

## Uncovering the cultural knowledge of sanctuary apes

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**B**ehavioral differences observed between wild communities of the same species have been called “cultures” by some researchers who aimed to underline the similarities with human cultures. However, whether these differences truly result from social learning processes is debated. Despite promising recent research, data acquired in the wild still fail to exclude genetic and ecological factors from being potential explanations for the observed behavioral differences. A potential way to address this problem is through field experiments where communities of the same subspecies are exposed to identical apparatuses. This way, genetic and ecological factors can be controlled for, although their influence cannot be fully excluded. Working with wild-born Sumatran orangutans originating from two genetically distinct populations, we recently combined field experiments with captive work to show that genetic differences could not account for differences in their knowledge of stick use. Additionally, we found evidence that our subjects arrived at the sanctuary with a knowledge that they acquired but could not express in their community of origin. These findings suggest that animal cultures must also be analyzed at the cognitive level. Only in this way can we understand the true extent of animal cultures and how they relate to human cultures.

in apes, is uncontroversial,<sup>2,3</sup> the question of whether they constitute “cultures” in the human sense of the term remains strongly debated.<sup>4</sup> One major reason is that the concept of animal culture, based on early observations of primatologists,<sup>5,6</sup> is grounded at the observed behavioral level. As such, animal traditions and cultures are seen as variations in patterns of behaviors.<sup>7</sup> However, human behavioral differences, while included in the notion of human cultures, only constitute one part of what anthropologists consider “culture,” a notion that includes a strong representational component and is more accurately defined as set of beliefs, values or norms shared by individuals.<sup>8</sup> Human cultural behavioral differences are thus the consequences of differences in cultural ideas.

The animal culture debate, however, has mostly fallen short of addressing such questions (although see refs. 8 and 9 for commentators who stress this conceptual difference); instead concentrating on two related questions: (1) Whether the behavioral differences are a result of social learning processes in the first place, as opposed to being developed in response to different ecological conditions or genetic endowment; and (2) What kind of social learning processes are at work.<sup>10,11</sup> In terms of addressing these two questions, much progress has been made over the last decade. Question (1) has been most famously developed through the controversy over the “ethnographic method” proposed by Whiten and colleagues,<sup>2</sup> which led field researchers to analyze the different behavioral influences at stake, and showing that some behavioral variation, notably in closely located communities, could not be attributed to

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genetic or ecological differences; suggesting a role for social learning processes.<sup>12-14</sup> Additionally, work in captivity has shown repeatedly that, in terms of question (2), apes rely on a diversity of social learning processes in their lives and notably are able to imitate novel actions,<sup>15</sup> suggesting that such mechanisms could be available to them in the wild.<sup>16</sup> However, conclusive proof of social learning for presumed cultural behaviors in the field has yet to be demonstrated.

Recently, 'field experiments' have been seen as one way to address this problem.<sup>17,18</sup> The goal of field experiments is to import the carefully designed protocol of the laboratory into the field, allowing researchers to control for more factors than in the case of simple observations, and by presenting subjects with the same situation in repeated trials if necessary.<sup>19</sup> One particular protocol, the honey-trap experiments, exposed two communities of Eastern chimpanzees found in Western Uganda, which differed in their knowledge of stick use, to a honey acquisition task, where liquid honey was trapped in a vertical hole drilled into a wooden log.<sup>18,20</sup> Members of the two communities relied on different techniques, consistent with their cultural knowledge. Additionally, they found different parts of the same object (a branch) salient to be used as tools: at Sonso, the chimpanzees used the leaves of the branch to manufacture leaf-sponges, while at Kanyawara, the chimpanzees used the stick part to dip for honey. These experiments, paired with an ecological analysis,<sup>21</sup> showed that chimpanzees are, similarly to humans, biased in their cognition by their cultural knowledge.

Interestingly, experiments designed initially for the field can be transferred back to captivity and can, when used with the right populations, contribute meaningful results to the debate on culture. Although the early history of the captive apes is rarely known in this setting, it is possible to make use of some of the available information: place where the individual was seized, age estimation based on teeth eruption and size, or genetic analysis. In our latest study, we evaluated the tool-related cognitive abilities and cultural knowledge of wild-born Sumatran orangutans (*Pongo abelii*) sheltered in a quarantine center in

North Sumatra.<sup>22</sup> Sumatran orangutans are the only orangutans who use tools on a regular basis.<sup>3</sup> However, not every population of Sumatran orangutans uses tools.<sup>23</sup> Swamp populations (Tripa, Kluet and Singkil), have been observed to use sticks to extract honey,<sup>23</sup> but not orangutans from the east-coast regions around Langkat. Knowing the geographic (and for some, genetic) origin of the orangutans we were working with, it was possible to apply the honey-trap experimental protocol originally designed to study cultures in wild chimpanzees to uncover potential differences in the cultural knowledge of the captive orangutans.

Additionally, we could control for the impact of the known genetic differences between the two populations<sup>24</sup> by exposing the orangutans to a simple food-raking task. The rationale was that orangutans from different populations might have a different genetic endowment that would favor the use of tools in one population but not in the other. Captive orangutans routinely rake food outside their enclosure,<sup>25</sup> and some orangutans in the quarantine center already displayed this particular action. Given that no orangutan in the wild has been observed raking for food to date,<sup>26</sup> we assumed that this behavior could only have been learnt by the orangutans at the quarantine center, either through individual learning, or social learning with previously arrived orangutans being potential models for newcomers. As our tested subjects were on average of the same age and had spent about the same amount of time in the center, any difference in stick use in the raking task could only be explained by genetic differences. We found that the orangutans of the two populations differed significantly in the honey-trap task, but not in the raking task, and that the results in the two tasks were not correlated, providing convincing evidence that genetic differences did not play a role in the differences in tool use between these two populations. However, the significant difference found in the honey-dipping task, as in the chimpanzee studies,<sup>18-20</sup> suggested a cultural difference between the two populations.

The dual use of two experiments to control for genetics was a first and could only be achieved because the work was

conducted in a sanctuary with wild-born animals. The raking behavior is a common feature in zoo and sanctuary animals;<sup>25</sup> however, it is rarely if ever observed in the wild.<sup>27</sup> This aspect of the study was fundamental to show that genetic differences between the two populations had no impact on their understanding of stick use, a control condition that could not be implemented in the chimpanzee studies, as they were only conducted in the wild.<sup>18-20</sup> Our study thus shows that a careful monitoring of the animals' life traits and information in sanctuaries (age at arrival, duration spent in captivity, exposure to humans, original place where they were seized) can be fruitful to address questions that originated from field observations and can generate productive, novel avenues of research.<sup>28</sup>

A second major finding of this study was that tool-using orangutans arrived at the center at a very young age (average of 3.4 y old), despite the fact that tool use is only observed from age 6 in the wild.<sup>29</sup> This observation suggests that orangutans arrived at the center with acquired cultural knowledge of their communities of origin, suggesting a deep cognitive basis to their culture. This finding justified our calling the mental representations underlying tool use behaviors variations 'cultural ideas'. An important and growing body of captive work shows that apes are cognitive animals and do not simply react following stimulus-response patterns;<sup>30</sup> therefore, it is not entirely surprising that they can represent their cultural knowledge. The use of the word 'idea' will prove to be controversial for animals as it is not possible to extrapolate the nature of these representations without language. However, considering animal cultures within the scope of cognition will allow us to address the questions raised by anthropologists, and ultimately to find out whether their cultures are also sets of beliefs and norms, rather than simple sets of behaviors.

In conclusion, sanctuary animals, as young as they can be, can nonetheless be considered to have already lived two lives. They first lived a "normal life" with their mother, and acquiring information by observing her. This information was extracted from the social environment (how to behave like an orangutan in a

social setting?), as well as from the physical world, extending to tool use in some cases (how to extract honey, an important and sweet food, from a tree trunk?). After the trauma of being separated from their original community, their rescue also means the start a new life, through rehabilitation in sanctuaries, where they learn again how to live together with other apes, before a potential release in the wild. Our study shows that what they experienced in their first life, far from being forgotten, lingers in their mind, ready to be used to tackle their new life.

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No potential conflicts of interest were disclosed.

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