. Then, they proceeded as in Experiment 1. We expected tutored naïve subjects to detect handled stones more accurately than untutored naïve subjects.

STATISTICS

Data were tested for normality, and accordingly either parametric (two-sample t test) or non-parametric (Mann–Whitney U, Kruskal-Wallis one-way analysis of variance, Spearman rank correlation coefficient, Chi-squared) statistical tests were used to compare groups. Alpha was set at 0.05, one-tailed, unless otherwise noted.

Results

EXPERIMENT 1

Figure 4 shows that there was a near-tendency (Chi-squared, $df = 1$, $z = 1.60$, $p = 0.11$, two-tailed) for subjects to be better than chance at detecting handled stones: 25 correctly identified >16 stones, while only 14 identified <16 stones (two subjects identified 16, that is, exactly at chance level).

Contrary to expectations, there was no overall difference among the three classes of subject in detecting handled stones, although there was a non-significant trend [Kruskal–Wallis, H (corrected for ties) = 5.29, $df = 2$, $0.05 < p < 0.10$] in the predicted direction (see Table 3). Inexplicably, the two highest scores overall, both outliers at 30 (of a possible 32), were from Class 3, who were the *most* naïve subjects. One subject was a geneticist, the other a first-year masters student; neither had heard of SH before taking part in the experiment. (This was unexpected.) Of the remaining 12 subjects in Class 3, six had scores above 16 (chance) and six had scores at 16 and below. However, pairwise comparison by class showed Class 1 subjects to be more accurate in detecting H stones than Class 3

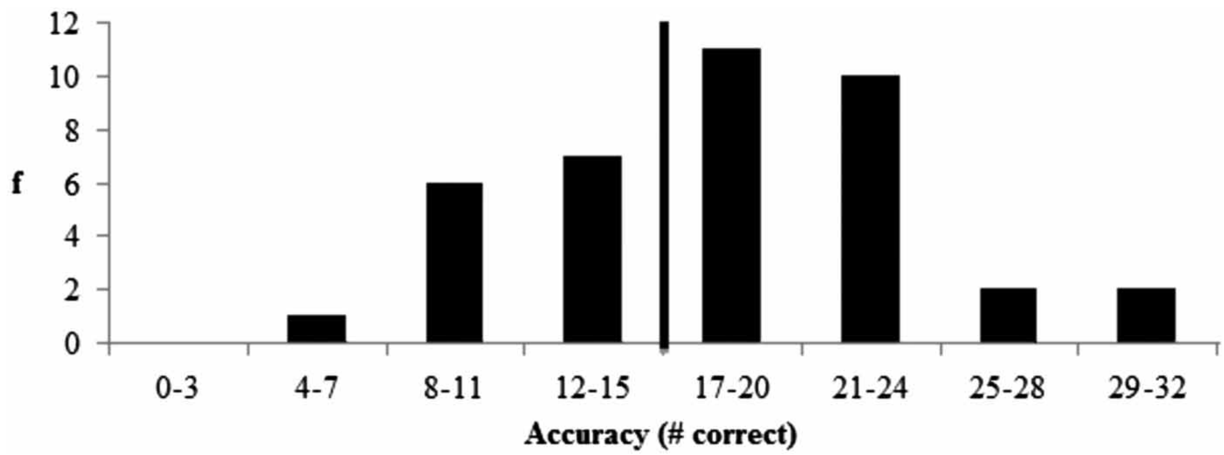

Figure 4. Distribution of correct detection scores of handled stones by subjects ($N = 39$) in Experiment 1. Chance level of 16 indicated by black vertical line.

Table 3. Accuracy of detection of handled stones and (self-determined) duration of testing session, as a function of extent of prior knowledge of stone handling, in Experiment 1. For definitions of 3 classes, see text

	Class			
	1 ($n = 10$)	2 ($n = 17$)	3 ($n = 14$)	Total ($N = 41$)
Mean score	19.4	17.8	17.9 (14.7)[1]	17.85
Median score	21.5	18	17.5 (15.5)	18
Range of scores	11–26	7–25	9–30 (9–20)	7–30
Mean duration	21.4	26.1	25.3	25
Median duration	18	26	25	25
Range of durations	5–60	12–50	13–45	5–60

[1]Two outliers removed, so $n = 12$.
Kruskal–Wallis one-way ANOVA, $df = 2$, two-tailed, NS.

subjects (Mann–Whitney, $U = 27$, $n_1 = 10$, $n_2 = 12$, $p < 0.05$). The other two pairwise comparisons (1 vs. 2, 2 vs. 3) showed no difference.

There was no correlation between time taken by a subject to complete the task and the score achieved, in either experiment: Expt. #1: Spearman, $r_s = 0.05$, $n = 32$, two-tailed, NS; Expt. #2: $r_s = 0.08$, $n = 25$, two-tailed, NS. So, subjects' duration of deliberation was unrelated to the accuracy of their judgments.

Finally, size (= weight) of stone was not a bias. When the middle 50 percent of weights of handled stones ($n = 16$) was split into heavier-than-the-median vs. lighter-than-the-median, there was no difference in their accuracy of detection ($U = 27$, $n_1 = 8$, $n_2 = 8$, $p = 0.40$).

EXPERIMENT 2

As expected, the Class 3-students given instruction on detecting handled stones were more accurate than their counterparts in Experiment 1 (see Table 4). Their mean score was 20.4 (median 20, range 14–27), a 39 percent improvement when compared to the untutored Class 3 subjects in Experiment 1. Of the 28 subjects, 22 had scores of >16 or above, while only three were <16 (three scored 16, or chance) (see Figure 5). This difference was highly significant: $n_1 = 12$, $n_2 = 28$, $z = 3.51$, $p = 0.0002$.

Discussion

Archaeology typically addresses the "when and where" of recovered artifacts but less often can elucidate the "who and what" questions. Thus the agents and their activities are inferred, either by intuition or based on actualistic studies, in the absence of observational data. Here we tested the external validity of such detection, by taking stones of known provenance and testing whether or not they could be identified. Not surprisingly, results from first-time experience of scrutinizing monkey-handled stones did not differ from chance. However, enough subjects (25 of 39) scored above chance-level to suggest that the task was worth pursuing.

More surprisingly, level of background knowledge did not predict accuracy of judgment overall. Better-informed subjects were no more

Table 4. Accuracy of detection of handled stones by untutored versus tutored naïve subjects

	Expt. 1 Class 3u ($n = 12$)	Expt. 2 Class 3t ($n = 28$)
Mean	14.7	20.4
Median	15.5	20
Range	9–20	14–27

Mann–Whitney U test, $n_1 = 12$, $n_2 = 28$, $z = 3.51$, $p = 0.0002$, one-tailed.

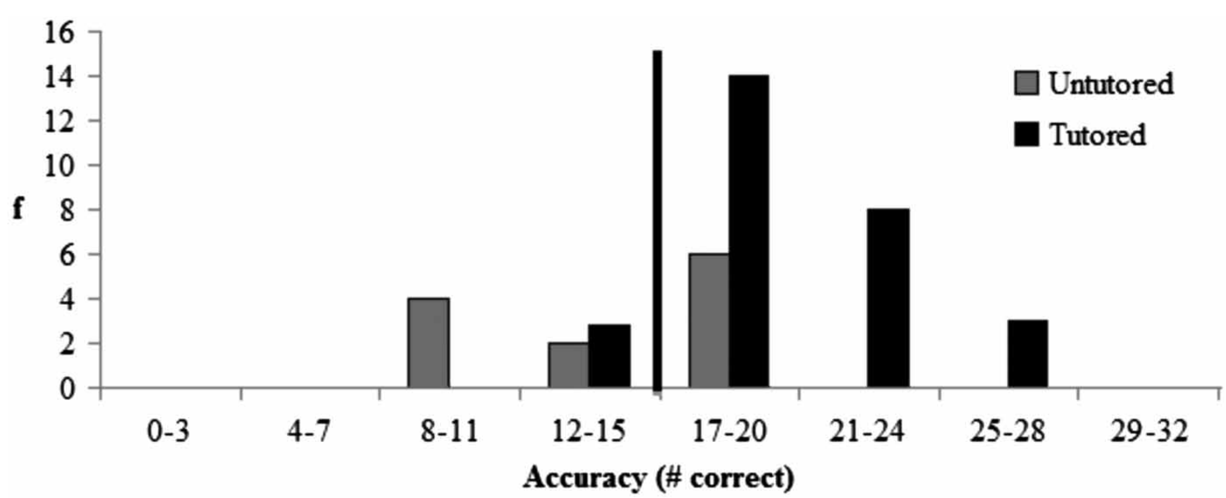

Figure 5. Distribution of correct detection scores by totally naïve subjects, untutored ($N = 12$) in Experiment 1 *versus* tutored ($N = 28$) in Experiment 2. Chance level of 16 indicated by black vertical line.

accurate than less-informed ones, even with two conspicuous outliers removed. However, another near-tendency ($n < 0.10$) suggested that this variable deserved further consideration. Breakdown of the overall dataset into classes showed the two extremes (1 vs. 3) to differ, with the best-informed being superior to the least-informed.

Another independent variable, about which we had no expectations, proved unable to distinguish between the three groups: duration of time taken to assess the stones was no predictor of accuracy.

Hence, we devised the second experiment, based on empirical findings gained inductively from the first. The improvement in detection was dramatic: naïve subjects with only a few minutes of tuition and handling of a few identified stones were notably better at detection: 79 percent (22 of 28) scored above chance in accuracy.

Conclusions

Doing archaeology on lithics left behind by non-humans is demonstrably feasible. Monkey artifacts (= user-modified objects) of known origin and use are distinguishable in "blind" testing. Having shown success with these surface finds, we may now move on to excavation of the monkeys' play stations.

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References

Carvalho, Susana, Dora Biro, Eugenia Cunha, Kimberley Hockings, William McGrew, Brian Richmond, and Tetsuro Matasuzawa 2012 Chimpanzee Carrying Behaviour and the Origins of Human Bipedality. *Current Biology* 22: R180–R181.

Carvalho, Susana, Dora Biro, William McGrew, and Tetsuro Matsuzawa 2009 Tool-Composite Re-use in Wild Chimpanzees (Pan Troglodytes): Archaeologically Invisible Steps in the Technological Evolution of Early Hominins? *Animal Cognition Supplement* 12: S103–S114.

Carvalho, Susana, Eugenia Cunha, Claudia Sousa, and Tetsuro Matsuzawa 2008 Chaines Operatoires and Resource Exploitation Strategies in Chimpanzee Nut-Cracking (*Pan troglodytes*). *Journal of Human Evolution* 55: 148–163.

Gumert, Michael D., M. Kluck, and Suchinda Malaivijitnond 2009 The Physical Characteristics and Usage Patterns of Stone Axe and Pounding Hammers Used by Long-Tailed Macaques in the Andaman Sea Region of Thailand. *American Journal of Primatology* 71: 594–608.

Haslam, Michael, Adriana Hernandez-Aguilar, Victoria Ling, Susana Carvalho, Ignacio de la Torre, April DeStefano, Andrew Du, Bruce Hardy, Jack Harris, Linda Marchant, Tetsuro Matsuzawa, William McGrew, Julio Mercader, Rafael Mora, Michael Petraglia, Helene Roche, Elisabetta Visalberghi, and Rebecca Warren 2009 Primate Archaeology. *Nature* 460: 339–344.

Huffman, Michael A. 1984 Stone-Play of *Macaca fuscata* in Arashiyama B Troop: Transmission of a Non-Adaptive Behavior. *Journal of Human Evolution* 13: 725–735.

Huffman, Michael A., Jean-Baptiste Leca, and Charmalie A. D. Nahallage 2010 Cultured Japanese Macaques: a Multidisciplinary Approach to Stone Handling Behavior and its Implications for the Evolution of Behavioral Tradition in Nonhuman Primates. In *The Japanese Macaques*, edited by Naofumi Nakagawa, Masayuki Nakamichi, and Hideki Sugiura, pp. 191–219. Springer, Tokyo.

Leca, Jean-Baptiste, Noelle Gunst, and Michael A. Huffman 2010 Indirect Social Influence in the Maintenance of the Stone Handling Tradition in Japanese Macaques, *Macaca fuscata*. *Animal Behaviour* 79: 117–126.

Leca, Jean-Baptiste, Noelle Gunst, and Michael A. Huffman 2012 Thirty Years of Stone Handling Tradition in Arashiyama-Kyoto Macaques: Implications for Cumulative Culture and Tool use in Non-Human Primates. In *The Monkeys of Stormy Mountain: 60 Years of Primatological Research on the Japanese Macaques of Arashiyama*, edited by Jean-Baptiste Leca, Michael A. Huffman, and Paul L. Vasey, pp. 223–257. Cambridge University Press, Cambridge.

Luncz, Lydia, Roger Mundry, and Christophe Boesch 2012 Evidence for Cultural Differences between Neighboring Chimpanzee Communities. *Current Biology* 22: 1–5.

Matsuzawa, Tetsuro 1994 Field Experiments on the use of Stone Tools by Chimpanzees in the Wild. In *Chimpanzee Cultures*, edited by Richard Wrangham, William McGrew, Frans de Waal, and Paul Heltne, pp. 351–370. Harvard University Press, Cambridge, MA.

McGrew, William C. 1992 *Chimpanzee Material Culture: Implications for Human Evolution*. Cambridge University Press, Cambridge.

Mercader, Julio, Huw Barton, Jason Gillespie, Jack Harris, Steven Kuhn, Robert Tyler, and Christophe Boesch 2007 4,300-Year-Old Chimpanzee Sites and the Origins of Percussive Stone Technology. *Proceedings of the National Academy of Sciences USA* 104: 3043–3048.

Mercader, Julio, Melissa Panger, and Christophe Boesch 2002 Excavation of a Chimpanzee Stone Tool Use Site in the African Rainforest. *Science* 296: 1452–1455.

Nishie, Hitonaru 2002 The Proximate Factors of Stone Handling Behavior of Japanese Macaques (*Macaca fuscata*) in Arashiyama E Troop. *Reichorui Kenkyu [Primate Research]* 18: 225–232. [in Japanese with English summary].

Shumaker, Robert W., Kristina R. Walkup, and Benjamin B. Beck 2011 *Animal Tool Behavior. The Use and Manufacture of Tools by Animals*. Rev. edit. Johns Hopkins University Press, Baltimore.

Visalberghi, Elisabetta, Elsa Addessi, Valentina Truppa, Noemi Spagnoletti, Eduardo Ottoni, Patricia Izar, and Dorothy Fragaszy 2009 Selection of Effective Stone Tools by Wild Bearded Capuchin Monkeys. *Current Biology* 19: 213–217.

Wynn, Thomas, Adriana Hernandez-Aguilar, Linda Marchant, and William McGrew 2011 "An Ape's View of the Oldowan" Revisited. *Evolutionary Anthropology* 20: 181–197.

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