

# ORANGUTAN CULTURES?

TOOL USE, SOCIAL  
TRANSMISSION AND  
POPULATION  
DIFFERENCES

Copyright by  
Michelle Y. Merrill  
2004, 2008

ORANGUTAN CULTURES?  
TOOL USE, SOCIAL TRANSMISSION AND  
POPULATION DIFFERENCES

by

Michelle Yvonne Merrill

Department of Biological Anthropology and Anatomy  
Duke University

Date: \_\_\_\_\_

Approved:

\_\_\_\_\_  
Carel P. van Schaik, Supervisor

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Dissertation submitted in partial fulfillment of  
the requirements for the degree of Doctor  
of Philosophy in the Department of  
Biological Anthropology and Anatomy  
in the Graduate School  
of Duke University

2004

ABSTRACT

ORANGUTAN CULTURES?  
TOOL USE, SOCIAL TRANSMISSION AND  
POPULATION DIFFERENCES

by

Michelle Yvonne Merrill

Department of Biological Anthropology and Anatomy  
Duke University

Date: \_\_\_\_\_

Approved:

\_\_\_\_\_  
Carel P. van Schaik, Supervisor

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

An abstract of a dissertation submitted in partial  
fulfillment of the requirements for the degree  
of Doctor of Philosophy in the Department of  
Biological Anthropology and Anatomy  
in the Graduate School of  
Duke University

2004

## **ABSTRACT**

### ORANGUTAN CULTURES?

### TOOL USE, SOCIAL TRANSMISSION AND

### POPULATION DIFFERENCES

This dissertation considers the evidence for orangutan (*Pongo pygmaeus*) cultures. Eight long-term orangutan research sites were compared using the geographic approach. Correlation between rare behavior count and observation intensity showed innovation is fairly consistent across sites. Lack of correlation between observation intensity and number of cultural behaviors indicates that something else explains this variation. Cultural behaviors were classified into subsistence skills, weal skills, reference variants, display variants and those whose function remains unknown. Types of behaviors that vary culturally in orangutans were similar to those reported for chimpanzees (*Pan troglodytes*).

Further evidence for the role of social learning and proximity is based on data from focal animal follows of wild orangutans at Ketambe and Suaq

Balimbing on Sumatra. Suaq Balimbing had more cultural variants requiring close proximity for observational learning, including tool use. Adult female orangutans at Suaq Balimbing (particularly in the sub-group with greater tree-hole tool-use specialization) spent more time with independent conspecifics and had more diverse social partners at close proximity.

Behaviors related to nest building were examined in detail. Data from nests built with or without the nest raspberry (ubiquitous at Suaq Balimbing, absent at Ketambe) were investigated. Duration of nest-building activities is related to nest raspberry production. Nest raspberries were not related to nearest neighbor proximity or nest position; their adaptive function is not apparent. Adult females at both sites tended to be alone (no independent conspecifics within 50m) more often when building a night nest than during the rest of the active day, but this trend was stronger at Ketambe.

Evidence for vertical social transmission of a limited traditional behavior was based on published work, interviews with previous field researchers, and videotape and data collected during fieldwork at Ketambe. The persistence of unusual behaviors within rehabilitant matriline, and the failure of these behaviors to spread throughout the wild population, may result from

selectivity in social learning.

The presence of complex cultural variation in orangutans and chimpanzees suggests that the capacity for such behavior was present over 12 million years ago, in the last common ancestor of the great apes.

## DEDICATION

For Erik, without whose incredible patience, understanding and support I could never have done this, and for the orangutans Abby, Agus, Andai, Ani, Ans, Arno, Ati, Beki, Bestel, Binjei, Brus, Budi, Caca, Chris, David, Diana, Doba, Elisa, Hanes, Herdi, Ida, Karen, Mira, Musa, Ngon, Novi, Olly, Pelet, Pluis, Sela, Tevi, Tomi, William, X, Yet, Yinta, Yenni, Yop, Zuar and especially Payung – hang in there, guys!

## Table of Contents

|   |              |
|---|--------------|
| Abstract  | <i>iv</i>    |
| Dedication  | <i>vii</i>   |
| Table of Contents                                   | <i>viii</i>  |
| List of Tables                                      | <i>xiii</i>  |
| List of Figures                                     | <i>xvi</i>   |
| Acknowledgments                                     | <i>xviii</i> |
| Chapter 1   |              |
| <b><i>Introduction to Orangutan Cultures</i></b>    | <b>1</b>     |
| Culture: Definitions and Disagreements              | <b>3</b>     |
| Animal “Ethnography”: Using the Geographic Approach | <b>6</b>     |
| Cultural Variation in Other Species                 | <b>9</b>     |
| The Study of Orangutan Cultures                     | <b>10</b>    |
| Chapter 2   |              |
| <b><i>The Content of Orangutan Cultures</i></b>     | <b>18</b>    |
| Introduction: The search for non-human culture      | <b>18</b>    |
| The geographic approach                             | <b>20</b>    |

|  |    |
|--|----|
| The content of culture   | 22 |
| Methods  | 24 |
| Results  | 29 |
| Orangutan behaviors  | 29 |
| Relationship of observation intensity and observed behaviors                       | 45 |
| Behavioral categories: comparison with chimpanzees                                 | 46 |
| Discussion   | 46 |
| The roles of ecology, innovation and social transmission                           | 46 |
| Behavioral categories – cultural content   | 53 |
| Future study suggestions   | 59 |
| <br>Chapter 3  |    |
| <b><i>Social Proximity in the Orangutans of Suaq<br/>Balimbing and Ketambe</i></b> | 72 |
| Introduction   | 72 |
| The importance of proximity to social learning                                     | 76 |
| Proximity and social learning opportunities for specific<br>behavior variants      | 78 |
| Methods  | 82 |
| Measures of sociality  | 85 |
| Results  | 89 |

|                               |    |
|-------------------------------|----|
| Mean party size               | 89 |
| Percent time in parties       | 89 |
| Cumulative number of partners | 90 |
| Partner diversity             | 91 |
| Discussion                    | 91 |

#### Chapter 4

|  |            |
|--|------------|
| <b><i>Orangutan Nest-Building Behaviors</i></b>      | <b>111</b> |
| Introduction   | 111        |
| Great ape nests                                      | 112        |
| Methods  | 121        |
| Sites  | 121        |
| Video  | 122        |
| Field Datasheets                                     | 122        |
| Data Analysis  | 124        |
| Results  | 128        |
| Video of nest building at Suaq Balimbing and Ketambe | 128        |
| Nest raspberry correlates at Suaq Balimbing          | 129        |
| Comparison of Ketambe and Suaq Balimbing             | 134        |
| Discussion   | 136        |

Chapter 5

|   |            |
|---|------------|
| <b><i>Rehabilitant Orangutans and Their Descendants at Ketambe: The Role of Social Learning in Intra-population Differences</i></b> | <b>158</b> |
| Introduction  | <b>158</b> |
| Selectivity in social learning  | <b>161</b> |
| Rehabilitant orangutans   | <b>163</b> |
| History of the Binjei matriline   | <b>165</b> |
| Unusual behaviors seen in rehabilitant orangutans   | <b>167</b> |
| Methods   | <b>169</b> |
| Results   | <b>171</b> |
| Other's reports of unusual behaviors in rehabilitants and their descendants, and wild residents' opportunities to observe them      | <b>172</b> |
| Video records of rehabilitant descendants in camp   | <b>173</b> |
| Recorded camp visits  | <b>175</b> |
| Social partners of rehabilitants and their descendants  | <b>175</b> |
| Discussion  | <b>176</b> |

Chapter 6

|  |            |
|--|------------|
| <b><i>Discussion and Conclusions about<br/>Orangutan Cultures</i></b>              | <b>188</b> |
| Overview   | <b>188</b> |
| Types of Cultural Behaviors  | <b>191</b> |
| Culture in the Context of Human Evolution  | <b>197</b> |
| Conservation of Diversity in Multiple<br>Ethnospheres                              | <b>199</b> |
| Future Research Suggestions  | <b>201</b> |
| Apendices  | <b>207</b> |
| <i>Appendix I. Social Proximity Data Entry<br/>        and Analysis Procedures</i> | <b>207</b> |
| <i>Appendix II. Chewing Clothes: A Day<br/>        with Chris</i>                  | <b>209</b> |
| References   | <b>215</b> |
| Biography  | <b>230</b> |

## **List of Tables**

|   |            |
|---|------------|
| Table 1.1 Mammalian taxa exhibiting potentially socially transmitted adjustable behaviors that vary between wild populations. | <b>15</b>  |
| Table 2.1 Orangutan study sites   | <b>63</b>  |
| Table 2.2 Very Likely Cultural Behaviors  | <b>64</b>  |
| Table 2.3 Likely Cultural Behaviors   | <b>65</b>  |
| Table 3.1 Very likely cultural behaviors at Suaq Balimbing and Ketambe  | <b>97</b>  |
| Table 3.2 Research Sites  | <b>98</b>  |
| Table 3.3 Information on Focal Individuals  | <b>99</b>  |
| Table 3.4 Mean Party Size, Ketambe vs. Suaq Balimbing   | <b>100</b> |
| Table 3.5 Mean Party Size, Ketambe, Suaq Balimbing North and Suaq Balimbing South/Central                                     | <b>100</b> |
| Table 3.6 Mean Party Size (without next youngest offspring), Ketambe vs. Suaq Balimbing                                       | <b>101</b> |
| Table 3.7 Mean Party Size (without next youngest offspring), Ketambe, Suaq Balimbing North and Suaq Balimbing South/Central   | <b>101</b> |
| Table 3.8 Percent time in parties, Ketambe and Suaq Balimbing   | <b>102</b> |
| Table 3.9 Percent time in parties, Ketambe, Suaq Balimbing North and Suaq Balimbing South/Central                             | <b>102</b> |
| Table 3.10 Cumulative Number of Partners (by day)   | <b>103</b> |

|   |            |
|---|------------|
| Table 3.11 Comparisons of differences between mean cumulative number of partners by observation day for KTB and SQB (signed rank test)                                    | <b>103</b> |
| Table 3.12 Comparisons of differences between mean cumulative number of partners by observation day for KTB, SQB N and SQB S/C (signed rank test)                         | <b>104</b> |
| Table 3.13 Indices of Partner Diversity, Ketambe and Suaq Balimbing   | <b>104</b> |
| Table 4.1 Nest-related behaviors that vary between Suaq Balimbing and Ketambe.  | <b>144</b> |
| Table 4.2 Number of identified focal individuals by age/sex class at each site included in this study, with age/sex class abbreviations defined.                          | <b>144</b> |
| Table 4.3 Presence or absence of nest raspberry during nest building observations   | <b>145</b> |
| Table 4.4 Mean day and night nest building duration for each age/sex class at Suaq Balimbing, with comparisons of day and night nest building duration within each class. | <b>146</b> |
| Table 4.5 Day and Night Nests With or Without Nest Raspberries  | <b>146</b> |
| Table 4.6 Individual comparisons for nest position and presence or absence of the nest raspberry.   | <b>147</b> |
| Table 4.7 Comparisons for pooled Adult Females and Adult Males of nest position and presence or absence of the nest raspberry.  | <b>148</b> |
| Table 4.8 Paired-sample signed rank tests for distance between nest and top of tree for nests with and without nest raspberries.  | <b>148</b> |

|   |            |
|---|------------|
| Table 4.9 Results of $X^2$ analysis of nearest neighbor distance effects on whether a nest raspberry was given for either day nests or night nests  | <b>149</b> |
| Table 4.10. Results of $X^2$ analysis and Fisher's Exact Test of nearest neighbor's line-of-sight relationship with whether a nest raspberry was given when day nests or night nests were built.                                | <b>150</b> |
| Table 4.11 Results of $X^2$ analysis of focal female's infant distance effects on whether a nest raspberry was given.   | <b>150</b> |
| Table 4.12 Comparisons of percent of multi-tree nests, Mann-Whitney/Wilcoxon.   | <b>151</b> |
| Table 4.13 Dispersion tendency for females at Ketambe and Suaq Balimbing  | <b>151</b> |
| Table 5.1 Focal Observaion Times for Rehabilitants and Their Descendents  | <b>182</b> |
| Table 5.2 Observed and Reported Unusual Behaviors   | <b>182</b> |
| Table 5.3 Orangutans entering camp, August – September 1999.  | <b>183</b> |
| Table 5.4 Other focal orangutans with whom rehabilitants or their descendents were observed at $\leq 50m$ , $\leq 10m$ , and $\leq 2m$ distance classes, with percent of total time spent with partners at that distance class. | <b>184</b> |
| Table 6.1 Mammalian taxa exhibiting potentially socially transmitted adjustable behaviors that vary between wild populations, and the cultural category for those behaviors   | <b>204</b> |

## **List of Figures**

|                |  |            |
|----------------|--|------------|
| Figure 2.1     | Locations of orangutan research sites mentioned in this study.   | <b>66</b>  |
| Figure 2.2     | A schematic representation of the arrangement of twigs in a nest, seen in the artistic pillows made by orangutans at Tanjung Puting. | <b>67</b>  |
| Figure 2.3     | Number of rare behaviors observed at each site (by observation intensity at site).   | <b>68</b>  |
| Figure 2.4     | Number of VLC behaviors observed at the customary or habitual level at each site (by observation intensity at site).                 | <b>69</b>  |
| Figure 2.5     | Likely and Very Likely Cultural Behaviors of Orangutans and Chimpanzees.   | <b>70</b>  |
| Figure 2.6     | Rare Behaviors of Orangutans and Chimpanzees.  | <b>71</b>  |
| Figure 3.1     | Percent Time in Parties (by Nearest Neighbor Distance)   | <b>105</b> |
| Figures 3.2a-b | Cumulative number of partners by observation day for each focal at Ketambe and Suaq Balimbing for $\leq 50\text{m}$ distances.       | <b>106</b> |
| Figures 3.2c-d | Cumulative number of partners by observation day for each focal at Ketambe and Suaq Balimbing for $\leq 10\text{m}$ distances.       | <b>107</b> |
| Figures 3.2e-f | Cumulative number of partners by observation day for each focal at Ketambe and Suaq Balimbing for $\leq 10\text{m}$ distances.       | <b>108</b> |

|   |            |
|---|------------|
| Figures 3.3a-c Means of the cumulative number of partners for each observation day with the focal.  | <b>109</b> |
| Figures 3.4a-c Means of the cumulative number of partners for each observation day with the focal.  | <b>110</b> |
| Figure 4.1 Nest positions in tree   | <b>152</b> |
| Figure 4.2 Average nest building duration by age/sex class and presence/absence of nest raspberries   | <b>153</b> |
| Figure 4.3 Mean night nest building duration for individuals, for nests where the nest raspberry was recorded as present or absent.   | <b>154</b> |
| Figure 4.4 Mean day nest building duration for individuals, for nests where the nest raspberry was recorded as present or absent.   | <b>155</b> |
| Figure 4.5 Percent of day nests with or without nest raspberries with nearest neighbors at each distance class for focals with significant $X^2$ relationships.                     | <b>156</b> |
| Figure 4.6 Percent of nests built with nearest neighbor at various distance classes for Ketambe and Suaq Balimbing females.   | <b>157</b> |
| Figure 5.1 Binjei's family, with year of birth noted  | <b>185</b> |
| Figures 5.2a-d Percent of focal observation time that each focal had nearest neighbors at $\leq 50\text{m}$ , $\leq 10\text{m}$ , and $\leq 2\text{m}$ .                            | <b>186</b> |
| Figure 5.3 Percent of each focal's time spent in parties that was spent with each social partner for $\leq 50\text{m}$ , $\leq 10\text{m}$ , and $\leq 2\text{m}$ distance classes. | <b>187</b> |

## ACKNOWLEDGMENTS

I wish to thank the L.S.B. Leakey foundation for sponsoring my field research and the “Orangutans Compared” workshop, and the National Science Foundation for sponsoring my field research.

I thank Dr. Ir. Abdi Abdul Wahab and Dra. Sunarti of Universitas Syiah Kuala, and Dr. Kathryn A. Monk from the Leuser Management Unit for logistical support. I thank the Indonesian Institute of Sciences (LIPI) and the directorate general of Forest Protection and Nature Conservation Service in the Ministry of Forestry for permission to work in Indonesia.

For assistance in the field, spectacular videography work, patience and kindness, I thank Nuzuar S. Hut. I thank Mohammed Isa for his enthusiasm, diligence, team spirit and effort in collecting data. I thank Bakrijas for remarkable bravery and persistence after his ordeals with the bees. Thanks also to Asril, who helped me to find and communicate with this great team. For all their hard work in data collection, and general conviviality and good cheer, I thank the 1999 staff of the Suaq Balimbing research station, especially Yasra, who was always ready to boost our spirits and fill our tummies. For helping me get to know Ketambe, and for her kindness and reassurances, I thank Sri Suci Utami Atmoko. Thanks also to Serge Wich, Ivona Foitova, Sue Thorpe and Beth Fox for moral support in the field and R-and-R in Medan.

For contributions to the “Orangutans Compared” database and/or discussion during the workshop, I thank C. Boesch, G. Borgen, M. Brown, I. Foitova, E. Fox, N. Ghaffar, S. Husson, A. Johnson, T. Laman, C. McLardy, J. Mitani, I.

bin’Muhammad, H. Murrrough-Bernard, M. Setia, H. Peters, and S. Wich.

Thanks to Merideth Bastian for her inspirational ambition to continue developing these ideas and putting them into practice in the field.

Thanks to Derek Johnson and Simon Habegger for making those first years in grad school a bit more entertaining. Special thanks to Elena Davis for a home-away-from-home in Durham, and for far more assistance and sugary baked goods than I deserved – you are a true friend, and I never would have made it without your help (especially the day of the format check!).

Thanks to Ken Glander, Steve Churchill and Liz Brannon for suggestions and remarks during the defense. For insightful commentary and extremely constructive criticism on early drafts, I thank Leslie Digby. For conversational co-creation of the ideas and practical direction on completion of this project I thank my advisor, Carel P. van Schaik.