1. The Groves effect: 50 years of influence on behaviour, evolution and conservation research

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This volume explores the complexity, diversity and interwoven nature of taxonomic pursuits primarily within the context of explorations of humans and related species, although it also delves into more distantly related species to show how taxonomy has impacted fields outside of human research. Essentially we are interested in showcasing recent research into that somewhat unique species we call humankind through the theoretical and conceptual approaches afforded by the discipline of biological anthropology. Structurally, our approach to understanding human uniqueness is tripartite in focusing on: (1) the evolution of the human species, (2) the behaviour of primates and other species, and (3) how humans affect the distribution and abundance of other species through anthropogenic impact. In this manner we weave together these three key areas of bio-anthropological endeavour and scrutinise how changes in taxonomic theory and methodology, including our fluctuating understanding of speciation, have recrafted the way in which we view animal behaviour, human evolution and conservation studies.

Taxonomy forms perhaps the most fundamental structural principle of arguably all biological knowledge and research. Indeed, taxonomy is the epistemological cornerstone of the biological sciences. In this context it is somewhat astonishing to note that within the last 20 years significant gaps in taxonomic knowledge have appeared, ostensibly due to a dearth of adequately trained taxonomists in the current generation of scholars. This lacuna, referred to as the taxonomic impediment, is in our view exacerbated by a recent over reliance on 'geno-hype' (Holtzmann, 1999), which refers to our scientific love affair with genetic-based approaches, at the expense of traditional taxonomic principles. Taxonomy, however, is more than its constituent parts, with DNA but one piece of the taxonomic fabric.

While the invention of improved and non-invasive ways to collect DNA has resulted in its resurgence in the field of taxonomy, this reliance on genetics to define species is nothing new. The Biological Species Concept defines species as 'groups of actually or potentially interbreeding natural populations, which are reproductively isolated from other such groups' (Mayr, 1940: 256). This concept, which relies heavily on interbreeding, or lack thereof, to define species,

has been a mainstream way to view and define species for decades. Despite its common acceptance, there are controversies surrounding it, many of which were brought to the forefront by Professor Colin Groves. One major criticism is that this concept can only be applied to species with overlapping ranges, meaning we cannot differentiate species that do not have the opportunity to attempt breeding due to non-overlapping ranges. In addition, our ability to analyse the genetics of many wild populations has allowed us to see that in some groups hybrid animals may actually be more numerous than the parent species, suggesting that reproductive isolation may not in fact separate species (Groves, 2012).

Up to 24 species concepts have been proposed over the years, but in the interest of brevity, just a few major players will be described here. The Ecological Species Concept proposes that species are groups of animals 'evolving separately from others with its own evolutionary role and tendencies' (Simpson, 1963: 153), which by anyone's definition is a vague concept that would be nearly impossible to apply in practice. The Genetic Species Concept defines species based on the amount of genetic variation both within and between species, assuming more variation between than within species. While simple and logical, it is nearly impossible to determine a cut off point for determining too much (multiple species) or too little (single species) genetic variation. The Phylogenetic Species Concept provides a more encompassing view of species in that they are defined by their possession of unique features and/or characteristics, either primitive or derived, that separate them from other groups (Nixon and Wheeler, 1990). It does not ignore genetics, but does not require different species be genetically incompatible, while also taking into account other features such as morphological similarities (Kimbel and Martin, 1993). It is this concept that has been strongly supported by Colin Groves throughout his career.

To date, debate over the definition of species continues, creating uncertainty for any researcher using species as their basic taxonomic unit of study. While this is an important issue, no volume has yet attempted to examine how changing views on the nature and processes of taxonomy have shaped modern research agendas and interpretations in the key areas of biological anthropology. It is, however, an issue with profound implications and one may ask: Does it matter if different scientists take different approaches to defining species? Will our understanding of evolution and behaviour, or the way in which we attempt to conserve species, really be impacted by the taxonomic classification system we choose to use? Important questions such as these are what this volume explores by using new data to interpret how a fluid and ever changing understanding of taxonomy has led to diverse and disparate research outcomes. The chapters in this volume will explore the significant impacts that these changes have had by investigating both historical perspectives relating to taxonomy and employing

new data to uncover how the taxonomic impediment has influenced research processes and outcomes, with particular emphasis on humans and our close primate relatives.

Colin Groves

As one of the world's leading taxonomists, this volume pays tribute to Colin Groves. Professor of Biological Anthropology at The Australian National University, where he has worked for the past 40 years, Colin's influence has spread through multiple disciplines including, but certainly not limited to, animal morphology, animal behaviour, human evolution and conservation. Colin sees himself as a taxonomist above all else, and his dedication to taxonomic pursuits stems directly from his true love of animals, which can perhaps be traced back to his childhood when his grandfather bought him a book on animals. This fascination grew in his teen years, which would see him heading to the London Natural History Museum and requesting access to their bone collections. When it was time to attend university, it is no surprise Colin wanted to study zoology, but as his father had a preference for him to undertake a degree in linguistics, he settled on anthropology as a compromise between the two. And the rest, as they say, is history.

Immediately following his undergraduate years, Colin entered the PhD program at the University of London under the tutelage of the esteemed John Napier, who was at the time regarded as the leader in primate taxonomy. His doctoral research, completed in 1966, involved a large-scale survey of gorilla skulls. Somewhat serendipitously Colin's work led to a meeting with Dian Fossey, who invited him to Karisoke to see the population of mountain gorillas she is now so famous for studying. Colin's work with gorillas resulted in numerous high impact publications at a very young age, vastly expanding our knowledge of gorilla ecology, biology and morphology. The influence these early years had on Colin can still be seen today in his passion for and involvement in gorilla conservation.

Colin's doctoral research success not only fuelled his future academic pursuits, such as his two-year postdoctoral fellowship at Berkeley and his fixed-term appointment at Cambridge, but also beat a path to his wife of more than 40 years, Phyll. As Colin had studied with John Napier, who worked at the Royal University Hospital at the University of London, it was not surprising that when Colin fell ill in the fall of 1973 he was admitted to that hospital with a request to be put in a private ward due to the fact he was suspected of having tuberculosis, which luckily he did not. He did, however, get placed in a ward where the Ward Sister was one Phyll Dance. She would watch Colin taking the tea cart

around, not realising it may have been because he wanted a cuppa himself, and playing chess with the elderly patients. Their connection rapidly grew into a whirlwind romance leading to Phyll packing her bags and moving to Australia with Colin just a short four months later when, in January 1973, Colin took up a position at The Australian National University. This is where he has been ever since, supervising scores of Honours, Masters, Doctoral and other graduate students in addition to collaborating with myriad scientists from around the globe, resulting in close to 200 peer-reviewed publications. Lest we forget the opportunities to travel: it also gave him the opportunity to continue to conduct field work expeditions in places such as Tanzania, Indonesia, Rwanda, Kenya and Iran.

Colin's field work adventures have included trips to museums and national parks around the globe, allowing him to study hundreds of species of animal, including every species of rhinoceros, which is still one of his greatest personal achievements. This love of the rhinoceros may have its genesis in the work he did as an undergraduate, which resulted in his first publication, entitled 'On the Rhinoceroses of South-East Asia'. This connection to rhinoceroses remains strong, which would be apparent to anyone who entered the Groves' home and noticed the vast collection of rhinoceros paraphernalia crowding the shelves and walls. When Phyll first met Colin and realised she may too have to participate in these trips, she asked him 'Do you get chased by wild animals?' to which Colin replied 'No. Animals don't chase people.' An answer he may now regret considering they have been chased by lions, a herd of banteng, as well as by a rhinoceros in Ujung Kulon. We might add that this was a rhinoceros they had been cautioned not to get too close to, but Colin with his ever inquisitive nature began to follow, not realising it would soon be following them.

Despite these close calls, Colin has always been a true conservationist. In this respect he was well ahead of his time in understanding the impact of humans on the environment. Phyll can recall when she first took Colin to her home town shortly after they met, he refused a plastic bag from a shop keeper. Although she was embarrassed by this at the time, it just goes to show that he has always been ahead of the game in his devotion to conservation – a devotion that quickly becomes apparent to anyone who has ever heard Colin speak about the plight of wild animals and the need to conserve them. He is avidly involved with conservation organisations, and right here in Canberra he often speaks at fundraising events where he is never shy about voicing his opinion on controversial topics such as the boycotting of products containing palm oil due to the impact palm oil plantations have on Asian wildlife. As taxonomy is the basis for conservation and as 'threats to the natural world and its biodiversity are ubiquitous and accelerating, it affects conservation strategies'. After all,

how can we know what to conserve if we don't know what species are out there? Links such as these, tying taxonomy to practical and real research outputs, are what have set Colin apart.

Colin has also devoted much of his career to refining mammalian taxonomy, which has resulted in his naming more than 40 taxa, including species of rats, civets, possums and, most famously, the human ancestor, *Homo ergaster*, which was undertaken with colleague Vratislav Mazák in 1975. This is likely the thing he is most remembered for, but his contributions to the field of human evolution certainly do not end there. As a renowned skeptic and a 30-year member of the Australian Skeptics, Colin is always pushing the boundaries and looking for new ways to understand the world and challenge those around him. This has led to him arguably making more contributions to mammalian taxonomy than any other modern scientist, including the addition of his two influential books *Primate Taxonomy* and *Ungulate Taxonomy*, which are now used as landmark taxonomy guides. More recently, Colin has also been a major player in the recent debate surrounding *Homo floresiensis* and its relationship to modern humans. Never shy to turn away from a debate, he gets great pleasure in educating young people about many things including the truth behind creationism, which is one of the only things he seems to take offence to.

Colin has undoubtedly influenced, directly or indirectly, thousands of people far and wide, which embodies what he truly is: a teacher. Having students in his lab or speaking in schools and getting young people excited about behaviour, morphology, evolution or conservation, or any other topic of interest, makes Colin happy. He is an educator on every level, whether working as a supervisor, mentor or even simply by taking the time to write numerous letters to newspapers to discuss topics of interest. There is no doubt his many undergraduate students enjoy hearing him lecture, his graduate students appreciate his support, supervision and insight, and the staff he has mentored welcome his helpful nature and encyclopaedic knowledge of the discipline.

Despite everything Colin has obviously achieved, what might make him the most endearing to those who know him is his humility. Just recently he was made an honorary member of the American Society of Mammalogists, something which has been bestowed on less than 100 people. He was also the 2014 recipient of an award from the Margot Marsh Biodiversity Fund for Excellence in Contribution to Primate Conservation. Both awards were a surprise, and to hear Colin tell the story, he didn't even realise that the great person being described as they began the ceremonies was himself. This is not the first time that we have heard Colin say such things. His gentle spirit and true passion for what he does leave no room for ego or arrogance, and all of us who have had the pleasure to work with or even briefly chat with Colin Groves are the better for it.

Volume structure

This volume is broken down into four main sections, prefaced by this introduction as Part I. Part II, Chapters 2 through 7, explores the influence of changing taxonomic and speciation mechanisms on studies of behaviour and morphology. Chapter 2 describes a new species of murid rodent endemic to the island of Sulawesi, *Lenomys grovesi*, a genus that up until now has been thought to be monotypic. Chapters 3 to 5 focus on primatology, with Chapter 3 providing new insights into the evolution of gibbons through consideration of the morphology of their last common ancestor. Chapter 4 considers how natural disasters may play a role in the speciation of New World monkeys, while Chapter 5 summarises, for the first time, the influence of the primatologist Adolf Remane on primatological studies. Chapter 6 turns to the hominid lineage by using new ways of thinking about lithic technology to weigh in on current debates about hominid and Neanderthal cognition. Finally, Chapter 7 explores how changes to the taxonomy of anopheline (malarial) mosquitoes have contributed to our understanding of human malaria transmission.

Part III shifts focus to studies of evolution, starting with Chapter 8, which revisits the contributions of Lamarck's ideas on the nature of species, re-evaluating his contributions to the field of biological evolution. Chapter 9 investigates the changing nature of taxonomy from Aristotle to the current day, with a focus on what this has meant to studies of domestication. The remainder of this section focuses on human evolution, starting with Chapter 10, followed by reviews of how relationships between diet, farming and cooking techniques with reductions in tooth size and corresponding cranial changes can affect evolution in the Holocene human skeletal record. Chapter 11 uses cladistic analyses to test existing hypotheses regarding the phylogenetic relationships of Ceprano, Daka, Kabwe and Bodo in the Early and Middle Pleistocene. Chapter 12 focuses on important new insights that studies of ancient DNA (aDNA) can contribute to our rewriting of the human evolutionary narrative in Sunda and Sahul.

Part IV moves from studying species themselves, to studies that consider how to conserve them. Chapter 13 describes how Mongolians have cooperated with western conservation organisations to enable the takhi to be released back on the Mongolian steppe from a captive existence in zoos and reserves. Chapter 14 describes the history of systematic research of the small group of currently existing species of rhinoceros to better understand rhinoceros conservation needs and plans. Chapters 15 through 17 consider primate conservation. Chapter 15 examines how the ever changing taxonomy of red colobus monkeys has impacted conservation efforts in Africa, while Chapter 16 evaluates the claim that use of the phylogenetic species concept undermines conservation efforts by focusing on two groups of Southeast Asian mammals, pigs (Suidae)

and gibbons (Hylobatidae). Chapter 17 tries to make sense of the complexity of gorilla conservation in light of ever changing species designations as well as threats. Finally, Chapter 18 synthesises our taxonomic tapestry.

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